

Exhibit DD

Specific Standards

Wheatridge Renewable Energy Facility East
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Prepared for
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Acronyms and Abbreviations

APLIC	Avian Power Line Interaction Committee
BESS	battery energy storage system
Certificate Holder	Wheatridge East Wind, LLC
Council	Oregon Energy Facility Siting Council
FAA	Federal Aviation Administration
Facility	Wheatridge Renewable Energy Facility East
kV	kilovolts
MBTH	maximum blade-tip height
NESC	National Electric Safety Code
O&M	operations and maintenance
OPUC	Oregon Public Utility Commission
RFA	Request for Amendment
SCADA	Supervisory Control and Data Acquisition
WREFII	Wheatridge Renewable Energy Facility II

1.0 Introduction

The Wheatridge Renewable Energy Facility East (Facility) is an approved, but not yet constructed, wind energy generation facility consisting of up to 66 turbines and related or supporting facilities with a peak generating capacity of up to 200 megawatts (MW), to be located in an Approved Site Boundary of approximately 4,582 acres on over 42,000 acres of leased land in Morrow and Umatilla counties, Oregon. As part of Request for Amendment (RFA) 1 to the Facility Site Certificate, Wheatridge East Wind, LLC (Certificate Holder) is proposing to expand wind power generation at the Facility to provide the opportunity for increased power capacity and availability. This includes expanding the Site Boundary and micrositing corridors, increasing the peak generating capacity by adding more and newer turbines, change the intraconnection routes, and extending the construction date. See the RFA 1's Division 27 document (*Request for Amendment #1 for the Wheatridge Renewable Energy Facility East*) for a more detailed summary of the proposed changes.

This Exhibit DD was prepared to meet the submittal requirements in Oregon Administrative Rules (OAR) 345-021-0010(1)(dd). Analysis in this exhibit incorporates and/or relies on reference information, analysis, and findings found in the Application for Site Certificate, previous RFAs, and Oregon Department of Energy Final Orders to demonstrate that the Facility, as modified by RFA 1, continues to comply with applicable Site Certificate conditions and the standard in OAR 345-021-0010(1)(dd). OAR 345 Division 22 does not provide an approval standard specific to Exhibit DD.

2.0 Specific Standards Applicable to the Facility – OAR 345-021-0010(1)(dd)(A)

OAR 345-021-0010(1)(dd) If the proposed facility is a facility for which the Council has adopted specific standards, information about the facility providing evidence to support findings by the Council as required by the following rules:

OAR 345-021-0010(1)(dd)(A) For wind energy facilities, OAR 345-024-0010 and 345-024-0015.

Previously, the Oregon Energy Facility Siting Council (Council) found that the Certificate Holder can design, construct, and operate the Facility to exclude members of the public from close proximity to the turbine blades and electrical equipment.¹ Additionally, the Council found that the Certificate Holder can design, construct, and operate the Facility to preclude structural failure, implement adequate impending failure warning procedures, and minimize consequences, if a failure did occur.² In the Wheatridge Renewable Energy Facility II (WREFII) RFA 1 Final Order, the Council

¹ Final Order on Request for Amendment 5 to the Site Certificate for the Wheatridge Wind Energy Facility (May 2020), p. 47

² Final Order on Request for Amendment 5 to the Site Certificate for the Wheatridge Wind Energy Facility (May 2020), p. 47

found that based on the administrative scope of the amendment request the public health and safety standards for wind energy facilities were listed among the standards not likely to be impacted by the request for amendment (ODOE 2020b³). The Certificate Holder is proposing to expand wind power generation at the Facility to increase power capacity and availability.

OAR 345-024-0090 To issue a site certificate for a facility that includes any transmission line under Council jurisdiction, the Council must find that the applicant:

(1) Can design, construct and operate the proposed transmission line so that alternating current electric fields do not exceed 9 kV per meter at one meter above the ground surface in areas accessible to the public;

(2) Can design, construct and operate the proposed transmission line so that induced currents resulting from the transmission line and related or supporting facilities will be as low as reasonably achievable.

Exhibit AA demonstrates compliance with the OAR 345-024-0090 Siting Standard. The Council previously found that the Facility's Intraconnection Line would not generate alternating current electric fields exceeding the 9 kilovolts (kV) per meter standard.⁴ The Council also determined that public health and safety standards were unlikely to be impacted by WREFII RFA 1.⁵ RFA 1 seeks to replace the previously approved Intraconnection Line Corridors with a new Intraconnection Line, approximately 27 miles in length. This change is necessary to expand wind power generation at the Facility. Before construction, Condition PRE-TL-01 requires the Certificate Holder to schedule a time to brief the Oregon Public Utility Commission (OPUC) Safety, Reliability, and Security Division staff on how it will comply with OAR Chapter 860, Division 024 during design, construction, operations, and maintenance of the facilities. Additionally, OPR-TL-01 requires the Certificate Holder to update OPUC Safety staff with final facility design operations information. During construction, Condition CON-TL-01 requires the Certificate Holder to take reasonable steps to reduce or manage human exposure to electromagnetic fields. This includes designing and maintaining all Intraconnection Lines so that "alternating current electric fields do not exceed 9 kV per meter at one meter above the ground surface in areas accessible to the public," and "induced voltages during operation are as low as reasonably achievable." The Certificate Holder must submit verification that these requirements are met to the department. The existing conditions of approval will ensure that the proposed changes will not affect the Certificate Holder's ability to comply with these standards and conditions.

³ Final Order on Request for Amendment 1 to the Site Certificate for the Wheatridge Renewable Energy Facility II (November 2020), p. 39

⁴ Final Order on Request for Amendment 5 to the Site Certificate for the Wheatridge Wind Energy Facility (May 2020), p. 45

⁵ Final Order on Request for Amendment 1 to the Site Certificate for the Wheatridge Renewable Energy Facility II (November 2020), p. 39

3.0 Public Health and Safety

OAR 345-024-0010 Public Health and Safety Standards for Wind Energy Facilities

To issue a site certificate for a proposed wind energy facility, the Council must find that the applicant:

3.1 Public Access Restrictions

OAR 345-024-0010(1) Can design, construct and operate the facility to exclude members of the public from close proximity to the turbine blades and electrical equipment

Public access to Facility infrastructure will be minimal to none. All infrastructure will be on private land where public access is already restricted. Access roads developed for construction and operation will be gated and locked as necessary, when not actively in use. Should the Facility be accessed without permission, design features will limit access to infrastructure and prevent equipment tampering. The wind turbines can be accessed only through a steel door that will be locked except during maintenance. The wind turbine model under consideration has a minimum ground-to-blade clearance of over 82 feet. Pad transformers would be enclosed within vented steel boxes (per Condition CON-WF-01), and the remainder of the electrical collection system would be largely, if not entirely, underground. The shared/existing operations and maintenance (O&M) building will be in a fenced area, and locked when unoccupied. The Facility substations and battery energy storage system (BESS) will be collocated with the previously approved substation in fenced enclosures with locking gates (Division 27 document; per Condition OPR-WF-01). The 230-kV Intraconnection Line will use overhead poles that inhibit climbing. The temporary construction yards will be signed as private and with no trespassing, with onsite security staff.

The Facility also includes substantial setbacks that further limit public access to turbines and associated electrical components. The Facility is setback from public roads a minimum of 110 percent of the maximum blade-tip height (MBTH). This both limits public access and prevents members of the public from being harmed in the unlikely event of a catastrophic failure (e.g., fall-down) of a turbine. Similarly, the Facility maintains a fall-down distance setback (100 percent of MBTH) from non-participating landowner properties. County-required setbacks are analyzed in detail in Exhibit K of this RFA 1. With these restrictions, design features, and setbacks, only Facility employees or landowners will come in close proximity to the turbines or electrical equipment. Landowners will not be near the turbine blades, given the considered turbine model's minimum 82-foot ground-to-blade clearance.

3.2 Structural and Equipment Safety

OAR 345-024-0010(2) Can design, construct and operate the facility to preclude structural failure of the tower or blades that could endanger public safety and to have adequate safety devices and testing procedures designed to warn of impending failure and to minimize the consequences of such failure.

To prevent wind turbine structural failure, the Facility will be designed, engineered, and constructed to meet or exceed all current applicable standards. This includes various strategies to reduce or prevent human safety-related and non-seismic dangers, like conducting site-specific geotechnical evaluations to inform Facility design and construction. Exhibit H provides information on structural codes and standards that will be followed in Facility design.

During operations, the turbine foundations and the BESS will be maintained through a rigorous monthly inspection program. In addition, the Supervisory Control and Data Acquisition (SCADA) system (described in the Division 27 document) will serve as the “nerve center” of the Facility by connecting individual turbines, BESS, substations, and meteorological towers to a central computer housed in the shared/existing O&M building (per Condition CON-WF-02). The SCADA system allows for real-time monitoring of each Facility component. If an issue with a turbine arises, O&M staff are alerted so that the component can be shut down to minimize a failure’s consequences and potential safety risks.

In addition, as noted above, the Facility design includes substantial setbacks which would prevent a collapsed turbine or thrown blade from impacting public roads, or non-participating property owners if a catastrophic failure were to occur.

Failure of turbine components or foundations is extremely rare. It can be avoided by carefully selecting turbine and foundation characteristics based on site-specific geotechnical conditions (as described in Exhibit H) and careful construction methods by experienced professionals to ensure the turbine is installed under best safety practices. After turbine installation, continued safe operation depends on monitoring the structures responses to stresses such as rotational, axial, torsion, bending, and vibration. Turbines and their foundations are regularly inspected during monthly operating rounds and annual maintenance. During operating rounds, turbine foundations and turbine-foundation connection materials are assessed visually. In addition, SCADA data is observed to determine how the turbine’s structural components are withstanding stresses. During annual maintenance, components are inspected and lubricated, and worn parts are replaced if needed (per Condition CON-WF-02).

Suppose an anomaly is observed during routine maintenance or inspections. In that case, the engineering team is advised, and subject matter experts may perform further checks to determine the root cause and recommended any remediating actions needed.

Structural failure of tower and blades is also very rare, but not impossible. When it does occur, it is most often relatively soon after construction. Tower failure early in a Facility’s life cycle is usually caused by faulty construction, material defects, or improper design (Ma et al. 2018). These causes can be mitigated through careful material selection from reliable vendors, construction by experienced contractors, and design by dedicated and experienced engineers, all of which are described in this application (see upfront Division 27 document for the RFA). Materials testing during and after construction verifies proper installation. Turbine failure during normal operation is uncommon, but when it does occur the literature indicates that it is most often due to improper maintenance or early material degradation (Ma et al. 2018). Proper staff training, oversight, and routine inspections can prevent these failure factors. Wind tower collapse also can occur during

extreme conditions like typhoons, hurricanes, earthquakes, or fires. Fires can be caused by mechanical or electrical issues or by lightning strikes. While natural disasters cannot be prevented, electrical and mechanical concerns can be identified through the SCADA system and regular inspections.

Turbine towers and blades are inspected during annual turbine maintenance. All turbine related-components are inspected annually for irregular wear and are repaired as needed (per Condition CON-WF-02), following all manufacturers' recommendations (per Condition GEN-WF-01).

If an anomaly is found by the SCADA system or during an inspection, original equipment manufacturer engineering is advised. Subject matter experts may conduct further inspections to determine the root cause of the anomaly and the action needed to rectify it. Any accidents, including mechanical failures, will be reported to the Oregon Department of Energy, and the Morrow and Umatilla County Planning Departments within 72 hours (per Condition GEN-WF-02 and CON-WF-02).

4.0 Cumulative Effects

OAR 345-024-0015 Cumulative Effects Standard for Wind Energy Facilities

To issue a site certificate for a proposed wind energy facility, the Council must find that the applicant can design and construct the facility to reduce cumulative adverse environmental effects in the vicinity by practicable measures including, but not limited to, the following:

This standard requires the Certificate Holder to take all practical measures to reduce the cumulative effects of the Facility, including but not limited to minimizing the creation of new roads; placing electrical collector line underground; interconnecting via existing facilities; designing the Facility to reduce risks to raptors and other sensitive species; and designing the Facility to mitigate visual impacts including lighting effects. This section describes the measures that the Certificate Holder has taken to minimize the cumulative impacts of the Facility.

4.1 Access Roads

OAR 345-024-0015(1) Using existing roads to provide access to the facility site, or if new roads are needed, minimizing the amount of land used for new roads and locating them to reduce adverse environmental impacts.

The Certificate Holder will utilize existing private roads to access wind turbines and infrastructure to the greatest extent practical. The total mileage of new permanent site access roads for the wind layout will require approximately 76 miles of new permanent access roads and 15 miles of new temporary access roads to access portion of the Intraconnection Line. No other existing farm roads that can be used for the Facility due to their location, route, geometry (slope, in particular), or ownership. Where new access roads are needed, they are sited to limit the Facility's overall impact on soils, habitat, and agricultural practices. For example, new access roads are generally sited along the edges of farm fields to limit plowing pattern disruptions. Roads are placed within the fields only

when the alternative would impact sensitive habitats. New access roads would be constructed to limit the environmental impact as well. Access roads would be the minimum width necessary to accommodate construction equipment during construction. Following construction, they would be narrowed to accommodate smaller maintenance vehicles. After construction, the extra disturbed area and any temporary roads would be restored to a condition appropriate for the location. Stormwater best management practices would be employed at all times to reduce or avoid impacts to streams in the area.

4.2 Electrical Lines

The Facility would require up to 95 miles of underground collector line and up to 27 miles of Intraconnection Line. All collector lines and the Intraconnection Line will be constructed following National Electrical Safety Code (NESC) standards. Electrical line options are discussed in sections 5.2.1 and 5.2.2. Per Condition CON-LU-03, the Certificate Holder is required to install the electrical collector cable system underground, where practicable. In agricultural areas, the collector system lines must be installed at a depth of 3 feet or deeper as necessary to prevent adverse impacts on agriculture operations. In all other areas, the collector system lines must be installed a minimum of 3 feet where practicable (Condition CON-LU-03). Condition CON-TL-01 outlines steps the Certificate Holder must take to reduce or manage human exposure to electromagnetic fields and submit verification to the department, including:

- Constructing all aboveground collector and transmission lines at least 200 feet from any residence or other occupied structure, measured from the centerline of the transmission line.
- Constructing all aboveground 34.5-kV transmission lines with a minimum clearance of 25 feet from the ground.
- Constructing all aboveground 230-kV transmission lines with a minimum clearance of 30 feet from the ground.
- Developing and implementing a program that provides reasonable assurance that all fences, gates, cattle guards, trailers, irrigation systems, or other objects or structures of a permanent nature that could become inadvertently charged with electricity are grounded or bonded throughout the life of the line (OAR 345-025-0010(4)).
- Providing to landowners a map of underground, with any applicable NESC demarking for underground facilities, and overhead transmission lines on their property and advising landowners of possible health and safety risks from induced currents caused by electric and magnetic fields.
- Designing and maintaining all transmission lines so that alternating current electric fields do not exceed 9 kV per meter at one meter above the ground surface in areas accessible to the public.

- Increasing the Intraconnection Line height, shielding the electric field, or installing access barriers, if needed, to prevent induced current and nuisance shock of mobile vehicles.
- Designing and maintaining all transmission lines so that induced voltages during operation are as low as reasonably achievable.
- Designing, constructing and operating the transmission line in accordance with the requirements of the version of the NESC that is most current at the Facility 35 the time that final engineering of each of these components is completed (OAR 345-025- 0010(4)).
- Implement a safety protocol to ensure adherence to NESC grounding requirements.

4.2.1 Underground Collector Lines

The Facility would require approximately 95 miles of collector line, all located underground. Underground line installation would have minimal, temporary impacts on soils, habitat, wildlife, and agricultural practices. The collector line would be placed within narrow trenches about 3 feet below ground. Most collector lines would be placed within or adjacent to access roads to minimize additional disturbance. When underground collector lines cross farming fields, they may be placed deeper to prevent damage from agricultural activities like deep tillage, but not deep enough to affect groundwater resources. When soils or underlying geology make a 3-foot depth impractical, the collector line may be buried less than 3 feet deep, but still following NESC standards.

Topsoil and subsoils would be segregated during trench excavation and placed back into the trenches in the proper order after the line is installed. Topsoil and vegetation that is disturbed by underground electrical line construction will be re-topsoiled and revegetated as soon as it's practicable following construction and monitored to ensure successful revegetation and avoid weed infestations. Implementing the erosion and sediment control best management practices would ensure disturbed soils from collector line installation are treated properly. These best practices are included in the final Erosion and Sediment Control Plan, as required by the National Pollutant Discharge Elimination System Construction Stormwater Discharge General permit 1200-C.

4.2.2 Overhead Intraconnection Line

The Facility will be connected by the proposed Intraconnection Corridor containing up to two parallel overhead 230-kV Intraconnection Lines, each no longer than 27 miles long. The proposed Intraconnection Line runs north of the previously approved Intraconnection Corridors to avoid operational portions of the Facility. An overhead design was chosen because the environmental costs associated with overhead line installation are much lower than for underground lines. In addition, temporary impacts associated with underground transmission lines would be substantial; Underground installation would require digging a trench for the length of the line, crossing several streams, riparian areas, and public and private roads. Additionally, underground construction would require large access vaults to be placed at regular intervals along the line, resulting in a similar or larger overall permanent footprint as an overhead line. An overhead line requires

minimal ground disturbance at the pole locations, and construction during summer when the ground is hard eliminates the need to construct access roads.

The design and routes of the Intraconnection Line were chosen to minimize other types of impacts as well. The lines are routed to avoid high ground and public roads to minimize visual impacts. The wooden or non-reflective steel monopole construction would further reduce the lines' visibility compared to steel lattice construction. Finally, the lines are routed far from existing residences to avoid noise and electromagnetic impacts. To reduce potential impacts to raptors and other avian species, they would be constructed to Avian Power Line Interaction Committee (APLIC) standards.

4.3 Substations

The Facility would include two substations: one new substation and one previously approved/permitted alternative substation where power from the collector lines would be aggregated and stepped up to transmission voltage. The proposed and alternative substations are located central to the Facility along Little Butter Creek Road and within the northeast portion of the Amended Site Boundary adjacent to the BESS, respectively. The Certificate Holder anticipates that the Facility will connect to the existing Blue Ridge Substation via one of two potential Intraconnection Corridors.

4.4 Avian and Wildlife Impact Minimization

The Facility has been sited and designed to minimize impacts on wildlife and essential wildlife habitat, as described in Exhibits P and Q of this application. On a broad scale, the Facility has been sited in an area dominated by grassland and with little native habitat for sensitive or protected species. Facility infrastructure has been sited to avoid all impacts to wetlands and to critical (Category 1) habitats and minimize impacts to other important habitats. This was accomplished by situating Facility infrastructure in existing agricultural fields and utilizing existing access roads to the greatest extent practical. The Facility layout has been planned to minimize permanent impacts associated with infrastructure, particularly onsite access roads. Other design aspects of the Facility that will reduce wildlife habitat impacts include using an underground electrical collection system; applying APLIC design standards for the Intraconnection Line; siting turbines at least 1,350 meters from Little and Big Butter creeks; and using freestanding, non-guyed turbines and permanent met towers (see Exhibit P, Section 9.1). Per Condition GEN-FW-01, the Certificate Holder will impose a 20 mile per hour speed limit on new and improved private access roads, which have been approved as a related and supporting facility to the energy facility. In addition, Condition GEN-FW-02 requires the Certificate Holder to construct all overhead collector and transmission Intraconnection Lines in accordance with the latest APLIC design standards, and shall only install permanent meteorological towers that are unguyed. Additional measures to avoid and minimize impacts on wildlife will be implemented during Facility construction. These include raptor nest monitoring and seasonal construction timing restrictions; having onsite environmental monitors during construction; implementing dust abatement measures; observing low speed limits; implementing measures to control the spread of invasive weed species; and restoring disturbed areas as soon as

practicable following completion of construction, as outlined in the Revegetation Plan (see Attachment P attachments). Additional measures are described in Exhibits P and Q.

Finally, the Certificate Holder will mitigate any unavoidable wildlife habitat impacts as outlined in the Habitat Mitigation Plan and the Wildlife Monitoring and Mitigation Plan (see Exhibit P attachments) that are required to be finalized prior to construction (see Condition PRE-FW-02 and PRE-FW-04). The avoidance, minimization, and proposed mitigation measures limit the impacts on wildlife to a minimum necessary and compensate for unavoidable impacts as mandated by Oregon's fish and wildlife habitat goals and standards.

4.5 Visual Impacts Minimization

The size of modern wind turbines makes it challenging to reduce the visual impacts of the Facility effectively. However, the Certificate Holder has and will utilize several design and engineering measures to reduce the visual effects as much as possible. First, the Certificate Holder has sited the Facility in a remote area of Morrow and Umatilla counties and has designed the turbine array to not be visible from the nearest towns of Heppner, Lexington, and Ione. While it may be visible from other cities or developed areas in the vicinity, it would be at a background viewing distance of over 7 miles, so it would not dominate the viewshed (see Exhibit R). In addition, there are no important scenic resources identified in the area. The Intraconnection Line route and design has also been chosen partly to minimize the lines' visibility.

Additional measures that the Certificate Holder would employ to minimize visual impacts of the Facility, include:

- The wind turbines would be painted a uniform, matte-finish neutral white or off-white color (Condition GEN-SR-02);
- Support poles for the Intraconnection Line will be wood or non-reflective steel (e.g., self-weathering steel) to blend with the surroundings (Condition GEN-SR-02);
- Substation structures would be finished in neutral colors to agree with the landscape (Condition GEN-SR-02);
- Lighting will be kept to a minimum necessary and designed to prevent offsite glare (Condition GEN-SR-02);
- No advertising or commercial signage is to be displayed on any part of the facility (Condition GEN-SR-02);
- Vegetation clearing and ground disturbance will be limited to the minimum area necessary to safely and efficiently install the Facility components (Condition GEN-SR-02);
- Access roads and other areas of ground disturbance will be watered during construction, as needed, to avoid the generation of airborne dust (Condition GEN-SR-02); and
- Temporary impact areas will be restored and revegetated as soon as possible following completion of construction (Condition GEN-SR-02).

4.6 Lighting

Facility lighting impacts would be minimal. Lighting would consist of the minimum necessary for safety purposes. Lights at the shared/existing O&M building and substations would be downward-shielded and aimed into the site to avoid casting glare offsite. These lights would be off at night and would utilize motion-sensor switches to provide lighting only when needed.

Turbine lighting would meet the minimum standards required by Federal Aviation Administration (FAA) regulations (Condition GEN-LU-03). Based on FAA guidance, turbines will likely be lit with an array of red flashing lights synchronized to flash simultaneously. Lights are not required on all turbines. Generally, lights would be installed on turbines nearest the Facility perimeter to define the outer boundaries of the obstruction area, and on select turbines within the Facility such that the lit turbines are no more than 0.5 miles apart. Daytime lighting is not required; the white color of the turbines is the most effective daytime warning device. The Certificate Holder will submit a Notice of Proposed Construction to the FAA as required pursuant to 14 Code of Federal Regulations 77 Subpart B, Section 77.5-7 and base the final lighting design on FAA recommendations.

5.0 Siting Standards for Transmission Lines

Exhibit AA of this application demonstrates compliance with the Siting Standard of OAR 345-024-0090. Specifically, Exhibit AA indicates that the proposed Intraconnection Line would generate alternating current electric fields not exceeding 4 kV per meter at one meter above the ground surface. This is substantially lower than the 9 kV per meter required by the standard (Exhibit AA).

Exhibit AA also provides information about induced currents and describes actions that the Certificate Holder will take during final project engineering to reduce or eliminate the potential for induced current and nuisance shocks (Condition CON-TL-01). Specifically, during engineering and construction, the Certificate Holder will identify wire fences, pipelines, irrigation lines, metal roofs, and other objects near the Intraconnection Line and collector lines where a current could be induced. Such objects will be properly grounded within or as close as practicable to the right-of-way, to prevent induced current and nuisance shocks. Additionally, the Intraconnection Line will be designed and constructed according to NESC standards. These standards require sufficient conductor-to-ground to limit the short-circuit current induced in the largest vehicle expected under the line to 5 milliamperes or less (NESC 2012). A minimum 30-foot conductor-to-ground clearance required by NESC standards would generally meet this standard. If necessary, induced current potential at locations where large vehicles are anticipated can be further reduced by increasing the Intraconnection Line height, shielding the electric field, or by limiting access.

6.0 References

- Ma, Y., P. Martinez-Vazquez, and C. Baniotopoulos. 2018. Wind turbine tower collapse cases: a historical overview. *Proceedings of the Institution of Civil Engineers - Structures and Buildings* 172 (8): 547-555. Available online at: <https://doi.org/10.1680/jstbu.17.00167>.
- NESC (National Electric Safety Code). 2012. National Electrical Safety Code. 2012 ed. Institute of Electrical and Electronics Engineers, Inc., New York, NY. 287 pages.

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