Field Validation of Equipotential Bonding Systems for Permanent In-ground Swimming Pools

- **Date of Report:** June 20, 2025
- **Prepared For:** Pool Industry Council and Regulatory Stakeholders
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- **Testing Conducted By**: Industrial Inspection and Analysis (IIA) - ISO 9001:2015

Certification of Independence

SunSmart Engineering hereby certifies that it was commissioned by the Pool Industry Council (PIC) to conduct an independent evaluation of equipotential bonding performance in residential swimming pools across Central Florida.

SunSmart Engineering affirms the following:

- It does not hold, nor will it seek to acquire, any financial interest in either the Pool Industry Council or any other associated organization or company.
- It has not entered into any agreement, express or implied, that would influence the outcome of this study.
- The objective of this study was not to endorse or discredit any particular bonding method or product, but rather to evaluate the field performance of different bonding configurations using standard electrical safety and engineering practices.
- The scope of this project was to observe and measure equipotential voltage performance in existing swimming pools. Any investigation into the cause of any unknown equipotential voltage sources or “stray current” was not in the scope of this study.
- All findings, interpretations, and conclusions in this report are the result of independent technical analysis, supported by data gathered through on-site measurement and scientifically accepted testing procedures, including protocols derived from the Electric Power Research Institute (EPRI) and the National Electrical Code (NEC).
- The data presented herein are offered in good faith, without prejudice, and are suitable for review by regulatory authorities, safety professionals, and industry stakeholders.

Acknowledgements

SunSmart Engineering would like to thank the following organizations for their valuable contributions and support throughout this study. Any opinions, findings, conclusions, or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of any other party directly or indirectly involved.

- Pool Industry Council (PIC)
- Industrial Inspection and Analysis (ILA)
- Holland Pools & Spas – Longwood, FL
- Aqua Blue Pools & Spas – Melbourne, FL
- Mad River Pool Construction – Maitland, FL

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I. Executive Summary

This report summarizes the results of an equipotential bonding validation study conducted across nine residential pools in Central Florida between April 7 and June 12, 2025. The Pool Industry Council (PIC) commissioned SunSmart Engineering to conduct this independent testing. The objective of this study was not to determine strict code compliance, but rather to analyze and compare the real-world performance of different bonding methods used across pool construction types. Particular attention was given to understanding the behavior of #8 AWG copper wire loops, copper reinforcement grids, and inline water bond plates in operational field conditions.

SunSmart Engineering enlisted the assistance of Industrial Inspection and Analysis (ILA), an accredited third-party testing laboratory, who provided professional test technicians, calibrated equipment, and oversight of the testing at all sites.

While the National Electrical Code (NEC) does not specify a voltage performance threshold, a value of **1.0 VAC under 500 ohm load** has been widely adopted in technical literature and validation testing protocols (e.g., EPRI, IEEE, etc.) as a practical upper bound for safe equipotential bonding effectiveness. This threshold was used in the analysis below as a comparative metric, not as a legal or enforcement standard.

II. Technical Background

Equipotential bonding minimizes voltage gradients between conductive parts and surfaces within and around pool environments. This measure reduces shock hazard potential due to stray or fault currents. Bonding all conductive parts ensures voltage differences stay within tolerable limits for human safety. The Electric Power Research Institute (EPRI), IEEE, and Consumer Product Safety Commission (CPSC) have highlighted cases of pool electrocutions, primarily due to improper bonding of metallic parts and lighting fixtures. EPRI's research has established recommended methods for voltage gradient testing, which influenced state and industry guidelines.

NEC 680.26 establishes the requirements for equipotential bonding in and around permanently installed swimming pools. Its primary purpose is to ***minimize*** voltage gradients that could occur between conductive parts (e.g., pool water, decks, metal objects, electrical equipment) during a fault or leakage event. By electrically interconnecting all metallic and conductive components using a copper bonding conductor or approved methods, the code aims to prevent hazardous shock conditions and ensure safe touch and step potentials for pool users. **Figures 1 & 2** graphically detail this.

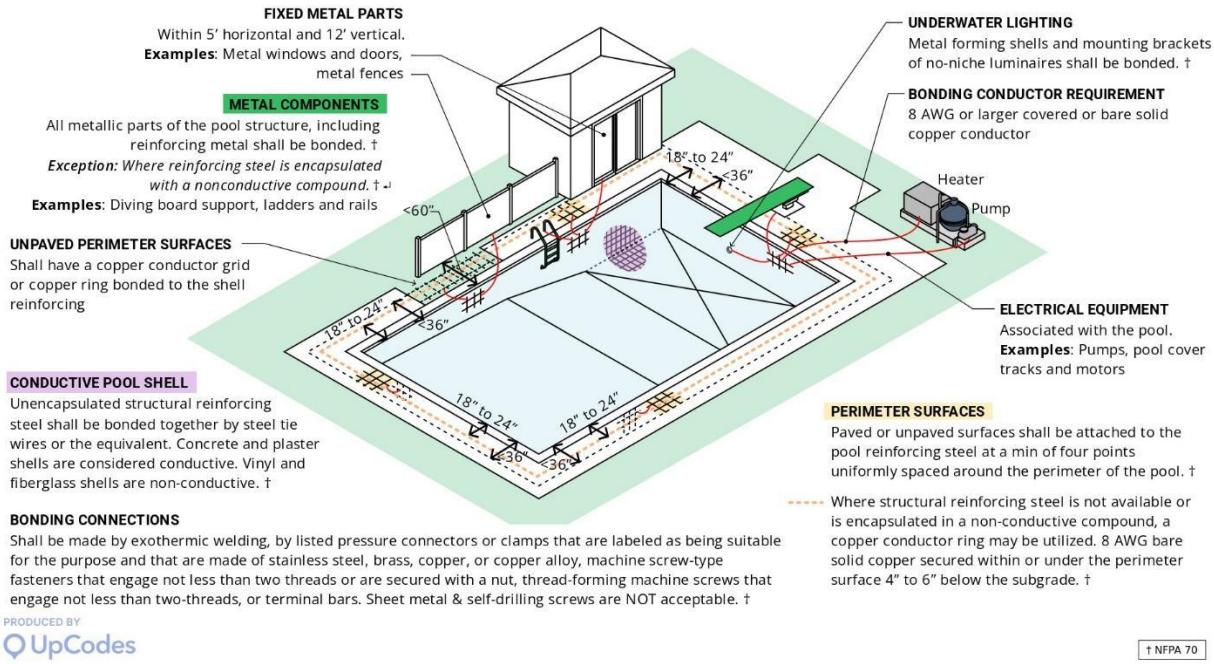

FIGURE 1 – EQUIPOTENTIAL BONDING OF SWIMMING POOLS (NEC 680.26)

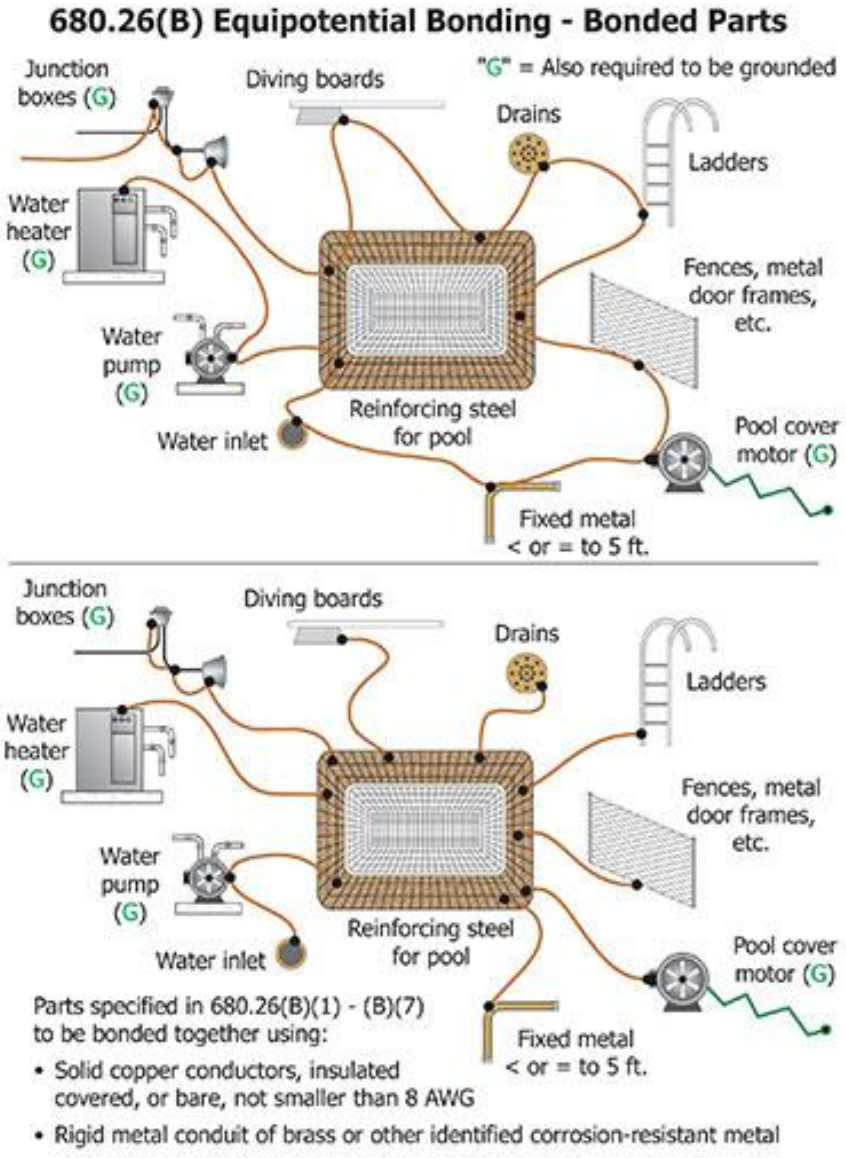

FIGURE 2. EQUIPOTENTIAL BONDING GRID FORMS AN EQUIPOTENTIAL BONDING PLANE IN AND AROUND THE POOL AREA. THIS BONDING PLANE CAN BE ACHIEVED WITH ONE "ALTERNATIVE MEANS" BONDING JUMPER (TOP) OR MULTIPLE BONDING JUMPERS (BOTTOM).

Historical Timeline of Equipotential Bonding Requirements in Florida

The evolution of equipotential bonding requirements in Florida reflects a commitment to enhancing pool safety through alignment with national standards and empirical research.

2005: Introduction of Equipotential Bonding in NEC

The 2005 edition of the National Electrical Code (NEC) introduced the term "equipotential bonding," replacing the earlier "common bonding grid." This change aimed to clarify the purpose of bonding in reducing voltage gradients in pool areas. NEC 680.26 outlined requirements for bonding conductive pool shells, perimeter surfaces, and metallic components.

2007: Florida's Adoption of Alternative Bonding Methods

In response to legislative direction, Florida proposed Rule 9B-3.0477, allowing an alternative to the copper bonding grid specified in the 2005 NEC. The rule permitted the use of a single #8 AWG solid copper conductor for equipotential bonding under certain conditions, providing a cost-effective solution without compromising safety. Florida Administrative Rules

2008: Inclusion of Pool Water Bonding

The 2008 NEC expanded bonding requirements to include an intentional bond to the pool water, recognizing that water itself could be a conductive path for stray voltages. This addition mandated a conductive surface area of at least 9 square inches in contact with the pool water, connected to the equipotential bonding system.Florida Building

2011: Reinforcement of Bonding Requirements

The 2011 NEC reinforced existing bonding requirements and clarified the necessity of bonding for various pool components, including underwater lighting and fixed metal parts. These provisions aimed to address ambiguities and ensure comprehensive bonding practices.Florida Building+1InterNACHI® Forum+1

2014: Florida Building Code Alignment

Florida's 5th Edition Building Code (2014) incorporated the updated NEC provisions, emphasizing the importance of equipotential bonding in reducing voltage gradients. The code mandated bonding for all

conductive pool shells, perimeter surfaces, and metallic components, aligning state requirements with national standards.Florida Building

2016: Florida Building Commission Advisory

In 2016, the Florida Building Commission issued a fact sheet titled "Swimming Pool Electrical Safety," highlighting the critical role of equipotential bonding in pool safety. The document clarified when bonding is required and provided guidance on proper implementation. Florida Building

2020: Emphasis on Bonding in Florida Building Code

The 7th Edition of the Florida Building Code (2020) continued to emphasize the necessity of equipotential bonding, incorporating the latest NEC standards. The code specified bonding requirements for existing pools, mandating the use of solid copper conductors not smaller than #8 AWG. ICC Digital Codes+1ICC Digital Codes+1

2023: Current Standards and Practices

The 8th Edition of the Florida Building Code (2023) maintains stringent equipotential bonding requirements, ensuring that all new and existing pools adhere to safety standards. The code continues to reference NEC 680.26, mandating comprehensive bonding of all conductive components to mitigate electrical hazards.

TIA 23-9

In the first printing of the 2023 NEC, § 680.26(B)(2)(b) allowed a single #8 AWG bare copper conductor (“copper ring”) to serve as the alternate perimeter-bonding means whenever exposed reinforcing steel was absent or encapsulated, regardless of whether the overlying surface was concrete, masonry pavers, or bare soil. The conductor was to be located 450–600 mm (18–24 in.) from the pool wall and 100–150 mm (4–6 in.) below sub-grade, with only listed splices or exothermic welds permitted.

Tentative Interim Amendment 23-9 (Log 1687, effective 4/10/2023) rewrites § 680.26(B)(2) and withdraws that option for all *conductive paved portions* of the perimeter. The revised § 680.26(B)(2)(a) now requires one of three bonded assemblies under concrete, shotcrete, gunite, tile, or masonry-paver decks:

- Un-encapsulated structural reinforcing steel tied in accordance with § 680.26(B)(1)(a);
- ASTM 6 × 6-W2.0 × W2.0 welded-wire reinforcement or No. 3 rebar in a 300 mm (12 in.) grid; or

- A listed #8 AWG copper or steel conductor grid, also in a 300 mm grid pattern, all located no more than 150 mm (6 in.) below finished grade.

The TIA in question was issued on 3/21/2023 for the NEC 2023 and required both the copper grid and any un-encapsulated steel mesh used for this purpose must carry a corrosion- and mechanical-performance listing. It was left to each AHJ whether to accept this TIA and/or when the effective date would be.

The single #8 AWG copper ring is retained—but only in re-designated § 680.26(B)(2)(b)—for *unpaved portions* of the perimeter surface, and then only where the area is "not intended to have direct access to swimmers." Depth is now referenced to *finished grade* instead of sub-grade, and the original lateral offset and burial depth remain unchanged.

Under the TIA, a linear #8 AWG copper ring can no longer be specified beneath concrete or paver decks. These surfaces must be bonded with either embedded reinforcing steel, welded-wire reinforcement, or a listed grid having two-dimensional continuity. The #8 AWG copper ring has been relegated to landscaped or otherwise non-traffic areas, reflecting test data that showed a single conductor to be inadequate for controlling touch-potential gradients in conductive decks.

Key References:

- **NEC 680.26 (2023 Edition)** – Bonding requirements for permanently installed pools
- **IEEE 1695-2024** - Guide for Understanding, Diagnosing, and Mitigating Stray and Contact Voltage
- **EPRI** – Field procedures for bonding validation
- **Florida Building Commission Advisory (2016)** – Testing standards for equipotential planes
- **CPSC Electrical Injury Reports (2002–2014)**

A commonly referenced safety threshold is **1.0 VAC at a 500-ohm load**, approximating the human body's resistance in a wet environment. Voltages below this level are considered safe for barefoot human exposure.

III. Human Shock Risk and Voltage Thresholds in Pool Environments

Introduction

Electrical safety in swimming pool environments is paramount due to the increased risk of electric shock in wet conditions. Equipotential bonding systems are designed to minimize voltage gradients, thereby reducing the risk of electric shock. However, the *National Electrical Code (NEC) Section 680.26* outlines general bonding requirements but does **not** specify a particular voltage limit for performance under fault conditions (see NEC 2023, Section 680.26).

To address this gap, industry stakeholders have adopted empirical benchmarks—most notably the **1.0 VAC across a 500-ohm load**—to assess the effectiveness of bonding systems under real-world conditions.

Rationale for the 500-Ohm Load

The selection of a 500-ohm load in voltage gradient testing is based on approximating the **electrical resistance of the human body under wet conditions**. According to IEC 60479-1 (https://webstore.iec.ch/en/publication/62980), the total body impedance can vary significantly depending on factors such as skin moisture, contact area, and current path. In wet conditions, resistance can fall to approximately **500 ohms**, particularly for a hand-to-foot or foot-to-ground path—a common scenario for barefoot individuals in or near a pool. This approximation is therefore considered a **conservative and technically justified baseline** for simulating realistic shock scenarios.

Origins of the 1.0 VAC Threshold

The **1.0 VAC at 500-ohm load** threshold originates from a combination of **field validation studies** and **regulatory advisories**:

- The **Electric Power Research Institute (EPRI)** conducted extensive testing of stray and contact voltages in pool environments. Their findings demonstrated that even low-level voltage gradients (as low as 1.0 VAC) across a 500-ohm resistance could produce perceptible shocks, particularly in wet barefoot conditions (EPRI Recommendations).
- The **Florida Building Commission**, in its 2016 technical sessions, supported adoption of equipotential test protocols referencing the 1.0 VAC threshold as a practical safety benchmark (Florida Building Commission – Program Committees).

Human Sensitivity to Electric Current

The severity of an electric shock depends not just on voltage but also on the current path, duration, and impedance. Using Ohm's Law:

$$I = \frac{V}{R}$$

At 1.0 VAC and 500 ohms, current equals **2 mA**, which is *above the perception threshold* but **well below levels associated with serious harm**.

Current (mA)	Physiological Effect
1	Threshold of perception
5	Slight shock, not harmful
10–20	Painful shock, loss of muscular control
50–100	Ventricular fibrillation becomes possible

These values are supported by international safety literature, including the IEEE, NFPA, and OSHA, and are formalized in IEC 60479-1.

Human Body Resistance Context

Based on conditions encountered around pools (wet skin, conductive deck, etc.), representative resistance values are as follows:

Condition	Typical Resistance (Ohms)
Dry skin (hand-to-hand)	1,000 – 100,000
Wet skin (hand-to-hand)	500 – 1,500
Foot-to-ground (wet surfaces)	300 – 1,000
Full-body path (wet conditions)	~500 (median)

Sources: IEC 60479-1, EPRI Testing Protocols, NFPA 70E

Resistance Value Used

Alternative values are sometimes proposed, but each has shortcomings in this context:

Load Value (Ohms)	Rationale
1,000	Suitable for dry environments but overestimates impedance for barefoot pool users
100	Overly conservative; does not reflect realistic human body impedance under wet conditions
500 (Used)	Balances realism and safety margin; widely used in standards for human shock simulations

This makes **500 ohms** the most appropriate reference load for voltage gradient testing in pool safety studies.

Industry Adoption and Best Practices

While not codified in the NEC, the **1.0 VAC at 500-ohm** threshold is widely used in:

- **EPRI stray voltage field validation protocols** for pools and wet areas (EPRI Field Guide)
- **ANSI/IEEE Std 80** (touch voltage guidelines for grounded systems)

By adopting this benchmark, engineers and inspectors can ensure bonding performance meets realistic and biologically informed safety criteria.

Conclusion

The **500-ohm load** simulates realistic human body resistance in wet pool conditions. Combined with the **1.0 VAC threshold**, it serves as a practical and empirically supported benchmark for assessing equipotential bonding systems. These parameters help confirm that voltage gradients in pool environments remain **far below levels capable of causing injury**, reinforcing the effectiveness of bonding designs even when small differences exist between construction methods.

IV. Field Testing Procedure

To better judge the performance of various electrical bonding methods in real-world scenarios a number of pools across the Central Florida area were measured and evaluated in April & June of 2025. The equipotential bonding evaluation was conducted to assess voltage gradients and bonding continuity across various residential pool types in accordance with empirical field standards, including EPRI guidelines and NEC Article 680.26.

Test Specimens

A total of nine residential pools were selected, categorized as follows:

- **(3)** Steel-reinforced concrete pools with **#8 AWG copper single-wire bonding ring**
- **(3)** Steel-reinforced concrete pools with **copper bonding grid**
- **(3)** Non-conductive (fiberglass) pools with **inline water bonding systems with a water bond and #8 AWG copper perimeter loop.**

All pools were assumed to be compliant with NEC 680.26 bonding and grounding provisions, with electrical equipment installed per applicable code and in operational condition. All pools were newly constructed, built by licensed contractors, and permitted and inspected by the local AHJ for code compliance with the 2023 Florida Building Code and 2020 National Electric Code. At the time of this study there were **no incidences of shocks or other electrical issues** reported by the owners or known to the author of this report.

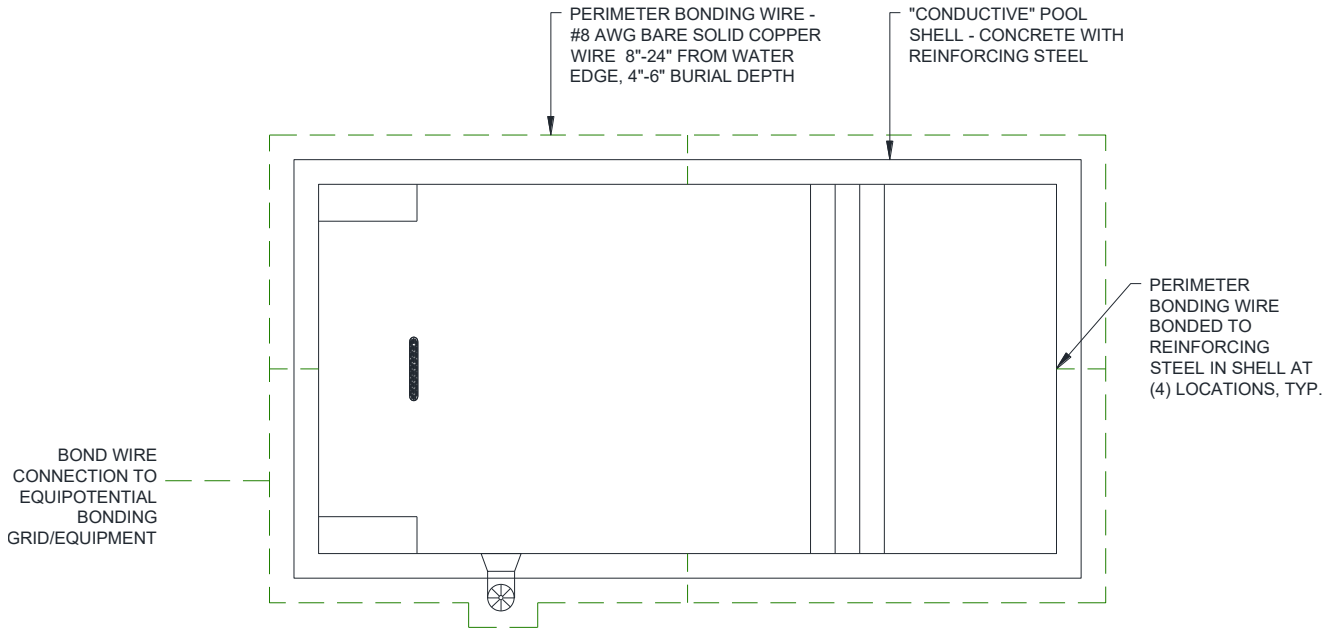

FIGURE 3 – CONDUCTIVE (CONCRETE) POOL WITH #8 COPPER PERIMETER BOND RING METHOD

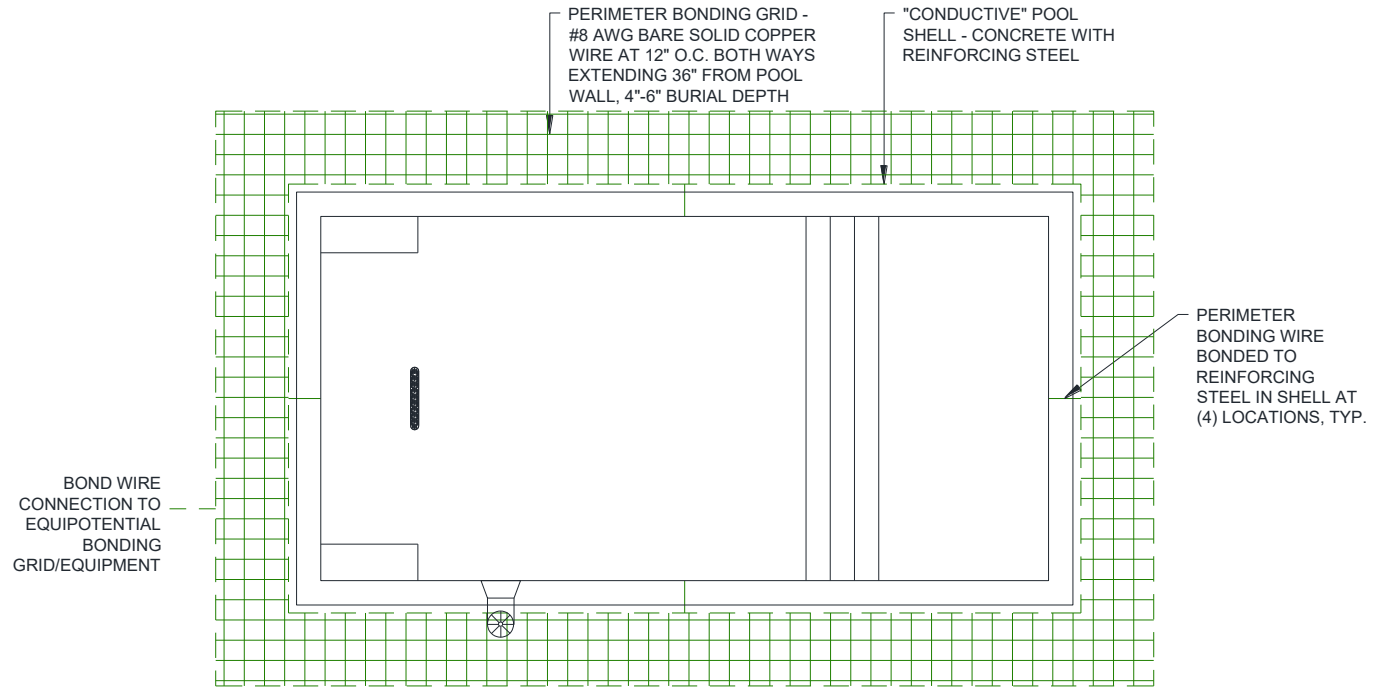

FIGURE 4 – CONDUCTIVE (CONCRETE) POOL WITH #8 COPPER PERIMETER BOND GRID METHOD

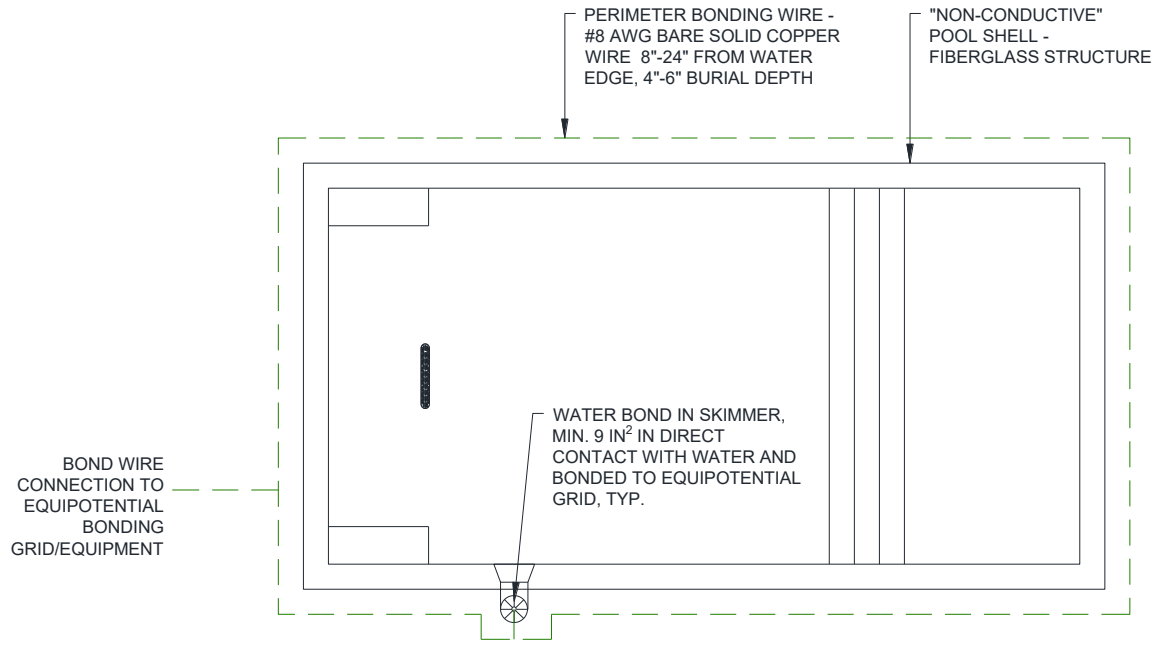

FIGURE 5 – NON-CONDUCTIVE (FIBERGLASS) POOL WITH #8 COPPER PERIMETER BOND RING & WATER BOND METHOD

Testing Protocol Overview

The testing was comprised of two components:

1. **Bonding Continuity Testing** – Measuring ohmic resistance between several bonded components to verify low-resistance continuity.
2. **Voltage Gradient Testing** – Simulating a fault current by energizing the bonding grid and measuring potential differences between the pool water and adjacent wetted decking.

Testing was non-invasive and performed only with owner permission, in partnership with the Pool Industry Council (PIC), which coordinated site access with several of its Licensed Swimming Pool Contractor members who were present during testing.

Equipment Utilized

- 1800 W, 15 A, 120 VAC Portable Power Supply
  - Used to provide power to the VARIAC unit during fault testing.
- Hewlett Packard 973A Multimeter (True RMS)
  - Calibrated: 11/29/2023
  - Calibration Expires: 11/29/2025
- Staco 3PN2520-MOD AC Variable Power Supply (VARIAC)
  - Calibration not required
  - Input: 120 VAC
  - Output: 0-280 VAC, 5 A

- Copper lead wires and clamps
- Copper ground rod
- Copper plates

Continuity Testing

The purpose of continuity testing was to **verify proper electrical continuity and functional integrity of the bonding system** at each pool site. Resistance measurements were taken using a precision digital ohmmeter to ensure that all bonded metallic components maintain a low-resistance path to the equipment grounding system.

For each pool, continuity testing was performed between the equipment grounding conductor and **three distinct bonding points** at the pool equipment pad or subpanel area, typically including:

- Bond wire at the pump motor
- Heater chassis or bonding lug
- Subpanel or control box bonding terminal

The target resistance for a properly functioning bonding system was <1.0 ohm, with most sites yielding readings well below that threshold, confirming effective electrical continuity throughout the bonding network.

Voltage Gradient Test Method

The voltage gradient test was based on procedures outlined in the **EPRI Equipotential Bonding Validation Protocol** (2015), with the following key steps:

1. **Instrumentation**
    - Digital voltmeter (sensitive to 0.0004 VAC, True RMS)
    - Inline 200Ω and 500Ω resistive load configurations
    - VARIAC voltage source (120 VAC / 0.5 A max)
    - Copper contact bars (144 in^2) for water and deck reference points
    - Remote earth ground rod (driven into ground remote from equipment and pool)
2. **Pre-Test Baseline Measurement**
    - All pools were tested with their equipment powered on and the circulation pump running as well as in an “off” state with all power circuits de-energized.
    - Any pre-existing voltage gradients were measured between the water and wetted deck at 1–5 ft distances to establish a baseline with the pool equipment on and off.
3. **Measurement Procedure**
    - The bonding grid of the pool was energized using the VARIAC hot lead.
        - In the case of the (3) non-conductive, fiberglass pools the hot lead was placed directly in contact with the pool water at a minimum depth of 12”. In these cases each pool had a water bonding plate in the skimmer.

- The VARIAC neutral was connected to a remote grounding electrode driven into the earth a minimum of 24”.
- Measurements were taken between the water and wetted deck at 1, 2, 3, 4, and 5 ft distances from the water’s edge.
  - While the NEC defines the “perimeter” surface as extending 3 ft. from the inside of the pool wall the tests were done to a distance of up to 5 ft. from the inside of the pool wall. This was done to align with previous testing published on the subject and because a person in the pool could conceivable reach out and touch the deck 5ft. from the water and still be in contact with the pool water.
- Each measurement was performed under:
  - **Open-circuit (VOC)**
  - **At 200 ohms (V200)**
  - **At 500 ohms (V500)**
- The test was repeated under three fault voltage levels: **60 VAC**, **90 VAC**, and **120 VAC**.

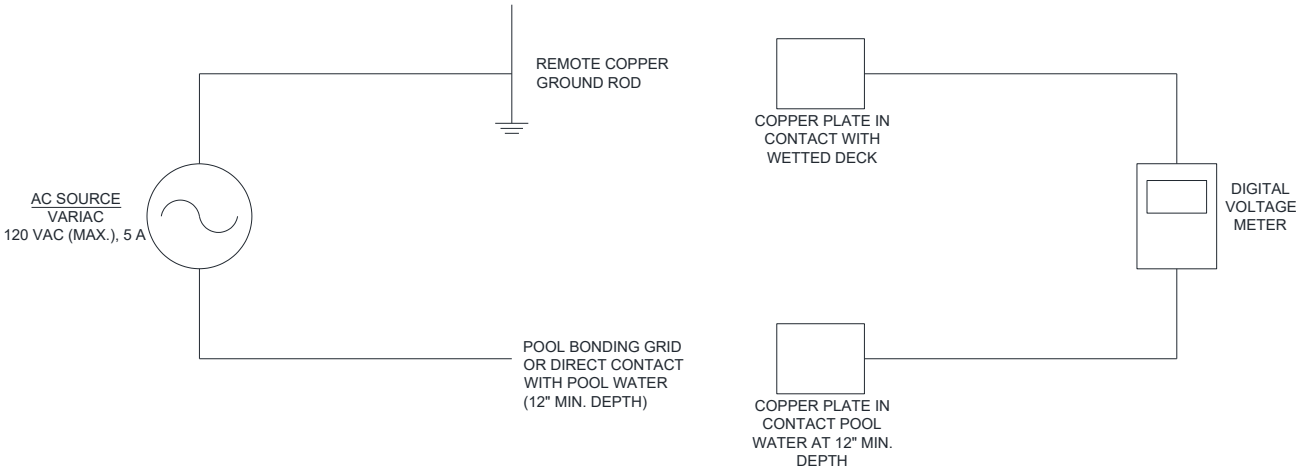

FIGURE 6 – SIMPLIFIED TEST SETUP DIAGRAM

Purpose of Multi-Voltage and Resistive Load Testing

To fully characterize the performance of each pool’s equipotential bonding system under simulated fault conditions, tests were conducted using **three voltage levels**—**60 VAC**, **90 VAC**, and **120 VAC**—and under **three load conditions**: open circuit (VOC), 200-ohm, and 500-ohm resistive loads. These levels were selected to represent low, intermediate, and full-line fault stressors consistent with EPRI modeling protocols.

This approach served several purposes:

1. Simulating Varying Fault Severity

- **60 VAC and 90 VAC** represent moderate fault scenarios, such as partial line-to-ground faults or transient energy from external circuits.
- **120 VAC** reflects a full-phase fault, simulating the worst-case scenario of energized pool bonding infrastructure relative to remote earth.

Testing across these voltages allowed for:

- Assessment of voltage gradient linearity and attenuation with distance.
- Identification of bonding systems that become unstable or nonlinear under higher stress conditions.

2. Emulating Human Electrical Load

- The **200Ω and 500Ω resistive loads** simulate the impedance of the human body in contact with pool water and surrounding surfaces.
    - **500 ohms** approximates the body resistance of a barefoot person in wet conditions (per IEC 60479-1 and EPRI methodology).
    - **200 ohms** represents a conservative or worst-case human impedance for children or highly conductive conditions.

By comparing voltage measurements across these resistive loads, engineers can estimate the **current a person might be exposed to**, and thereby assess shock risk.

3. Validating Bonding System Effectiveness

- A properly bonded system should:
    - Keep voltages low under increasing fault stress.
    - Exhibit a more or less linear response with increasing voltage and distance.
    - Exhibit **consistent attenuation** of voltage with increasing distance from the pool edge.

Multi-voltage and multi-load testing ensures a thorough evaluation of how the bonding system would perform during real-world electrical fault events, not just ideal conditions.

V. Findings and Test Results

Table 1 - Site Descriptions

Pool ID	Address	Pool Type	Deck Type	Bonding Type	Soil Type	Test Date(s)	T (°F)	H (%)
1	10961 Prairie Hawk Dr, Orlando, FL 32837	Concrete	Concrete	#8 AWG Wire Loop	Myakka Fine Sand	4/7/2025	84	51
2	667 Linville Falls Dr, West Melbourne, FL 32904	Concrete	Concrete	Copper Grid	Eau Gallie Fine Sand	4/8/2025 4/16/2025	66	75
3	1906 Summerfield Rd, Winter Park, FL 32792	Concrete	Paver	Copper Grid	Smyrna Sand	4/9/2025 4/16/2025	65 / 76	70 / 30
4	17909 Lookout Hill Rd, Winter Garden, FL 34787	Fiberglass	Paver	Inline Bonding	Candler Sand	4/9/2025 4/14/2025	74 / 69	41 / 62
5	13331 Sugarloaf Ct, Clermont, FL 34715	Fiberglass	Concrete	Inline Bonding	Tavares Sand	4/14/2025	76	56
6	20451 Fieldcrest Ct, Clermont, FL 34715	Fiberglass	Concrete	Inline Bonding	Tavares Sand	4/14/2025 6/12/2025	76 / 91	56 / 61
7	5753 Timber Mdw Wy, St Cloud, FL 34771	Concrete	Concrete	#8 AWG Wire Loop	Pineda Fine Sand	4/15/2025	72	64
8	1512 Pines End Pl, St Cloud, FL 34771	Concrete	Concrete	#8 AWG Wire Loop	Tavares Sand	4/15/2025	72	64
9	590 Dinner St NE, Palm Bay, FL 32907	Concrete	Paver	Copper Grid	Eau Gallie Fine Sand	6/12/2025	89	57

***In-line bonding in fiberglass pools indicates a stainless-steel bonding plate in the skimmer providing a direct water bond to the equipotential grid. All fiberglass pools tested used a single #8 AWG copper wire for the perimeter bonding.*

Soil Composition and Conductivity

Soil characteristics at each pool location influence the performance of bonding systems, particularly under fault current conditions. Factors such as moisture, composition, and texture affect electrical resistivity. Below is a summary of soil profiles based on USDA NRCS and Florida Geological Survey data for each site:

Table 2 - Soil Composition and Conductivity

Pool ID	City	Soil Type	Drainage Class	Electrical Conductivity (avg)
1	Orlando	Myakka Fine Sand	Poorly Drained	Low to Moderate
2	West Melbourne	Eau Gallie Fine Sand	Poorly Drained	Low to Moderate
3	Winter Park	Smyrna Sand	Poorly Drained	Low to Moderate
4	Winter Garden	Candler Sand	Excessively Drained	Low to Moderate
5	Clermont	Tavares Sand	Excessively Drained	Low to Moderate
6	Clermont	Tavares Sand	Excessively Drained	Low to Moderate
7	St Cloud	Pineda Fine Sand	Poorly Drained	Low to Moderate
8	St Cloud	Pineda Fine Sand	Poorly Drained	Low to Moderate
9	Palm Bay	Pineda Fine Sand	Poorly Drained	Low to Moderate

Table 3 - Baseline Equipotential Voltage Readings

Pool ID	Location	Equipment Status	Maximum Voltage Reading		
			VOC (VAC)	V200 (VAC)	V500 (VAC)
1	10961 Prairie Hawk Dr, Orlando	On	0.131	0.032	0.054
		Off	0.176	0.059	0.117
2	667 Linville Falls Dr, West Melbourne	On	0.009	0.006	0.006
		Off	0.011	0.009	0.009
3	1906 Summerfield Rd, Winter Park	On	0.005	0.003	0.004
		Off	0.008	0.007	0.008
4	17909 Lookout Hill Rd, Winter Garden	On	0.118	0.082	0.065
		Off	0.173	0.123	0.064
5	13331 Sugarloaf Ct, Clermont	On	0.047	0.021	0.011
		Off	0.031	0.016	0.009
6	20451 Fieldcrest Ct, Clermont	On	0.037	0.025	0.016
		Off	0.028	0.022	0.017
7	5753 Timber Meadow Wy, St Cloud	On	0.011	0.017	0.032
		Off	0.008	0.010	0.011
8	1512 Pines End Pl, St Cloud	On	0.043	0.015	0.014
		Off	0.017	0.012	0.011
9	590 Dinner St NE, Palm Bay	On	0.016	0.003	0.003
		Off	0.010	0.004	0.001

Table 3A - Summary of Median Baseline Equipotential Voltage Readings

Equipment Status	VOC Median (VAC)	V200 Median (VAC)	V500 Median (VAC)
On	0.043	0.025	0.020
Off	0.035	0.018	0.016

Notes:

- All baseline measurements were low, typically under 0.2 VAC.
- Turning pool equipment ON (e.g., pumps, lighting) resulted in only minor increases in measured voltage (typically <0.05 VAC). The low-level values could have also been affected by electrical current in the ground external to the pool environment.
- The small difference in V500 from OFF to ON conditions indicates that the bonding systems effectively suppressed operational voltage gradients
- The mean V500 voltage with equipment on was approximately 0.020 VAC, translating to 0.04 mA, well below any known safety concern.

- No indication of circulating current or bonding deficiencies was detected due to equipment operation.
- The minimal differences between on and off conditions suggest that bonding continuity and system integrity are sound across all tested pools.

Table 4 - Summary of Equipotential Voltage Readings Under Simulated Fault Conditions

Pool ID	Location	Test Voltage (VAC)	VOC (VAC)	V200 (VAC)	V500 (VAC)
1	10961 Prairie Hawk Dr, Orlando	60	0.227	0.082	0.154
		90	0.324	0.142	0.217
		120	0.446	0.193	0.260
2	667 Linville Falls Dr, West Melbourne	60	0.011	0.008	0.010
		90	0.011	0.008	0.005
		120	0.011	0.008	0.006
3	1906 Summerfield Rd, Winter Park	60	0.020	0.015	0.007
		90	0.032	0.009	0.005
		120	0.042	0.020	0.010
4	17909 Lookout Hill Rd, Winter Garden	60	0.155	0.115	0.073
		90	0.248	0.187	0.117
		120	0.353	0.252	0.183
5	13331 Sugarloaf Ct, Clermont	60	0.138	0.084	0.052
		90	0.203	0.127	0.075
		120	0.257	0.174	0.105
6	20451 Fieldcrest Ct, Clermont	60	0.774	0.634	0.472
		90	1.548	1.076	0.745
		120	2.084	1.545	1.122
7	5753 Timber Meadow Wy, St Cloud	60	0.021	0.024	0.021
		90	0.032	0.037	0.030
		120	0.031	0.034	0.040
8	1512 Pines End Pl, St Cloud	60	0.027	0.015	0.012
		90	0.022	0.020	0.009
		120	0.052	0.044	0.016
9	590 Dinner St NE, Palm Bay	60	0.050	0.007	0.027
		90	0.082	0.031	0.031
		120	0.114	0.042	0.042

Table 4A - Aggregate Statistical Summary

Voltage	Load	Mean (VAC)	Std Dev	Min	Max	95% Confidence Interval
60 VAC	VOC	0.142	0.229	0.007	0.774	0.176
	V200	0.100	0.183	0.003	0.634	0.141
	V500	0.071	0.121	0.002	0.472	0.093
90 VAC	VOC	0.246	0.452	0.009	1.548	0.347
	V200	0.160	0.301	0.005	1.076	0.231
	V500	0.111	0.191	0.003	0.745	0.147
120 VAC	VOC	0.343	0.620	0.007	2.084	0.477
	V200	0.227	0.435	0.003	1.545	0.334
	V500	0.161	0.288	0.004	1.122	0.222

Key Observations:

- **V500 values remain well below 1.0 VAC** for all pools except Pool #6 at 120 VAC (1.122 VAC), which is attributed to high soil moisture, site-specific conditions, or other anomalies.
- The **mean V500 at 120 VAC is 0.161 VAC**, with 7 out of 9 pools below 0.25 VAC.
- The **highest variability** occurs in VOC readings at higher voltages (std. dev. 0.620 at 120 VAC), again due to Pool #6.
- **Linear voltage response** across the three fault levels confirms bonding effectiveness and field repeatability.

Table 5 - V500 Voltage Summary by Bonding Type

Bonding Type	Pools Included	V500 @ 60V (VAC)	V500 @ 90V (VAC)	V500 @ 120V (VAC)	Mean V500 (All Voltages)
#8 AWG Wire Loop	Pools 1, 7, 8	0.154	0.217	0.260	**0.210**
Copper Grid	Pools 2, 3, 9	0.027	0.031	0.042	**0.033**
Water Bond Plate & Inline Bonding & #8 Loop	Pools 4, 5	0.073	0.117	0.183	**0.124**
Pool #6 Only	Pool 6	0.472	0.745	1.122	**0.780**

Notes:

- **Pool #6** yielded results that are far outside of the normal range of the other pools tested. This may have been due to soil anomalies, issues with the pool bonding system, or other external circumstances.
- By isolating Pool #6, the performance of the **fiberglass pools with water bond plate and #8 AWG perimeter loop** method under more typical conditions (Pools 4 and 5) shows **average V500 values well within acceptable industry benchmarks**.
- Aside from **Pool #6**, all bonding types, including #8 AWG loop and copper grid, remained **below 0.25 VAC** across all voltages, with **no outliers**.

Table 5A – Verification Testing of Pool #6

Voltage	Distance from Water	Test #1 - 4/14/2025			Test #2- 6/12/2025		
		VOC	V200	V500	VOC	V200	V500
60 VAC	1	0.751	0.634	0.472	0.805	0.249	0.451
	2	0.772	0.593	0.385	0.812	0.243	0.498
	3	0.774	0.566	0.32	0.816	0.294	0.539
	4	0.753	0.616	0.405	0.816	0.279	0.533
	5	0.771	0.627	0.419	0.812	0.243	0.487
90 VAC	1	1.429	1.076	0.745	1.216	0.311	0.665
	2	1.456	1.073	0.606	1.223	0.403	0.725
	3	1.521	0.947	0.497	1.222	0.423	0.826
	4	1.548	0.942	0.632	1.226	0.376	0.757
	5	1.533	0.938	0.647	1.232	0.326	0.757
120 VAC	1	1.981	1.545	1.122	1.643	0.477	1.158
	2	2.081	1.435	0.848	1.641	0.496	1.163
	3	2.084	1.320	0.752	1.600	0.626	1.222
	4	2.083	1.416	0.873	1.652	0.526	1.198
	5	2.054	1.454	1.112	1.661	0.540	1.186

Notes:

- Upon completion of all testing **Pool #6** was found to be a major outlier due to the elevated voltage readings taken in comparison to the other eight pools. Because of this it was deemed necessary to return and perform confirmation testing to rule out equipment issues or other aspects that may have provided erroneous results.
- As **Table 5A** shows above the verification testing performed on 6/12 yielded readings that, more or less, confirm the original readings.
- **Table 5B** below displays the percentage and voltage differences between Test #1 and Test #2. The comparison indicates nearly equivalent or lower readings is Test #2 than Test #1 for VOC and V200 testing across all voltages. For V500 testing the second test yielded somewhat higher results than the original test.
- These differences notwithstanding, the verification measurements remained within the same general range as the original data and were significantly higher than in the other eight test sites.
- Based on this it can be assumed that the data collected is sound and indicates a potential issue with the bonding grid, an unknown electrical anomaly present in the ground, or some other external cause.

- It should be noted that even though the V500 readings at 120 VAC "fail" the threshold test they do seem to represent an "edge case" due to the slight voltage overage. According to the IEEE paper entitled "*Determining Voltage Levels of Concern for Human and Animal Response to AC Current*" written by Douglass Dorr, "*The applicable voltage level that applies to the contact scenario and to the human species would yield a* ***minimum voltage level of perception at 1.0 to 1.25 volts****…*" which would seem to indicate that the voltage threshold should be moved from 1 V to 1.25 V and also illustrates the range of "acceptable" touch voltage limits.
- Bonding continuity between the pool equipment and metal components (pool enclosure frame, handrail, etc.) was verified prior to voltage testing.
- There may have been other, unknown current sources in the ground on this property which may have contributed to the readings. Investigation into this or other causes of stray current was not performed or included in the scope of this study.

Table 5B – Summary of Differences Between Test #1 & #2 for Pool #6

Voltage	Distance from Water	% Diff. between Test #2 & Test #1			Voltage Diff. between Test #2 & Test #1 (VAC)		
		VOC	V200	V500	VOC	V200	V500
60 VAC	1	7.2%	-60.7%	-4.4%	0.054	-0.385	-0.021
	2	5.2%	-59.0%	29.4%	0.040	-0.350	0.113
	3	5.4%	-48.1%	68.4%	0.042	-0.272	0.219
	4	8.4%	-54.7%	31.6%	0.063	-0.337	0.128
	5	5.3%	-61.2%	16.2%	0.041	-0.384	0.068
90 VAC	1	-14.9%	-71.1%	-10.7%	-0.213	-0.765	-0.080
	2	-16.0%	-62.4%	19.6%	-0.233	-0.670	0.119
	3	-19.7%	-55.3%	66.2%	-0.299	-0.524	0.329
	4	-20.8%	-60.1%	19.8%	-0.322	-0.566	0.125
	5	-19.6%	-65.2%	17.0%	-0.301	-0.612	0.110
120 VAC	1	-17.1%	-69.1%	3.2%	-0.338	-1.068	0.036
	2	-21.1%	-65.4%	37.1%	-0.440	-0.939	0.315
	3	-23.2%	-52.6%	62.5%	-0.484	-0.694	0.470
	4	-20.7%	-62.9%	37.2%	-0.431	-0.890	0.325
	5	-19.1%	-62.9%	6.7%	-0.393	-0.914	0.074

Chart 1 – Equipotential Voltage Measurements at V500, 120 VAC

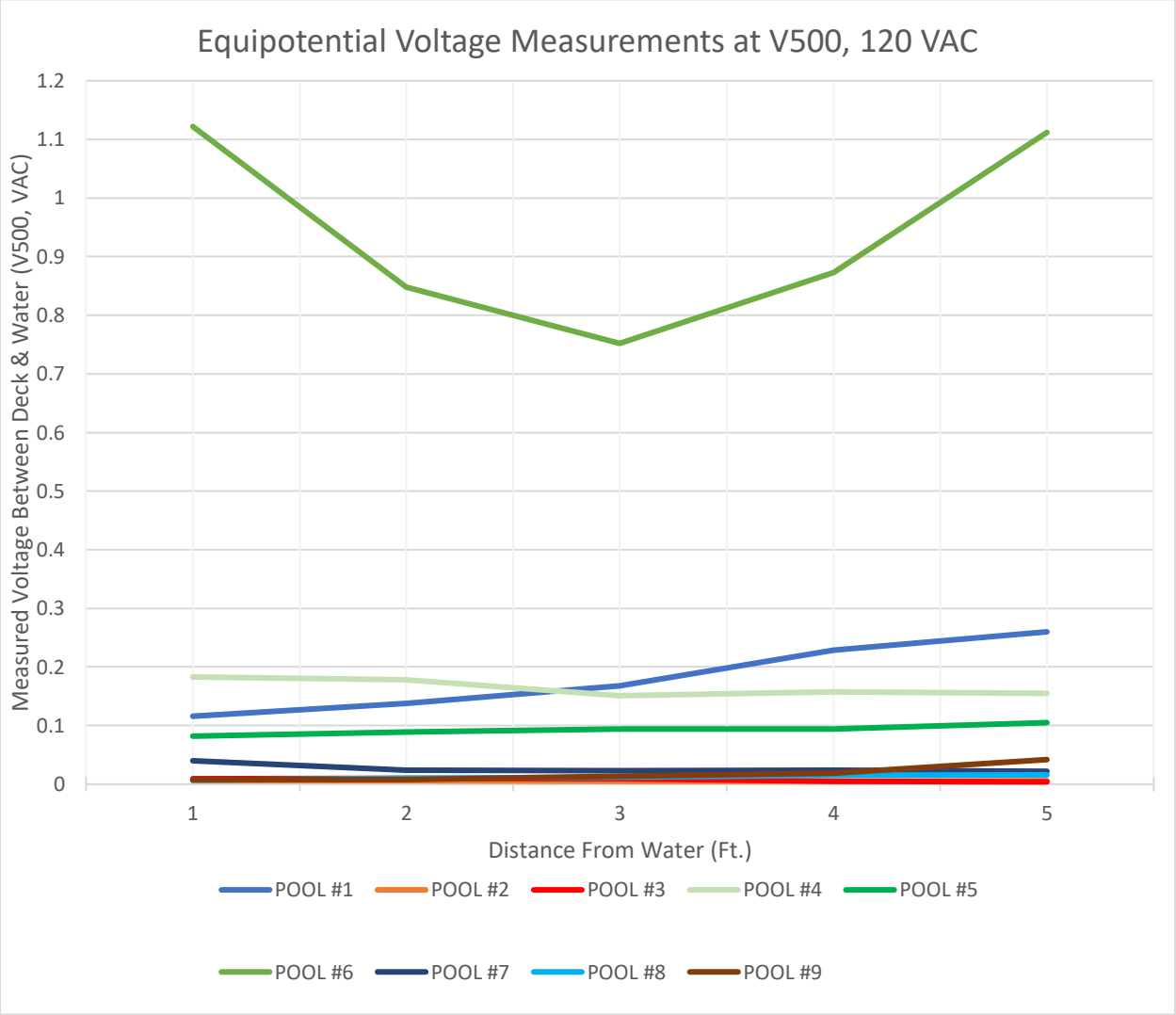

Chart 2 – Equipotential Voltage Measurements at V500, 120 VAC (Without Pool #6)

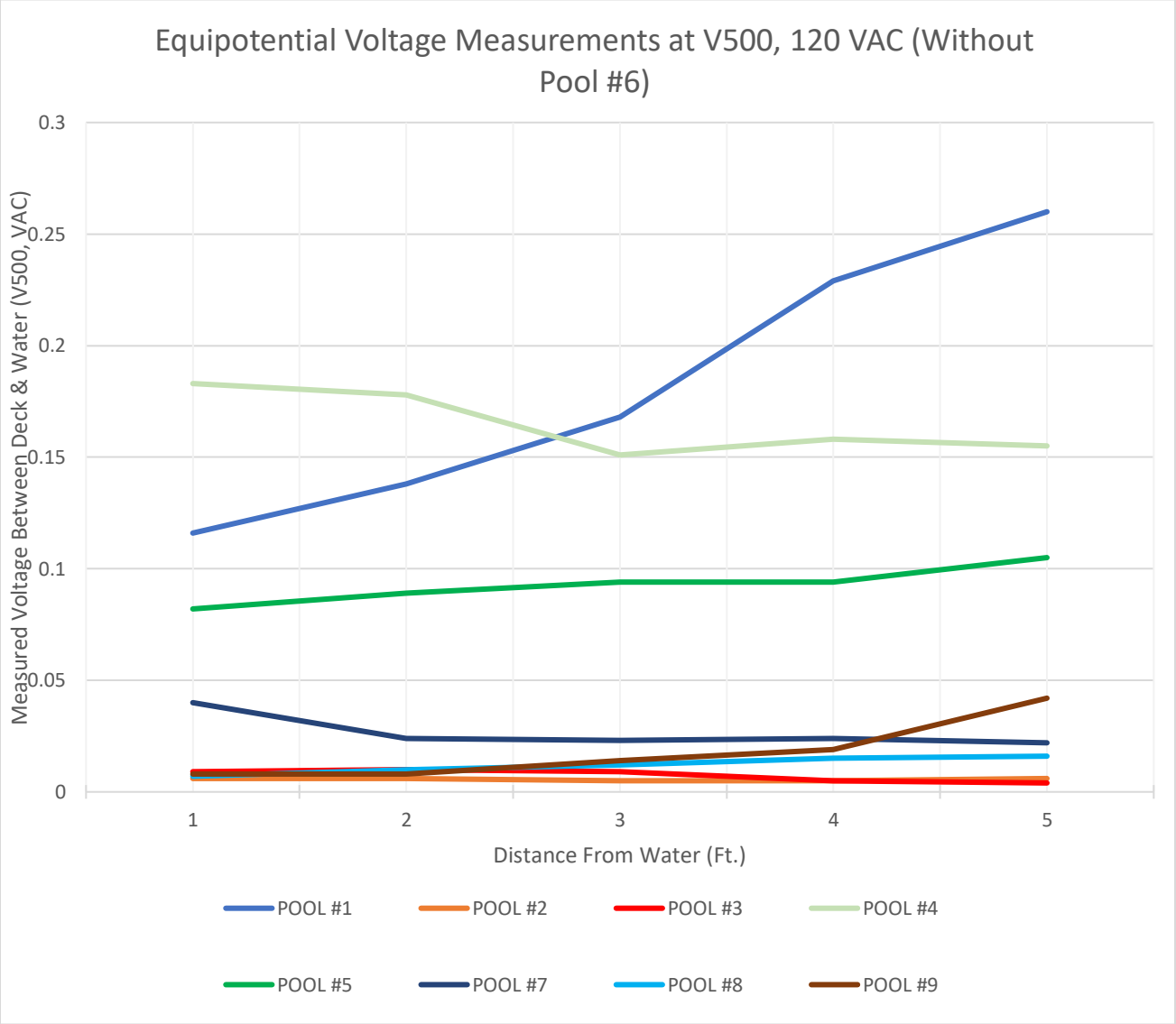

Table 6 - Equivalent Current (mA) by Pool, Voltage, and V500 Measurement

Pool	Equivalent Current at V500 (mA)		
	60V	90V	120V
1	0.308	0.434	0.52
2	0.02	0.01	0.012
3	0.014	0.01	0.02
4	0.146	0.234	0.366
5	0.104	0.15	0.21
6	0.944	1.49	2.244
7	0.042	0.06	0.08
8	0.024	0.018	0.032
9	0.054	0.062	0.084

Table 6A - Summary of V500 Current by Bonding Type (at 120 VAC)

Bonding Type	Pools Included	Max V500 (VAC)	I (mA) @ 500Ω	Pass/Fail (<1 mA)
#8 AWG Copper Wire Loop	1, 7, 8	0.260	0.520	✅ Pass
Copper Grid (Steel-Reinforced)	2, 3, 9	0.042	0.084	✅ Pass
Water Bond Plate & Inline Bonding with #8 AWG Loop	4, 5	0.183	0.366	✅ Pass
Pool #6 Only	6	1.122	**2.244**	⚠️ Questionable

Notes:

- All pools **except Pool #6** produced V500 currents **well under 2 mA**, which is widely regarded as a **safe upper limit** for barefoot human contact in wet conditions.
    - Pool #6 is listed as "Questionable" due to disagreements with safe voltage limits of either 1 V (2 mA at 500 Ω) or 1.25V (2.5 mA at 500 Ω) as presented in "*Determining Voltage Levels of Concern for Human and Animal Response to AC Current*"
- The pool's utilizing the **copper grid perimeter bonding** exhibited the **lowest equipotential voltage (best performance)** and resulting current of all pools tested.
- **Pool #6 exceeded 2 mA**, more than double the recommended limit. The root cause of this difference in comparison to the other pools has not been ascertained.
- The **#8 AWG copper wire loop & copper grid bonding systems** all demonstrated acceptable safety margins **in typical conditions**.
- The test validates that **multiple bonding configurations can be compliant**, provided they are properly installed and local conditions (e.g., soil, moisture) are managed or mitigated.

VI. Conclusions & Commentary

Based on the comprehensive field testing, voltage gradient measurements, and statistical analysis conducted across nine residential pools in Central Florida, this study concludes that **both bonding methods**—#8 AWG copper wire loop and the copper bonding grid— **can provide effective equipotential bonding when properly installed** under the fault conditions simulated and measured. The data show that under simulated fault conditions up to 120 VAC, nearly all measured V500 voltages yielded current levels well below 1 mA when modeled against a 500-ohm human resistance, a widely accepted safety benchmark. The only exception was a single pool (Pool #6) using the water bond plate method with a #8 AWG copper wire loop, which exhibited elevated readings attributable to unknown soil anomalies, issues with the pool bonding system, or other external circumstances. However, investigation into the root cause of this anomaly was not conducted or within the scope of this report. It should be noted that the homeowner may have had other buried electrical equipment on the property that may have contributed to this.

It is important to note that the pools evaluated in this study were not constructed under uniform conditions—they were located in different geographic areas, built by different contractors, and employed varying construction materials and installation practices. These variations introduce field variables that are not fully controlled, and naturally affect bonding system performance. Despite this, the measured results across all systems and sites consistently fell within or near the thresholds considered safe for human contact, reinforcing the overall reliability of equipotential bonding when executed per accepted design principles. During testing, the soil on the property was found to be mostly dry having not experienced precipitation in the preceding time before testing. No additional soil wetting was done during testing.

While the copper grid perimeter bonding method produced the lowest equipotential voltage values overall (**in the pools tested**), no system categorically “failed” to keep equipotential voltage levels within what can be considered “safe” parameters. Again, these were the specific results from these specific pools and differences may arise in these comparisons if a larger sample size of pools were used. These findings indicate that **both the #8 AWG copper wire loop and the copper bonding grid can meet performance expectations for voltage mitigation in residential pools when installed properly**. This report does not advocate for any specific system but provides a neutral, data-driven evaluation to assist stakeholders in making informed engineering and safety decisions.

VII. Bibliography

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4. **Consumer Product Safety Commission**, Electric Shock Drowning Incidents, 2002–2014
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8. **D. Dorr,** "Determining Voltage Levels of Concern for Human and Animal Response to AC Current," in Proceedings of the IEEE PES Transmission and Distribution Conference and Exposition, 2009, pp. 1–6. doi: 10.1109/TDC.2009.5167483

Appendix A – Full Voltage Gradient Test Data by Pool

POOL INFORMATION	
Pool ID	**Test Pool #1**
Location	10961 Prairie Hawk Dr, Orlando, FL 32837
Pool Type (Concrete/Fiberglass/Vinyl)	Concrete with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	#8 copper wire loop
Date of Test	4/7/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Richard Moseley (Holland Pools)

TO EQUIPMENT GROUND			
Location	**1**	**2**	**3**
Description	Pump Lug to Pool Panel	Lighting Transformer to Pool Panel	Lighting J-box to Pool Panel
Bonding Continuity (Ω)	1.4	0.2	0.3

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.037	0.012	0.018
2	0.051	0.017	0.025
3	0.091	0.026	0.038
4	0.126	0.028	0.042
5	0.131	0.032	0.054

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.069	0.038	0.038
2	0.113	0.047	0.052
3	0.144	0.056	0.077
4	0.171	0.055	0.093
5	0.176	0.059	0.117

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.084	0.033	0.036
2	0.124	0.048	0.051
3	0.169	0.051	0.079
4	0.182	0.076	0.108
5	0.227	0.082	0.154

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.091	0.056	0.073
2	0.119	0.068	0.107
3	0.162	0.103	0.141
4	0.234	0.115	0.176
5	0.324	0.142	0.217

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.128	0.069	0.116
2	0.218	0.084	0.138
3	0.314	0.104	0.168
4	0.399	0.143	0.229
5	0.446	0.193	0.260

Final Observations & Sign-Off

Observations	12' x 28' pool - Weather: 84 F, 51% humidity at time of test (10:00 AM) - Voltage test done connected from main bonding wire at pump to remote earth rod

Test Completed by:

Name:	Kristoffer Costa	**Name:**	John Antonelli
Title:	EMC Technician - IIA	**Title:**	VP - SunSmart Engineering

POOL INFORMATION	
Pool ID	**Test Pool #2**
Location	667 Linville Falls Dr, West Melbourne, FL 32904
Pool Type (Concrete/Fiberglass/Vinyl)	Concrete with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	Copper Grid
Date of Test	4/8/2025 & 4/16/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Albert Underwood, Dustin Underwood (Aqua Blue Pools)

TO EQUIPMENT GROUND			
Location	**1**	**2**	**3**
Description	Pump Lug to Pool Panel	Lighting Transformer to Pool Panel	Lighting J-box to Pool Panel
Bonding Continuity (Ω)	0.1	0.1	0.1

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.005	0.004	0.004
2	0.006	0.006	0.005
3	0.006	0.005	0.006
4	0.007	0.004	0.004
5	0.009	0.004	0.004

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC						
Distance from Water (ft)	**Open Circuit**		**200 Ω Resistor**		**500 Ω Resistor**	
	4/8	**4/16**	**4/8**	**4/16**	**4/8**	**4/16**
1	0.007	0.011	0.007	0.005	0.003	0.003
2	0.007	0.009	0.007	0.005	0.004	0.005
3	0.005	0.01	0.007	0.008	0.004	0.009
4	0.007	0.009	0.005	0.009	0.004	0.001
5	0.006	0.01	0.006	0.009	0.004	0.009

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.011	0.005	0.002
2	0.009	0.005	0.007
3	0.009	0.008	0.008
4	0.01	0.007	0.01
5	0.01	0.005	0.006

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.01	0.008	0.003
2	0.011	0.008	0.003
3	0.01	0.006	0.004
4	0.011	0.005	0.005
5	0.01	0.005	0.005

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.010	0.003	0.006
2	0.011	0.008	0.006
3	0.008	0.008	0.005
4	0.007	0.006	0.005
5	0.007	0.006	0.006

Final Observations & Sign-Off

Observations	4/8/2025 - 66 F, 75% humidity, Heavy rain prior to test, ground was saturated. Low soil impedance caused the fuse in the VARIAC to blow when starting ground fault testing. Rescheduling ground-fault testing for 4/16/2025. - 4/16/2025 - 76 F, 54% humidity

Test Completed by:

Name:	Kristoffer Costa	**Name:**	John Antonelli
Title:	EMC Technician - IIA	**Title:**	VP - SunSmart Engineering

POOL INFORMATION	
Pool ID	**Test Pool #3**
Location	1906 Summerfield Rd, Winter Park, FL 32792
Pool Type (Concrete/Fiberglass/Vinyl)	Concrete with Paver Deck
Bonding Type (Wire Loop/Copper Grid)	Copper Grid
Date of Test	4/7/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Brad Quehl (Holland Pools), Richard Smith (SunSmart Engineering)

TO EQUIPMENT GROUND			
Location	**1**	**2**	**3**
Description	Pump Lug to Pool Panel	Lighting Transformer to Pool Panel	Lighting J-box to Pool Panel
Bonding Continuity (Ω)	0.2	0.2	0.3

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.005	0.002	0.002
2	0.005	0.003	0.002
3	0.005	0.002	0.002
4	0.005	0.002	0.002
5	0.005	0.002	0.004

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.005	0.005	0.001
2	0.005	0.003	0.002
3	0.005	0.002	0.002
4	0.006	0.002	0.002
5	0.006	0.001	0.002

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.368	0.212	0.045
2	0.829	0.259	0.163
3	2.568	0.289	0.331
4	3.562	0.481	0.463
5	6.81	0.235	0.772

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	1.072	0.255	0.112
2	0.909	0.328	0.144
3	4.33	1.456	0.436
4	7.84	1.601	1.135
5	9.67	2.983	1.746

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	1.818	0.312	0.045
2	2.217	0.476	0.115
3	2.856	0.958	0.276
4	9.170	1.976	0.712
5	13.840	3.664	0.834

Final Observations & Sign-Off

Observations	14' x 22' pool - Weather: 65 F, 70% humidity at time of test (10:00 AM) - Voltage test done connected from main bonding wire at pump to remote earth rod - Power source for VARIAC was from non-GFCI outlet in home

Test Completed by:

Name:	Kristoffer Costa	**Name:**	John Antonelli
Title:	EMC Technician - IIA	**Title:**	VP - SunSmart Engineering

POOL INFORMATION	
Pool ID	**Test Pool #4**
Location	17909 Lookout Hill Rd, Winter Garden, FL 34787
Pool Type (Concrete/Fiberglass/Vinyl)	Fiberglass with Paver Deck
Bonding Type (Wire Loop/Copper Grid)	In-line bonding, water bond plate in skimmer
Date of Test	4/9/2025 & 4/14/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Michael Ramee (Mad River Pools)

TO EQUIPMENT GROUND			
Location	**1**	**2**	**3**
Description	Pump Lug to Pool Panel	Lighting Transformer to Pool Panel	Heat Pump Lug to Pool Panel
Bonding Continuity (Ω)	0.4	0.2	0.4

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.084	0.063	0.048
2	0.091	0.071	0.043
3	0.089	0.067	0.036
4	0.108	0.082	0.065
5	0.118	0.079	0.053

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC						
Distance from Water (ft)	**Open Circuit**		**200 Ω Resistor**		**500 Ω Resistor**	
	4/9	**4/14**	**4/9**	**4/14**	**4/9**	**4/14**
1	0.093	0.126	0.068	0.094	0.052	0.062
2	0.109	0.141	0.059	0.099	0.027	0.064
3	0.103	0.156	0.056	0.096	0.046	0.053
4	0.124	0.163	0.056	0.102	0.045	0.043
5	0.136	0.173	0.062	0.123	0.046	0.056

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.153	0.115	0.072
2	0.138	0.102	0.073
3	0.138	0.106	0.037
4	0.151	0.097	0.047
5	0.155	0.095	0.072

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.224	0.187	0.116
2	0.241	0.162	0.107
3	0.229	0.116	0.106
4	0.228	0.152	0.112
5	0.248	0.168	0.117

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.322	0.252	0.183
2	0.341	0.245	0.178
3	0.345	0.252	0.151
4	0.353	0.242	0.158
5	0.351	0.205	0.155

Final Observations & Sign-Off

Observations	15' x 39' pool - Weather: 74 F, 41% humidity at time of test (1:00 PM, 4/9) - Water bonding plate installed in skimmer - No access to non-GFCI outlets; fault testing to be completed Monday 4/14 - Voltage test done connected directly to pool water to remote earth rod on 4/14 - Weather: 69 F, 62% humidity at time of test (10:00 AM, 4/14)

Test Completed by:

Name:	Kristoffer Costa	**Name:**	John Antonelli
Title:	EMC Technician - IIA	**Title:**	VP - SunSmart Engineering

POOL INFORMATION	
Pool ID	**Test Pool #5**
Location	13331 Sugarloaf Ct, Clermont, FL 34715
Pool Type (Concrete/Fiberglass/Vinyl)	Fiberglass with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	In-line bonding, water bond plate in skimmer
Date of Test	4/14/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Michael Ramee (Mad River Pools)

TO EQUIPMENT GROUND			
Location	**1**	**2**	**3**
Description	Pump Lug to Pool Panel	Lighting Controller to Pump Lug	Chlorinator to Pool Panel
Bonding Continuity (Ω)	0.2	0.2	0.3

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.040	0.019	0.007
2	0.039	0.017	0.008
3	0.042	0.016	0.010
4	0.045	0.021	0.010
5	0.047	0.021	0.011

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.027	0.015	0.005
2	0.028	0.014	0.005
3	0.027	0.014	0.006
4	0.030	0.015	0.009
5	0.031	0.016	0.008

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.135	0.081	0.049
2	0.126	0.080	0.042
3	0.094	0.084	0.041
4	0.138	0.064	0.052
5	0.135	0.056	0.046

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.190	0.127	0.062
2	0.191	0.123	0.071
3	0.195	0.117	0.075
4	0.197	0.117	0.066
5	0.203	0.121	0.052

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.257	0.169	0.082
2	0.230	0.159	0.089
3	0.245	0.155	0.094
4	0.248	0.164	0.094
5	0.238	0.174	0.105

Final Observations & Sign-Off

Observations	12' x 31' pool - Weather: 76 F, 56% humidity at time of test (11:00 AM) - Water bonding plate installed in skimmer - Voltage test done connected directly to pool water to remote earth rod

Test Completed by:

Name:	Kristoffer Costa	**Name:**	John Antonelli
Title:	EMC Technician - IIA	**Title:**	VP - SunSmart Engineering

POOL INFORMATION	
Pool ID	**Test Pool #6**
Location	20451 Fieldcrest Ct, Clermont, FL 34715
Pool Type (Concrete/Fiberglass/Vinyl)	Fiberglass with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	In-line bonding, water bond plate in skimmer
Date of Test	4/14/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Michael Ramee (Mad River Pools)

TO EQUIPMENT GROUND			
Location	**1**	**2**	**3**
Description	Pump Lug to Pool Panel	Heat Pump Lug to Pump Lug	Lighting Transformer to Pool Panel
Bonding Continuity (Ω)	0.5	0.2	0.2

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.023	0.022	0.014
2	0.027	0.019	0.015
3	0.032	0.025	0.014
4	0.025	0.019	0.015
5	0.037	0.021	0.016

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.028	0.017	0.017
2	0.023	0.018	0.015
3	0.025	0.017	0.015
4	0.023	0.021	0.014
5	0.024	0.022	0.017

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.751	0.634	0.472
2	0.772	0.593	0.385
3	0.774	0.566	0.320
4	0.753	0.616	0.405
5	0.771	0.627	0.419

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	1.429	1.076	0.745
2	1.456	1.073	0.606
3	1.521	0.947	0.497
4	1.548	0.942	0.632
5	1.533	0.938	0.647

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	1.981	1.545	1.122
2	2.081	1.435	0.848
3	2.084	1.320	0.752
4	2.083	1.416	0.873
5	2.054	1.454	1.112

Final Observations & Sign-Off

Observations	15' x 30' pool - Weather: 76 F, 56% humidity at time of test (11:45 AM) - Water bonding plate installed in skimmer - Voltage test done connected directly to pool water to remote earth rod

Test Completed by:

Name:	Kristoffer Costa	**Name:**	John Antonelli
Title:	EMC Technician - IIA	**Title:**	VP - SunSmart Engineering

POOL INFORMATION	
Pool ID	**Test Pool #6b**
Location	20451 Fieldcrest Ct, Clermont, FL 34715
Pool Type (Concrete/Fiberglass/Vinyl)	Fiberglass with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	In-line bonding, water bond plate in skimmer
Date of Test	6/12/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Michael Ramee (Mad River Pools), Adam Alstott (Tropical Pools)

TO EQUIPMENT GROUND			
Location	**1**	**2**	**3**
Description	---	---	---
Bonding Continuity (Ω)	---	---	---

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	---	---	---
2	---	---	---
3	---	---	---
4	---	---	---
5	---	---	---

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	---	---	---
2	---	---	---
3	---	---	---
4	---	---	---
5	---	---	---

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.805	0.249	0.451
2	0.812	0.243	0.498
3	0.816	0.294	0.539
4	0.816	0.279	0.533
5	0.812	0.243	0.487

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	1.216	0.311	0.665
2	1.223	0.403	0.725
3	1.222	0.423	0.826
4	1.226	0.376	0.757
5	1.232	0.326	0.757

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	1.643	0.477	1.158
2	1.641	0.496	1.163
3	1.600	0.626	1.222
4	1.652	0.526	1.198
5	1.661	0.540	1.186

Final Observations & Sign-Off

Observations	15' x 30' pool - Weather: 91 F, 61% humidity at time of test (1:00 PM) - Water bonding plate installed in skimmer - Voltage test done connected directly to pool water to remote earth rod. ONLY FAULT VOLTAGE TESTING CONDUCTED TO CONFIRM PREVIOUS MEASURMENTS. Homeowner present stated that he had installed 24 VAC lights to the screen enclosure which was bonded to the pool. He stated some of this voltage may be increasing the voltage present in the pool.

Test Completed by:

Name:	Kristoffer Costa	**Name:**	John Antonelli
Title:	EMC Technician - IIA	**Title:**	VP - SunSmart Engineering

POOL INFORMATION	
Pool ID	**Test Pool #7**
Location	5753 Timber Meadow Wy, St Cloud, FL 34771
Pool Type (Concrete/Fiberglass/Vinyl)	Concrete with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	#8 copper wire loop
Date of Test	4/15/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Richard Moseley (Holland Pools)

TO EQUIPMENT GROUND			
Location	**1**	**2**	**3**
Description	Pump Lug to Lighting J-box	Lighting Transformer to Pump Lug	Lighting Transformer to Pool Panel
Bonding Continuity (Ω)	0.1	0.3	0.2

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.011	0.007	0.032
2	0.007	0.008	0.012
3	0.010	0.017	0.016
4	0.009	0.011	0.012
5	0.008	0.009	0.010

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.008	0.008	0.008
2	0.006	0.008	0.008
3	0.008	0.008	0.011
4	0.007	0.009	0.010
5	0.008	0.010	0.009

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.021	0.022	0.013
2	0.018	0.024	0.016
3	0.017	0.020	0.015
4	0.021	0.017	0.021
5	0.016	0.021	0.019

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.024	0.025	0.030
2	0.029	0.025	0.026
3	0.024	0.027	0.020
4	0.032	0.027	0.023
5	0.028	0.037	0.019

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.030	0.029	0.040
2	0.022	0.030	0.024
3	0.027	0.028	0.023
4	0.031	0.027	0.024
5	0.029	0.034	0.022

Final Observations & Sign-Off

Observations	10'-8" x 26'-8" pool - Weather: 72 F, 64% humidity at time of test (10:00 AM) - Voltage test done connected from main bonding wire at pump to remote earth rod

Test Completed by:

Name:	Kristoffer Costa	**Name:**	John Antonelli
Title:	EMC Technician - IIA	**Title:**	VP - SunSmart Engineering

POOL INFORMATION	
Pool ID	**Test Pool #8**
Location	1512 Pines End Pl, St Cloud, FL 34771
Pool Type (Concrete/Fiberglass/Vinyl)	Concrete with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	#8 copper wire loop
Date of Test	4/15/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Richard Moseley (Holland Pools)

TO EQUIPMENT GROUND			
Location	**1**	**2**	**3**
Description	Pump Lug to Pool Panel	Lighting J-box to Pump Lug	Lighting Transformer to Pool Panel
Bonding Continuity (Ω)	0.8	0.5	0.5

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.015	0.006	0.004
2	0.015	0.007	0.004
3	0.037	0.008	0.010
4	0.043	0.015	0.014
5	0.037	0.012	0.009

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.012	0.012	0.005
2	0.015	0.007	0.005
3	0.017	0.010	0.006
4	0.016	0.011	0.011
5	0.017	0.009	0.009

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.012	0.014	0.005
2	0.016	0.015	0.008
3	0.016	0.011	0.012
4	0.021	0.010	0.009
5	0.027	0.011	0.006

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.012	0.012	0.007
2	0.016	0.014	0.007
3	0.016	0.015	0.008
4	0.019	0.016	0.009
5	0.022	0.020	0.006

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.022	0.007	0.007
2	0.030	0.010	0.010
3	0.046	0.022	0.012
4	0.052	0.038	0.015
5	0.046	0.044	0.016

Final Observations & Sign-Off

Observations	15' x 30' pool - Weather: 72 F, 64% humidity at time of test (11:00 AM) - Voltage test done connected from main bonding wire at pump to remote earth rod

Test Completed by:

Name:	Kristoffer Costa	**Name:**	John Antonelli
Title:	EMC Technician - IIA	**Title:**	VP - SunSmart Engineering

POOL INFORMATION	
Pool ID	**Test Pool #9**
Location	590 Dinner St NE, Palm Bay, FL 32907
Pool Type (Concrete/Fiberglass/Vinyl)	Concrete with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	Copper Grid
Date of Test	6/12/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Albert Underwood, Dustin Underwood (Aqua Blue Pools)

TO EQUIPMENT GROUND			
Location	**1**	**2**	**3**
Description	Heater to Pump	Pump to Controller	Lighting Xfrmr to Controller
Bonding Continuity (Ω)	0.1	0.1	0.3

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.007	0.001	0.001
2	0.016	0.003	0.001
3	0.012	0.002	0.002
4	0.008	0.003	0.002
5	0.009	0.003	0.003

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.006	0.004	0.001
2	0.006	0.003	0.001
3	0.007	0.002	0.001
4	0.007	0.001	0.001
5	0.010	0.001	0.001

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.008	0.006	0.007
2	0.008	0.003	0.009
3	0.010	0.005	0.010
4	0.029	0.007	0.019
5	0.050	0.006	0.027

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.010	0.005	0.005
2	0.009	0.004	0.005
3	0.018	0.007	0.010
4	0.046	0.013	0.023
5	0.082	0.019	0.031

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.010	0.005	0.008
2	0.011	0.003	0.008
3	0.018	0.002	0.014
4	0.060	0.002	0.019
5	0.114	0.003	0.042

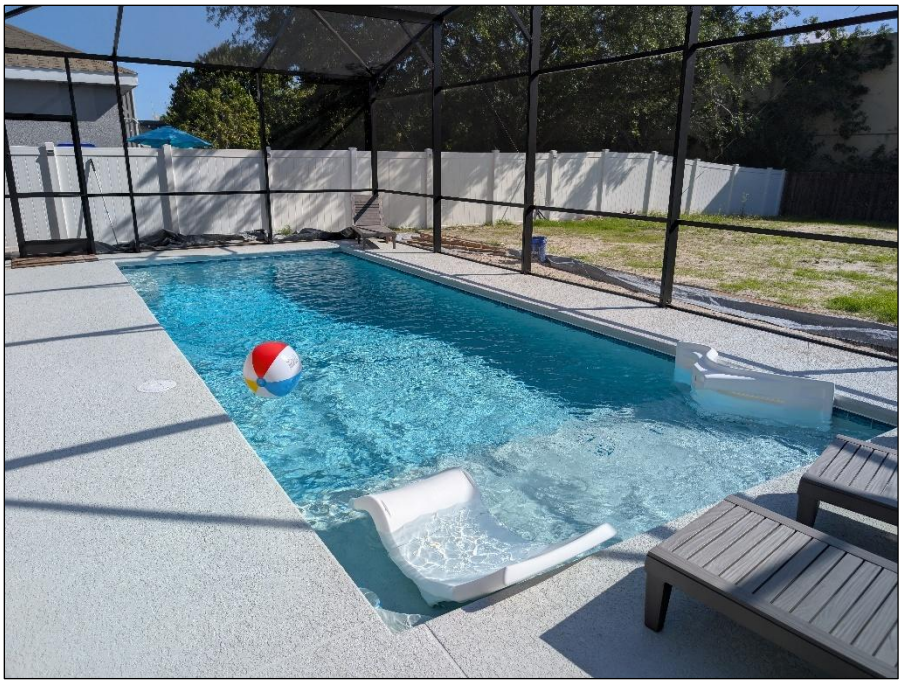
Final Observations & Sign-Off

Observations	12K gallon free-form pool, 89 F, 57% humidity at time of test (10:00 AM) - Voltage test done connected from main bonding wire at pump to remote earth rod

Test Completed by:

Name:	Kristoffer Costa	**Name:**	John Antonelli
Title:	EMC Technician - IIA	**Title:**	VP - SunSmart Engineering

Appendix B – Site Photos



Pool #1 - 10961 Prairie Hawk Dr, Orlando, FL 32837

Pool #2 – 667 Linville Falls Dr, West Melbourne, FL 32904

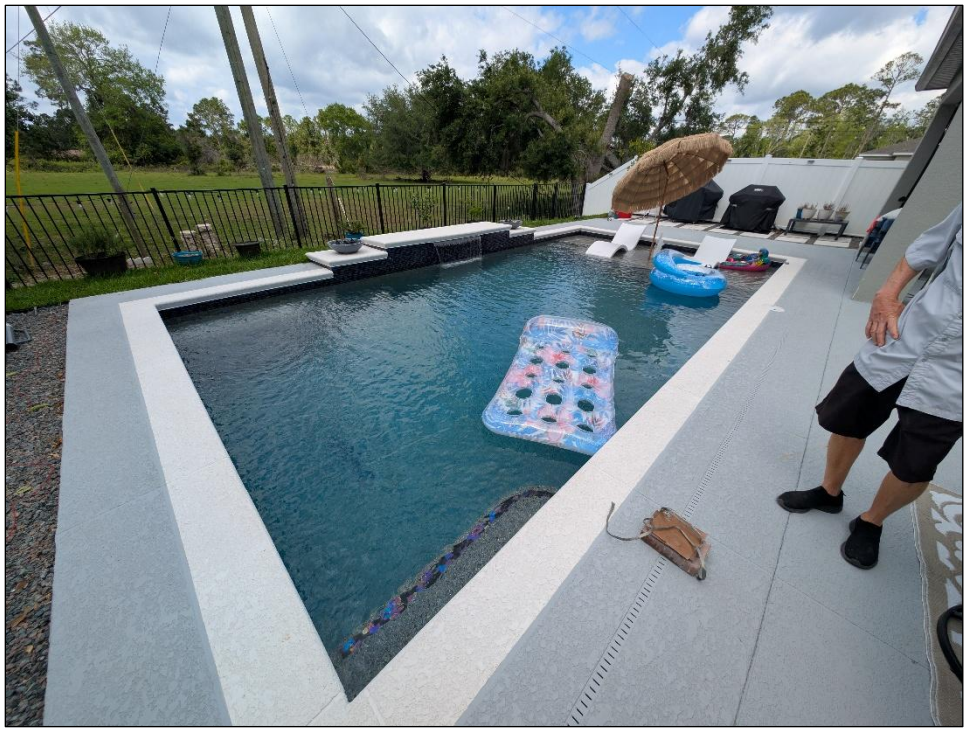
Pool #3 – 1906 Summerfield Rd, Winter Park, FL 32792

Pool #4 – 17909 Lookout Hill Rd, Winter Garden, FL 34787

Pool #5 – 13331 Sugarloaf Ct, Clermont, FL 34715

Pool #6 – 20451 Fieldcrest Ct, Clermont, FL 34715

Pool #7 – 5753 Timber Meadow Wy, St Cloud, FL 34771

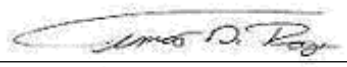


Pool #8 – 1512 Pines End Pl, St Cloud, FL 34771

Pool #9 – 590 Dinner St NE, Palm Bay, FL 32907

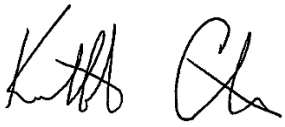
Appendix C – Industrial Inspection and Analysis (IIA) Test Report TR_18836-25

Test Report: Pool Bonding Test
Applicant: SunSmart Engineering

Signature:  Sr. EMC Engineer EMC-003838-NE

Name & Title: Tim Royer, EMC Engineer

Date of Signature 6/11/2025

Signature: 

Name & Title: Kristoffer Costa, EMC Technician

Date of Signature 6/11/2025

This test report relates only to the items tested as identified and is not valid for any subsequent changes or modifications made to the equipment under test.

Table of Contents

1. Applicant Information

Applicant: SunSmart Engineering
Address: 255 Primera Boulevard
Suite 160
Lake Mary FL 32746 United States

1.1 Test Result Summary

The following test procedure was used EPRI Equipotential Bonding Validation Procedure. Full test results are available in this report.

No additions to the test methods were needed. There were no deviations, or exclusions from the test methods. No test results are from external providers or from the customer. The test results relate only to the items tested. Timco does not offer opinions and interpretations, only a pass/fail statement.

Applicable Clauses from Part 15.236		
Clauses	Description of the requirements	Result:
	Voltage Gradient Testing	See Data
2020 NEC 250.53	Bonding System Continuity Testing (Resistance to Ground)	See Data

2. Location of Testing

2.1 Test Laboratory

Timco Engineering Inc. is a subsidiary of Industrial Inspection & Analysis, Inc. ("IIA").Located at IIA's permanent laboratory located at 13146 NW 86th Drive, Suite 400, Alachua, Florida 32615.

FCC test firm # 578780
FCC Designation # US1070
FCC site registration is under A2LA certificate # 0955.01
ISED Canada test site registration # 2056A
EU Notified Body # 1177
For all designations see A2LA scope # 0955.01

3. Test Sample(s) (EUT/DUT)

The test sample was received: 2/7/2025

Dates of Testing: 4/7/2025-4/9/2025, 4/14/2025-4/16/2025, 5/26/2025, 6/10/2025

3.1 Description of the Location

Testing was performed at the following locations:

1. 10961 Prairie Hawk Dr, Orlando, FL 32837
    1. Owner -Noel Ramsaroop
    2. Pool Type – Concrete - #8 wire bonding
    3. Contractor – Holland Pools
2. 667 Linville Falls Dr. W. Melbourne, FL 32904
    1. Owner - Colwell
    2. Pool Type – Concrete - Copper Grid Bonding
    3. Contractor – Aqua Blue Pools
    4. Gate Code #8600
3. 1906 Summerfield Road Winter Park, FL 32792
    1. Owner –Dane Norman
    2. Pool Type – Concrete - Copper Grid Bonding
    3. Contractor – Holland Pools
4. 17909 Lookout Hill Rd, Winter Garden, FL 34787
    1. Owner –Kyle Creeden
    2. Pool Type – Fiberglass
    3. Contractor – Mad River Pool Construction Inc.
5. 13331 Sugarloaf Ct, Clermont, FL 34715
    1. Owner –Elizabeth & Jim Agar
    2. Pool Type – Fiberglass
    3. Contractor –Mad River Pool Construction Inc.
6. 20451 Fieldcrest Ct, Clermont, FL 34715
    1. Owner –Raymond Eme
    2. Pool Type – Fiberglass
    3. Contractor – Mad River Pool Construction Inc.
7. 5753 Timber Meadow Way, St Cloud, FL 34771
    1. Owner – Steve Mitchell
    2. Pool Type - Concrete
    3. Contractor – Holland Pools
8. 1512 Pines End Pl, St Cloud, FL 34771
    1. Owner - Cooke
    2. Pool Type - Concrete
    3. Contractor - Holland Pools
9. 590 Dinner St NE Palm Bay, FL 3290
    1. Owner -Hanlon
    2. Pool Type – Concrete - Copper Grid Bonding
    3. Contractor – Aqua Blue Pools

3.2 Test Setup of Location

Equipment, antenna, and cable arrangement. The setup of the equipment and cable or wire placement on the test site that produces shall be shown clearly and described. Information on the orientation of portable equipment during testing shall be included. Drawings or photographs may be used for this purpose.

Test Setups are included in the test report.

4. Test methods & Applicable Regulatory Limits

4.1 Test methods/Standards/Guidance

The measurement was performed as per EPRI Equipotential Bonding Validation Procedure. Full test results are available in this report.

Limits and Regulatory Limits:

1) NEC 6890.26
2) 2020 NEC 250.53

5. Measurement Uncertainty

Parameter	Uncertainty (dB)
Conducted Measurements	± 3.14 dB
Note: The uncertainties provided in this table represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of K=2.	

6. Environmental Conditions

Temperature & Humidity

Measurements performed at the test site did not exceed the following:

Parameter	Measurement
Temperature	21 C +/- 5%
Humidity	80% +/- 5%
Barometric Pressure	30.22 in Hg
Note: Specific environmental conditions that are applicable to a specific test are available in the test result section.	

7. List of Test Equipment and Test Facility

The test equipment used identified by type, manufacturer, serial number, or other identification and the date on which the next calibration or service check is due.

Description of the firmware or software used to operate EUT for testing purposes.

A complete list of all test equipment used shall be included with the test report. The manufacturer's model and serial numbers, and date of last calibration, and calibration interval shall be included.

List of Test Equipment

Test Equipment						
Type	Device	Manufacturer	Model	SN#	Current Cal	Cal Due
Multimeter	Digital Multimeter	Fluke	77	35053830	11/29/23	11/28/2026
Power Supply	AC Variable Power Supply, 50/60 Hz, Single Ph., 120 V in, 0-280 V out, 5 A	Staco	3PN2520-MOD	N/A	NCR	NCR

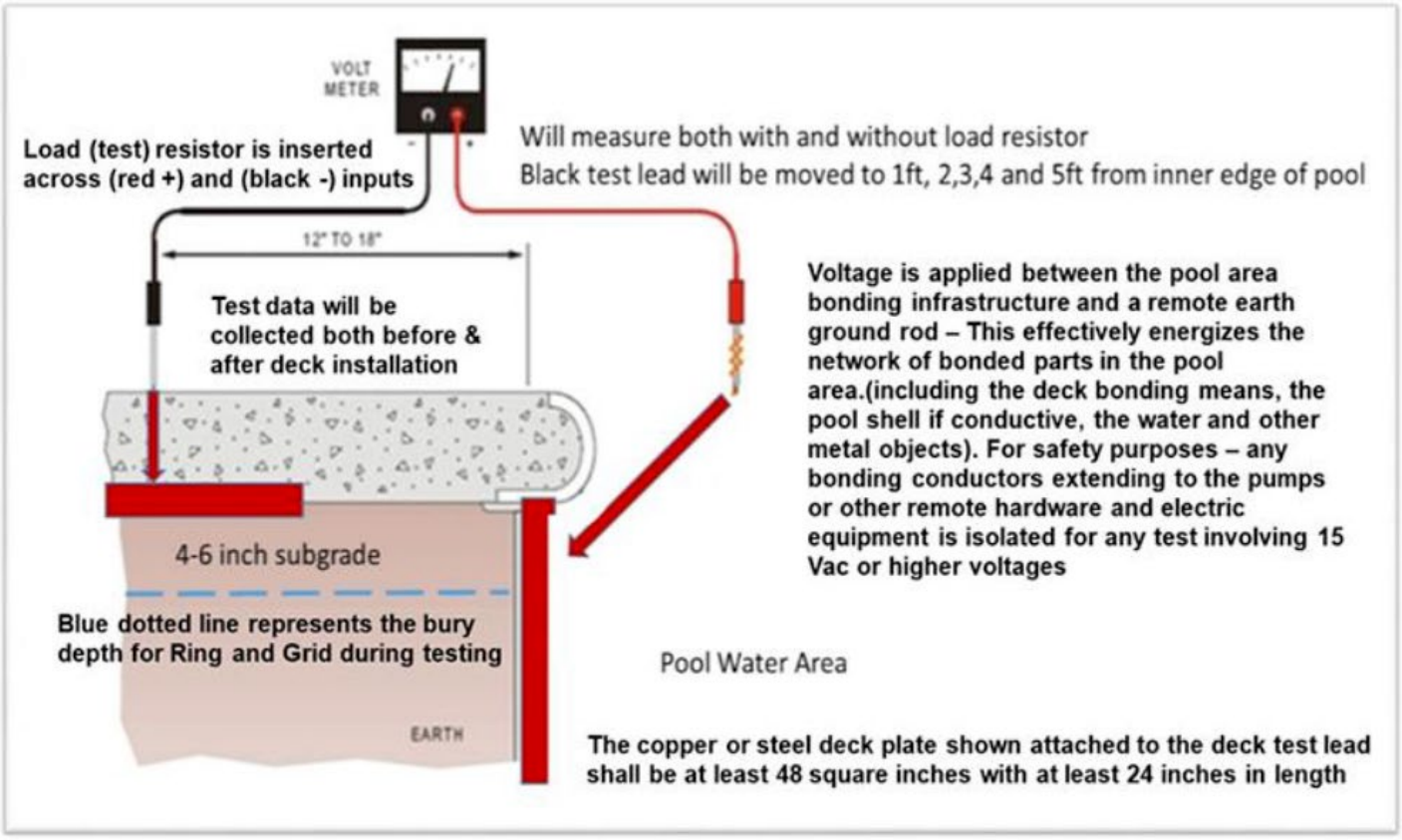
8. Test Results

The results of the test are usually indicated in the form of tables, sample calculations, as appropriate for each test procedure.

A description and/or a block diagram of the test setup is usually provided.

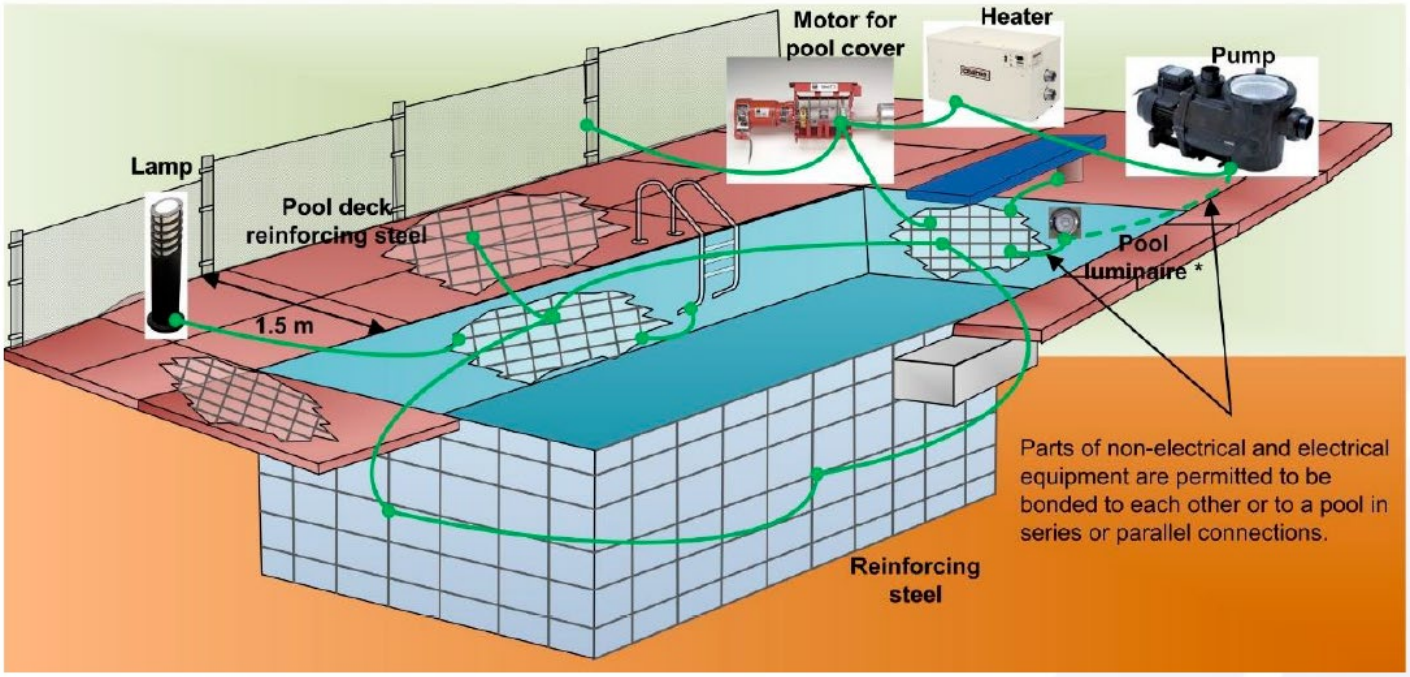
8.1 Voltage Gradient Testing

Test procedure from 2025-2-10 FSPA EPB Test Procedure.



8.2 Bonding System Continuity Testing (Resistance to Ground)

Limits from 2020 NEC 250.53, test procedure from 2025-2-10 FSPA EPB Test Procedure.



8.3 Test Data

8.3.1 Test Data, Pool #1, 10961 Prairie Hawk Dr, Orlando, FL

Pool Bonding & Equipotential Voltage Test Form

POOL INFORMATION	
Pool ID	Test Pool #1
Location	10961 Prairie Hawk Dr, Orlando, FL 32837
Pool Type (Concrete/Fiberglass/Vinyl)	Concrete with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	#8 wire loop
Date of Test	4/7/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Richard Moseley (Holland Pools)

CONTINUITY TESTING			
TO REMOTE EARTH GROUND ROD			
Location	1	2	3
Description	---	---	---
Bonding to Earth Ground (Ω)	---	---	---
TO EQUIPMENT GROUND			
Location	1	2	3
Description	Pump Lug to Pool Panel	Lighting Transformer to Pool Panel	Lighting J-box to Pool Panel
Bonding to Equip. Ground (Ω)	1.4	0.2	0.3

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.037	0.012	0.018
2	0.051	0.017	0.025
3	0.091	0.026	0.038
4	0.126	0.028	0.042
5	0.131	0.032	0.054

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.069	0.038	0.038
2	0.113	0.047	0.052
3	0.144	0.056	0.077
4	0.171	0.055	0.093
5	0.176	0.059	0.117

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.084	0.033	0.036
2	0.124	0.048	0.051
3	0.169	0.051	0.079
4	0.182	0.076	0.108
5	0.227	0.082	0.154

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.091	0.056	0.073
2	0.119	0.068	0.107
3	0.162	0.103	0.141
4	0.234	0.115	0.176
5	0.324	0.142	0.217

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.128	0.069	0.116
2	0.218	0.084	0.138
3	0.314	0.104	0.168
4	0.399	0.143	0.229
5	0.446	0.193	0.260

Final Observations & Sign-Off

Observations	12' x 28' pool - Weather: 84 F, 51% humidity at time of test (10:00 AM) - Voltage test done connected from main bonding wire at pump to remote earth rod

Test Completed by:

Name:	Kristoffer Costa	Name:	John Antonelli
Title:	EMC Technician - IIA	Title:	VP - SunSmart Engineering
Signature:		Signature:	
Date:		Date:	

8.3.2 Test Data, Pool #2, 667 Linville Falls Dr. W. Melbourne, FL

Pool Bonding & Equipotential Voltage Test Form

POOL INFORMATION	
Pool ID	Test Pool #2
Location	667 Linville Falls Dr, West Melbourne, FL 32904
Pool Type (Concrete/Fiberglass/Vinyl)	Concrete with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	Copper Grid
Date of Test	4/8/2025 & 4/16/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Albert Underwood, Dustin Underwood (Aqua Blue Pools)

CONTINUITY TESTING			
TO REMOTE EARTH GROUND ROD			
Location	1	2	3
Description	---	---	---
Bonding to Earth Ground (Ω)	---	---	---
TO EQUIPMENT GROUND			
Location	1	2	3
Description	Pump Lug to Pool Panel	Lighting Transformer to Pool Panel	Lighting J-box to Pool Panel
Bonding to Equip. Ground (Ω)	0.1	0.1	0.1

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.005	0.004	0.004
2	0.006	0.006	0.005
3	0.006	0.005	0.006
4	0.007	0.004	0.004
5	0.009	0.004	0.004

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC						
Distance from Water (ft)	Open Circuit - 4/8	4/16	200 Ω Resistor-4/8	4/16	500 Ω Resistor-4/8	4/16
1	0.007	0.011	0.007	0.005	0.003	0.003
2	0.007	0.009	0.007	0.005	0.004	0.005
3	0.005	0.01	0.007	0.008	0.004	0.009
4	0.007	0.009	0.005	0.009	0.004	0.001
5	0.006	0.01	0.006	0.009	0.004	0.009

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.011	0.005	0.002
2	0.009	0.005	0.007
3	0.009	0.008	0.008
4	0.01	0.007	0.01
5	0.01	0.005	0.006

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.01	0.008	0.003
2	0.011	0.008	0.003
3	0.01	0.006	0.004
4	0.011	0.005	0.005
5	0.01	0.005	0.005

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.010	0.003	0.006
2	0.011	0.008	0.006
3	0.008	0.008	0.005
4	0.007	0.006	0.005
5	0.007	0.006	0.006

Final Observations & Sign-Off

Observations	4/8/2025 - 66 F, 75% humidity, Heavy rain prior to test, gorund was saturated. Low soil impedence caused the fuse in the VARIAC to blow when starting ground faul testing. Rescheduling ground-fault testing for 4/16/2025. - 4/16/2025 - 76 F, 54% humidity

Test Completed by:

Name:	Kristoffer Costa	Name:	John Antonelli
Title:	EMC Technician - IIA	Title:	VP - SunSmart Engineering
Signature:		Signature:	
Date:		Date:	

8.3.3 Test Data, Pool #3a, 1906 Summerfield Road Winter Park, FL

Pool Bonding & Equipotential Voltage Test Form

POOL INFORMATION	
Pool ID	Test Pool #3
Location	1906 Summerfield Rd, Winter Park, FL 32792
Pool Type (Concrete/Fiberglass/Vinyl)	Concrete with Paver Deck
Bonding Type (Wire Loop/Copper Grid)	Copper Grid
Date of Test	4/9/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Brad Quehl (Holland Pools), Richard Smith (SunSmart Engineering)

CONTINUITY TESTING			
TO REMOTE EARTH GROUND ROD			
Location	**1**	**2**	**3**
Description	---	---	---
Bonding to Earth Ground (Ω)	---	---	---
TO EQUIPMENT GROUND			
Location	**1**	**2**	**3**
Description	Pump Lug to Pool Panel	Lighting Transformer to Pool Panel	Lighting J-box to Pool Panel
Bonding to Equip. Ground (Ω)	0.2	0.2	0.3

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.005	0.002	0.002
2	0.005	0.003	0.002
3	0.005	0.002	0.002
4	0.005	0.002	0.002
5	0.005	0.002	0.004

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.005	0.005	0.001
2	0.005	0.003	0.002
3	0.005	0.002	0.002
4	0.006	0.002	0.002
5	0.006	0.001	0.002

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.368	0.212	0.045
2	0.829	0.259	0.163
3	2.568	0.289	0.331
4	3.562	0.481	0.463
5	6.81	0.235	0.772

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	1.072	0.255	0.112
2	0.909	0.328	0.144
3	4.33	1.456	0.436
4	7.84	1.601	1.135
5	9.67	2.983	1.746

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	1.818	0.312	0.045
2	2.217	0.476	0.115
3	2.856	0.958	0.276
4	9.170	1.976	0.712
5	13.840	3.664	0.834

Final Observations & Sign-Off

Observations	14' x 22' pool - Weather: 65 F, 70% humidity at time of test (10:00 AM) - Voltage test done connected from main bonding wire at pump to remote earth rod - Power source for VARIAC was from non-GFCI outlet in home

Test Completed by:

Name:	Kristoffer Costa	**Name:**	John Antonelli
Title:	EMC Technician - IIA	**Title:**	VP - SunSmart Engineering
Signature:		**Signature:**	
Date:		**Date:**	

8.3.4 Test Data, Pool #3b, RECHECK, 1906 Summerfield Road Winter Park, FL

Pool Bonding & Equipotential Voltage Test Form

POOL INFORMATION	
Pool ID	Test Pool #3
Location	1906 Summerfield Rd, Winter Park, FL 32792
Pool Type (Concrete/Fiberglass/Vinyl)	Concrete with Paver Deck
Bonding Type (Wire Loop/Copper Grid)	Copper Grid
Date of Test	4/16/2025 - RE-CHECK
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Richard Moseley (Holland Pools)

CONTINUITY TESTING			
TO REMOTE EARTH GROUND ROD			
Location	1	2	3
Description	---	---	---
Bonding to Earth Ground (Ω)	---	---	---
TO EQUIPMENT GROUND			
Location	1	2	3
Description	Pump Lug to Pool Panel	Lighting Transformer to Pool Panel	Lighting J-box to Pool Panel
Bonding to Equip. Ground (Ω)	---	---	---

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	---	---	---
2	---	---	---
3	---	---	---
4	---	---	---
5	---	---	---

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.008	0.006	0.006
2	0.008	0.006	0.007
3	0.008	0.006	0.008
4	0.008	0.007	0.006
5	0.008	0.007	0.006

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.007	0.01	0.004
2	0.012	0.015	0.005
3	0.013	0.009	0.006
4	0.014	0.008	0.006
5	0.02	0.009	0.007

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.01	0.008	0.004
2	0.011	0.006	0.004
3	0.012	0.009	0.003
4	0.02	0.007	0.005
5	0.032	0.007	0.003

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.013	0.013	0.009
2	0.018	0.007	0.010
3	0.018	0.006	0.009
4	0.026	0.020	0.005
5	0.042	0.016	0.004

Final Observations & Sign-Off

Observations	14' x 22' pool - Weather: 76 F, 30% humidity at time of test (12:00 PM) - Voltage test done connected from main bonding wire at pump to remote earth rod - RE-CHECK DUE TO ANOMALOUS VALUES FROM TESTING ON 4/9 - - Power source for VARIAC was from portable battery power supply

Test Completed by:

Name:	Kristoffer Costa	Name:	John Antonelli
Title:	EMC Technician - IIA	Title:	VP - SunSmart Engineering
Signature:		Signature:	
Date:		Date:	

8.3.5 Test Data, Pool #4, 17909 Lookout Hill Rd, Winter Garden, FL

Pool Bonding & Equipotential Voltage Test Form

POOL INFORMATION	
Pool ID	Test Pool #4
Location	17909 Lookout Hill Rd, Winter Garden, FL 34787
Pool Type (Concrete/Fiberglass/Vinyl)	Fiberglass with Paver Deck
Bonding Type (Wire Loop/Copper Grid)	In-line bonding, water bond plate in skimmer
Date of Test	4/9/2025 & 4/14/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Michael Ramee (Mad River Pools)

CONTINUITY TESTING			
TO REMOTE EARTH GROUND ROD			
Location	1	2	3
Description	---	---	---
Bonding to Earth Ground (Ω)	---	---	---
TO EQUIPMENT GROUND			
Location	1	2	3
Description	Pump Lug to Pool Panel	Lighting Transformer to Pool Panel	Heat Pump Lug to Pool Panel
Bonding to Equip. Ground (Ω)	0.4	0.2	0.4

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.084	0.063	0.048
2	0.091	0.071	0.043
3	0.089	0.067	0.036
4	0.108	0.082	0.065
5	0.118	0.079	0.053

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC						
Distance from Water (ft)	Open Circuit - 4/9	4/14	200 Ω Resistor-4/9	4/14	500 Ω Resistor-4/9	4/14
1	0.093	0.126	0.068	0.094	0.052	0.062
2	0.109	0.141	0.059	0.099	0.027	0.064
3	0.103	0.156	0.056	0.096	0.046	0.053
4	0.124	0.163	0.056	0.102	0.045	0.043
5	0.136	0.173	0.062	0.123	0.046	0.056

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.153	0.115	0.072
2	0.138	0.102	0.073
3	0.138	0.106	0.037
4	0.151	0.097	0.047
5	0.155	0.095	0.072

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.224	0.187	0.116
2	0.241	0.162	0.107
3	0.229	0.116	0.106
4	0.228	0.152	0.112
5	0.248	0.168	0.117

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.322	0.252	0.183
2	0.341	0.245	0.178
3	0.345	0.252	0.151
4	0.353	0.242	0.158
5	0.351	0.205	0.155

Final Observations & Sign-Off

Observations	15' x 39' pool - Weather: 74 F, 41% humidity at time of test (1:00 PM, 4/9) - Water bonding plate installed in skimmer - No access to non-GFCI outlets; fault testing to be completed Monday 4/14 - Voltage test done connected directly to pool water to remote earth rod on 4/14 - Weather: 69 F, 62% humidity at time of test (10:00 AM, 4/14)

Test Completed by:

Name:	Kristoffer Costa	Name:	John Antonelli
Title:	EMC Technician - IIA	Title:	VP - SunSmart Engineering
Signature:		Signature:	
Date:		Date:	

8.3.6 Test Data, Pool #5, 13331 Sugarloaf Ct, Clermont, FL

Pool Bonding & Equipotential Voltage Test Form

POOL INFORMATION	
Pool ID	Test Pool #5
Location	13331 Sugarloaf Ct, Clermont, FL 34715
Pool Type (Concrete/Fiberglass/Vinyl)	Fiberglass with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	In-line bonding, water bond plate in skimmer
Date of Test	4/14/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Michael Ramee (Mad River Pools)

CONTINUITY TESTING			
TO REMOTE EARTH GROUND ROD			
Location	**1**	**2**	**3**
Description	---	---	---
Bonding to Earth Ground (Ω)	---	---	---
TO EQUIPMENT GROUND			
Location	**1**	**2**	**3**
Description	Pump Lug to Pool Panel	Lighting Controller to Pump Lug	Chlorinator to Pool Panel
Bonding to Equip. Ground (Ω)	0.2	0.2	0.3

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.040	0.019	0.007
2	0.039	0.017	0.008
3	0.042	0.016	0.010
4	0.045	0.021	0.010
5	0.047	0.021	0.011

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.027	0.015	0.005
2	0.028	0.014	0.005
3	0.027	0.014	0.006
4	0.030	0.015	0.009
5	0.031	0.016	0.008

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.135	0.081	0.049
2	0.126	0.080	0.042
3	0.094	0.084	0.041
4	0.138	0.064	0.052
5	0.135	0.056	0.046

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.190	0.127	0.062
2	0.191	0.123	0.071
3	0.195	0.117	0.075
4	0.197	0.117	0.066
5	0.203	0.121	0.052

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	**Open Circuit**	**200 Ω Resistor**	**500 Ω Resistor**
1	0.257	0.169	0.082
2	0.230	0.159	0.089
3	0.245	0.155	0.094
4	0.248	0.164	0.094
5	0.238	0.174	0.105

Final Observations & Sign-Off

Observations	12' x 31' pool - Weather: 76 F, 56% humidity at time of test (11:00 AM) - Water bonding plate installed in skimmer - Voltage test done connected directly to pool water to remote earth rod

Test Completed by:

Name:	Kristoffer Costa	**Name:**	John Antonelli
Title:	EMC Technician - IIA	**Title:**	VP - SunSmart Engineering
Signature:		**Signature:**	
Date:		**Date:**	

8.3.7 Test Data, Pool #6a, 20541 Fieldcrest Ct, Clermont, FL

Pool Bonding & Equipotential Voltage Test Form

POOL INFORMATION	
Pool ID	Test Pool #6
Location	20451 Fieldcrest Ct, Clermont, FL 34715
Pool Type (Concrete/Fiberglass/Vinyl)	Fiberglass with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	In-line bonding, water bond plate in skimmer
Date of Test	4/14/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Michael Ramee (Mad River Pools)

CONTINUITY TESTING			
TO REMOTE EARTH GROUND ROD			
Location	1	2	3
Description	---	---	---
Bonding to Earth Ground (Ω)	---	---	---
TO EQUIPMENT GROUND			
Location	1	2	3
Description	Pump Lug to Pool Panel	Heat Pump Lug to Pump Lug	Lighting Transformer to Pool Panel
Bonding to Equip. Ground (Ω)	0.5	0.2	0.2

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.023	0.022	0.014
2	0.027	0.019	0.015
3	0.032	0.025	0.014
4	0.025	0.019	0.015
5	0.037	0.021	0.016

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.028	0.017	0.017
2	0.023	0.018	0.015
3	0.025	0.017	0.015
4	0.023	0.021	0.014
5	0.024	0.022	0.017

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.751	0.634	0.472
2	0.772	0.593	0.385
3	0.774	0.566	0.320
4	0.753	0.616	0.405
5	0.771	0.627	0.419

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	1.429	1.076	0.745
2	1.456	1.073	0.606
3	1.521	0.947	0.497
4	1.548	0.942	0.632
5	1.533	0.938	0.647

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	1.981	1.545	1.122
2	2.081	1.435	0.848
3	2.084	1.320	0.752
4	2.083	1.416	0.873
5	2.054	1.454	1.112

Final Observations & Sign-Off

Observations	15' x 30' pool - Weather: 76 F, 56% humidity at time of test (11:45 AM) - Water bonding plate installed in skimmer - Voltage test done connected directly to pool water to remote earth rod

Test Completed by:

Name:	Kristoffer Costa	Name:	John Antonelli
Title:	EMC Technician - IIA	Title:	VP - SunSmart Engineering
Signature:		Signature:	
Date:		Date:	

8.3.8 Test Data, Pool #6b, RECHECK, 20541 Fieldcrest Ct, Clermont, FL

Pool Bonding & Equipotential Voltage Test Form

POOL INFORMATION	
Pool ID	Test Pool #6
Location	20541 Fieldcrest Ct. Clermont, FL. 34715
Pool Type (Concrete/Fiberglass/Vinyl)	Fiberglass with concrete deck
Bonding Type (Wire Loop/Copper Grid)	In-line bonding, water bond plate in skimmer
Date of Test	6/10/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Michael Ramee (Mad River Pools)

CONTINUITY TESTING			
TO REMOTE EARTH GROUND ROD			
Location	1	2	3
Description	---	---	---
Bonding to Earth Ground (Ω)	---	---	---
TO EQUIPMENT GROUND			
Location	1	2	3
Description	Lighting Transformer to Pool Panel	?? to Pool Pump	Pump Lug to Pool Panel
Bonding to Equip. Ground (Ω)	0.2	0.2	0.5

Baseline Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.023	0.022	0.014
2	0.027	0.019	0.015
3	0.032	0.025	0.014
4	0.025	0.019	0.015
5	0.037	0.021	0.016

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.805	0.249	0.451
2	0.812	0.243	0.498
3	0.816	0.294	0.539
4	0.816	0.279	0.533
5	0.812	0.243	0.487

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	1.216	0.311	0.665
2	1.233	0.403	0.725
3	1.222	0.423	0.826
4	1.226	0.376	0.757
5	1.232	0.326	0.757

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	1.643	0.477	1.158/ 1.085
2	1.641	0.496	1.163/ 1.115
3	1.652	0.626	1.222/ 1.176
4	1.657	0.526	1.191/ 1.147
5	1.661	0.54	1.186/ 1.154

Final Observations & Sign-Off

Observations	

Test Completed by:

Name:	Kristoffer Costa	Name:	John Antonelli
Title:	EMC Technician - IIA	Title:	VP - SunSmart Engineering
Signature:		Signature:	
Date:	6/10/2025	Date:	6/10/2025

8.3.9 Test Data, Pool #7, 5753 Timber Meadow Way, St Cloud, FL

Pool Bonding & Equipotential Voltage Test Form

POOL INFORMATION	
Pool ID	Test Pool #7
Location	5753 Timber Mdw Wy, St Cloud, FL 34771
Pool Type (Concrete/Fiberglass/Vinyl)	Concrete with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	#8 wire loop
Date of Test	4/15/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Richard Moseley (Holland Pools)

CONTINUITY TESTING			
TO REMOTE EARTH GROUND ROD			
Location	1	2	3
Description	---	---	---
Bonding to Earth Ground (Ω)	---	---	---
TO EQUIPMENT GROUND			
Location	1	2	3
Description	Pump Lug to Lighting J-box	Lighting Transformer to Pump Lug	LightingTransformer to Pool Panel
Bonding to Equip. Ground (Ω)	0.1	0.3	0.2

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.011	0.007	0.032
2	0.007	0.008	0.012
3	0.010	0.017	0.016
4	0.009	0.011	0.012
5	0.008	0.009	0.010

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.008	0.008	0.008
2	0.006	0.008	0.008
3	0.008	0.008	0.011
4	0.007	0.009	0.010
5	0.008	0.010	0.009

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.021	0.022	0.013
2	0.018	0.024	0.016
3	0.017	0.020	0.015
4	0.021	0.017	0.021
5	0.016	0.021	0.019

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.024	0.025	0.030
2	0.029	0.025	0.026
3	0.024	0.027	0.020
4	0.032	0.027	0.023
5	0.028	0.037	0.019

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.030	0.029	0.040
2	0.022	0.030	0.024
3	0.027	0.028	0.023
4	0.031	0.027	0.024
5	0.029	0.034	0.022

Final Observations & Sign-Off

Observations	10'-8" x 26'-8" pool - Weather: 72 F, 64% humidity at time of test (10:00 AM) - Voltage test done connected directly to pool water to remote earth rod

Test Completed by:

Name:	Kristoffer Costa	Name:	John Antonelli
Title:	EMC Technician - IIA	Title:	VP - SunSmart Engineering
Signature:		Signature:	
Date:		Date:	

8.3.10 Test Data, Pool #8, 1512 Pines End Pl, St Cloud, FL

Pool Bonding & Equipotential Voltage Test Form

POOL INFORMATION	
Pool ID	Test Pool #8
Location	1512 Pines End Pl, St Cloud, FL 34771
Pool Type (Concrete/Fiberglass/Vinyl)	Concrete with Concrete Deck
Bonding Type (Wire Loop/Copper Grid)	#8 wire loop
Date of Test	4/15/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Richard Moseley (Holland Pools)

CONTINUITY TESTING			
TO REMOTE EARTH GROUND ROD			
Location	1	2	3
Description	---	---	---
Bonding to Earth Ground (Ω)	---	---	---
TO EQUIPMENT GROUND			
Location	1	2	3
Description	Pump Lug to Pool Panel	Lighting J-box to Pump Lug	LightingTransformer to Pool Panel
Bonding to Equip. Ground (Ω)	0.8	0.5	0.5

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT ON (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.015	0.006	0.004
2	0.015	0.007	0.004
3	0.037	0.008	0.010
4	0.043	0.015	0.014
5	0.037	0.012	0.009

Baseline Equipotential Voltage Measurements - POOL EQUIPMENT OFF (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.012	0.012	0.005
2	0.015	0.007	0.005
3	0.017	0.010	0.006
4	0.016	0.011	0.011
5	0.017	0.009	0.009

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.012	0.014	0.005
2	0.016	0.015	0.008
3	0.016	0.011	0.012
4	0.021	0.010	0.009
5	0.027	0.011	0.006

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.012	0.012	0.007
2	0.016	0.014	0.007
3	0.016	0.015	0.008
4	0.019	0.016	0.009
5	0.022	0.020	0.006

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.022	0.007	0.007
2	0.030	0.010	0.010
3	0.046	0.022	0.012
4	0.052	0.038	0.015
5	0.046	0.044	0.016

Final Observations & Sign-Off

Observations	15' x 30' pool - Weather: 72 F, 64% humidity at time of test (11:00 AM) - Voltage test done connected from main bonding wire at pump to remote earth rod

Test Completed by:

Name:	Kristoffer Costa	Name:	John Antonelli
Title:	EMC Technician - IIA	Title:	VP - SunSmart Engineering
Signature:		Signature:	
Date:		Date:	

8.3.11 Test Data, Pool #9, 590 Dinner St NE Palm Bay, FL

Pool Bonding & Equipotential Voltage Test Form

POOL INFORMATION	
Pool ID	Test Pool #9
Location	590 Dinner St. NE, Palm Bay, FL 32907
Pool Type (Concrete/Fiberglass/Vinyl)	Paver deck
Bonding Type (Wire Loop/Copper Grid)	Grid
Date of Test	6/10/2025
Tested By	Kristoffer Costa (IIA), John Antonelli (SunSmart Engineering)
Witnessed By	Aqua Blue Pools

CONTINUITY TESTING			
TO REMOTE EARTH GROUND ROD			
Location	1	2	3
Description	---	---	---
Bonding to Earth Ground (Ω)	---	---	---
TO EQUIPMENT GROUND			
Location	1	2	3
Description	Heater to Pump	Pump to Cont	XFMR to cont
Bonding to Equip. Ground (Ω)	0.1	0.1	0.3

Baseline Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.007	0.001	0.001
2	0.016	0.003	0.001
3	0.012	0.002	0.002
4	0.008	0.003	0.002
5	0.009	0.002	0.003

Simulated Fault Test: 60 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.008	0.006	0.007
2	0.008	0.003	0.009
3	0.01	0.005	0.01
4	0.029	0.007	0.019
5	0.05	0.006	0.027

Simulated Fault Test: 90 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.01	0.005	0.005
2	0.009	0.004	0.005
3	0.018	0.007	0.016
4	0.046	0.013	0.023
5	0.082	0.019	0.031

Simulated Fault Test: 120 VAC - Equipotential Voltage Measurements (Water-to-Deck) - VAC			
Distance from Water (ft)	Open Circuit	200 Ω Resistor	500 Ω Resistor
1	0.01	0.005	0.008
2	0.011	0.003	0.008
3	0.018	0.002	0.014
4	0.06	0.002	0.019
5	0.114	0.003	0.042

Final Observations & Sign-Off

Observations	89 Degrees Fahrenheit, 57% Humidity. 12k Gallon freeform pool

Test Completed by:

Name:	Kristoffer Costa	Name:	John Antonelli
Title:	EMC Technician - IIA	Title:	VP - SunSmart Engineering
Signature:		Signature:	
Date:	6/10/2025	Date:	6/10/2025

9. ANNEX-B – Test Setup Photographs

Test setup photographs are located in a separate document.

10. History of Test Report Changes

Test Report #	Revision #	Description	Date of Issue
TR_18836-25_Pool Bonding Test_	1	Initial release	6/11/2025

END OF TEST REPORT

Pool #1

Pool #2

Pool #3

Pool #4

Pool #5

Pool #6

Pool #7

Pool #8

Pool #9