

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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AFFORDABLE WIRE MANAGEMENT, LLC,  
Petitioner,

v.

CAMBRIA COUNTY ASSOCIATION FOR THE BLIND AND  
HANDICAPPED, INC.,  
Patent Owner.

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IPR2024-00139  
Patent 10,177,551

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**DECLARATION OF JOSHUA WEINER**

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## **I. INTRODUCTION**

1. I, Joshua Weiner, am submitting this declaration on behalf of Petitioner Affordable Wire Management, LLC (“AWM” or “Petitioner”) in two pending matters before the Patent Trial and Appeal Board, IPR2024-00139 and IPR2024-00178. I understand that in those proceedings, AWM has challenged the validity of two patents assigned to Cambria County Association for the Blind and Handicapped, Inc. (“CAB” or “Patent Owner”), U.S. Patent No. 10,177,551 (IPR2024-00139) and U.S. Patent No. 11,349,291 (IPR2024-00178).

2. I further understand that several individuals submitted declarations on behalf of CAB that discuss the solar industry and the development of wire management systems in the solar industry. I have been asked to provide my opinions and describe my experiences with the development of electrical cable management and grounding solutions in the solar industry from the mid-2000s to 2017, particularly with a focus on the use of a messenger cable-based systems and systems using a messenger cable as an equipment grounding conductor, and my experience with the industry’s perception of these types of systems during that time.

3. I believe I am qualified by education and experience to do so. Attached as EX1053 is a copy of my resumé. Below is an overview of some of my relevant background.

4. After earning a bachelor's degree in astrophysics and astronomy, and a minor in physics, from University of California, Berkeley, I began my career at Akeena Solar, one of the leading turn-key residential and commercial solar contractors from 2002 to 2012. From 2005 to 2009 I took on a supervisory role in managing the drafting, engineering, and project management teams in designing and implementing solar power installations, those installations supporting over 20 Megawatts of energy generation in both residential and small photovoltaic (PV) systems including over 2,000 residential projects and dozens of commercial and industrial projects.

5. In 2009, I founded SepiSolar, a national renewable energy design, engineering, and consulting company. From 2009 to the present, I have been committed to providing system solutions to clients. More specifically, SepiSolar specializes in supporting solar and energy storage EPCs, contractors, developers, asset owners, and installers in the development, design, planning, execution, and regulatory navigation of a solar energy project. My expertise includes designing, engineering, and project managing residential, commercial, and utility-scale solar power systems. These solar power systems include components commonly grouped together as Electrical Balance of Systems (EBOS) including, for example, wire systems, cabling systems, cable support and protection components, wire harnesses,

connectors, fuses, combiner boxes, inverters, and other components used in the collection, storage, and interconnection of energy generated by solar power systems.

6. In addition to founding SepiSolar, I was a co-founder of Green Charge Networks, which was awarded a \$10 million grant from the United States Department of Energy to deploy eight micro-grid and utility-interactive solar and energy storage projects. The purpose of these projects was to optimize “behind-the-meter” electricity usage. That is, to improve the ability of buildings and electric vehicles to generate, store, and use electricity. After exiting Green Charge Networks in 2015, I have continued to develop grid-connected and off-grid energy storage and micro-grid projects with roles dedicated to, for example, business, finance, policy, project development, product, hardware, and software.

7. In 2007, I earned from the North American Board of Certified Energy Practitioners (NABCEP) its PV Installation Professional certification, described by the NABCEP as “the gold standard for PV professionals in the renewable energy industry.” (See <https://www.nabcep.org/certifications/nabcep-board-certifications/>.)

8. In 2010, I was hired by the University of California, Berkeley, to develop and teach an extension program course, “Advanced PV System Design and Project Management,” in solar PV system design, engineering, development, and project management.

9. Throughout my career, I have personally designed and supported the design and engineering of over 10,000 residential solar power systems including, for example, rooftop residential solar power systems. I have, in addition, helped to design and engineer hundreds of commercial, industrial, and agricultural solar power systems as well as over a dozen utility-scale solar power systems. My breadth of experience with different sizes of solar installations has made me intimately familiar with the unique challenges presented by residential solar installations as compared with commercial/industrial scale solar installations as compared with utility-scale solar installations.

10. Over the past 19 years, I have become recognized as an expert in designing and engineering solar power installations. In that capacity, I have been directly involved with several contractual and other disputes. As an expert, matters where I have offered my expert opinion include, but are not limited to: FTE Solar v. Stonybrook Village, LLC, No. 1984CV00903-BLS1 in Massachusetts Superior Court; Daniel Selling v. Sunco Capital LLC, a proceeding before the American Arbitration Association; District of Columbia ex rel. Sam Brooks v. Solar Solution DC LLC, No. 2019 CA 000165 B in the District of Columbia Superior Court; and Shoals Technologies Group v. Hikam Tecnologia de Sinaloa & Ningbo Voltage Smart Production Co, Inv. No. 337-TA-1365 in United States International Trade Commission in Washington DC.

11. My rate for case preparation and consulting is \$950 per hour. My compensation is not dependent upon the outcome of this matter. If called upon to do so, I am prepared to testify at a deposition or other proceeding.

## **II. MATERIALS CONSIDERED**

12. In addition to my own knowledge, I have drawn on or considered at least the following, in arriving at the opinions expressed in this declaration:

- Declaration of Mitchel F. Bowman and associated exhibits
- Declaration of William F. Brooks and associated exhibits
- Declaration of Joseph William Novak and associated exhibits
- Declaration of Allen Garrett Smith and associated exhibits
- 2002, 2008, 2011, and 2020 versions of the National Electric Code (NFPA 70)
- UL 2703 standard scope summary, (EX1054) <https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=29007>
- “Photovoltaic Module Grounding: Issues and Recommendations” white paper prepared by BEW Engineering, dated April 2012 (EX1055)
- “91076\_9.15.2011” 7-Post, 1000 VDC, TTI Tracker drawing for SPG Solar, dated September 15, 2011 (EX1056)
- “2C\_600V\_Airguard\_UL” multi-conductor cable assembly specification, dated January 18, 2011 (EX1057)
- Images of SnakeTray mock-up at SPG Solar’s facility in Novato, CA, dated 2011 (EX1058)
- “Solar Snake Tray Announces New Cable Tray that Attaches to Messenger Wire Rope for Solar Installations,” (EX1059) <https://www.snaketray.com/solar-snake-tray-announces-new-cable-tray-that-attaches-to-messenger-wire-rope-for-solar-installations/>
- “Snake Tray Offers New Double Tier, Dual Purpose Cable Tray for MC Cables and Datacom Cables,” (EX1060) <https://www.snaketray.com/snake-tray-offers-new-double-tier-dual-purpose-cable-tray-for-mc-cables-and-datacom-cables/>

### **III. OPINION OF CAB'S ABOVE-GROUND CABLE MANAGEMENT SYSTEM**

13. As a part of my analysis, I have reviewed and considered the declarations and materials referenced above in Section II “Materials Considered.” In my opinion, the solar industry as a whole was seeking, designing, and in fact employing above-ground wire management solutions, including those using a messenger cable, that were code-compliant, safe, and cost-effective in and around 2011.

14. In my review of the aforementioned declarations, I observe that both Novak’s and Bowman’s declarations each make reference to “SnakeTray.” I also observe several statements like “No solar project bids at this time proposed using above-ground cable management systems” (EX2028, paragraph #32) and “CAB’s above-ground cable management system was the first cable management system in the solar industry to use messenger wire supported cable hangers” (EX2028, paragraph #8), and similar statements in Novak’s and Smith’s declarations. These declarations also suggest that the industry was skeptical that these types of above-ground cable management systems would work in the solar industry.

15. In my experience, these aforementioned statements regarding the unpopularity of above-ground cable management systems are categorically false because of my personal knowledge of the existence of above-ground management

systems (for instance, messenger-supported systems), including those manufactured by SnakeTray in the 2010 – 2013 time period. I was personally involved in designing utility-scale solar power system components and products that utilized above-ground cable support systems, including, but not limited to, those manufactured by SnakeTray. While these systems required routine engineering and due diligence to ensure compliance with the relevant codes and standards, based on my experience, I do not believe that the industry was skeptical that these systems would work in solar. In fact, many of the relevant codes and standards encouraged the use of known cable management systems (including messenger based systems), so industry participants would have felt confident that they would work in solar applications.

16. First, at the time I began my career in the solar industry in 2005, I was aware of Article 396 of the 2002 version of the National Electric Code (NEC) as part of my initial training in solar electric design and engineering concepts, requirements, and regulations. During my early days in solar, I recall referring to the NEC (as well as did many of my colleagues) when developing safe and code compliant solutions to make solar installations cheaper and safer. It was very well understood at the time, and still is, that the NEC provides helpful guardrails for engineers and industry participants looking to commercialize technologies in the solar industry.

17. Even though my first reading of the NEC was through the lens of a solar designer, I had the understanding that all electrical installations (be they solar, hospitals, residential wiring, fuel dispensing stations (aka “gas stations”), or otherwise) must conform to all relevant, applicable Articles of the NEC. Therefore, to know which Articles were or were not applicable to any particular project I worked on at the time, I needed to have a thorough and comprehensive appreciation of the entire NEC, not just isolated parts of the NEC.

18. As an example, I mentioned earlier in the introduction section of this declaration that I have previously worked on both residential and industrial solar systems. The applicable NEC Articles for residential and industrial systems are different, meaning that some Articles in the NEC that apply to a residential installation will not apply to an industrial installation, and vice-versa. In addition, the relevant sections of Article 690 on Solar Photovoltaic (PV) Systems will often refer to various other Articles throughout the NEC outside of Article 690. Moreover, to prepare for my NABCEP certification exam, I recall studying the NEC’s Table of Contents and Glossary sections, since I knew it was as important to appreciate the entire scope of the NEC as well as understanding details of various Articles. I also had to study and understand these Articles in the context of solar photovoltaic installations.

19. Further along in my career, and in the context of various product development endeavors I played a role in, I came to appreciate the NEC as a kind of requirements specification for regulatory approvals. In other words, any product I help develop that violates even a single section of the NEC puts the product at-risk from a commercial perspective – one cannot expect to successfully sell or distribute electrical products in the electrical industry that violate electrical health and safety codes.

20. Article 396 is titled “Messenger-Supported Wiring” and “...covers the use, installation, and construction specifications for messenger-supported wiring” (NEC Article 396.1 Scope). This Article has remained in the NEC in all subsequent publications of the NEC throughout my career. Since the NEC is a national health and safety code publication made widely available to the public to support the construction of safe electrical systems (including solar electricity, aka “photovoltaics”), I do not consider the messenger-supported cable support system manufactured by CAB to be the first cable system of its kind, novel, nor unique as the declarants claim.

21. Between 2010 - 2013, I was engaged by SPG Solar, one of the leading, nationwide, turnkey solar EPC’s (Engineering, Procurement, and Construction firms) to support the development of its single-axis tracker product, known as the “TTI Tracker.” My role at SPG Solar was to design and engineer solutions for the

electrical balance of system components (aka “E-BOS”) for the tracker’s DC power distribution system. E-BOS generally refers to all components in a solar installation beyond the PV panels and inverters. A key consideration when responsible for E-BOS design is the management of conductor cables. In this role, I referred to products and components available from within and outside the solar industry.

22. Around the time of my engagement with SPG Solar, there was much technological development unfolding throughout the solar industry. For instance, new integrated DC wire harnesses (with over-molded junctions) were being developed to streamline DC wire management on utility scale solar projects, new codes and regulations were being negotiated to allow 1,000 VDC rated solar systems, and new UL (Underwriters Laboratories) standards were being drafted to allow more sophisticated grounding and bonding systems. There was also an increased use of trackers in utility-scale solar projects, which generally increased the number of wires present in those projects. To support the development of SPG’s tracker and SPG’s reputation as a leader in the design and construction of solar energy systems, it was my job to be aware of and utilize cost-effective, efficient, and code-compliant components and systems in the E-BOS design of SPG’s tracker.

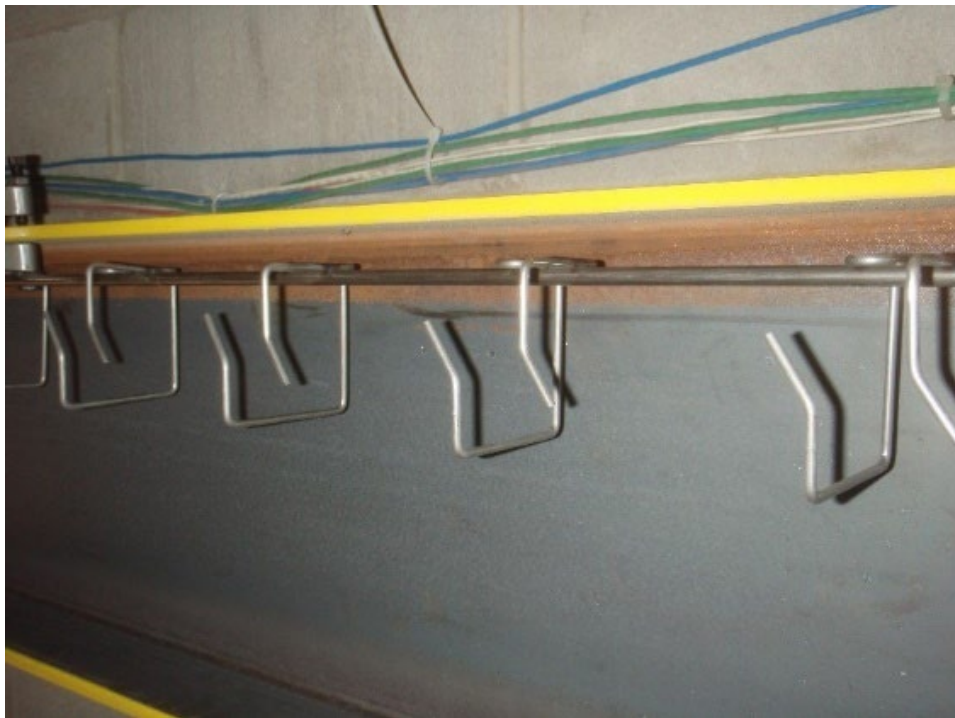
23. For example, when I first began my tenure at SPG Solar in 2010, I quickly noticed that SPG Solar had standardized its tracker’s cable support system around metallic wireways, as allowed by Article 376 of the NEC. These wireways

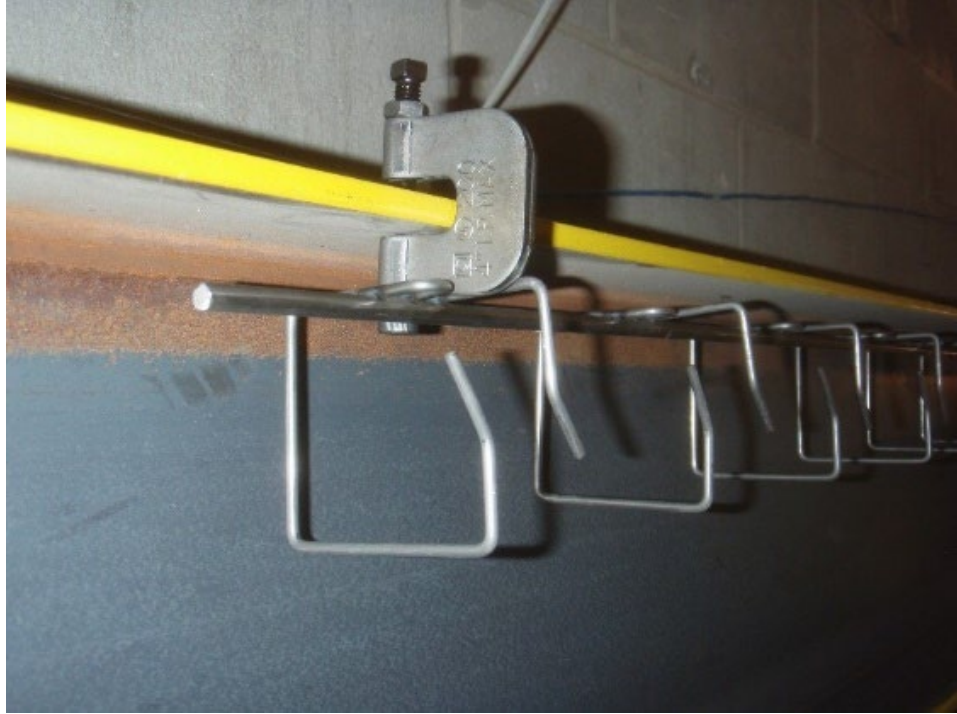
were utilized as above-ground cable support systems that were made of sheet metal troughs, were flexible enough to withstand many different kinds of environmental conditions, and complied with various requirements of the NEC. Part of my role at SPG was to identify a lower cost solution for this wireway.

24. As part of my research at SPG, in 2011-2012, I and my colleagues identified messenger-supported wiring systems as an opportunity to replace wireways and conventional cable trays as a potentially lower cost solution. At this time, the predominant above-ground cable management systems were wireways, raceways, and conventional cable trays. Around this time solar panels themselves became cheaper so companies were exploring installing solar plants in geographies that previously were not economically viable for solar energy. I noticed various embodiments of the messenger-supported concept available in the electrical industry, including aerial multi-conductor cable assemblies (like the AirGuard product line manufactured by Prysmian Cables & Systems, which expressly contemplates use in a messenger based system, EX1057) and cable tray-like assemblies provided by SnakeTray (EX1059, EX1060).

25. In my conversations with SnakeTray in the 2011 time frame, we discussed different code interpretations and applications of various product lines that SnakeTray offered. Due to interpretation and application issues associated with Article 392 “Cable Trays” and various solar grounding requirements, we specifically

discussed modifying SnakeTray's product in order to align with other non-Article-392 NEC sections, including but not limited to Article 396, that were more advantageous from cost, efficiency, and regulatory compliance perspectives. Eager to use these known methods for cable management in solar applications, we subsequently tested a few different iterations of SnakeTray's products on a mock-up of SPG's tracker in its Novato facility in 2011 – 2012 time frame, including a messenger-like metal rod to support saddles or hangers that were at the time welded to the messenger cable:





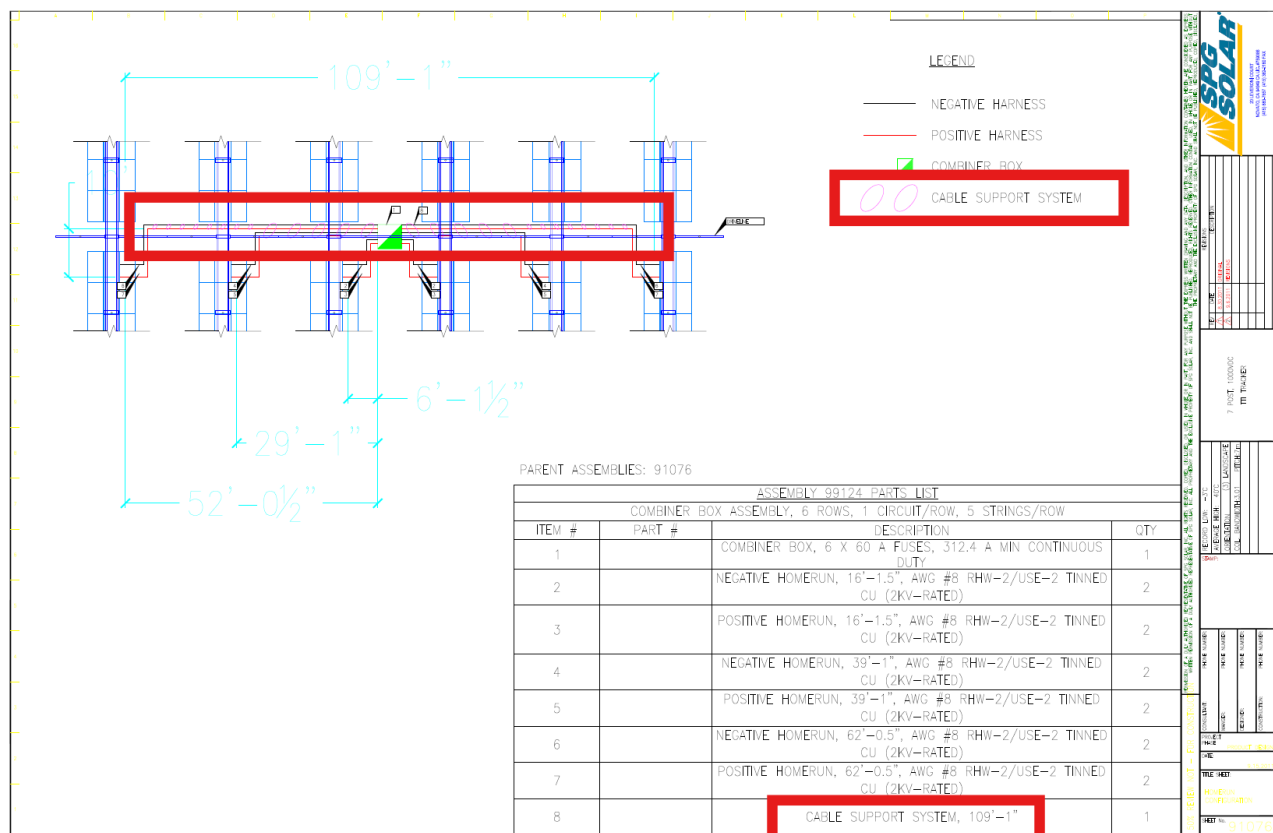




Each of the photos above were taken by me at the Novato facility in 2011. EX 1058. Though the mock-ups depicted above make use of a solid rod as a messenger to support the wire hangers, any deployment of this system could have made use of a variety of messenger types (including stranded messenger wire) to make installation easier and more cost efficient.

26. As further evidence of the discussions that took place, in 2011, I personally generated designs for standardized layouts of SPG's tracker showing these "cable support systems" for the purposes of estimating material costs and labor efficiency. As can be seen below, my design included a number of solar panels arranged with a tracker drive line running horizontally in the middle of the design (depicted in blue). Hanging off of the drive line is a messenger with cable hangers

(depicted as pink circles) for supporting the conductor cables (see pp 2-3 of TTI Tracker drawing, annotations provided in red below):



EX1056.

While the wire management in the schematic above has conductor cables running perpendicular to the solar arrays, it was not uncommon during this time of solar innovation to see cable supports running in parallel to solar arrays until reaching the “home run” of the solar plant. I do not recall any of my colleagues, vendors, operations and maintenance (“O & M”) personnel, or clients expressing skepticism that the use of messenger wire supported cabling would work.

27. It wasn't until the publication of the 2020 version of the NEC that the NEC defined "messenger" or "messenger wire" as: "A wire that is run along with or integral with a cable or conductor to provide mechanical support for the cable or conductor." With the benefit of hindsight, this 2020 definition validates the approach we were pursuing back in 2011 when we defined one of SnakeTray's product iterations (the one shown in the images above) as a messenger-supported wire system.

#### **IV. OPINION OF CAB'S INTEGRATED GROUNDING SYSTEM**

28. In addition to the above, I also focused on simplifying, integrating, and reducing costs in grounding systems related to SPG's tracker in 2011 - 2013. As part of this work, I looked to the cable support system and associated wiring that I was developing as an opportunity to reduce costs associated with grounding. As an initial step I, like any other similarly situated solar professional would have done, turned to the NEC for guidance because the NEC provided guidance for safe electrical practices in solar and other fields. Indeed, Article 396 of the NEC makes reference to using the messenger cable as an equipment grounding conductor, as shown in NEC 396.30(C). This made clear to me that it was code compliant, and certainly cost-efficient to simply use the messenger wire as the equipment grounding conductor (or, equivalently, to use the equipment grounding conductor as the messenger wire). This approach to grounding was nothing novel nor unique – it was

just a simple reading of Article 396 of the NEC, which could be a path to a more efficient, cost-effective, and compliant grounding system as compared to the other Articles of Chapter 3 in the NEC.

29. Around 2012, I became aware of a draft standard that would become known as UL 2703 titled “Mounting Systems, Mounting Devices, Clamping / Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels.” Based on my understanding of this standard, which in part came from BEW’s white paper titled “Photovoltaic Module Grounding: Issues and Recommendations,” this new standard was intended to simplify the often complex and cumbersome requirements of solar photovoltaic grounding. EX1055. BEW was a well-known and respected engineering consulting firm that advised frequently on solar photovoltaic projects and was subsequently acquired by DNV (one of the largest independent consulting firms that advises on solar risk management and assurance) in 2010.

30. For example, this white paper states: “The standard is expected to quantify ampacity and cross-sectional area requirements, similar in principle to the approach taken for the listing of cable tray systems,” and “...it will provide a means to evaluate and certify an intuitive and effective use of structural hardware for grounding purposes.” EX1055, 9. This suggested to me that UL 2703 was paving the way the solar industry to convert structural hardware (which is prevalent and

standardized in a tracker system) into a consolidated grounding system without introducing much additional hardware accessories, regulatory uncertainty, or labor requirements. This, to me, resembled the grounding system of an automobile, where the frame of the vehicle forms the grounding foundation to which all other components electrically bond to facilitate a grounding connection. In other words, I aimed to use UL 2703 to convert the structural hardware frame of a solar tracker into a functionally-equivalent car frame, where all the tracker components act as a consolidated grounding system.

31. My goal with UL 2703 was to integrate the multitude of pile-driven, structural I-beams (which effectively function like grounding rods) into a complete, integrated grounding system complete with ground rods (pile-driven I-beams), grounding electrode conductors (driveline), and equipment grounding conductors (messenger-supported wiring systems, solar module racking, and solar modules). It was clear to me that the pile-driven I-beams, the structural support for the solar panels and/or tracker system (sometimes referred to simply as piles), could even be used as grounding electrodes under NEC Article 250.52(2)(1) (permitting structural

metal elements 10 feet<sup>1</sup> or more in the earth to serve as a grounding electrode). Subsequent to gaining a deeper appreciation and understanding of SPG's tracker's fastener hardware and design, I worked with UL to investigate the path to code-compliance for a self-grounding tracker system that comprised of integrated, grounding cable support systems. We subsequently tested grounding braids (a type of grounding or bonding hardware), various Burndy grounding hardware, and star washers installed onto SPG's tracker in one of UL's testing laboratories located in San Jose, CA to see if we could certify the tracker as a UL 2703 compliant grounding and bonding system.

32. Because of the development of UL 2703 as a means to certify metallic hardware as equipment grounding conductors, NEC Article 396's definition of messenger-supported wiring, and SPG's corporate objectives, I found myself designing and investigating systems comparable and similar in both structure and function to the CAB above-ground cable management and integrated grounding system well before 2017. For example, I facilitated many conversations with other industry professionals, manufacturers, and colleagues in the 2011 – 2013 time period

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<sup>1</sup> In my experience, it is commonplace for solar piles to be driven at least 10 feet into the ground in order to provide sufficient support for the large solar panels supported thereon.

for the purposes of investigating such a design. I learned that it was not just myself, but many others who were just as excited as I to integrate and streamline the complexities of solar system grounding using UL 2703 as a means toward that end.

33. For all these reasons, it is my opinion that the so-called CAB above-ground cable management and integrated grounding system was the subject of technological innovation among many companies in the 2013 period and was not exclusive to CAB. In point of fact, there were public health and safety codes (NEC 396), testing standards (UL 2703), and available hardware (SnakeTray and Prysmian) publicly available to all professionals to support the design of any similar system to that of CAB's.

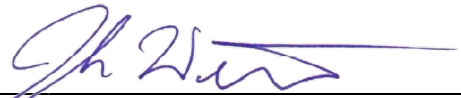
34. I submit this report with a reasonable degree of professional certainty based on the facts, evidence, and materials considered herein. I reserve the right to modify any opinions expressed in this report if new information becomes available to me.

## **V. CONCLUSION**

35. I declare that all statements made in this declaration based on my own knowledge and experience are true to the best of my knowledge and that any statements made on information and belief are believed to be true.

36. I further declare that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: October 28, 2024



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Joshua Weiner

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