Overview of CPV Tracker Safety

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Introduction

Until recently in the United States, the safety evaluation of CPV Trackers was relatively directionless in that safety certification agencies were left to put together a "best fit" evaluation approach because of a lack of an available standard for trackers in general. With the publication of the Outline of Investigation for Solar Trackers, UL 3703, in May 2011, a clear evaluation approach was established for CPV Trackers. This UL 3703 overview offers a glimpse of the key safety construction and testing considerations and how the evolution of this outline will affect evaluation of future CPV Trackers.

Key Tests in UL 3703

The following are key UL 3703 safety tests for a CPV Tracker system:

1. Maximum-Voltage Measurements Test – This test is used as a basis for the Dielectric Voltage Withstand Test and determination of minimum electrical spacings
2. Temperature Test – Determines if maximum rated temperatures are exceeded for the tracker system and its components during normal operation
3. Dielectric Voltage Withstand Test – Evaluates the electrical insulation of the tracker
4. Overload Test – Evaluates the tracker in an abnormal electrical overload condition
5. Grounding Impedance Test – Evaluates the grounding continuity between the equipment bonding conductor and any other metal part that is required to be grounded
6. Strain Relief Test – Determines if mechanical strain is transmitted to field-wiring leads or an input/output cord
7. Bonding Conductor Test – Evaluates the bonding circuit's ability to hold an overload current and limited short-circuit current
8. Static Load Test – Evaluates the tracker's structural ability during a weight overload condition
9. Rain and Sprinkler Tests – Evaluates the tracker's ability to keep water away from live parts during rain/sprinkler conditions
10. Flexing Test – Evaluates wiring which is subject to flexing or movement during normal use
11. Power Restoration Test – Evaluates the tracker's ability to prevent risk of injury to persons during a loss of power condition
12. Locked Platform Test – Evaluates the tracker's ability to operate safely during a locked rotor condition
13. Emergency Stop Test – Evaluates the tracker's ability to stop in a timely manner during an emergency stop condition

Key Construction Considerations of UL 3703

The key UL 3703 safety construction considerations are mainly mechanical in nature and place an emphasis on the following key topics for a CPV Tracker system:

1. Tracker Enclosure – All live and moving parts must be enclosed and protected from mechanical damage to reduce risk of fire, shock, etc.
2. Grounding System – An NEC compliant grounding system is required for all dead metal parts, giving consideration to the grounding connection means, location, intended application, etc.
3. Tracker Controller - The burden of proof is on the manufacturer to establish how the control circuit works and how it controls the CPV Tracker. It is essential to establish if a given control circuit is being relied upon for safety.
4. Protection of Users and Service Personnel – Covers requirements for accessibility of live parts in order to protect users and service personnel from electric shock or injury.
5. UL 2703 – The platform, which supports PV modules, is to be evaluated per the Outline for Rack Mounting Systems and Clamping Devices for Flat Plate PV Modules, UL 2703. Such an evaluation is not insignificant in cost.
6. Installation Manual - An Installation Manual shall be provided for the tracker, which describes assembly, grounding means, required cautionary statements/markings, operation of the tracker, etc. This is one of the first things that is looked at during an evaluation.
7. Electrical Spacings - Minimum spacings must be maintained between uninsulated live parts and dead metal or uninsulated live parts of opposite polarity, based on the voltage potential involved.

Outstanding Questions

- As CPV Trackers evolve, how will these designs fit into a one size fits all approach anticipated within the construct of UL 3703?
- How will a hazard based engineering approach evolve for CPV Trackers?
- How will UL 3703 find a way to harmonize to its IEC counterpart?

Conclusion

With a clearer safety evaluation direction provided by UL 3703, this outline has paved a uniform approach when evaluating CPV Trackers in the United States. Understanding the key construction considerations and tests in UL 3703 will enable a CPV Tracker manufacturer to proactively design a tracker system which complies with the safety certification requirements of UL 3703.