DEPARTMENT OF LABOR AND INDUSTRY

Solar Photovoltaic (PV) Systems And Energy Storage Systems

Frequently Asked Questions and Answers

Revised August 17, 2020

(This document is subject to change as solar PV, energy storage and other alternative energy and distributed energy technologies and codes continue to evolve)

The following frequently asked questions and answers are a compendium of existing statutes, rules and National Electrical Code (NEC) provisions that are applicable to all electrical installations, with a special emphasis related to the installation of solar photovoltaic systems and energy storage systems. The general licensing, code, equipment approval, inspection and other provisions that follow are applicable to all electrical work and all electrical systems.

Electrical Licensing

Statutes, Rules and Code

EL-1) Are solar PV systems, including photovoltaic modules, panels and arrays, and their associated components, considered to be electrical equipment under the State Electrical Code?

Answer: Yes. The State Electrical Code adopts by reference the 2017 edition of the National Electrical Code (NEC). Solar photovoltaic systems fall within the definition of "equipment" as it is defined in the NEC. See NEC Articles 100, 690, 691, 705 and other applicable articles for all pertinent definitions. Accordingly, solar PV systems, including the placement, positioning and securement of photovoltaic modules, panels and arrays, and their associated components and all electrical wiring, are electrical equipment under the State Electrical Code.

(Reference the Board of Electricity Final Interpretation dated July 8, 2009 available at http://www.dli.mn.gov/sites/default/files/pdf/SPS.pdf)

EL-2) How is the term "electrical work" defined in state law?

Answer: Minnesota Statute 326B.31, Subdivision 17, defines "electrical work" as follows:

> *Electrical work. "Electrical work" means the installing, altering, repairing, planning, or laying out of electrical wiring, apparatus, or equipment for electrical light, heat, power, technology circuits or systems, or other purposes. The installing, altering, repairing, planning, or laying out of electrical wiring, apparatus, or equipment for electrical light,*

heat, power, technology circuits or systems, or other purposes includes, but is not limited to, the performance of any work regulated by the standards referred to in section 326B.35.

EL-3) Are the solar PV systems that are regulated by the National Electrical Code considered "electrical work", as the term is defined in Minnesota Statute 326B.31, Subdivision 17?

Answer: Yes. Unless specifically exempt in Minnesota Statute Chapter 326B, all electrical work installed in Minnesota is required to be installed in accordance with all applicable electrical licensing and inspection requirements.

EL-4) Are there any specific licensing requirements, other than an electrical contractors license, required to install a residential rooftop solar system?

Answer: All electrical work that is performed as part of the installation of a solar PV system must be performed by properly licensed or registered employees of a licensed electrical contractor. That said, the real question is whether an additional DLI issued residential building contractor, residential remodeler, or residential roofer license is also required. In some situations, because municipalities generally require building permits for this work and they are required to verify state licensure before issuing permits, the question of which state licenses are required for this work is important.

The state residential contractor licensing law has always contained an exemption for "specialty contractors" who perform work in just one skill area. Generally, DLI has interpreted the work involved in attaching the non-electrical elements of the support system for a solar PV system to a residential roof as that of a specialty contractor. Therefore, no state residential building contractor, remodeler, or roofer license is required for most installations and municipalities can grant a building permit to the solar contractor. However, if the support system for a residential roof must be reinforced in order to support the additional load of the solar PV system, this work does require a residential building contractor, remodeler, or roofer license. Also, integrated-grounding elements of the support system (racking) are classified as electrical work and must be installed by a licensed electrical contractor.

Because the residential contractor licensing requirements apply to the company that contracts directly with the homeowner, the solar contractor that contracts with the homeowner must comply with the residential contractor licensing requirements, regardless of whether this work is performed by the solar contractor's employees or is subcontracted to another contractor.

In its 2019 session, the Minnesota legislature considered a bill that would have amended the definition of skill areas to make it clear that all solar PV installations would require a residential contractor license, but this bill did not pass and has not been reintroduced.

Jobsite Attendance Rosters

EL-5) Are electrical contractors required to complete jobsite daily attendance records?

Answer: Yes, if so requested by the department. The department reserves the right to implement a jobsite daily attendance record to ensure personal licensing compliance on large projects. Copies of the daily attendance record must be provided to the electrical inspector when requested. Jobsite daily attendance forms are available online. They are also available as an Excel file upon request: http://www.dli.mn.gov/sites/default/files/pdf/ele_record.pdf

Jobsite Electrical License and Registration Checks

EL-6) Do electrical inspectors routinely check electrical license or registration cards?

Answer: Yes. Electrical inspectors and department staff routinely check the electrical license or registration cards either randomly or for all electrical workers on the project site. Unlicensed registered individuals are required to carry their registration card when performing electrical work and must present it to electrical inspectors upon request. Licensed electricians are also advised to carry their license cards when performing electrical work. If an individual fails to present a valid license or registration card it may result in a cessation of electrical work.

Electrical Material Handling

EL-7) Do individuals handling, unloading and transporting electrical materials on a jobsite need to be licensed or registered by the department?

Answer: No. Minnesota Statute 326B.31, Subdivision 17, defines "electrical work" as follows:

> *Electrical work. "Electrical work" means the installing, altering, repairing, planning, or laying out of electrical wiring, apparatus, or equipment for electrical light, heat, power, technology circuits or systems, or other purposes. The installing, altering, repairing, planning, or laying out of electrical wiring, apparatus, or equipment for electrical light, heat, power, technology circuits or systems, or other purposes includes, but is not limited to, the performance of any work regulated by the standards referred to in section 326B.35.*

When electrical materials are being managed on the project site (i.e. transporting, moving, stacking, storing, uncrating, etc.) it is not considered to be "electrical work" as defined by Minnesota Statute, therefore no licensing and registration for individuals would be required.

Racking Systems

Non-electrical racking systems

EL-8) Solar PV systems are generally installed on some form of structural support system (racking) on building roofs, on poles, on the ground and on a wide variety of structures. Are the non-electrical structural support systems considered to be “electrical work”, as the term is defined in Minnesota Statute 326B.31, Subdivision 17?

Answer: Generally no. (See EL-9 below for integrated-grounding racking systems). Non-electrical equipment and non-electrical structural support elements that consist of brackets, racking, purlins, blocking, frames, poles, concrete, roofing ballast, skids, anchors and similar are not considered electrical work. Such structural support systems usually require professional design by a registered structural engineer; this type of professional design work is not within the scope or authority of any classification of Minnesota electrical license. See the following website for professional design requirements: https://www.revisor.mn.gov/statutes/cite/326

Totally-enclosed racking systems (no exposed conductors)

EL-9) Some solar PV systems use a support system that incorporates enclosed electrical wireways (channels) and interconnecting electrical conduits that are used to provide structural support for the individual solar PV modules and they also serve as raceways for electrical circuit conductors. Is this type of support system, or portions thereof, considered to be “electrical work”, as the term is defined in Minnesota Statute 326B.31, Subdivision 17?

Answer: Yes. This type of support system, or the applicable portions thereof, is considered to be “electrical work”, as the term is defined in Minnesota Statute 326B.31, Subdivision 17. Portions of the support system that includes wireways, conduits, raceways or other enclosed channels expressly intended for electrical circuit conductors or the extension of electrical circuitry is considered electrical work.

Integrated-grounding type racking systems

EL-10) Some solar PV support systems provide structural support for the solar PV modules and the metallic support system (structure) is identified or listed as an equipment grounding conductor (in accordance with UL 2703, UL 1703, UL 467, etc.). Is this type of support system or structure, or portions thereof, considered to be “electrical work”, as the term is defined in Minnesota Statute 326B.31, Subdivision 17?

Answer: Yes. NEC Article 690 has specific requirements for such support systems or structures.

Electrical bonding for metallic racking systems

EL-11) Some solar PV support systems provide structural support for the solar PV modules and the metallic support system may also be bonded to a grounding electrode and a grounding electrode conductor, where the metallic support system may serve as a path for electrical ground-faults (e.g. structural steel for a carport canopy) (See the definition of “ground-fault current path” in the NEC). Is this type of metallic support system, or portions thereof,

considered to be “electrical work”, as the term is defined in Minnesota Statute 326B.31, Subdivision 17?

Answer: Generally no. Metallic structural support systems such as carport canopies or similar structures that may serve as a path for ground-fault current does not automatically mean that the installation of such structural support system is considered electrical work. There are numerous metallic systems and elements in the built environment that serve as paths for ground-fault current or that may also serve as a means for other forms of electrical grounding and bonding, yet they are not considered to be electrical work. They could include, but not be limited to, structural steel for buildings, carport canopies, etc., reinforcing steel, metal building components, water piping, gas piping, ductwork, electrical shielding and the earth itself.

Grounding and bonding conductors and components

EL-12) Is the installation of any of the following items considered to be “electrical work”, as the term is defined in Minnesota Statute 326B.31, Subdivision 17?; Grounding and bonding adapters, bushings, clamps, clips, conductors, couplings, devices, electrodes, fittings, grids, hubs, jumpers, locknuts, lugs, mesh, plates, rods, shunts, straps, wedges, wires and similar.

Answer: Yes. The installation of electrical grounding and bonding conductors, apparatus, components and similar is considered to be “electrical work”, as the term is defined in Minnesota Statute 326B.31, Subdivision 17. All such electrical grounding and bonding conductors, apparatus, components and similar are required to be identified and listed for the purpose and installed in accordance with the manufacturer’s installation instructions.

Professional Engineering

EL-13) With respect to electrical or structural systems, are there other statutes and rules that may be applicable to solar PV installations?

Answer: Yes. Minnesota Statutes 326.02, Subdivision 1 contains provisions that require licensure of persons who practice or offer to practice professional engineering. The practice of professional engineering is further defined in Minnesota Statute 326.02, Subdivision 2.

EL-14) Are licensed electrical contractors allowed to plan and layout their own electrical work?

Answer: Yes. Minnesota Statutes 326.02, Subdivision 5 states in pertinent part:

“Subd. 5. Limitation. The provisions of sections 326.02 to 326.15 shall not apply to…the planning for and supervision of the construction and installation of work by an electrical…contractor…as defined in and licensed pursuant to chapter 326B, where such work is within the scope of such licensed activity and not within the practice of professional engineering...”

EL-15) If someone has additional questions related to professional design and licensure, who should they contact with their questions?

Answer: Please contact the Minnesota Board of Architecture and Engineering at https://mn.gov/aelslagid/index.html or 651-296-2388.

Electrical Code and Technical

EC-1) National Electrical Code (NEC) Section 690.9 requires overcurrent devices for PV source and PV output conductors to be accessible, but does not require them to be readily accessible. What does the NEC require or allow when the PV system is on a rooftop or an elevated structure? See the applicable definitions below.

Answer: NEC Article 100 definitions:

> **Accessible (as applied to equipment)** *Admitting close approach; not guarded by locked doors, elevation, or other effective means.*
>
> **Accessible (as applied to wiring methods)** *Capable of being removed or exposed without damaging the building structure or finish or not permanently closed in by the structure or finish of the building.*
>
> **Accessible, Readily (Readily Accessible)** *Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom access is requisite to actions such as to use tools, to climb over or remove obstacles, or to resort to portable ladders, and so forth.*

The definitions are not intended to mean that equipment may not be elevated where it can be reached with a portable ladder or located behind locked doors, when qualified persons who need access have the necessary means to do so. The requirement states only that locked doors, elevation or other effective means must not "guard" against access.

The overcurrent devices mounted on or behind modules or structural members of a PV system shall be accessible without damaging the PV modules or the structure in order to permit safe access for installers, maintenance personnel and the electrical inspector.

EC-2) NEC Section 690.31(A) requires readily accessible PV source and PV output conductors over 30 volts to be guarded or installed in a raceway. What methods will be acceptable in order to comply with the requirements for guarding or protecting PV conductors that are installed in readily accessible locations?

Answer: NEC Article 100 defines guarded as covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove

the likelihood of approach or contact by persons or objects to a point of danger. Most PV systems do not have means for attaching raceways. The conductors would be considered "not readily accessible" by using any of the items mentioned in the NEC definition or by elevation or location, provided the conductors are high enough or located in such a manner to remove the likelihood that individuals could approach or come into contact with conductors. Installations will be considered guarded when access is limited to qualified persons.

EC-3) Does the 2020 NEC have specific color code requirements for the identification of PV conductors?

Answer: Yes. NEC Section 690.31(B) and 215.12(C)(2) state that each ungrounded conductor of direct-current (dc) PV circuits and feeders shall be identified by polarity at all terminations, connections and splice points by color coding, marking tape, tagging and other approved means. See NEC Sections 690.31(B) and 215.12(C)(2) for the specific conductor color code requirements.

EC-4) Do the rules in NEC Article 225 for outside branch circuits and feeders apply to solar PV systems?

Answer: Yes. The scoping provisions in NEC 225.1 state that the article covers requirements for outside branch circuits and feeders run on or between buildings, structures or poles on the premises. It also covers electrical equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures or poles. NEC 225.3 and the accompanying table also act as a reminder that Article 225 is specifically applicable to solar photovoltaic systems in Article 690.

See Article 100 for the definitions of *Building* and *Structure*. The definition of *Structure* has broad applicability as determined by the Authority Having Jurisdiction (AHJ). It might not be obvious to solar PV installers, but a ground-mounted solar PV array, located away from the building, is considered a structure for the purpose of Article 225. However, when considering the disconnect requirements found in Part II of Article 225, the DC conductors extended from a ground-mounted array would not be considered to be "supplying power" to the array; therefore, the DC conductors would not be required to comply with NEC 225.31. In addition to all of the rules in Article 690 for the solar PV system, all of the general rules in NEC Chapters 1 through 4 are applicable, including Article 225, unless otherwise exempt.

EC-5) Do the requirements for surge protective devices (NEC 230.67) and emergency disconnects (NEC 230.85) apply to residential solar installations?

Answer: Generally yes. If the connection of the PV disconnect is located on the supply side of the service disconnect, you would be required to comply with both NEC 230.67 for the "surge protection" and NEC 230.85 for the "emergency disconnect." Residential PV disconnect(s) located on the supply side service disconnect must be installed using the same NEC requirements for a service disconnect (see definition of service*). The requirements in NEC 230.82(6) mandates that a PV disconnect must be "suitable for service equipment," and also NEC 250.25 explains that when PV disconnect(s) is located on the supply side of the service disconnect, the equipment is required to be grounded and bonded the same as a service disconnect (NEC 250.24). Interconnected PV systems connected on the supply side of the service disconnect must be installed in accordance with NEC 705.11.

* **Service.** The conductors and equipment connecting the serving utility to the wiring system of the premises served.

EC-6) Do PV string inverters need to meet the working space requirements of NEC 110.26?

Answer: Generally yes. NEC 110.26 states: "Working space for equipment operating at 600 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized shall comply with the dimensions of 110.26(A)(1), (A)(2), and (A)(3) or as required or permitted elsewhere in this Code". The code is very clear; if the equipment is likely to be examined, adjusted or serviced while energized, the requirements for height, depth and headroom would need to be met according to NEC 110.26.

However, if the inverter can be serviced while de-energized or if the inverter doesn't have any exposed live parts as defined in Article 100, the distance requirements would not apply.

If you have a questionable installation in the field regarding string inverter working clearances, please check with your local AHJ prior to the installation.

EC-7) Can the CAB Support System (Messenger Supported Cable System) be installed at PV system installations?

Answer: Generally yes. The department will accept the use of the CAB system as a messenger support system and apply the requirements given in Article 396 of the National Electrical Code. Article 396.12 clearly states the messenger support system can't be subject to physical damage and will only be considered at PV systems where protected by a fence or substantial structure that reduces access to unqualified individuals.

The department understands that "subject to physical damage" could be a very subjective interpretation among electrical inspectors in the field. That being said, the department will accept the use of the CAB support system at solar arrays under the following conditions:

- Installations are required to evaluated/approved by department staff prior to installation.

- The CAB support system is routed parallel to and under the long axis of the solar array; the array will help in protecting the conductors and/or cables from physical damage. The height of the conductors and/or cables must be installed as high as possible to the underside of the modules when utilizing a fixed rack mounting system or as high as possible to the underside of the torque tube for a single axis tracker systems.

- The department will accept incidental jumps of a reasonably short length between rows of arrays (perpendicular to the long axis); such jumps shall be properly supported and protected from physical damage. Additional signage may be required

The department will NOT accept the use of the CAB support system where the support system extends beyond the array and routed any distance to the distribution equipment (e.g., inverter skids, combiners or switchgear). It is our position that installing the CAB system in open areas for long distances will subject the conductors and/or cables to physical damage. Physical damage could occur during snow removal, grounds-keeping operations, maintenance or other operations.

Additionally, please provide the department installation instructions regarding the use of the CAB system. Furthermore, if not specifically addressed in the installation instructions, provide information for the following questions/concerns regarding the CAB support system installation parameters, such as;

- Hanger interval spacing,
- How often will the cables be secured to the system,
- How is tension controlled on the messenger cable so the hanger height is maintained,
- Provide documentation that allows the purlins and tensioning hardware of the racking system to be used with the additional stress and tensioning force of the CAB system,
- How far off the ground will the hangers be installed,
- Will vegetation or rodents be a concern,
- Identify all equipment grounding specifications,
- List the number and size of the conductors that will be installed in each hanger,
- List the ampacities and overcurrent protection for all the conductors installed utilizing the CAB system using NEC table 310.15(B)(16) and NEC table 310.15(B)(3)(a).

Inspection Fees and Procedures

EF-1) How are the department's solar PV system inspection fees calculated?

Answer: The following inspection fees will be applicable to solar PV systems and installations:

(a) The inspection fee for the installation of solar PV systems, is

(1) 0 watts to and including 5,000 watts, $60; or

(2) 5,001 watts to and including 10,000 watts, $100 or

(3) 10,001 watts to and including 20,000 watts, $150 or

(4) 20,001 watts to and including 30,000 watts, $200 or

(5) 30,001 watts to and including 40,000 watts, $250 or

(6) 40,001 watts to and including 1,000,000 watts, $250, and $25 for each additional 10,000 watts over 40,000 watts or

(7) 1,000,000 watts to 5,000,000 watts, $2,650, and $15 for each additional 10,000 watts over 1,000,000 watts or

(8) 5,000,000 watts and larger, $8,650, and $10 for each additional 10,000 watts over 5,000,000 watts.

(b) For the purpose of paragraph (a), the watt rating is the total estimated alternating current (ac) energy output of the solar system. The total dc energy output is not used.

(c) The solar PV inspection fees shall include inverters, modules, panels, combiners, converters, charge controllers, disconnecting means and electrical conductors between the interactive inverter and the service equipment or another electrical production and distribution network. For solar PV systems over 200 KW, the inspection fees will include all of the electrical wiring and equipment for the solar PV system, to the service point or point of connection to another electrical production and/or electrical distribution network whichever occurs first. Please contact the department for clarification on complex projects.

(d) When a plan review is required or performed the plan review fee is $80 per hour.

Minnesota Solar PV System
Electrical Inspection Fee Chart

Solar PV System Rating*	**Inspection Fees**
0 – 5,000 watts	$60
5,000 – 10,000 watts	$100
10,001 – 20,000 watts	$150
20,001 – 30,000 watts	$200
30,001 – 40,000 watts	$250
40,001 – 1,000,000 watts	$250, and $25 for each additional 10,000 watts over 40,000 watts
1,000,000 - 5,000,000 watts	$2,650 and $15 for each additional 10,000 watts over 1,000,000 watts
5,000,000 watts and larger	$8,650 and $10 for each additional 10,000 watts over 5,000,000 watts
*The watt rating is the total estimated alternating current (ac) energy output of the solar system. The total dc energy output is not used.	

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When a plan review is required or performed the plan review fee is $80 per hour.

EF-3) Is a plan review required prior to the installation of a solar PV system?

Answer: Not at this time. However, installers of solar PV systems are expected to be able to answer any questions about the solar PV system posed by the Authority Having Jurisdiction (AHJ). The Solar America Board for Codes and Standards (Solar ABCs) has developed a set of standardized plan submittal and permit application documents that can be used to outline all of the plans, specifications and details for various types of solar PV systems. Solar PV installers are strongly encouraged to utilize these documents and make them available to the AHJ well in advance of the start of construction.

For large-scale solar PV projects, the department strongly encourages solar PV installers to contact the department well in advance of the start of construction in order to schedule one or more project review meetings. There is no plan review fee for these meetings. The purpose of the meetings is for the exchange of information and to help ensure the successful completion of the solar PV project. The department welcomes the opportunity to host these meetings.

EF-4) Upon request will the department perform a plan review prior to the installation of a solar PV system?

Answer: Yes. Please contact the department at dli.electricity@state.mn.us for more information. The department reserves the right to charge a plan review fee of $80 per hour when performing plan reviews.

Solar America Board for Codes and Standards Expedited Permitting
http://www.solarabcs.org/about/publications/reports/expedited-permit/forms/index.html

- Standard String System
- http://www.solarabcs.org/about/publications/reports/expedited-permit/pdfs/Example1-StandardStringSystem.pdf

- Micro-Inverter System
- http://www.solarabcs.org/about/publications/reports/expedited-permit/pdfs/Example2-Micro-Inverter.pdf

- AC-Module System
- http://www.solarabcs.org/about/publications/reports/expedited-permit/pdfs/Example3-ACModule.pdf

- Supply-Side Connection System
- http://www.solarabcs.org/about/publications/reports/expedited-permit/pdfs/Example4-Supply-SideConnection.pdf

Equipment Approval

EA-1) For electrical installations covered by the National Electrical Code (NEC), what is the difference between "*approved*" and "*listed*" when it comes to the acceptability of electrical equipment?

Answer: In accordance with NEC 110.2, conductors and equipment required or permitted in the NEC shall be acceptable only if they are approved. The term *Approved* is defined in Article 100 simply as "Acceptable to the authority having jurisdiction" (AHJ). However, suitability of electrical equipment is commonly required to be evidenced by *Listing* and *Labeling*. See the definitions of *Listing* and *Labeling* in NEC Article 100. Listed and labeled equipment is required to be installed in accordance with any instructions that are included in the listing and labeling. In North America there are several testing laboratories that evaluate electrical equipment, list the equipment in published product directories and label the equipment as evidence that the equipment meets all applicable safety standards. In the U.S., the Department of Labor Occupational Safety & Health Administration (OSHA) administers the program that is responsible for accrediting the Nationally Recognized Testing Laboratories (NRTLs) (Examples of NRTLs include UL, ETL-ITSNA, MET, CSA, etc.) https://www.osha.gov/dts/otpca/nrtl/index.html

EA-2) Does the NEC require solar PV equipment to be listed?

Answer: Yes. Simple approval of solar PV equipment by an AHJ is not permitted in the NEC. There are numerous examples in the NEC where electrical equipment is specifically required to be listed (e.g. luminaries, wiring methods, automatic transfer switches, service equipment, hazardous locations, etc.). NEC 690.4(B) specifically requires inverters, motor generators, PV modules, PV panels, ac PV modules, dc combiners, dc-to-dc converters and charge controllers to be listed or field labeled for PV applications.

EA-3) Does the U.S. Department of Labor Occupational Safety & Health Administration (OSHA) require electrical equipment in the workplace to be listed and labeled?

Answer: Yes. More information is available in Standards – 29 CFR, part 1910.303, Occupational Safety and Health Standards.

EA-4) Does Minnesota have similar OSHA regulations requiring electrical equipment in the workplace to be listed and labeled?

Answer: Yes. The Minnesota Department of Labor and Industry also enforces the Minnesota Occupational Safety and Health Act (MNOSHA) and federal standards.
http://www.dli.mn.gov/business/safety-and-health-work

EA-5) In addition to the equipment approval requirements in the NEC, does Minnesota have overriding statutes or rules related to the approval of electrical equipment?

Answer: Yes. Minnesota Rules Chapter (MRC) 3801.3619 and 3800.3620 contain provisions for the approval of electrical equipment. MRC 3801.3619 contains definitions. MRC 3801.3620 contains the provisions for the approval of electrical equipment. MRC 3801.3620, Subpart 1 essentially requires all equipment used as part of or in connection with an electrical installation to be listed and labeled by a nationally recognized testing laboratory.

EA-6) Does MRC 3801.3620 contain any alternatives to listing and labeling?

Answer: Yes. MRC 3801.3620, Subpart 2 outlines the provisions that can be utilized to obtain the department's approval of certain types of electrical equipment. The two most common methods for third-party certification of non-listed equipment includes; 1) field evaluation by a nationally recognized testing laboratory, or 2) field evaluation by a registered electrical engineer.

EA-7) Does the department have more information online related to equipment approval?

Answer: Yes. Approval requirements for electrical equipment are online at
http://www.dli.mn.gov/business/electrical-contractors/equipment-approval

Removal and reinstallation of existing solar PV systems

RR-1) Is an electrical permit and inspection required for the reinstallation of the solar PV system, or portions of the solar PV system?

Answer: Yes. The reinstallation of the solar PV support system (racking), modules and other equipment and wiring would require an electrical permit and inspection, the same as it would for a new installation. The inspection exemption for minor repair work, as defined in Minnesota Rules Chapter 3800.3500, Subp. 10, is not applicable. Due to the complexity of the reinstallation of the solar PV system, and the importance of maintaining and ensuring the equipment grounding and bonding path for the racking, modules and other equipment, an electrical inspection will be required. A Request for Electrical Inspection (permit) must be filed at or before commencement of the electrical installation with a minimum inspection fee of $35. Additional inspection fees may be assessed if necessary due to reinspections or other required inspections.

NOTE: UL 2703 states that for devices that are only to be utilized one time, such as torque fasteners or single-use bonding and grounding devices, the installation instructions shall include the statement "For single-use only", or the equivalent. In other words, devices, washers, fasteners, etc. that are only approved for single-use must be discarded and replaced with new, unused devices, washers, fasteners, etc.

RR-2) Is the reinstallation of the solar PV system required to comply with the currently adopted National Electrical Code (NEC)?

Answer: Yes. All electrical installations must comply with the current code that is in effect at the time the permit is issued. The reinstallation of the PV modules, PV support system (racking) and associated equipment and wiring must comply with the requirements of the currently adopted NEC, including but not limited to all grounding requirements, conductor sizing, wire management and module mounting.

RR-3) Would the replacement of solar PV modules require compliance with the rapid shutdown requirements of NEC 690.12?

Answer: No. The existing Rapid Shutdown system technology installed at the time of the initial installation of the solar PV system would be acceptable. NEC Section 690.12 addresses the Rapid Shutdown requirements for “new” solar PV systems installed in or on a building, and not to existing solar PV systems.

Energy Storage Systems

ESS-1) Some energy storage systems are provided with metal support racks or framework for batteries, capacitors and kinetic energy devices (e.g. flywheels and compressed air). These systems can have ac or dc output for utilization and can include inverters and converters to change stored energy into electrical energy. In some cases the metal support racks or framework are utilized and approved as the equipment grounding conductor (ground-fault current path). Is this type of metal support system, or portions thereof, considered to be "electrical work", as the term is defined in Minnesota Statute 326B.31, Subdivision 17?

Answer: Yes. NEC Article 250 has specific requirements for ground-fault protection of systems.

Energy Storage Systems; One or more components assembled together capable of storing energy for use at a future time. ESS(s) can include but is not limited to batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air). These systems can have ac or dc output for utilization and can include inverters and converters to change stored energy into electrical energy.

ESS-2) Are energy storage systems considered to be electrical equipment in the National Electrical Code?

Answer: Yes. Energy storage systems fall within the definition of "equipment" as it is defined in the NEC. See NEC Articles 100, 706 and other applicable articles for all pertinent definitions. Accordingly, energy storage systems, including the final placement, positioning and securement of batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air) and all electrical wiring, are electrical equipment under the State Electrical Code.

ESS-3) How are the department's inspection fees calculated for energy storage systems?

Answer: The following inspection fees will be applicable to energy storage systems and installations:

- (a) The inspection fee for the installation of energy storage system is
    - (1) 0 watts to and including 5,000 watts, $60 or
    - (2) 5,001 watts to and including 10,000 watts, $100 or
    - (3) 10,001 watts to and including 20,000 watts, $150 or
    - (4) 20,001 watts to and including 30,000 watts, $200 or
    - (5) 30,001 watts to and including 40,000 watts, $250 or
    - (6) 40,001 watts to and including 1,000,000 watts, $250, and $8 for each additional 10,000 watts over 40,000 watts or
    - (7) 1,000,000 watts to 5,000,000 watts, $1,518 and $5 for each additional 10,000 watts over 1,000,000 watts or
    - (8) 5,000,000 watts and larger, $3,518, and $2 for each additional 10,000 watts over 5,000,000 watts.

- (b) For the purpose of paragraph (a), the watt rating is the total estimated alternating current (ac) energy output of the energy storage system. The total dc energy output is not used.

- (c) The energy storage system (ESS) inspection fees shall include batteries, capacitors, inverters, combiners, converters, charge controllers, kinetic energy devices (e.g. flywheels and compressed air), panelboards, disconnecting means and electrical conductors between the interactive inverter and the service equipment or another electrical production and distribution network. For a large ESS over 40 KW, the inspection fees will include all of the electrical wiring and equipment for the ESS system to the service point or point of connection to another electrical production and/or electrical distribution network, whichever occurs first. Please contact the department for clarification on complex projects.

- (d) When a plan review is required or performed the plan review fee is $80 per hour.

Minnesota Energy Storage System
Electrical Inspection Fee Chart

• Energy Storage System Rating*	• Inspection Fees
• 0 – 5,000 watts	• $60
• 5,000 – 10,000 watts	• $100
• 10,001 – 20,000 watts	• $150
• 20,001 – 30,000 watts	• $200
• 30,001 – 40,000 watts	• $250
• 40,001 – 1,000,000 watts	$250, and $8 for each additional 10,000 watts over 40,000 watts
• 1,000,000 - 5,000,000 watts	$1,518 and $5 for each additional 10,000 watts over 1,000,000 watts
• 5,000,000 watts and larger	$3,518 and $2 for each additional 10,000 watts over 5,000,000 watts
• *The watt rating is the total estimated alternating current (ac) energy output of the solar system. The total dc energy output is not used.	
• The energy storage system (ESS) inspection fees shall include batteries, capacitors, inverters, combiners, converters, charge controllers, kinetic energy devices (e.g. flywheels and compressed air), panelboards, disconnecting means and electrical conductors between the interactive inverter and the service equipment or another electrical production and distribution network. For a large ESS over 40 KW, the inspection fees will include all of the electrical wiring and equipment for the ESS system to the service point or point of connection to another electrical production and/or electrical distribution network, whichever occurs first. Please contact the department for clarification on complex projects.	
• When a plan review is required or performed the plan review fee is $80 per hour.	

Building Code

BC-1) Does the Minnesota State Building Code contain provisions related to the installation of solar PV systems?

Answer: Yes. The 2020 Minnesota Building Code contains provisions for the installation of solar PV systems. The code provisions include rules related to roof access, pathways and spacing requirements in an effort to mitigate hazards and to aid in firefighting operations.

The 2020 Minnesota Residential Code regulates solar PV systems on buildings classified as IRC-1 (one-family), IRC-2 (two-family), IRC-3 (townhouses) and IRC-4 (accessory structures). The 2020 Minnesota Building Code Section 3111 regulates solar PV systems installed on all other buildings (not classified as IRC-1, IRC-2, IRC-3, or IRC-4), structures and appurtenances connected or attached to them.

Ground-mounted installations accessory to IRC-1, IRC-2, or IRC- 3 buildings are classified as IRC-4 and are designed and installed in accordance with 2020 Minnesota Residential Code, Section R301.

Fact Sheet - Solar Photovoltaic Systems and the State Building Code
https://www.dli.mn.gov/sites/default/files/pdf/fs_res_solar.pdf