



Global Product Certification
EMC-EMF Safety Approvals

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EMC Test Report

Report Number: M120457

Test Sample: BLDC Swimming Pool Pumps

Tested For: Astral Pool Pty Ltd

Date of Issue: 22nd May 2012

EMC Technologies Pty Ltd reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. EMC Technologies Pty Ltd shall have no liability for any deductions, inferences or generalisations drawn by the client or others from EMC Technologies Pty Ltd issued reports. This report shall not be used to claim, constitute or imply product endorsement by EMC Technologies Pty Ltd.



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Certificate of Compliance

EMC Technologies Report No: M120457 Issue Date: 22nd May 2012

Test Sample: BLDC Swimming Pool Pumps
(refer to section 2.0 for complete product details)

Manufacturer: Fabtronics Australia Pty Ltd

Tested for: Astral Pool Pty Ltd
Address: 48 Hanna Street,
Noble Park, VIC 3174 Australia

Phone: +61 3 9554 2212

Fax: +613 9554 2270

Contact: Brendan Butler

Email: bbutler@astralpool.com.au

Test Standard: EN55014-2: 1997 Amendment 1: 2001 Amendment 2: 2008
(CISPR14-2: 2008 Ed 1.2)
*Electromagnetic compatibility – Requirements for household appliances,
electric tools and similar apparatus. Part 2: Immunity – Product family standard*

Result of Test: The Test Sample complied with the above Standard. Refer to Report
M120457 for full details

Test Dates: 1st – 2nd May 2012

Test Officer:



Matthew Grimwood

Authorised Signature:



Petra Hansen
EMC Technologies Pty Ltd

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Immunity Tests on the BLDC Swimming Pool Pumps in accordance with EN55014-2

1.0 INTRODUCTION

Electromagnetic Compatibility (EMC) tests were performed on the BLDC Swimming Pool Pumps, in accordance with the immunity requirements of EN55014-2 for a Category IV device.

There are four variants in the product family:

- 1 HP Pump
- 1 HP with Power Factor Correction (PFC)
- 1.5 HP Pump
- 2 HP Pump with Power Factor Correction (PFC)

Two pump variants - 1 HP pump & 2 HP pump with power factor correction (PFC) were tested as they encompassed the full functionality of the four variants.

The test samples were provided by the Client. All results herein apply only to the test samples.

1.1 Equipment Category

Category I: Clause 4.1: Apparatus containing no electronic control circuitry.

Category II: Clause 4.2: Transformer toys, dual supply toys, mains powered motor operated appliances, tools, heating appliances and similar electric apparatus containing electronic control circuitry with no internal clock frequency or oscillator frequency higher than 15 MHz.

Category III: Clause 4.3: Battery powered apparatus (with built-in or external batteries), which in normal use is not connected to the mains, containing an electronic control circuitry with no internal clock frequency or oscillator frequency higher than 15 MHz.

This category includes apparatus provided with rechargeable batteries which can be charged by connecting the apparatus to the mains power. However, this apparatus shall also be tested as an apparatus in category II while it is connected to the mains network.

Category IV: Clause 4.4: All other apparatus covered by the scope of this standard.

1.2 Summary of Results

Electrostatic Discharges	4kV Contact, 8kV Air Discharges	Complied with Criterion B
Radiated Fields	3 V/m, 1kHz 80% AM, 80-1000 MHz	Complied with Criterion A
Fast Transient Bursts	1kV mains	Complied with Criterion A
	0.5kV Signal Lines, 0.5kV DC lines	Not applicable
Surges	1kV/ 2kV mains	Complied with Criterion B
Conducted Disturbances	3Vrms mains, 1kHz 80% AM, 0.15-80 MHz	Complied with Criterion A
	1Vrms signal lines, 1Vrms DC lines, 1kHz	Not applicable
Voltage Dips & Interruptions	100% dip 10ms, 60% dip for 200ms, 30% dip for 1000ms	Complied with Criterion B



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2.0 GENERAL INFORMATION

(Information supplied by the Client)

Test Sample: BLDC Swimming Pool Pumps

1 HP Pump:

Microprocessor: Microchip dsPIC30F3011 (power board),
PIC16F1946 (Premium User Panel),
PIC16F1936
Crystal frequency: Internal 7.37 MHz
Highest operating freq: 118 MHz
Input Supply: 230V nominal, 215V to 265V, 7A max, 50 Hz

2 HP Pump with PFC:

Microprocessor: Microchip dsPIC30F3011 (power board),
PIC16F1946 (Premium User Panel),
PIC16F1936
Crystal frequency: Internal 7.37 MHz
Highest operating freq: 118 MHz
Input Supply: 230V nominal, 210V to 265V, 10A max, 50 Hz

2.1 Description

The test samples are swimming pool pumps with multiple speeds, inbuilt timers (some models) and inbuilt Power Factor correction (some models).

2.2 Operating Conditions

Testing was performed with the EUT operating continuously, running (dry) at a speed of 2850 rpm, with LED status visually monitored for degradation.

2.3 Modifications

No modifications were performed.



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3.0 TEST REQUIREMENTS & PERFORMANCE CRITERIA

3.1 Regulations and Standards Applied

**EN55014-2: 1997 Amendment 1: 2001 Amendment 2: 2008
(CISPR14-2: 2008 Ed 1.2)**

Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus

Part 2: Immunity – Product family standard

IEC61000-4-2: 2001 Ed 1.2

Electromagnetic Compatibility - Part 4-2: Testing and Measurement Techniques – Electrostatic Discharge immunity test.

IEC61000-4-3: 2008 Ed 3.1

Electromagnetic Compatibility - Part 4-3: Testing and Measurement Techniques – Radiated, radio-frequency electromagnetic field immunity test.

IEC61000-4-4: 2004 Ed 2

Electromagnetic Compatibility - Part 4-4: Testing and Measurement Techniques – Electrical fast transient/ burst immunity test.

IEC61000-4-5: 2005 Ed 2

Electromagnetic Compatibility - Part 4-5: Testing and Measurement Techniques – Surge immunity test

IEC61000-4-6: 2006 Ed 2.2

Electromagnetic Compatibility - Part 4-6: Testing and Measurement Techniques – Immunity to conducted disturbances induced by radio-frequency fields

IEC61000-4-11: 2004 Ed 2

Electromagnetic Compatibility - Part 4-11: Testing and Measurement Techniques – Voltage dips, short interruptions and voltage variations immunity tests

3.2 EN55014-2: 1997 Amendment 1: 2001 Amendment 2: 2008 (CISPR14-2: 2008 Ed 1.2)

Clause 1	Scope and object	Noted
Clause 2	Normative references	Noted
Clause 3	Terms and Definitions	Noted
Clause 4	Classification of apparatus	Noted, the test sample was classified as a Category IV device
Clause 5	Tests	Tested to requirements of Tables 1 to 13 as applicable. Testing was performed in accordance to IEC61000-4-2, IEC61000-4-3, IEC61000-4-4, IEC61000-4-5, IEC61000-4-6 and IEC61000-4-11.
Clause 6	Performance Criteria	Noted, refer also to Section 3.3 of this report
Clause 7	Applicability of immunity tests	Noted
Clause 8	Conditions during testing	Noted
Clause 9	Assessment of conformity	Noted, one sample tested
Clause 10	Product documentation	Noted



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3.3 Test Sample Performance Criteria

The following performance criteria were used to determine the pass/fail status for immunity tests. Refer also to Clauses 6 and 7 of EN55014-2.

Performance Criterion A

The apparatus shall continue to operate as intended during the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance Criterion B

The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. During the test, degradation of performance is allowed, however. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance Criterion C

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls, or by any operation specified in the instructions for use.

The product standard or manufacturer determined the following pass criteria.

Test	Pass	Fail
Electrostatic Discharges	Criterion A or B	Criterion C
Radiated RF Fields	Criterion A	Criterion B or C
Transient Bursts	Criterion A or B	Criterion C
High Voltage Surge	Criterion A or B	Criterion C
Conducted Disturbances	Criterion A	Criterion B or C
Voltage Dips & Interruptions	Criterion A, B or C	Hardware Failure



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4.0 TEST RESULTS

4.1 Immunity to Electrostatic Discharge (IEC61000-4-2)

4.1.1 Test Procedure

This test was performed as per EMC Technologies test procedure TP801-2 and IEC61000-4-2. A minimum of ten discharges for each polarity were applied at each level.

4.1.2 Test Climatic Conditions

Shielded Room Temperature: 19°C
Relative Humidity: 63%

4.1.3 Discharge Points

Electrostatic discharge points were applied to each test sample (1 HP Pump & 2 HP pump with PFC) at the following points:

Indirect contact discharges were applied to the horizontal coupling plane (HCP) at one point on each of the four sides of the EUT.

Indirect contact discharges were applied to the vertical coupling plane (VCP) with the VCP placed along the four sides of the EUT.

Direct contact discharges were applied to the following points:

- Rear comms access panel screws
- Filter mounting bolts
- Motor mounting bolts
- Motor chassis

Direct air discharges were applied to the following points:

- Mains termination
- Comms cable termination
- Control buttons
- Chassis surround

4.1.4 Results

Testing was performed to the requirements of Table 1 of EN55014-2.

1 HP Pump

Contact Discharges	Level	Voltage	Response
Horizontal Coupling Plane	1	± 2kV	No effect
Horizontal Coupling Plane	2	± 4kV	No effect
Vertical Coupling Plane	1	± 2kV	No effect
Vertical Coupling Plane	2	± 4kV	No effect
Direct	1	± 2kV	No effect
Direct	2	± 4kV	*Code 1

Air Discharges	Level	Voltage	Response
Insulating Surfaces	1	± 2kV	No effect
Insulating Surfaces	2	± 4kV	No effect
Insulating Surfaces	3	± 8kV	No effect

Response Codes:

***Code 1:** Contact discharges to the chassis would cause the motor to stop – self-recovers within thirty seconds

Results: No effects were noted for air discharges – complied with Criterion A. For contact discharges, effects were noted (refer to Response Code 1). These were within the allowed performance degradation specified by the manufacturer. The EUT complied with Criterion B.

Conclusion: The EUT complied with the performance criteria.

2 HP Pump with PFC

Contact Discharges	Level	Voltage	Response
Horizontal Coupling Plane	1	± 2kV	No effect
Horizontal Coupling Plane	2	± 4kV	No effect
Vertical Coupling Plane	1	± 2kV	No effect
Vertical Coupling Plane	2	± 4kV	No effect
Direct	1	± 2kV	No effect
Direct	2	± 4kV	*Code 1

Air Discharges	Level	Voltage	Response
Insulating Surfaces	1	± 2kV	No effect
Insulating Surfaces	2	± 4kV	No effect
Insulating Surfaces	3	± 8kV	No effect

Response Codes:

***Code 1:** Contact discharges to the chassis would cause the motor to stop – self-recovers within thirty seconds

Results: No effects were noted for air discharges – complied with Criterion A. For contact discharges, effects were noted (refer to Response Code 1). These were within the allowed performance degradation specified by the manufacturer. The EUT complied with Criterion B.

Conclusion: The EUT complied with the performance criteria.



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4.2 Immunity to Radiated electromagnetic fields (IEC61000-4-3)

4.2.1 Test Procedure

This test was performed as per EMC Technologies test procedure TP1000-4-3, IEC61000-4-3.

The radiating antenna was positioned at a distance of 3m from the EUT. The dwell time at each frequency was 3 seconds with a frequency step rate of 1%. Three sides of the EUT (RHS, LHS, Rear) were directly exposed to the transmitting antenna. This was performed at the client's request since the exposed sides were deemed to be the most susceptible.

4.2.2 Test Climatic Conditions

Shielded Room Temperature: 17°C
Relative Humidity: 80%

4.2.3 Results

Testing was performed to the requirements of Table 11 of EN55014-2.

1 HP Pump

Field Level	Side	Polarisation	Modulation	Frequency Band	Response
3V/m	Rear	Vertical	1 kHz 80% AM	80-1000 MHz	No effect
3V/m	Rear	Horizontal	1 kHz 80% AM	80-1000 MHz	No effect
3V/m	LHS	Vertical	1 kHz 80% AM	80-1000 MHz	No effect
3V/m	LHS	Horizontal	1 kHz 80% AM	80-1000 MHz	No effect
3V/m	RHS	Vertical	1 kHz 80% AM	80-1000 MHz	No effect
3V/m	RHS	Horizontal	1 kHz 80% AM	80-1000 MHz	No effect

Results: No effects were noted. The EUT complied with Criterion A.

Conclusion: The EUT complied with the performance criteria.

2 HP Pump with PFC

Field Level	Side	Polarisation	Modulation	Frequency Band	Response
3V/m	Rear	Vertical	1 kHz 80% AM	80-1000 MHz	No effect
3V/m	Rear	Horizontal	1 kHz 80% AM	80-1000 MHz	No effect
3V/m	LHS	Vertical	1 kHz 80% AM	80-1000 MHz	No effect
3V/m	LHS	Horizontal	1 kHz 80% AM	80-1000 MHz	No effect
3V/m	RHS	Vertical	1 kHz 80% AM	80-1000 MHz	No effect
3V/m	RHS	Horizontal	1 kHz 80% AM	80-1000 MHz	No effect

Results: No effects were noted. The EUT complied with Criterion A.

Conclusion: The EUT complied with the performance criteria.

4.3 Immunity to Electrical Fast Transients (IEC61000-4-4)

4.3.1 Test Procedure

This test was performed as per EMC Technologies test procedure TP801-4 and IEC61000-4-4. The transients were applied for 2 minutes at each polarity.

4.3.2 Test Climatic Conditions

Shielded Room Temperature: 19°C
Relative Humidity: 63%

4.3.3 Power Lines (AC ports)

Testing was performed to the requirements of Table 4 of EN55014-2.

1 HP Pump

Injection Method	Level	Voltage	Repetition Rate	Response
Direct – active	1	± 0.5 kV	5 kHz	No effect
Direct – active	2	± 1.0 kV	5 kHz	No effect
Direct – neutral	1	± 0.5 kV	5 kHz	No effect
Direct – neutral	2	± 1.0 kV	5 kHz	No effect
Direct – earth	1	± 0.5 kV	5 kHz	No effect
Direct – earth	2	± 1.0 kV	5 kHz	No effect
Direct – active, neutral earth	1	± 0.5 kV	5 kHz	No effect
Direct – active, neutral earth	2	± 1.0 kV	5 kHz	No effect

Results: No effects were noted. The EUT complied with Criterion A.

Conclusion: The EUT complied with the performance criteria.

2 HP Pump with PFC

Injection Method	Level	Voltage	Repetition Rate	Response
Direct – active	1	± 0.5 kV	5 kHz	No effect
Direct – active	2	± 1.0 kV	5 kHz	No effect
Direct – neutral	1	± 0.5 kV	5 kHz	No effect
Direct – neutral	2	± 1.0 kV	5 kHz	No effect
Direct – earth	1	± 0.5 kV	5 kHz	No effect
Direct – earth	2	± 1.0 kV	5 kHz	No effect
Direct – active, neutral earth	1	± 0.5 kV	5 kHz	No effect
Direct – active, neutral earth	2	± 1.0 kV	5 kHz	No effect

Results: No effects were noted. The EUT complied with Criterion A.

Conclusion: The EUT complied with the performance criteria.

4.3.4 Power Lines (DC ports)

Not applicable, test samples have no DC ports.

4.3.5 Signal & Control Lines

Not applicable, signal and control cables are less than 3 metres in length.



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4.4 Immunity to Surges (IEC61000-4-5)

4.4.1 Test Procedure

This test was performed as per EMC Technologies test procedure TP1000-4-5 and IEC61000-4-5. Five impulses per polarity were applied at repetition rates of sixty seconds (common mode) and twenty seconds (differential mode).

Positive surges were applied at phase angles of 90° with respect to the phase of the incoming mains. Negative surges were applied at phase angles of 270° with respect to the phase of the incoming mains, as per Clause 5.6 of the standard.

4.4.2 Test Climatic Conditions

Shielded Room Temperature: 19°C
 Relative Humidity: 63%

4.4.3 Power Lines (AC)

Testing was performed to the requirements of Table 12 of EN55014-2.

1 HP Pump

Power Line	Level	Voltage	Response
Common-mode (Active-Earth)	3	± 2.0 kV	*Code 1
Common-mode (Neutral-Earth)	3	± 2.0 kV	*Code 1
Differential-mode (Active-Neutral)	2	± 1.0 kV	No effect

Response Codes:

***Code 1:** EUT switches off with every surge and eventually turns status LED “red” with all motor speed LEDs flashing green – self-recovers after 60 seconds.

Results: Effects were noted (refer to Response Code 1). These were within the allowed performance degradation specified by the manufacturer. The EUT complied with Criterion B.

Conclusion: The EUT complied with the performance criteria.

2 HP Pump with PFC

Power Line	Level	Voltage	Response
Common-mode (Active-Earth)	3	± 2.0 kV	*Code 1
Common-mode (Neutral-Earth)	3	± 2.0 kV	*Code 1
Differential-mode (Active-Neutral)	2	± 1.0 kV	No effect

Response Codes:

***Code 1:** EUT switches off with every surge, eventually stops and displays error message “BUSC - self-recovers after 3 minutes.

Results: Effects were noted (refer to Response Code 1). These were within the allowed performance degradation specified by the manufacturer. The EUT complied with Criterion B.

Conclusion: The EUT complied with the performance criteria.



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4.5 Immunity to Conducted Disturbances (IEC61000-4-6)

4.5.1 Test Procedure

This test was performed as per EMC Technologies test procedure TP1000-4-6 and IEC61000-4-6. The dwell time at each frequency was 3 seconds with a frequency step rate of 1%.

4.5.2 Test Climatic Conditions

Shielded Room Temperature: 20°C
 Relative Humidity: 56%

4.5.3 Power Lines (AC ports)

Testing was performed to the requirements of Table 10 of EN55014-2. The disturbance was injected directly onto the power cable using a CDN (coupling-decoupling network).

1 HP Pump

Cables	Injection Method	Voltage	Modulation	Frequency Band	Response
AC Power	CDN-M3	3 Vrms	1kHz 80% AM	0.15 - 80 MHz	No effect

Results: No effects were noted. The EUT complied with Criterion A.
Conclusion: The EUT complied with the performance criteria.

2 HP Pump with PFC

Cables	Injection Method	Voltage	Modulation	Frequency Band	Response
AC Power	CDN-M3	3 Vrms	1kHz 80% AM	0.15 - 80 MHz	No effect

Results: No effects were noted. The EUT complied with Criterion A.
Conclusion: The EUT complied with the performance criteria.

4.5.4 Power Lines (DC ports)

Not applicable, EUT has no DC ports.

4.5.5 Signal and Control Lines

Not applicable, signal and control cables are less than 3 metres in length.

4.6 Immunity to Voltage Interruptions (IEC61000-4-11)

4.6.1 Test Procedure

This test was performed as per EMC Technologies test procedure TP1000-4-11 and IEC61000-4-11. Testing was performed to the requirements of Table 13 of EN55014-2. The dips were applied at a phase angles of 0° and 180° with respect to the phase of the incoming mains (zero-crossings). The rated input was 230VAC 50Hz.

4.6.2 Test Climatic Conditions

Shielded Room Temperature: 19°C
Relative Humidity: 63%

4.6.3 Results

1 HP Pump

Ut	Test Level (in % Ut)	Angle	Test Duration (ms)	No. of Tests	Interval (between test event)	Response
240V	0	0°, 180°	10	3	10 seconds	No effect
240V	40	0°, 180°	200	3	10 seconds	*Code 1
240V	70	0°, 180°	500	3	10 seconds	*Code 1

Ut is the rated voltage for the EUT.

Response Codes:

***Code 1:** EUT motor speed varies (sags) for duration of the test – self-recovers

Results: Effects were noted (refer to Response Code 1). These were within the allowed performance degradation specified by the manufacturer. The EUT complied with Criterion B.

Conclusion: The EUT complied with the performance criteria.

2 HP Pump with PFC

Ut	Test Level (in % Ut)	Angle	Test Duration (ms)	No. of Tests	Interval (between test event)	Response
240V	0	0°, 180°	10	3	10 seconds	No effect
240V	40	0°, 180°	200	3	10 seconds	*Code 1
240V	70	0°, 180°	500	3	10 seconds	*Code 1

Ut is the rated voltage for the EUT.

Response Codes:

***Code 1:** EUT motor speed varies (sags) for duration of the test – self-recovers

Results: Effects were noted (refer to Response Code 1). These were within the allowed performance degradation specified by the manufacturer. The EUT complied with Criterion B.

Conclusion: The EUT complied with the performance criteria.

5.0 CONCLUSION

The BLDC Swimming Pool Pumps, tested on behalf of Astral Pool Pty Ltd, complied with the immunity requirements of EN55014-2 for a Category IV device.



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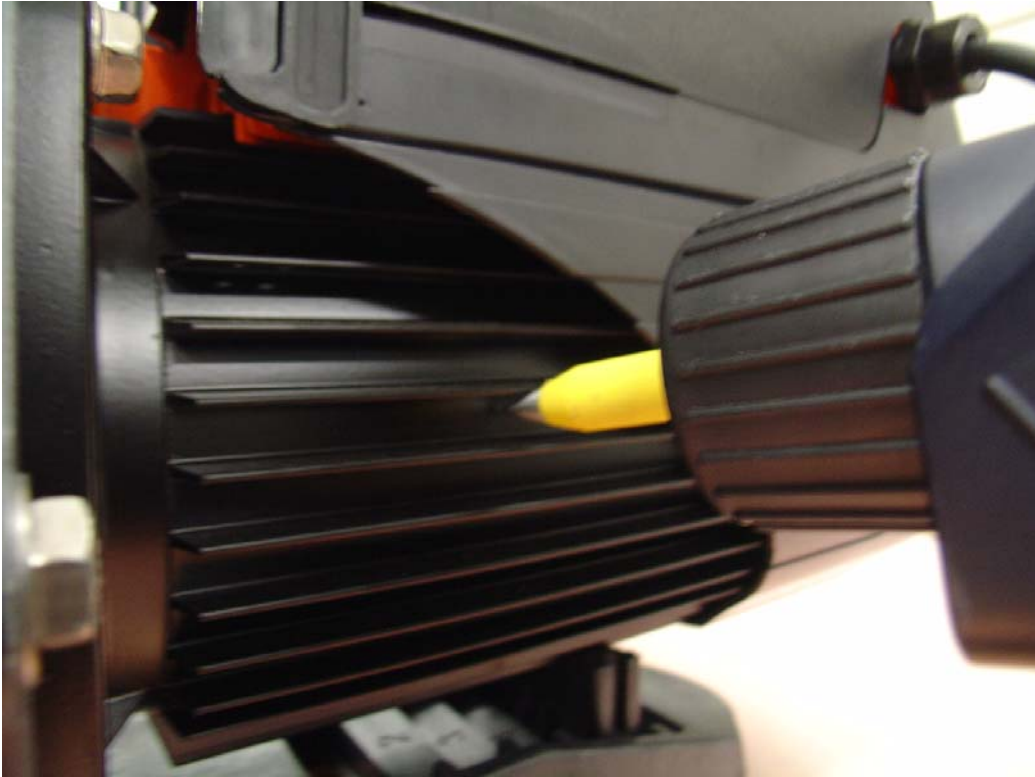
APPENDIX A1 TEST SAMPLE PHOTOGRAPHS

Electrostatic Discharges Test Setup



APPENDIX A2 TEST SAMPLE PHOTOGRAPHS

Electrostatic Discharges Test Setup

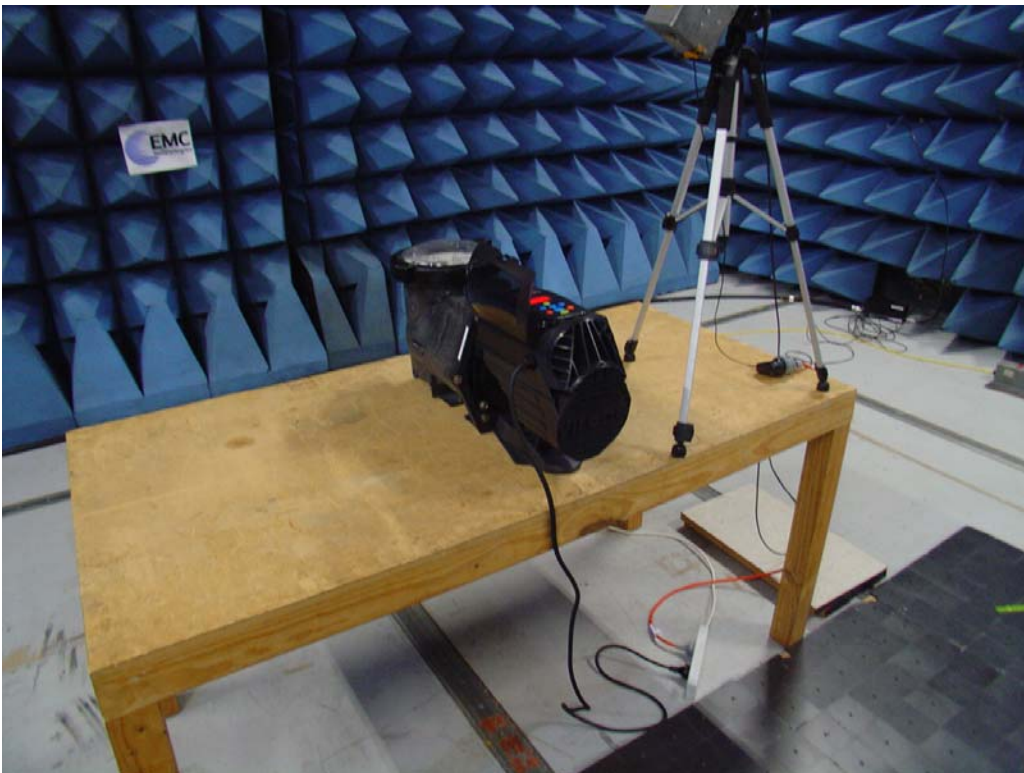
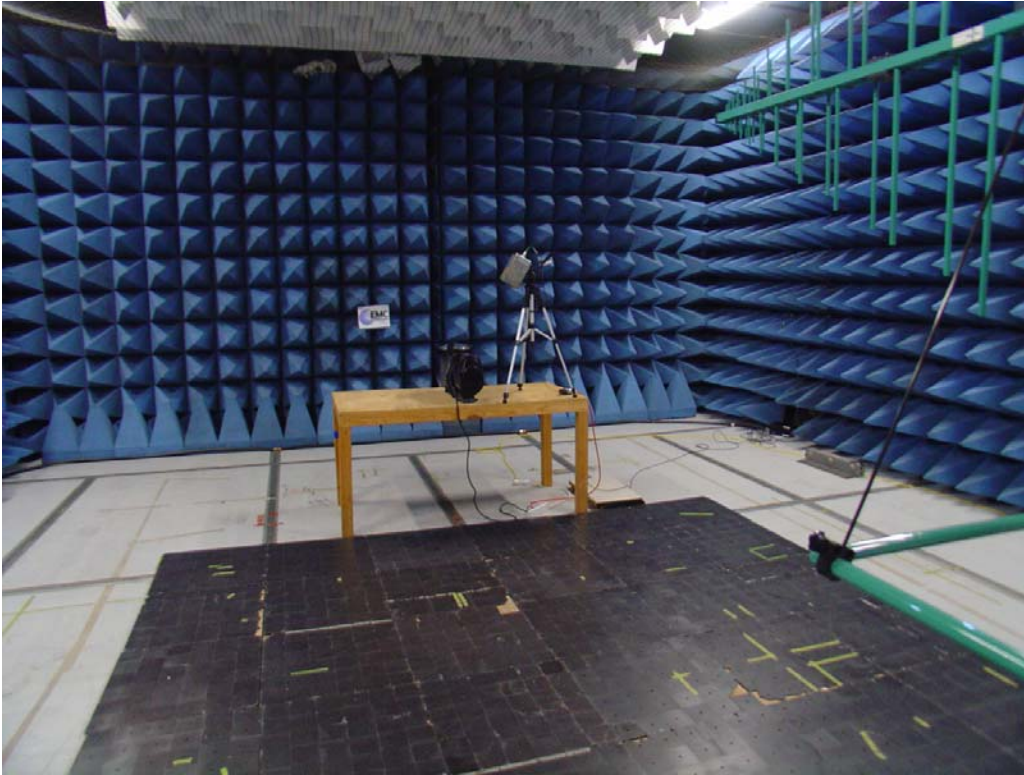


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APPENDIX A3 TEST SAMPLE PHOTOGRAPHS

Radiated Fields Test Setup

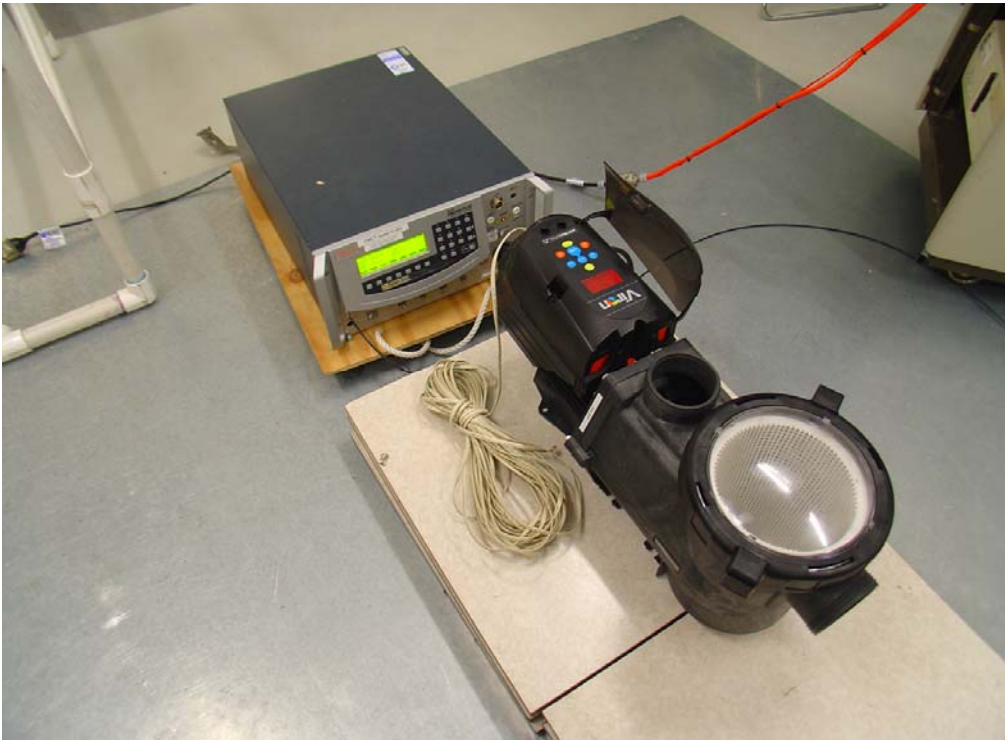


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APPENDIX A4 TEST SAMPLE PHOTOGRAPHS

Transients/ Surges/ Voltage Dips and Interruptions Test Setup



Conducted Disturbance Test Setup



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APPENDIX A5 TEST SAMPLE PHOTOGRAPHS

Test Sample



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