

TEST REPORT

Test Report No. : 11 0467
Date : 19.09.2019
Page No. : 1 of 19
Location of Testing : SCIENTIFIC AND INDUSTRIAL TESTING AND RESEARCH CENTRE (Si'Tarc)
83 & 84, Avarampalayam Road
COIMBATORE - 641 006.
Service Requested by : M/s. Kinetica Solar Pvt Ltd
A/2, ATULYA BHAVAN, NEAR C.E.R.C, S.G.
HIGHWAY, THALTEJ, AHMEDABAD-380054.
Customer Doc. Ref. No. & Date : 16600, 11.09.2019
Item Description : 3.7 kW/ 5.0 HP Universal Solar Pump Controller
Sample Identification Details : Model: KISAN UNIVERSAL,
Grade/Variety/Type/Size/Class. S. No. 0719_4050_002004
Batch No./Date of Manufacturing
Item Received on : 11.09.2019
Seal/Signature : -
Si'Tarc Invoice No. & Date : Invoice No. - Date: -
Any Other Information : Test as per Ministry of New and Renewable Energy
Testing Procedure for Universal Solar Pump Controller (USPC) Annexure-iii of circular no. F. No. 41/3/2018-spv division dated 17.7.2019

Issued By



R. JEYABHARATHI
Manager (Customer care)



Authorised By



A.M. SELVARAJ
Joint Director

- Note : This Report is Subjected to the Terms and Conditions Mentioned Overleaf.
- Recognised by Department of Scientific and Industrial Research (DSIR), Bureau of Indian Standards (BIS), Bureau of Energy Efficiency (BEE) and Ministry of New and Renewable Energy (MNRE) Govt of India, New Delhi
- ISO/IEC 17025 Accredited Laboratory by National Accreditation Board for Testing and Calibration (NABL), New Delhi in the Testing Field of Chemical, Electrical Mechanical & Biological and in the Calibration Field of Electro Technical, Mechanical & Thermal.

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TEST REPORT FOR UNIVERSAL SOLAR PUMP CONTROLLER

MINISTRY OF NEW AND RENEWABLE ENERGY

**UNIVERSAL SOLAR PUMP CONTROLLER (USPC) SPECIFICATIONS FOR STAND-ALONE
APPLICATIONS**

Annexure-III of Circular No. F. No. 41/3/2018-SPV Division dated 17.7.2019

1.0 DETAILS OF THE SAMPLE

Name of the Sample	UNIVERSAL SOLAR PUMP CONTROLLER				
Rating in kW / HP	3.7 / 5.0	Volts (Nom)	350V	SI.No	0719_4050_002004
Make	KINETICA SOLAR PVT LTD			Model No	KISAN UNIVERSAL
Description of the sample and specified requirements as received in data sheet enclosed with customer's Letter.					

2.0 SUPPLEMENTARY INFORMATION

2.1	Test Method	As per Ministry of new and Renewable Energy Testing Procedure for Universal Solar Pump Controller (USPC) Annexure-iii of circular no. F. No. 41/3/2018-spv division dated 17.7.2019		
2.2	Above sample as received in physically satisfactory condition.			
2.3	Only the tests requested by the customer have been carried out.			
2.4	The specified ambient conditions were maintained during the test.			
2.5	The tests declared in the SI.No (--) are/were sub contracted according to the established procedure of this laboratory.			
2.6	Reference to the sampling procedure, wherever applicable			NIL
2.7	Supporting documents for the measurements taken and results derived like graphs, tables, sketches and / or photographs as appropriate to test report, if any (to be attached)			Page. No 10 of 19 to Page. No 19 of 19
2.8	Deviations from test methods are prescribed in relevant IS / Work instruction if any			NIL
2.9	Measurement of uncertainty of test equipment is considered while testing			
2.10	"(see remark #)" refers to a remark appended to the report,"(see appended table)" refers to a table appended to the report.			
2.11	Under the test results the following indication (PASS, FAIL, N/A,"----") is marked against suitably.			
	Test item does meet the requirement	PASS	Test item does not meet the requirement	FAIL
	No Pass / Fail Decision Taken	"----"	Test case does not apply to the test object	N/A

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3.0 TEST DETAILS

SL.NO.	NAME OF THE TEST	TEST AS PER
3.1.	Selection and automatic operation of different solar based agriculture application	As per MNRE Testing Procedure for Universal Solar Pump Controller (USPC)
3.2.	Total Harmonics Distortion test	-DO-
3.3.	Protection(s) tests	-DO-
3.4.	Remote Monitoring	-DO-
3.5.	Measurement of Dynamic MPPT efficiency	-DO-
3.6.	Measurement of Converter efficiency	-DO-
3.7.	Torque observation on rated motor power	-DO-

4.0 TEST RESULTS

4 A SELECTION AND AUTOMATIC OPERATION OF DIFFERENT SOLAR BASED AGRICULTURE APPLICATION				
SL.NO.	NAME OF THE TEST	SPECIFICATION / TEST REQUIREMENTS	TEST RESULTS	REMARKS
1.	Application description on screen and selection of applications	LCD screen provided on controller shows various applications which can be selected by keypad using up-down and enter key.	Provided	
2.	Automatic operation of applications	Universal solar Agriculture controller comes with multiple outputs which can be permanently connected to the application by selecting appropriate options of the following application Automatically started • Water Pumping • Chaff Cutter • Atta Chakki • Deep fridge/ Cold storage/ Compressor No manual change over required	Provided, No manual change over observed in USPC	At a time, single application operates by the selection among all the connected applications

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4.0 TEST RESULTS

4 A SELECTION AND AUTOMATIC OPERATION OF DIFFERENT SOLAR BASED AGRICULTURE APPLICATION				
SL.NO.	NAME OF THE TEST	SPECIFICATION / TEST REQUIREMENTS	TEST RESULTS	REMARKS
3.	Application Specific output (Application specific software)	USPC should have inbuilt individual application specific software to run the agrarian applications other than pumps and output of the controller should be suitable for above mentioned applications	Provided	USPC is found to have satisfactory operation for above applications
4.	Overload torque test.	Up to 150% of rated torque of the connected motor.	Satisfactory	Ref Table – 8
5.	Constant torque test	Constant Load given to motor within 100% of rated torque of the motor	Satisfactory	Ref Table – 7
6.	Constant power test	At variable load i.e. from No load to 150%	Satisfactory	Ref Table – 8
7.	Quadratic load test	Load given to motor within 100% of rated torque of the motor	Satisfactory	Ref Table – 2
8.	Impact load test	Load given to motor within 150% of rated torque of the motor	Satisfactory	Ref Table – 8
9.	Hydraulic load test	Load given to pump set having rated capacity of the controller.	Satisfactory	Ref Table – 2

4B APPLICATION: SOLAR WATER PUMPING				
SL.NO.	NAME OF THE TEST	SPECIFICATION / TEST REQUIREMENTS	TEST RESULTS	REMARKS
1.	Input voltage range Minimum- Voc at STC Nominal - Voc at STC Maximum – Voc at STC	280 V 350 V 420 V	Tested on 280,350,420 VOC	Satisfactory Ref Table – 1, 2 and 3
2.	Ripple and Total Harmonic distortion at output on full load	Below 3%	< 2.64 %	Satisfactory Ref Table 1, 2 and 3
3.	Insulation resistance	700 M ohm 500 V applied for 1 minute	812 MΩ @ 500V applied for 1 minute	Observed at 32°C & 60% RH

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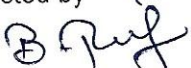
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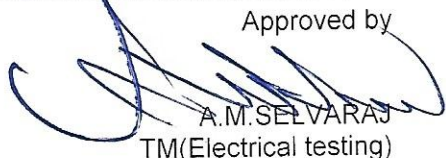
4.	Output Voltage (Sine Wave)	Three phase output with up to 400 V rms pure Sine Wave	Sin Wave CFU 1.43	Satisfactory
5.	Low radiation mode protection	Provided	Observed	USPC shutdown at the low radiation if power is not sufficient to drive the particular application and indicates low radiation and Voc value on LCD and operation RANGE for Voc
6.	Dry run protection	Provided	Observed	Shutdown and Dry run protection on LCD
7.	Reverse Polarity Protection	Provided	Observed	Satisfactory
8.	Short Circuit protection	Provided	Observed	Satisfactory
9.	Open circuit protection	Provided	Observed	Satisfactory
10.	Remote monitoring	Provided	Built in RMU Observed with data storage	Satisfactory (Ref photograph - 2)
11.	Average MPPT tracking efficiency in Hot profile	To be measured	99.6%	Hot profile operated with 350 Voc and 4800 Wp array
12.	Average MPPT tracking efficiency in Cold Profile	To be measured	99.8%	Cold profile operated with 350 Voc and 4800 Wp array
13.	Output voltage THD at rated PV	To be measured	< 2%	Satisfactory
14.	Instantaneous output voltage and voltage spikes	Sinusoidal & no voltage spikes	Observed	Satisfactory
15.	Crest Factor in output at rated PPV	1.6 maximum	CFU: 1.43 CFI: 1.46	Satisfactory Ref Photograph No. 1
16.	Efficiency Tests of the Controller at Voc 350 V To be Measured	Controller Efficiency (%)	MPPT Efficiency (%)	Overall charge controller Efficiency (%) Ref Table - .2
16.1.	At 10% of input power	76.50	99.5	76.11
16.2.	At 25% of input power	93.38	99.3	92.73
16.3.	At 50% of input power	92.96	99.6	92.58
16.4.	At 75% of input power	93.19	99.9	93.09
16.5.	At 100% of input power	93.23	99.9	93.13

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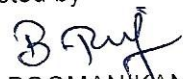
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4C. APPLICATION: SOLAR BASED CHAFF CUTTER				
SL.NO.	NAME OF THE TEST	SPECIFICATION / TEST REQUIREMENTS	TEST RESULTS	REMARKS (REF. TABLE - 4)
1.	Input PV voltage range Minimum-Voc at STC Nominal- Voc at STC Maximum-Voc at STC	280 V 350 V 420 V	Observed	Satisfactory
2.	Output voltage waveform	Sinusoidal at rated conditions 380 to 400 V Ac rms	Observed	Satisfactory
3.	Input PV power range P Nominal	4800 Watts STC	Tested with 4800 Wp	Satisfactory
4.	Motor Rating	2 hp, 3 Phase, 50 Hz, 4 pole, 1440 RPM	2 hp	Loads as per chaff cutter load
5.	Continuous operation started @ power output from array	To be measured	1500 Wp	Operation starts at 50 Hz above this power with chaff cutter loading
6.	Cutter rotation speed for 4 pole type Motor	To be measured	1447-1451 RPM at motor pulley	Satisfactory
7.	DC power in loading condition	To be measured	1083-1725 Wp	Totally depended on loading condition
8.	Cutter Operation at different output from 4800 Wp array At 40% Power At 50% Power At 75% Power At 100% Power	To be measured (cutter will not stop functioning)	Observed	Above 1083 Wp output from array chaff cutter operates satisfactory, else low radiation protection shutdown system and display on LCD
9.	Production Rate	kg/ hour	900 kg/hour	Produced 15 kg in 1 minute
10.	Total circuit protection	Provided	Observed	Soft Start up, low radiation protection
11.	Overload protection	Provided	Observed	Satisfactory
12.	Short Circuit protection	Provided	Observed	Satisfactory
13.	Open circuit protection	Provided	Observed	Satisfactory
14.	Reverse polarity protection	Provided	Observed	Satisfactory

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4C.	APPLICATION: SOLAR BASED CHAFF CUTTER			
SL.NO.	NAME OF THE TEST	SPECIFICATION / TEST REQUIREMENTS	TEST RESULTS	REMARKS (REF. TABLE - 4)
15.	PV source operating condition during cutter operation	Operates in constant voltage of PV curve	Constant	Satisfactory
16.	Cutter acceleration	Smooth	Soft start provided	Satisfactory

4 D	APPLICATION: SOLAR BASED COLD STORAGE/ DEEP FRIDGE/ COMPRESSOR			
SL.NO.	NAME OF THE TEST	SPECIFICATION / TEST REQUIREMENTS	TEST RESULTS	REMARKS (REF TABLE - 5)
1.	Input PV voltage range Minimum-Voc at STC Nominal-Voc at STC Maximum-Voc at STC	280 V 350 V 420 V	Observed	Satisfactory
2.	Output voltage waveform	Sinusoidal at rated conditions 380 to 400 V Ac rms	Observed	Satisfactory
3.	Input PV power range P Nominal	4800 Watts STC	Tested with 4800 Wp	Satisfactory
4.	Compressor rating	Capacity 220 litre,	Volume 220 litre	
5.	Motor rating	4 hp, 3 Phase, 50 Hz, 4 pole, 1440 RPM	4 hp	
6.	Continuous operation started @ power output from array	To be measured	2066 Wp	Satisfactory operation starts at 50 Hz above this power with compressor loading
7.	Compressor operation at different output from 4800 Wp array At 40% Power At 50% Power At 75% Power At 100% Power	To be measured (Compressor will not stop functioning)	Observed	Above 1060 Wp output from array compressor operates satisfactory, else low radiation protection shutdown system and display on LCD
8.	Time Required for Air Pressure (0 to 10 bar)	In minute	7 minutes and 24 second	Electrical observation continuous operation found after 1060 Wp
9.	Total circuit protection	Provided	Observed	Soft Start up, low radiation protection
10.	Short Circuit protection	Provided	Observed	Satisfactory

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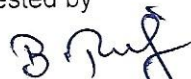
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4 D	APPLICATION: SOLAR BASED COLD STORAGE/ DEEP FRIDGE/ COMPRESSOR			
SL.NO.	NAME OF THE TEST	SPECIFICATION / TEST REQUIREMENTS	TEST RESULTS	REMARKS (REF TABLE - 5)
11.	Open circuit protection	Provided	Observed	Satisfactory
12.	Reverse polarity protection	Provided	Observed	Satisfactory
4 E	APPLICATION: SOLAR BASED ATTA CHAKKI			
SL.NO.	NAME OF THE TEST	SPECIFICATION / TEST REQUIREMENTS	TEST RESULTS	REMARKS (REF TABLE -6)
1.	Input PV voltage range Minimum-Voc at STC Nominal-Voc at STC Maximum-Voc at STC	280 V 350 V 420 V	Observed	Satisfactory
2.	Output voltage waveform	Sinusoidal at rated conditions 380 to 400 V Ac rms	Observed	Satisfactory
3.	Input PV power range P Nominal	4800 Watts	Tested with 4800 W/p	Satisfactory
4.	Atta Chakki type	14 inches, open hopper store type, Production rate 14 to 18 kg/hour wheat flour, hopper size 15 to 20 kg	Observed	17 kg/hour
5.	Atta Chakki motor	4 hp, 3 Phase, 50 Hz, 2 pole, 2820 RPM	4 hp	Loads as per Atta Chakki load
6.	Continuous operation started @ power output from array	To be measured	2950 Wp	Operation starts at 50 Hz above this power for full loading
7.	Rotation speed	To be measured	Motor: 2934 RPM	Satisfactory
8.	Atta Chakki operation at different output from 4800 Wp array At 40% Power At 50% Power At 75% Power At 100% Power	To be measured (Atta Chakki will not stop functioning)	Observed	Above 1018 Wp output from array Atta Chakki operates at full load satisfactory, else below low radiation protection shut downs the system and display on LCD
9.	Production rate with wheat	kg/ hour	17 kg/hour	Produced 8.5 kg in 30 minutes
10.	Total circuit protection	Provided	Observed	Soft Start up, low radiation protection
11.	Overload protection	Provided	Observed	Satisfactory

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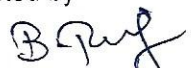
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4 D	APPLICATION: SOLAR BASED COLD STORAGE/ DEEP FRIDGE/ COMPRESSOR			
SL.NO.	NAME OF THE TEST	SPECIFICATION / TEST REQUIREMENTS	TEST RESULTS	REMARKS (REF TABLE - 5)
12.	Short Circuit protection	Provided	Observed	Satisfactory
13.	Open circuit protection	Provided	Observed	Satisfactory
14.	Reverse polarity protection	Provided	Observed	Satisfactory

DETAILS OF EQUIPMENTS USED AS LOAD				
S.NO.	EQUIPMENT USED	MODEL	SERIAL NO	REMARKS
1.	Motor and Pump (submersible)	Motor- 5 hp S.S. Pump- 20 stage S.S.	D152456	3 Phase
2.	Chaff Cutter	2 hp, 4 Pole	U9EEBC00004	3 Phase
3.	Compressor	4 hp, 4 Pole	12634	3 Phase
4.	Atta Chakki	4 hp, 4 Pole	SGV 1450	3 Phase

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TABLE 1		CONVERTER EFFICIENCY AT MINIMUM VOLTAGE (TESTED AT VOLTAGE AT 280 Voc)				
S.NO.	CONTROLLER INPUT POWER %	10	25	50	75	100
1.	Udc-1-Total	222.81	222.92	224.18	225.27	232.92
2.	Idc-1-Total	1.93	4.81	9.56	14.23	18.08
3.	P-1-Total	430.45	1074.0	2143.2	3206.0	4212.0
4.	Urms-2-Total	145.32	233.82	304.20	351.48	387.75
5.	Irms-2-Total	4.19	4.78	5.79	6.83	7.75
6.	P-2-Total (W)	464.8	973.8	1164.4	2335.3	2954.3
7.	FreqU-2-Total (Hz)	17.2	27.92	36.71	42.50	47.00
8.	PF-2-Total	0.763	0.871	0.944	0.972	0.982
9.	Urms-3-Total	144.58	233.38	304.35	351.90	388.09
10.	Irms-3-Total	4.22	4.77	5.78	6.78	7.69
11.	P-3-Total (W)	119	65.0	304.1	623.6	939.2
12.	FreqU-3-Total (Hz)	17.22	27.93	36.719	42.503	47.01
13.	PF-3-Total	0.196	0.0059	0.173	0.262	0.314
14.	Urms-4-Total	145.17	233.85	305.41	351.93	388.17
15.	Irms-4-Total	4.12	4.701	5.689	6.669	7.58
16.	P-4-Total (W)	565.9	948.5	1320	1621	1921
17.	FreqU-4-Total (Hz)	17.22	27.93	36.71	42.51	47.02
18.	PF-4-Total	0.944	0.862	0.760	0.690	0.652
19.	Uthd-2-Total	-	1.49	1.67	1.67	1.57
20.	lthd-2-Total	-	2.08	1.88	1.52	1.27
21.	Uthd-3-Total	-	1.57	1.72	1.71	1.74
22.	lthd-3-Total	-	2.16	1.79	1.32	1.06
23.	Uthd-4-Total	-	1.52	1.74	1.75	1.76
24.	lthd-4-Total	-	2.05	1.77	1.26	1.20
25.	Urms-SigmaA-Total	145.04	233.68	304.65	351.44	388.01
26.	Irms-SigmaA-Total	4.18	4.75	5.76	6.76	7.68
27.	P-SigmaA-Total (W)	345.2	967.3	1968.5	2958.9	3893.5
28.	PF-SigmaA-Total	0.33	0.51	0.65	0.72	0.75
29.	S-SigmaA-Total (VA)	1050.4	1924.0	3037.0	4116.6	5160.2
30.	Q-SigmaA-Total (VA)	992.6	1664.3	2315.0	2865.3	3394.9
31.	Controller efficiency (%)	80.20	90.06	91.85	93.03	93.05
32.	Mppts efficiency (%)	99.2	99.5	99.6	99.8	99.9
33.	Overall system efficiency	79.56	89.61	91.48	92.85	92.96

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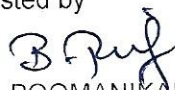
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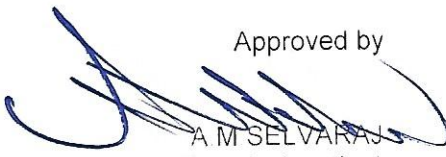
TABLE 2		CONVERTER EFFICIENCY AT NOMINAL VOLTAGE (TESTED AT VOLTAGE AT 350 Voc)				
S.NO.	CONTROLLER INPUT POWER %	10	25	50	75	100
1.	Udc-1-Total	291.93	283.04	272.01	277.77	274.41
2.	Idc-1-Total	1.45	3.80	7.93	11.72	15.82
3.	P-1-Total	423.2	1076.2	2157.6	3256	4341.1
4.	Urms-2-Total	134.93	231.85	306.17	334.17	367.70
5.	Irms-2-Total	4.09	4.76	5.85	7.03	8.16
6.	P-2-Total (W)	424.6	964.4	1691.7	2301.2	2966.0
7.	FreqU-2-Total (Hz)	16.28	27.88	36.87	41.65	46.12
8.	PF-2-Total	0.77	0.87	0.99	0.99	0.99
9.	Urms-3-Total	135.61	232.40	305.61	333.83	367.74
10.	Irms-3-Total	4.1	4.73	5.83	7.00	8.10
11.	P-3-Total (W)	100.8	83	296.7	729.8	1076.9
12.	FreqU-3-Total (Hz)	16.28	27.87	36.86	41.65	46.13
13.	PF-3-Total	0.18	0.0076	0.166	0.31	0.361
14.	Urms-4-Total	135.79	232.63	306.17	335.45	368.16
15.	Irms-4-Total	4.02	4.69	5.71	6.69	8.09
16.	P-4-Total (W)	514.9	935.4	1327.6	1645.3	1852.2
17.	FreqU-4-Total (Hz)	16.28	27.88	36.86	41.65	46.12
18.	PF-4-Total	0.94	0.85	0.76	0.66	0.62
19.	Uthd-2-Total	-	1.70	1.73	1.73	1.69
20.	lthd-2-Total	-	2.46	1.81	1.52	1.29
21.	Uthd-3-Total	-	1.83	1.74	1.78	1.76
22.	lthd-3-Total	-	2.36	1.69	1.16	1.05
23.	Uthd-4-Total	-	1.75	1.72	1.82	1.79
24.	lthd-4-Total	-	2.44	1.69	1.19	1.18
25.	Urms-SigmaA-Total	135.44	232.29	305.98	334.48	367.87
26.	Irms-SigmaA-Total	3.80	4.45	7.93	11.72	15.82
27.	P-SigmaA-Total (W)	423.2	1076.2	2157.6	3256	4341
28.	PF-SigmaA-Total	0.34	0.51	0.64	0.75	0.78
29.	S-SigmaA-Total (VA)	955.8	1902.4	3072.2	4054.4	5175.6
30.	Q-SigmaA-Total (VA)	899.9	1636.4	2345.2	2696.4	3937.9
31.	Controller efficiency (%)	76.50	93.38	92.96	93.19	93.23
32.	Mpvt efficiency (%)	99.5	99.3	99.6	99.9	99.9
33.	Overall system efficiency	76.11	92.73	92.58	93.09	93.13

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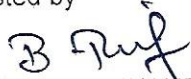
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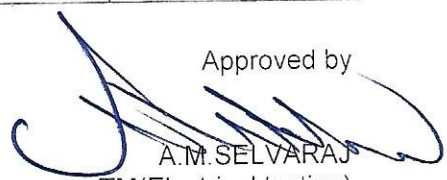
TABLE 3		CONVERTER EFFICIENCY AT MAXIMUM VOLTAGE (TESTED AT VOLTAGE AT 420 Voc)				
S.NO.	CONTROLLER INPUT POWER %	10	25	50	75	100
1.	Udc-1-Total	352.80	340.71	348.61	326.61	330.04
2.	Idc-1-Total	1.19	3.15	6.10	9.86	13.04
3.	P-1-Total	421.3	1073.2	2127.3	3223.0	4304.0
4.	Urms-2-Total	132.95	232.77	305.97	354.52	393.13
5.	Irms-2-Total	4.07	4.86	5.83	6.88	7.89
6.	P-2-Total (W)	414.2	968.8	1679.6	2369.1	3047.6
7.	FreqU-2-Total (Hz)	15.97	27.63	36.72	42.83	47.75
8.	PF-2-Total	0.77	0.87	0.94	0.97	0.98
9.	Urms-3-Total	132.94	232.10	306.74	354.62	394.11
10.	Irms-3-Total	4.11	4.81	5.80	6.84	7.83
11.	P-3-Total (W)	108.5	170.0	294.0	637.4	981.1
12.	FreqU-3-Total (Hz)	15.97	27.62	36.71	42.81	47.74
13.	PF-3-Total	0.19	0.0015	0.17	0.26	0.32
14.	Urms-4-Total	133.26	233.3	306.64	356.01	394.84
15.	Irms-4-Total	3.99	4.69	5.72	6.73	7.71
16.	P-4-Total (W)	503.0	949.2	1341.8	1664.5	1986.8
17.	FreqU-4-Total (Hz)	15.97	27.62	36.71	42.88	47.75
18.	PF-4-Total	0.95	0.87	0.76	0.69	0.65
19.	Uthd-2-Total	-	1.73	1.70	1.65	1.65
20.	lthd-2-Total	-	2.62	1.86	1.50	1.28
21.	Uthd-3-Total	-	1.78	1.74	1.70	1.70
22.	lthd-3-Total	-	2.47	1.78	1.30	1.05
23.	Uthd-4-Total	-	1.80	1.72	1.74	1.75
24.	lthd-4-Total	-	2.64	1.74	1.25	1.08
25.	Urms-SigmaA-Total	133.05	232.72	306.49	355.05	394.03
26.	Irms-SigmaA-Total	4.06	4.77	5.78	6.82	7.81
27.	P-SigmaA-Total (W)	305.7	951.8	1973.6	3006.5	4028.7
28.	PF-SigmaA-Total	0.33	0.49	0.64	0.72	0.76
29.	S-SigmaA-Total (VA)	935.4	1922.7	3071.2	4193.8	5329.4
30.	Q-SigmaA-Total (VA)	884.7	1673.3	2356.6	2927.7	3493.6
31.	Controllor efficiency (%)	72.56	88.69	92.78	93.29	93.60
32.	Mppt efficiency (%)	99.6	99.5	99.8	99.9	99.9
33.	Overall system efficiency	72.27	88.25	92.60	93.20	93.51

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TABLE 4		CHAFF CUTTER OPERATION					
S.NO.	CONT. INPUT POWER %	25	30	40	50	75	100
1.	Udc-1-Total	271.86	283.94	313.69	325.69	336.62	338.9
2.	Idc-1-Total	3.98	4.59	4.79	4.69	4.49	5.09
3.	P-1-Total	1083.2	1304.9	1505.5	1526.4	1511.3	1725.5
4.	Urms-2-Total	265.80	343.98	374.84	374.57	374.97	373.95
5.	Irms-2-Total	2.77	2.65	2.77	2.80	2.78	3.07
6.	P-2-Total (W)	729.2	898.8	1028.4	1039.4	1033.7	1145.5
7.	FreqU-2-Total (Hz)	35.69	46.14	50.19	50.15	50.13	50.20
8.	PF-2-Total	0.99	0.99	0.99	0.99	0.99	0.99
9.	Urms-3-Total	265.28	343.54	375.05	374.60	374.80	374.47
10.	Irms-3-Total	2.78	2.66	2.77	2.80	2.79	3.07
11.	P-3-Total (W)	270.6	297.6	357.1	369.2	360.4	456.0
12.	FreqU-3-Total (Hz)	35.69	46.14	50.19	50.15	50.13	50.20
13.	PF-3-Total	0.38	0.33	0.34	0.35	0.34	0.39
14.	Urms-4-Total	266.29	345.27	375.79	376.44	375.98	374.96
15.	Irms-4-Total	2.76	2.57	2.69	2.72	2.69	2.99
16.	P-4-Total (W)	441.8	574.9	635.9	639.9	636.7	456.0
17.	FreqU-4-Total (Hz)	35.76	46.15	50.18	50.19	50.18	50.19
18.	PF-4-Total	0.61	0.65	0.63	0.63	0.63	0.59
19.	Uthd-2-Total	1.87	1.82	1.69	1.69	1.69	1.60
20.	lthd-2-Total	3.00	2.97	2.76	2.74	2.74	2.33
21.	Uthd-3-Total	1.43	1.47	1.37	1.39	1.38	1.23
22.	lthd-3-Total	2.37	2.48	2.28	2.35	2.34	1.89
23.	Uthd-4-Total	1.93	1.87	1.73	1.73	1.73	1.58
24.	lthd-4-Total	2.60	2.36	2.12	2.06	2.1	1.76
25.	Urms-SigmaA-Total	265.79	344.47	375.23	375.20	375.25	374.44
26.	Irms-SigmaA-Total	2.75	2.63	2.74	2.77	2.76	3.05
27.	P-SigmaA-Total (W)	997.0	1196.4	1385.5	1408.2	1394.1	1601.5
28.	PF-SigmaA-Total	0.79	0.76	0.78	0.78	0.78	0.81
29.	S-SigmaA-Total (VA)	1265.9	1567.7	1783.5	1803.8	1791.5	1977.7
30.	Q-SigmaA-Total (VA)	781.4	1017.6	1126.6	1131.4	1128.7	1165.0
31.	Controller efficiency (%)	92.29	91.69	92.09	92.26	92.24	92.81
32.	Speed in rpm	1018	1325	1449	1451	1451	1447
33.	Torque in Nm	8.42	9.60	10.07	9.99	9.93	9.96

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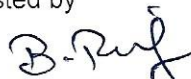
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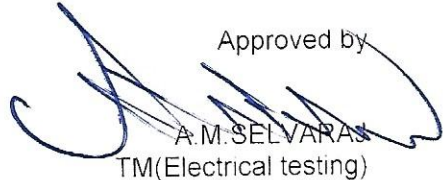
TABLE 5		COMPRESSOR OPERATION					
S.NO.	CONT. INPUT POWER %	25	30	40	50	75	100
1.	Udc-1-Total	296.37	256.87	271.51	301.62	325.21	332.92
2.	Idc-1-Total	3.58	4.95	6.63	6.85	7.09	6.97
3.	P-1-Total	1060.2	1269.9	1800.8	2066.3	2234.8	2261.2
4.	Urms-2-Total	265.16	266.82	358.61	376.08	372.58	372.82
5.	Irms-2-Total	2.88	3.28	3.43	3.70	4.05	4.09
6.	P-2-Total (W)	746.5	857.2	1218.4	1374.9	1418.1	1499.8
7.	FreqU-2-Total (Hz)	35.54	35.92	48.18	50.59	50.09	50.13
8.	PF-2-Total	0.98	0.98	0.99	0.99	0.98	0.94
9.	Urms-3-Total	265.05	267.24	359.85	377.49	374.2	373.32
10.	Irms-3-Total	2.84	3.24	3.36	3.62	3.97	4.01
11.	P-3-Total (W)	231.3	316.2	449.2	541.3	611.3	619.2
12.	FreqU-3-Total (Hz)	35.53	35.94	48.18	50.49	50.10	50.14
13.	PF-3-Total	0.31	0.36	0.37	0.39	0.41	0.41
14.	Urms-4-Total	265.83	266.1	360.71	377.50	373.54	373.81
15.	Irms-4-Total	2.72	3.28	3.25	3.52	3.88	3.91
16.	P-4-Total (W)	457.8	841.7	680.3	744.5	776.9	780.8
17.	FreqU-4-Total (Hz)	35.54	35.92	48.18	50.59	50.12	50.14
18.	PF-4-Total	0.64	0.67	0.59	0.56	0.54	0.53
19.	Uthd-2-Total	1.93	1.17	1.61	1.51	1.44	1.40
20.	lthd-2-Total	2.98	2.32	2.11	1.92	2.04	1.77
21.	Uthd-3-Total	1.65	1.35	1.31	1.29	1.18	1.14
22.	lthd-3-Total	2.56	2.03	1.94	1.88	1.66	1.69
23.	Uthd-4-Total	1.96	1.62	1.63	1.54	1.44	1.40
24.	lthd-4-Total	2.48	1.89	1.86	1.77	1.50	1.71
25.	Urms-SigmaA-Total	265.35	267.18	359.72	377.17	373.54	373.32
26.	Irms-SigmaA-Total	2.82	3.22	3.35	3.62	3.96	4.00
27.	P-SigmaA-Total (W)	977.7	1173.5	1667.6	1921.2	2089.9	2118.9
28.	PF-SigmaA-Total	0.76	0.79	0.79	0.81	0.82	0.82
29.	S-SigmaA-Total (VA)	1292.5	1488.8	2086.0	2362.6	2563.8	2587.4
30.	Q-SigmaA-Total (VA)	872.8	983.4	1303.7	1448.0	1647.1	1636.8
31.	Controller efficiency (%)	92.22	92.41	92.67	92.98	93.52	93.71
32.	Speed in rpm	921	1040	1329	1442	1440	1452

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TABLE 6		ATTA CHAKKI OPERATION					
S.NO.	CONT. INPUT POWER %	25	30	40	50	75	100
1.	Udc-1-Total	242.31	275.79	273.25	279.55	308.15	326.90
2.	Idc-1-Total	4.20	4.74	6.35	7.78	8.59	8.95
3.	P-1-Total	1018.2	1305.9	1735.0	2174.0	2957.0	2924.0
4.	Urms-2-Total	191.21	221.00	263.60	301.64	370.16	370.64
5.	Irms-2-Total	3.48	3.81	4.26	4.59	5.07	5.03
6.	P-2-Total (W)	662.0	839.8	1113.6	1382.4	1877.2	1863.7
7.	FreqU-2-Total (Hz)	25.98	30.14	35.83	41.06	50.08	50.05
8.	PF-2-Total	0.99	0.99	0.99	0.99	0.99	0.99
9.	Urms-3-Total	191.41	221.21	264.37	301.76	370.78	370.82
10.	Irms-3-Total	3.51	3.33	4.28	4.60	5.09	5.04
11.	P-3-Total (W)	283.3	382.4	515.6	476.3	911.4	896.5
12.	FreqU-3-Total (Hz)	25.98	30.14	35.84	41.04	50.09	50.04
13.	PF-3-Total	0.42	0.45	0.45	0.45	0.48	0.48
14.	Urms-4-Total	191.47	220.97	264.31	302.51	371.41	371.18
15.	Irms-4-Total	3.45	3.78	4.22	4.53	5.01	4.96
16.	P-4-Total (W)	377.9	454.2	598.3	709.2	958.5	948.2
17.	FreqU-4-Total (Hz)	25.97	30.15	35.82	41.06	50.08	50.05
18.	PF-4-Total	0.57	0.54	0.54	0.52	0.51	0.51
19.	Uthd-2-Total	1.02	0.96	1.09	0.94	0.98	1.00
20.	lthd-2-Total	3.90	3.40	2.11	1.48	1.42	1.57
21.	Uthd-3-Total	1.17	0.84	0.92	0.81	0.79	0.80
22.	lthd-3-Total	3.84	3.44	2.37	1.42	1.31	1.49
23.	Uthd-4-Total	1.25	0.99	1.14	0.89	0.91	0.93
24.	lthd-4-Total	3.62	3.21	2.10	1.44	1.40	1.48
25.	Urms-SigmaA-Total	191.38	221.06	264.09	301.97	370.70	370.88
26.	Irms-SigmaA-Total	3.45	3.81	4.26	4.58	5.06	5.01
27.	P-SigmaA-Total (W)	945.3	1222.8	1629.2	2048.1	2788.6	2760.3
28.	PF-SigmaA-Total	0.82	0.84	0.84	0.85	0.86	0.86
29.	S-SigmaA-Total (VA)	1155.7	1459.0	1945.6	2392.4	3248.9	3218.4
30.	Q-SigmaA-Total (VA)	690.8	831.5	1145.1	1279.3	1687.7	1688.1
31.	Controller efficiency (%)	92.83	93.59	93.89	94.20	94.31	94.41
32.	Speed in rpm	1498	1740	2084	2390	2923	2934
33.	Torque in Nm	2.19	3.03	4.21	5.43	6.51	7.07

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TABLE 7		TORQUE OBSERVATION ON 5 HP MOTOR WITH DYNAMOMETER AS LOAD					
S.NO.	CONT. INPUT POWER %	25	30	40	50	75	100
1.	Udc-1-Total	214.62	256.33	280.97	273.22	277.76	291.33
2.	Idc-1-Total	4.27	4.95	6.18	7.95	11.74	14.69
3.	P-1-Total	915.5	1267.0	1735.3	2173	3261	4280
4.	Urms-2-Total	136.81	163.56	197.42	228.41	296.90	361.55
5.	Irms-2-Total	4.16	4.80	5.44	5.92	6.90	7.46
6.	P-2-Total (W)	567	783.4	1072.5	1349.7	2047.3	2696.4
7.	FreqU-2-Total (Hz)	19.31	22.8	27.52	31.82	41.24	55.15
8.	PF-2-Total	0.99	0.99	0.99	0.99	0.99	0.99
9.	Urms-3-Total	136.54	164.13	198.15	229.03	296.53	361.35
10.	Irms-3-Total	4.18	4.83	5.46	5.92	6.90	7.45
11.	P-3-Total (W)	289.1	416.0	566.9	706.1	1036.2	1350.5
12.	FreqU-3-Total (Hz)	19.33	22.80	27.53	31.82	41.24	50.15
13.	PF-3-Total	506.1	525.2	524.2	520.7	507.6	501.9
14.	Urms-4-Total	137.25	164.15	197.96	228.62	296.73	361.74
15.	Irms-4-Total	4.12	4.81	5.44	5.91	6.85	7.40
16.	P-4-Total (W)	277.5	379.2	514.9	649.9	989.9	1322.5
17.	FreqU-4-Total (Hz)	19.32	22.80	27.45	31.86	41.26	50.15
18.	PF-4-Total	0.49	0.48	0.48	0.48	0.48	0.49
19.	Uthd-2-Total	1.10	1.01	0.96	0.90	0.78	0.81
20.	Ithd-2-Total	1.75	1.74	1.37	1.45	1.62	1.12
21.	Uthd-3-Total	1.35	1.13	1.06	0.97	0.81	0.70
22.	Ithd-3-Total	1.92	1.64	1.49	1.54	1.75	1.12
23.	Uthd-4-Total	1.16	1.07	1.02	0.93	0.83	0.77
24.	Ithd-4-Total	1.81	1.57	1.43	1.51	1.75	1.15
25.	Urms-SigmaA-Total	136.87	163.95	197.84	228.69	296.72	361.55
26.	Irms-SigmaA-Total	4.16	4.81	5.44	5.91	6.88	7.45
27.	P-SigmaA-Total (W)	856.2	1199.5	1639.4	2055.8	3083.5	4046.9
28.	PF-SigmaA-Total	0.89	0.88	0.88	0.87	0.87	0.87
29.	S-SigmaA-Total (VA)	985.5	1366.0	1866.0	2342.7	3535.5	4656.6
30.	Q-SigmaA-Total (VA)	446.6	628.6	876.5	1106.9	1685.5	2279.8
31.	Controller efficiency (%)	93.51	94.67	94.47	94.59	94.54	94.56
32.	RPM	1077	1226	1543	1792	2340	2860
33.	Torque in Nm	4.91	5.59	6.77	7.12	8.85	9.59

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Approved by

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TABLE 8		TORQUE OBSERVATION ON 5 HP MOTOR WITH DYNAMOMETER AS LOAD					
S.NO.	MOTOR LOAD %	25	50	75	100	125	150
1.	Udc-1-Total	341.32	332.55	321.11	307.92	255.96	275.18
2.	Idc-1-Total	4.02	7.04	9.95	12.79	16.24	15.28
3.	P-1-Total	1368.6	2339.0	3196	3938	4156	4203
4.	Urms-2-Total	369.78	366.52	363.60	362.07	295.67	267.85
5.	Irms-2-Total	2.67	4.13	5.53	6.85	8.83	9.90
6.	P-2-Total (W)	968.6	1512.0	2010.8	2480.2	2610.8	2653.0
7.	FreqU-2-Total (Hz)	50.17	50.33	50.32	50.29	41.46	37.65
8.	PF-2-Total	0.98	0.99	0.99	0.99	0.99	0.99
9.	Urms-3-Total	369.96	366.27	364.46	362.23	296.16	267.75
10.	Irms-3-Total	2.66	4.09	5.53	6.85	8.83	9.93
11.	P-3-Total (W)	288.8	687.4	1011.7	1250.3	1309.5	1323.4
12.	FreqU-3-Total (Hz)	50.17	50.33	50.33	50.29	41.46	37.65
13.	PF-3-Total	0.29	0.46	0.50	0.50	0.50	0.49
14.	Urms-4-Total	370.77	367.16	365.04	363.30	295.73	268.55
15.	Irms-4-Total	2.56	4.03	5.48	6.80	8.81	9.88
16.	P-4-Total (W)	628.1	779.1	993.8	1222.8	1300.1	1337.5
17.	FreqU-4-Total (Hz)	50.17	50.33	50.33	50.29	41.47	37.65
18.	PF-4-Total	0.66	0.53	0.50	0.50	0.50	0.50
19.	Uthd-2-Total	1.79	1.47	1.15	0.89	0.89	1.40
20.	Ithd-2-Total	4.63	2.30	1.31	1.15	1.65	1.59
21.	Uthd-3-Total	1.56	1.16	0.93	0.75	1.01	1.56
22.	Ithd-3-Total	4.44	2.06	1.18	1.03	1.76	1.71
23.	Uthd-4-Total	1.92	1.39	1.04	0.83	0.97	1.50
24.	Ithd-4-Total	3.89	1.90	1.19	1.09	1.71	1.69
25.	Urms-SigmaA-Total	370.17	366.66	364.37	362.57	295.85	268.05
26.	Irms-SigmaA-Total	2.63	4.09	5.51	6.83	8.83	9.91
27.	P-SigmaA-Total (W)	1257.5	2199.4	3022.6	3730.6	3920.2	3976.0
28.	PF-SigmaA-Total	0.746	0.847	0.869	0.869	0.867	0.865
29.	S-SigmaA-Total (VA)	1685.7	2594.9	3479.9	4291.9	4522.9	4600.0
30.	Q-SigmaA-Total (VA)	1130.0	1393.1	1701.0	2096.8	2181.9	2256.0
31.	Controller efficiency (%)	91.88	94.02	94.47	94.73	94.32	94.60
32.	RPM	2977	2930	2910	2886	2298	1931
33.	Torque in Nm	2.51	5.04	7.54	9.98	12.46	14.62

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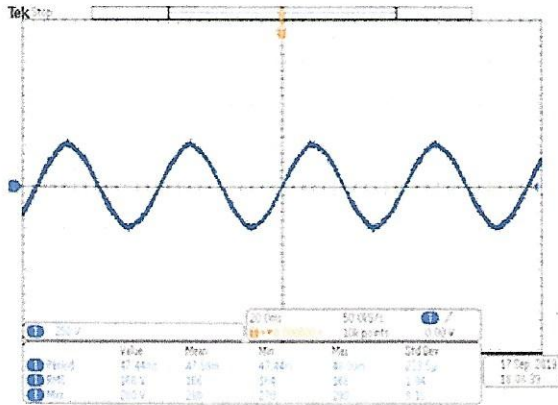
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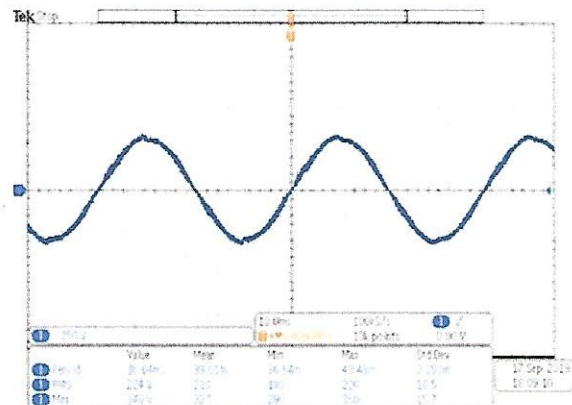
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PHOTOGRAPHS - 1 OUTPUT WAVE OF USPC AT DIFFERENT RADIATION / POWER

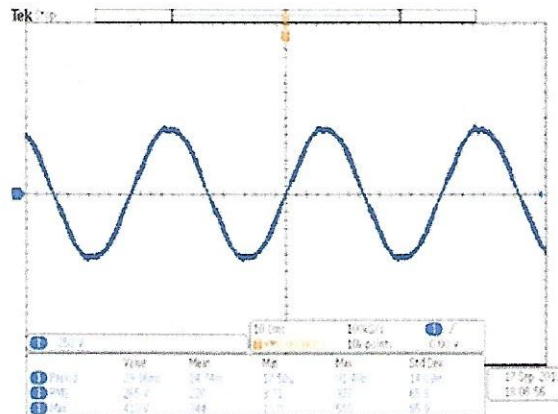
RADIATION 250 W/m²



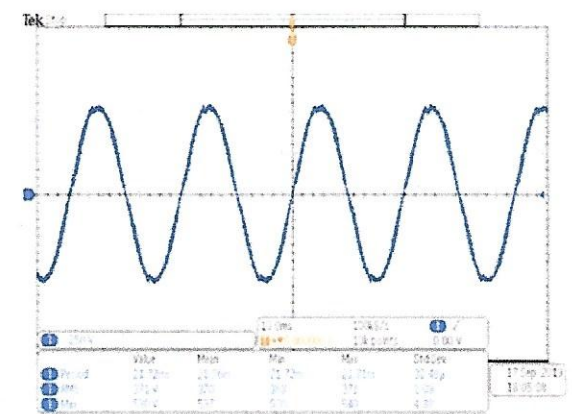
RADIATION 400 W/m²



RADIATION 600 W/m²



RADIATION 900 W/m²



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PHOTOGRAPHS - 2

FRONT VIEW

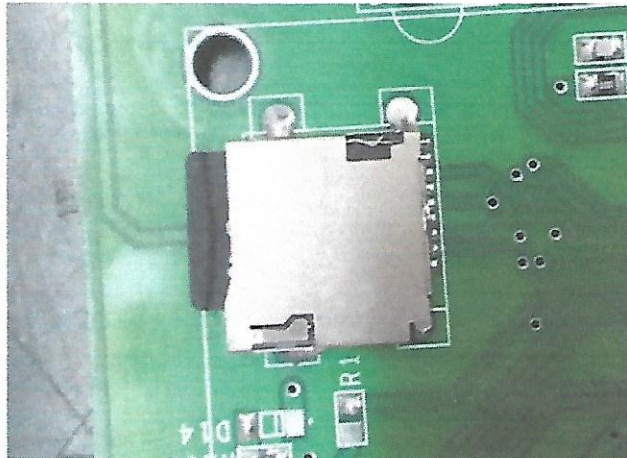


VISUAL INSPECTION OF USPC

NAME PLATE OF THE CONTROLLER



DATA STORAGE PROVISION



- End of the Report -

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