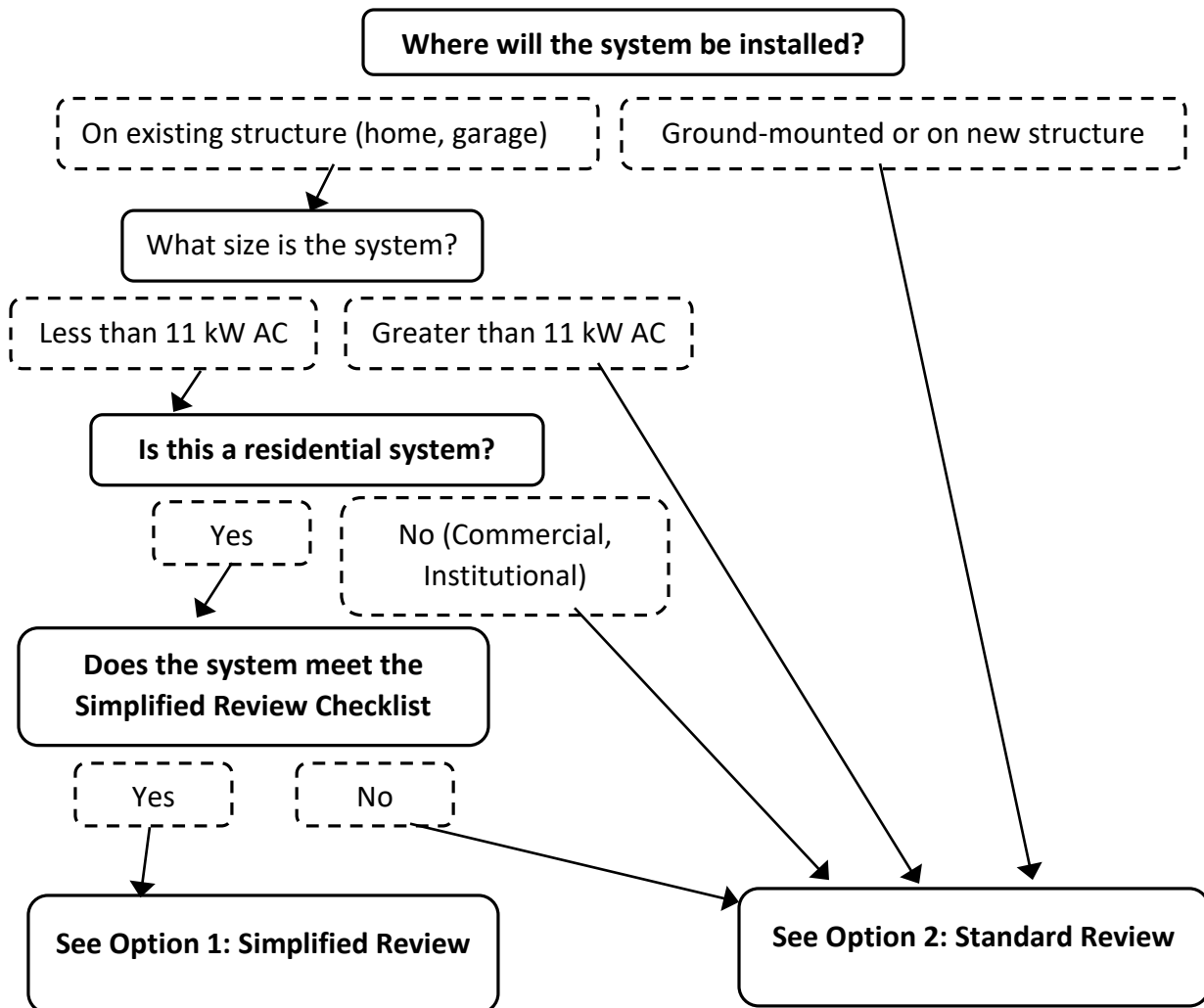


Solar Photovoltaic (PV) Permit Application Guidelines

All solar PV systems require a permit **before** installation may begin. Follow the steps below for either the 1) Simplified Review **OR** 2) Standard Review.

Applicant may email all materials to planning@goshencity.com. Permit fees must be paid before the permit is issued. Payment may be made in person (204 E Jefferson St Suite 5 Goshen, IN 46526), over the phone, or online (goshenindiana.org/building-department). For permit and inspection questions, call 574-534-1811. For zoning questions, call 574-534-3600.

Use the flow chart below to determine if the system qualifies for Simplified Review:



Option 1: Simplified Review (Small Residential Rooftop Systems)

Applicants may qualify for a simplified review for small, **residential rooftop** photovoltaic (PV) systems that are **less than 11 kW AC and meet criteria in the Simplified Review Checklist**.

The simplified review allows the majority of simple rooftop solar PV systems to be permitted and inspected without requiring additional structural and design calculations.

Review:

1. Simplified Review Checklist [See Appendix A]:

Review Appendix A in this document, pages 4-7, to identify whether the solar project likely falls under the simplified review. This document does not need to be submitted.

Required Information for Permit:

2. Permit Application:

Access online*: [http://goshenindiana.org/media/uploads/0/1475 Permit-Application-REVISED-MARCH-2016.pdf](http://goshenindiana.org/media/uploads/0/1475%20Permit-Application-REVISED-MARCH-2016.pdf)

3. Zoning Clearance Form:

Access online*: [https://goshenindiana.org/media/uploads/0/5460 2018-10-01-zoning-clearance-8X14.pdf](https://goshenindiana.org/media/uploads/0/5460%202018-10-01-zoning-clearance-8X14.pdf)

4. Basic Site Map with Roof Layout:

This drawing does not need to be to scale. Setbacks from property lines do not need to be indicated for roof-mounted systems. Mark the location of the panels on the roof, inverters, utility meter, and the AC disconnect switch. Roof setbacks should be marked.

5. Specification Sheets:

Digital or paper copies of specification sheets **must** be submitted **at the time of application** for all major PV system components including PV modules, dc-to-dc converters, inverters, and mounting systems. Digital files may be submitted by email to planning@goshencity.com.

**Permit and zoning clearance forms are periodically updated. Find the most recent permit and zoning clearance forms at <https://goshenindiana.org/>.*

Option 2: Standard Review

Standard review applies to: all non-residential systems, all ground-mounted systems, all residential rooftop systems that do not qualify for Simplified Review. *Commercial and institutional systems require standard review.*

Required Information for Permit:

1. Permit Application:

Access online*: http://goshenindiana.org/media/uploads/0/1475_Permit-Application-REVISED-MARCH-2016.pdf

2. Zoning Clearance Form [See Appendix B]:

In Appendix B, the highlighted fields show the required information for either rooftop or ground-mounted systems.

Access online*: https://goshenindiana.org/media/uploads/0/5460_2018-10-01-zoning-clearance-8X14.pdf

3. Site Plan: The site plan should represent the relative location of components on the parcel, including panels, inverters, utility meters, disconnect switches and existing structures.

- a. **Roof-mounted:** Mark location of the panels on the roof, labeling fire access setbacks from roof ridges and valleys. Setbacks from property lines do not need to be measured.
- b. **Ground-mounted:** Measure and mark setbacks from property lines to the solar system.

4. Structural Worksheet [See Appendix C]:

Supply the requested information for roof or ground-mounted systems and provide any additional information if necessary. This is not required if documentation is provided by a certified engineer or design professional.

5. Electrical Diagram [Examples in Appendix D]:

Provide an electrical diagram showing PV array configuration, wiring system, overcurrent protection, inverter, disconnects, and AC connection to building. Three examples have been provided for your convenience. Note that a simple one-line diagram will satisfy this requirement.

6. Specification Sheets:

Digital or paper copies of specification sheets **must** be submitted **at the time of application** for all major PV system components including PV modules, dc-to-dc converters, inverters, and mounting systems. Digital files may be submitted by email to planning@goshencity.com

**Permit and zoning clearance forms are periodically updated. Find the most recent permit and zoning clearance forms at <https://goshenindiana.org/>.*

APPENDIX A: Simplified Review Checklist

Step 1: Structural PV Array Mounting Requirements

Both Member-Attached and Sheathing-Attached Provisions

A. General Site and Array Requirements (all square boxes must be checked; where slanted check box sub-options occur, one sub-option must be checked):

- 1. Wind Exposure and Design Wind Speed (as defined by ASCE 7-10, select one below):
 - a. Member-Attached System: Exposure B or C and design wind speed does not exceed 150 mph.
 - b. Sheathing-Attached System (select one below):
 - i. Exposure C (open terrain/fields) and design wind speed does not exceed 120 mph, or
 - ii. Exposure B (urban, suburban and wooded areas more than 500 yards from open terrain) and design wind speed does not exceed 140 mph.
- 2. The structure is not in Wind Exposure D (within 200 yards of a body water wider than a mile).
- 3. The structure is not on a hill with a grade steeper than 5%, where topographic effects can significantly increase wind loads.
- 4. Ground snow loads do not exceed 60 psf (Goshen Building Department uses 30 psf).
- 5. Distributed weight of PV array is less than 4 lbs/ft² (less than 5 lbs/ft² for thermal systems).

B. Roof Information (all must apply):

- 1. The array is mounted on a permitted one- or two-family roof structure or similar structure.
If roof not permitted, show compliance with International Residential Code (IRC) span tables.
- 2. The roof is framed with wood rafters or trusses at no greater than 48" on center. Roof framing members run upslope/downslope (not horizontal purlins).
- 3. The roof structure appears to be structurally sound, without signs of alterations or significant structural deterioration or sagging.
- 4. Sheathing: At least 7/16" or thicker plywood, or 7/16" or thicker oriented strand board (OSB).
- 5. If a composition shingle roof, the roof has a single roof overlay (no multiple shingle layers).
If not, show compliance with IRC span tables.
- 6. Roof height: Mean roof height is not greater than 40 feet.

C. Array Mounting Equipment Information (all must be defined):

- 1. Mounting Equipment Manufacturer _____
- 2. Product Name and Model# _____
- 3. UL2703 fire rating for the PV modules used in the project. Fire rating Class ____ (A, B, or C).
- 4. Specify anchor-to-roof sealing (e.g. flashing, or sealant compatible with roofing):

If any structural item cannot be checked off, the building official may require the installer to provide structural calculations and/or details, stamped and signed by a design professional, addressing the unchecked item.

Step 2: Member-Attached Additional Provisions

(Skip to Step 3 if Sheathing-Attached)

D. Member-Attached Array Requirements (all square boxes must be checked; where slanted check box sub-options occur, one sub-option must be checked):

- 1. Array is set back from all roof edges and ridge by at least twice the gap under the modules (or more, where fire access pathways are required).
- 2. Array does not cantilever over the perimeter anchors more than 19”.
- 3. Gap under modules (roof surface to underside of module) is no greater than 10”.
- 4. Gaps between modules are (select one below):
 - a. at least 0.25” on both short and long sides of modules, or
 - b. 0” on short side, and at least 0.50” on long sides.
- 5. Mounting rail orientation or rail-less module long edges (select one below):
 - a. run perpendicular to rafters or trusses, and attached to them, or
 - b. run parallel to rafters and are spaced no more than 4’-0” apart, Ground Snow Load is no greater than 10 psf, and Design Wind Speed does not exceed 120 mph.
- 6. The anchor/mount/stand-off spacing perpendicular to rafters or trusses (select one below):
 - a. does not exceed 4’-0”, and anchors in adjacent rows are staggered where rafters or trusses are at 24” or less on center (see Figure), or
 - b. does not exceed 4’-0”, anchor layout is orthogonal, roof slope is 6:12 or less, Ground Snow Load is no greater than 10 psf, and Design Wind Speed does not exceed 120 mph, or
 - c. does not exceed 6’-0”, anchor layout is orthogonal, roof slope is 6:12 or less, Ground Snow Load is zero, and Design Wind Speed does not exceed 120 mph.
- 7. Upslope/downslope anchor spacing follows manufacturer’s instructions.
- 8. Anchor fastener is (select one below):
 - a. 5/16” diameter lag screw with 2.5” embedment into structural member, or
 - b. fastener other than (a.) embedded in structural members in accordance with manufacturer’s structural attachment details. Manufacturer’s anchor layout requirements must not exceed the anchor spacing requirements shown in Items 5 and 6 above.

If any structural item cannot be checked off, the building official may require the installer to provide structural calculations and/or details, stamped and signed by a design professional, addressing the unchecked item.

Step 3. Sheathing-Attached Additional Provisions

(Skip to Step 4 if Member-Attached)

E. Sheathing-Attached Array Requirements (all square boxes must be checked; where slanted check box sub-options occur, at least one sub-option must be checked):

- 1. Array is set back from all roof edges and ridge by at least twice the gap under the modules (or more, where fire access pathways are required).
- 2. Array does not cantilever over the perimeter anchors more than 19”.

- 3. Gap under modules (roof surface to underside of module) is no greater than 5”.
- 4. Gap between modules is at least 0.75” on both short and long sides of modules.
- 5. Roof framing and sheathing nailing options (select a, b, or c below):
 - a. *Manufactured Wood Trusses, or*
 - b. *Initially Dry Wood Rafters (lumber grade stamps are visible and state “S-DRY” (Surfaced Dry) or “KD” (Kiln-Dried), or*
 - c. *Initially Wet Wood Rafters meeting one of the field-verified sheathing nail options listed below. Note: If lumber stamps are not visible, or if lumber stamps state “S-GRN” (Surfaced Green), the lumber shall be assumed to have been initially “wet” (MC > 19%) at time of sheathing installation. (select I, ii, or iii below):*
 - i. *Deformed shank nails, 6d or greater, or*
 - ii. *8d smooth shank common or box nails, or*
 - iii. *6d smooth shank common or box nails, nailed into dense lumber, either Douglas Fir (stamp: DF or DF-L) or Southern Pine (stamp: SPIB).*

(NOTE: sheathing attached not allowed with Lower density lumber such as Spruce-Pine-Fir (stamp: S-P-F) and Hem-Fir (stamp: HF) and 6d smooth shank nails.)
- 6. Anchor location restrictions—all anchors must comply with at least one of the options below. Anchors verified to be in “Bands of Strength” are attached in the middle 16” wide strip centered between the long edges of sheathing panels (at least 16” from sheathing long edge). Check all boxes that apply to anchors in the array:
 - a. *Anchor is not in bands of strength (i) tributary region is more than 3 feet from any roof edge (wind Zone 1), (ii) tributary area is 9 square feet or less (up to half the area of a 60 cell PV module), and (iii) If initially wet lumber as defined by item 5c: Exposure B only, 120 mph max wind speed.*
 - b. *Anchor is in bands of strength (i) tributary region is more than 3 feet from any roof edge (wind Zone 1), and (ii) tributary area is 18 square feet or less (up to the full area of a 60 cell PV module).*
 - c. *Anchor is in bands of strength (i) tributary region is less than 3 feet from a roof edge (wind Zone 2), and (ii) tributary area is 9 square feet or less (up to half the area of a 60 cell PV module).*
 - d. *Anchor is in bands of strength (i) tributary region is within 3 feet of a roof corner (wind Zone 3), and (ii) tributary area is 4.5 square feet or less (up to ¼ of a 60 cell PV module).*

If any structural item cannot be checked off, the building official may require the installer to provide structural calculations and/or details, stamped and signed by a design professional, addressing the unchecked item.

Step 2: Electrical PV System Requirements Checklist

- 1. Major electrical components including PV modules, dc-to-dc converters, and inverters, are identified for use in PV systems.
- 2. Array mounting system UL2703 certified for bonding and grounding. Alternatively, the array mounting system may incorporate UL2703 grounding devices to bond separate exposed metal parts together or to the equipment grounding conductor.
- 3. The PV array consists of no more than 2 series strings per inverter input and no more than 4 series strings in total per inverter.
- 4. Field Installed PV array wiring meets the following requirements:
 - a. All exposed PV source circuit wiring is 10 AWG PV Wire.
 - b. All PV source circuit wiring in raceway is 10 AWG THWN-2, XHHW-2, or RHW-2.
 - c. Any field-installed PV output circuit wiring is 6 AWG THWN-2, XHHW-2, or RHW-2.
 - d. PV system circuits on buildings meet requirements for controlled conductors in 690.12.
- 5. The total inverter capacity has a continuous ac power output 11,000 Watts or less and meets the requirements of 705.12(D) where installed on the load side of the service disconnecting means (complies with Table 705.12(D) in Technical Appendix). (choose one below)
 - Load-side connection complying with Table 705.12(D)
 - Supply-side connection complying with 705.12(A)
- 6. Equipment is rated for the maximum dc voltage applied to the equipment (put N/A in all blanks that do not apply to the specific installation):
 - a. ASHRAE Extreme Annual Mean Minimum Design Dry Bulb Temperature (one source is www.solarabcs.org/permitting) = -22°C ; Table 690.7 (NEC) value 1.20
 - b. Max (temp adjusted) module Voc:
Rated Voc V x Table 690.7 value 1.20 = V
 - c. Dc-to-dc converter(s) or microinverter rated maximum input voltage: V (must be greater than Max module Voc in (B.))
 - d. Maximum number of dc-to-dc converters allowed in series (up to 600Vdc):
 - e. Maximum voltage of dc-to-dc converter circuit with maximum number in (C.): V
 - f. Inverter(s) rated maximum input voltage: V (must be greater than i to iv below)
 - i) Inverter 1 input 1: Max module Voc (B.) V x # in series = V
 - ii) Inverter 1 input 2: Max module Voc (B.) V x # in series = V
 - iii) Inverter 2 input 1: Max module Voc (B.) V x # in series = V
 - iv) Inverter 2 input 2: Max module Voc (B.) V x # in series = V
- 7. One of the standard electrical diagrams (E1.1a, E1.1b, E1.1c, E1.1d, or E1.1e) can be used to accurately represent the PV system.

Fill out the standard electrical diagram completely. If the electrical system is more complex than the standard electrical diagram can effectively communicate, the project does not meet the requirements for a simplified permit application and additional information may be necessary for the jurisdiction to process the permit application.

**Appendix B. Example Zoning Clearance Form - Highlighted for Rooftop Solar PV
ENGINEERING & ZONING CLEARANCE – BUILDING PERMIT APPLICATION
CITY OF GOSHEN, INDIANA**

Landowner/Applicant: _____ Phone: _____ Date: _____
Mailing Address: _____ Zip Code: _____

PROPOSED USE/CONSTRUCTION: _____

Building Address: _____ Twp: _____

PROPOSED CONSTRUCTION: _____ Zoning District: _____

Contractor: _____ Address: _____

Phone: _____ Email: _____ Approx. Cost: _____

Lot No. _____ Corner _____ Interior _____ Through _____ Subdivision: _____

Lot Width: _____ Lot Depth: _____ SF/Acres: _____ Existing Use: _____

Public Sewer _____ Public Water _____ Well _____ Septic System _____ Flood Zone Designation: _____

Dedicated Road _____ Private Road _____ Sidewalk Required _____ Landscaping Required _____

Size: _____ X _____ Square Footage: _____ Coverage: _____ % Height: _____ ft/story

Setbacks measured from the furthest projection to the property line:

Front _____ Rear _____ Side _____ Side _____

Conventional _____ Manufactured Home Type I (HUD Certified) _____ Modular Home (PL 360 Certified) _____ Mobile Home _____

For Manufactured/Modular/Mobile Homes, Installer's State ID #: _____

Deck _____ sq. ft. Patio _____ sq. ft. Porch _____ sq. ft. Basement: _____ Finished _____ sq. ft.

1st story _____ sq. ft. 2nd story _____ sf Garage: Attached _____ Detached _____ sq. ft. Total sq. ft.: _____

Subcontractors: Electrical _____ Mechanical _____ Plumbing _____

Temp electric: Yes _____ No _____ Central air: Yes _____ No _____ IPC _____ IRC _____ Total # plumbing fixtures _____

Principal Building _____ Accessory Structure _____ Addition _____ Remodeling _____ Rental unit: Yes _____ No _____

Parking required _____ Parking provided: _____

Parking/Driving aisle setbacks: Front _____ ft Rear _____ ft Side _____ ft Side _____ ft

The information on this application together with attachments thereto are true and complete. I agree that all structures and uses, as indicated, will comply with the standards and restrictions for the Zoning District in which they are located, and that any deviation there from will render this certificate null and void.

Date: _____ Signed: _____ Owner/agent _____

ENGINEERING CLEARANCE

The following have been approved by Goshen Engineering:

Water/Sewer _____ Site Plan _____ Stormwater Clearance _____ Post-construction Plan _____

Driveway Permit: Commercial _____ Residential _____ Industrial _____ Date Issued: _____

Engineering Project Number: _____

Conditions of Approval: _____

I have examined the above application for compliance with Engineering Department requirements. On the basis of the information submitted it is hereby determined that Engineering Department requirements have been met to allow a Zoning Clearance to be granted.

Date: _____ Signed: _____ By/For City Engineer _____

ZONING CLEARANCE

Sign: Temporary/Mobile _____ Location: _____ Dates used: _____ Time Left: _____

Staff Comments: _____

PLANNING INSPECTION REQUIRED BEFORE CERTIFICATE OF OCCUPANCY IS ISSUED

Variance: Granted _____ Denied _____ Board Action Date: _____

Conditions: _____

Zoning Clearance Fee for Primary Buildings: Paid: _____

I have examined the above application, including site plan, for compliance with all requirements of the Zoning Ordinance. On the basis of the information submitted it is hereby determined that a Zoning Clearance shall be granted.

Date: _____ Signed: _____ By/For Zoning Administrator _____

*This certificate applies to Zoning Clearance **only** and does not satisfy the requirements of any applicable building or engineering codes or permits required.*

**Appendix B. Example Zoning Clearance Form - Highlighted for Ground-Mounted Solar PV
ENGINEERING & ZONING CLEARANCE – BUILDING PERMIT APPLICATION
CITY OF GOSHEN, INDIANA**

Landowner/Applicant: _____ Phone: _____ Date: _____
Mailing Address: _____ Zip Code: _____

PROPOSED USE/CONSTRUCTION: _____
Building Address: _____ Twp: _____

PROPOSED CONSTRUCTION: _____ Zoning District: _____

Contractor: _____ Address: _____

Phone: _____ Email: _____ Approx. Cost: _____

Lot No. _____ Corner _____ Interior _____ Through _____ Subdivision: _____

Lot Width: _____ Lot Depth: _____ SF/Acres: _____ Existing Use: _____

Public Sewer _____ Public Water _____ Well _____ Septic System _____ Flood Zone Designation: _____

Dedicated Road _____ Private Road _____ Sidewalk Required _____ Landscaping Required _____

Size: _____ X _____ Square Footage: _____ Coverage: _____ % Height: _____ ft/story

Setbacks measured from the furthest projection to the property line:

Front _____ Rear _____ Side _____ Side _____

Conventional _____ Manufactured Home Type I (HUD Certified) _____ Modular Home (PL 360 Certified) _____ Mobile Home _____

For Manufactured/Modular/Mobile Homes, Installer's State ID #: _____

Deck _____ sq. ft. Patio _____ sq. ft. Porch _____ sq. ft. Basement: _____ Finished _____ sq. ft.

1st story _____ sq. ft. 2nd story _____ sf Garage: Attached _____ Detached _____ sq. ft. Total sq. ft.: _____

Subcontractors: Electrical _____ Mechanical _____ Plumbing _____

Temp electric: Yes _____ No _____ Central air: Yes _____ No _____ IPC _____ IRC _____ Total # plumbing fixtures _____

Principal Building _____ Accessory Structure _____ Addition _____ Remodeling _____ Rental unit: Yes _____ No _____

Parking required _____ Parking provided: _____

Parking/Driving aisle setbacks: Front _____ ft Rear _____ ft Side _____ ft Side _____ ft

The information on this application together with attachments thereto are true and complete. I agree that all structures and uses, as indicated, will comply with the standards and restrictions for the Zoning District in which they are located, and that any deviation there from will render this certificate null and void.

Date: _____ Signed: _____ Owner/agent _____

ENGINEERING CLEARANCE

The following have been approved by Goshen Engineering:

Water/Sewer _____ Site Plan _____ Stormwater Clearance _____ Post-construction Plan _____

Driveway Permit: Commercial _____ Residential _____ Industrial _____ Date Issued: _____

Engineering Project Number: _____

Conditions of Approval: _____

I have examined the above application for compliance with Engineering Department requirements. On the basis of the information submitted it is hereby determined that Engineering Department requirements have been met to allow a Zoning Clearance to be granted.

Date: _____ Signed: _____ By/For City Engineer _____

ZONING CLEARANCE

Sign: Temporary/Mobile _____ Location: _____ Dates used: _____ Time Left: _____

Staff Comments: _____

PLANNING INSPECTION REQUIRED BEFORE CERTIFICATE OF OCCUPANCY IS ISSUED

Variance: Granted _____ Denied _____ Board Action Date: _____

Conditions: _____

Zoning Clearance Fee for Primary Buildings: Paid: _____

I have examined the above application, including site plan, for compliance with all requirements of the Zoning Ordinance. On the basis of the information submitted it is hereby determined that a Zoning Clearance shall be granted.

Date: _____ Signed: _____ By/For Zoning Administrator _____

*This certificate applies to Zoning Clearance **only** and does not satisfy the requirements of any applicable building or engineering codes or permits required.*

APPENDIX C: Structural Worksheet

This section is for evaluating roof structural members that are site built. This includes rafter systems and site built trusses. Manufactured truss and roof joist systems, when installed with proper spacing, meet the roof structure requirements covered in item 2 below.

Note: Only required for Standard Review. This worksheet is not required if plans are certified by a design professional.

If the array is roof mounted:

1. **Roof construction:** Rafters Trusses Other: _____
2. **Describe site-built rafter or site-built truss system.**
 - a. Rafter Size: ___ x ___ inches
 - b. Rafter Spacing: _____ inches
 - c. Maximum unsupported span: _____ feet, _____ inches
 - d. Are the rafters over-spanned? (see the IRC span tables) Yes No
 - e. **If Yes**, complete section 3 below.
3. **If the roof system has:**
 - a. over-spanned rafters or trusses,
 - b. the array over 5 lbs/ft² on any roof construction, or
 - c. the attachments with a dead load exceeding 45 lbs per attachment;it is recommended that you provide one of the following:
 - i. A framing plan that shows details for how you will strengthen the rafters using the supplied span tables below.
 - ii. Confirmation certified by a design professional that the roof structure will support the array.

If array is ground mounted:

1. Show array supports, framing members, and foundation posts and footings.
2. Provide information on mounting structure(s) construction. If the mounting structure is unfamiliar to the local jurisdiction and is more than six (6) feet above grade, it may require engineering calculations certified by a design professional.
3. Show detail on module attachment method to mounting structure.

APPENDIX C: Continued

Span Tables

A framing plan is required only if the combined weight of the PV array exceeds 5 pounds per square foot (PSF or lbs/ft²) or the existing rafters are over-spanned. The following span tables from the 2003 International Residential Code (IRC) can be used to determine if the rafters are over-spanned. For installations in jurisdictions using different span tables, follow the local tables.

Span Table R802.5.1(1)

Use this table for rafter spans that have conventional light-weight dead loads and do not have a ceiling attached.

10 PSF Dead Load Roof live load = 20 psf, ceiling not attached to rafters, L/Δ=180							
Rafter Size			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
Spacing (inches)	Species	Grade	The measurements below are in feet-inches (e.g. 9-10 = 9 feet, 10 inches).				
16	Douglas Fir-larch	#2 or better	9-10	14-4	18-2	22-3	25-9
16	Hem-fir	#2 or better	9-2	14-2	17-11	21-11	25-5
24	Douglas Fir-larch	#2 or better	8-0	11-9	14-10	18-2	21-0
24	Hem-fir	#2 or better	7-11	11-7	14-8	17-10	20-9

Use this table for rafter spans that have heavy dead loads and do not have a ceiling attached.

20 PSF Dead Load Roof live load = 20 psf, ceiling not attached to rafters, L/Δ=180							
Rafter Size			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
Spacing (inches)	Species	Grade	The measurements below are in feet-inches (e.g. 9-10 = 9 feet, 10 inches).				
16	Douglas Fir-larch	#2 or better	8-6	12-5	15-9	19-3	22-4
16	Hem-fir	#2 or better	8-5	12-3	15-6	18-11	22-0
24	Douglas Fir-larch	#2 or better	6-11	10-2	12-10	15-8	18-3
24	Hem-fir	#2 or better	6-10	10-0	12-8	15-6	17-11

APPENDIX C: Continued

Span Table R802.5.1(2)

Use this table for rafter spans with a ceiling attached and conventional light-weight dead loads.

10 PSF Dead Load Roof live load = 20 psf, ceiling attached to rafters, L/Δ=240							
Rafter Size			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
Spacing (inches)	Species	Grade	The measurements below are in feet-inches (e.g. 9-10 = 9 feet, 10 inches).				
16	Douglas Fir-larch	#2 or better	8-11	14-1	18-2	22-3	25-9
16	Hem-fir	#2 or better	8-4	13-1	17-3	21-11	25-5
24	Douglas Fir-larch	#2 or better	7-10	11-9	14-10	18-2	21-0
24	Hem-fir	#2 or better	7-3	11-5	14-8	17-10	20-9

Use this table for rafter spans with a ceiling attached and where heavy dead loads exist.

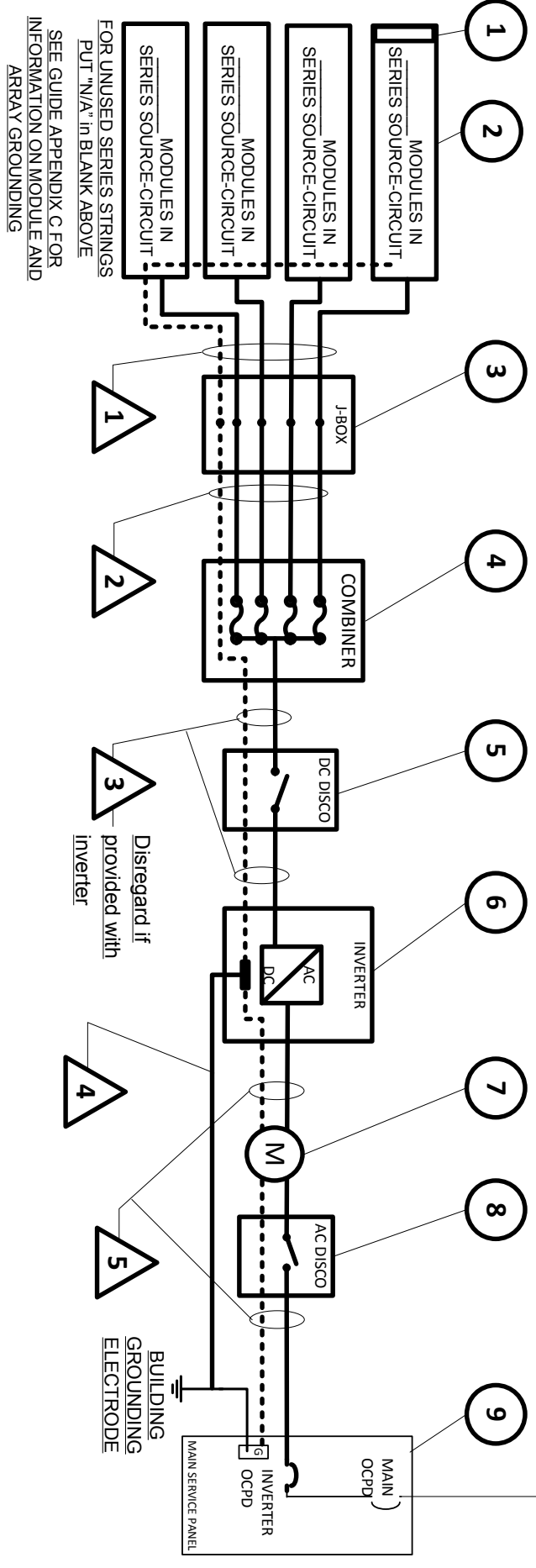
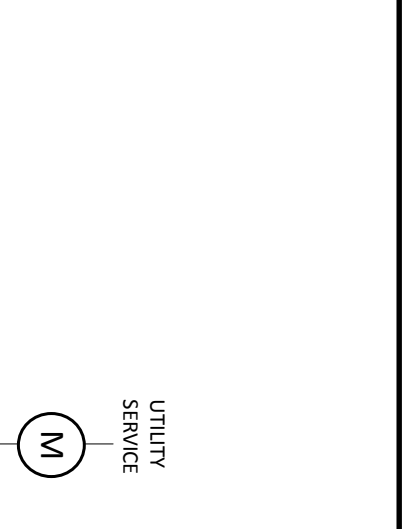
20 PSF Dead Load Roof live load = 20 psf, ceiling attached to rafters, L/Δ=240							
Rafter Size			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
Spacing (inches)	Species	Grade	The measurements below are in feet-inches (e.g. 9-10 = 9 feet, 10 inches).				
16	Douglas Fir-larch	#2 or better	8-6	12-5	15-9	19-3	22-4
16	Hem-fir	#2 or better	8-4	12-3	15-6	18-11	22-0
24	Douglas Fir-larch	#2 or better	6-11	10-2	12-10	15-8	18-3
24	Hem-fir	#2 or better	6-10	10-0	12-8	15-6	17-11

Use the conventional light-weight dead load table when the existing roofing materials are wood shake, wood shingle, composition shingle, or light-weight tile. (The rationale for allowing these tables to be used is that the installation of a PV system should be considered as part of the live load, since additional loading will not be added to the section of the roof where a PV array is installed.)

Where heavy roofing systems exist (e.g. clay tile or heavy concrete tile roofs), use the 20 lbs/ft² dead load tables.

STANDARD ELECTRICAL DIAGRAM

EQUIPMENT SCHEDULE			
TAG	DESCRIPTION	PART NUMBER	NOTES
1	SOLAR PV MODULE		
2	PV ARRAY		
3	J-BOX (IF USED)		
4	COMBINER (IF USED)		
5	DC DISCONNECT		
6	DC/AC INVERTER		
7	GEN METER (IF USED)		
8	AC DISCONNECT (IF USED)		
9	SERVICE PANEL		

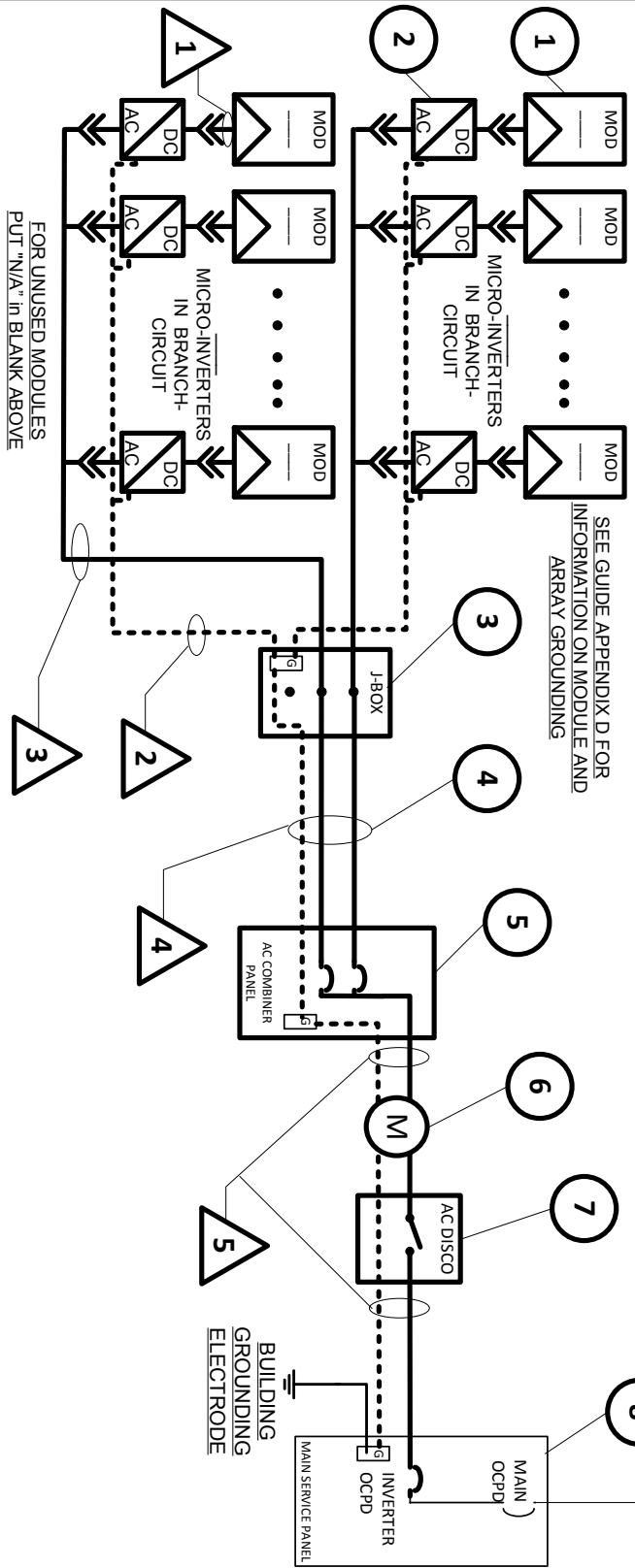


CONDUIT AND CONDUCTOR SCHEDULE				
TAG	DESCRIPTION OR CONDUCTOR TYPE	COND. GAUGE	NUMBER OF CONDUCTORS	CONDUIT TYPE AND SIZE
1	USE-2 <input type="checkbox"/> or PV WIRE <input type="checkbox"/>			N/A
2	BARE COPPER EQ. GRD. COND. (EGC)			N/A
3	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>			N/A
4	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>			N/A
5	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>			N/A

Contractor Name: Address and Phone:		One-Line Standard Electrical Diagram for Small-Scale, Single-Phase PV Systems	
Drawn By: _____ Checked By: _____		Site Name: _____ Site Address: _____ System AC Size: _____	
SIZE	FSCM NO	DWG NO	REV
SCALE	NTS	Date:	ET.1
		SHEET	

MICRO-INVERTER ELECTRICAL DIAGRAM

EQUIPMENT SCHEDULE			
○ TAG	DESCRIPTION	PART NUMBER	NOTES
1	PV DC or AC MODULE		
2	DC/AC INVERTER (MICRO)		
3	J-BOX (IF USED)		
4	PV ARRAY		
5	AC COMB. PANEL (IF USED)		
6	GEN METER (IF USED)		
7	AC DISCONNECT (IF USED)		
8	SERVICE PANEL		



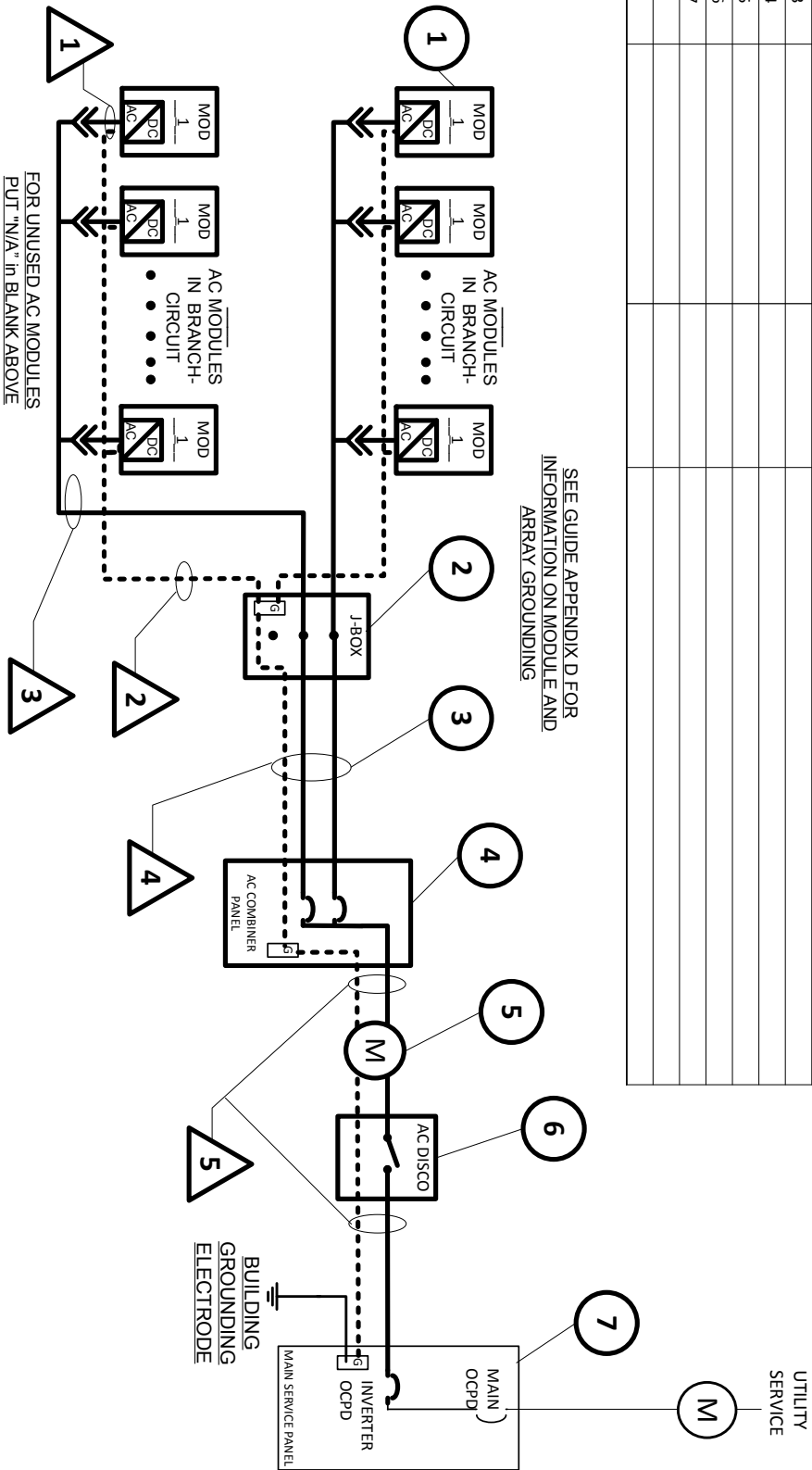
CONDUIT AND CONDUCTOR SCHEDULE					
△ TAG	DESCRIPTION OR CONDUCTOR TYPE	COND. GAUGE	NUMBER OF CONDUCTORS	CONDUIT TYPE	CONDUIT SIZE
1	USE-2 <input type="checkbox"/> or PV WIRE <input type="checkbox"/>	MFG	MFG Cable	N/A	N/A
2	GEC <input type="checkbox"/> EGC <input type="checkbox"/> X ALL THAT APPLY	MFG	MFG Cable	N/A	N/A
3	EXTERIOR CABLE LISTED W/ INV.	MFG	MFG Cable	N/A	N/A
4	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>			SAME	SAME
	GEC <input type="checkbox"/> EGC <input type="checkbox"/> X ALL THAT APPLY			SAME	SAME
	NO DC GEC IF 690.35 SYSTEM				
5	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>			SAME	SAME
	GEC <input type="checkbox"/> EGC <input type="checkbox"/> X ALL THAT APPLY			SAME	SAME

Contractor Name: Address and Phone:		One-Line Standard Electrical Diagram for Micro-Inverter PV Systems	
Drawn By:		Site Name:	
Checked By:		Site Address:	
SIZE		System AC Size:	
FSCM NO		DWG NO	
NTS		REV	
Date:		E1.1a	
Date:		SHEET	

AC MODULE ELECTRICAL DIAGRAM

EQUIPMENT SCHEDULE			
TAG	DESCRIPTION	PART NUMBER	NOTES
1			
2			
3			
4			
5			
6			
7			

SEE GUIDE APPENDIX D FOR INFORMATION ON MODULE AND ARRAY GROUNDING



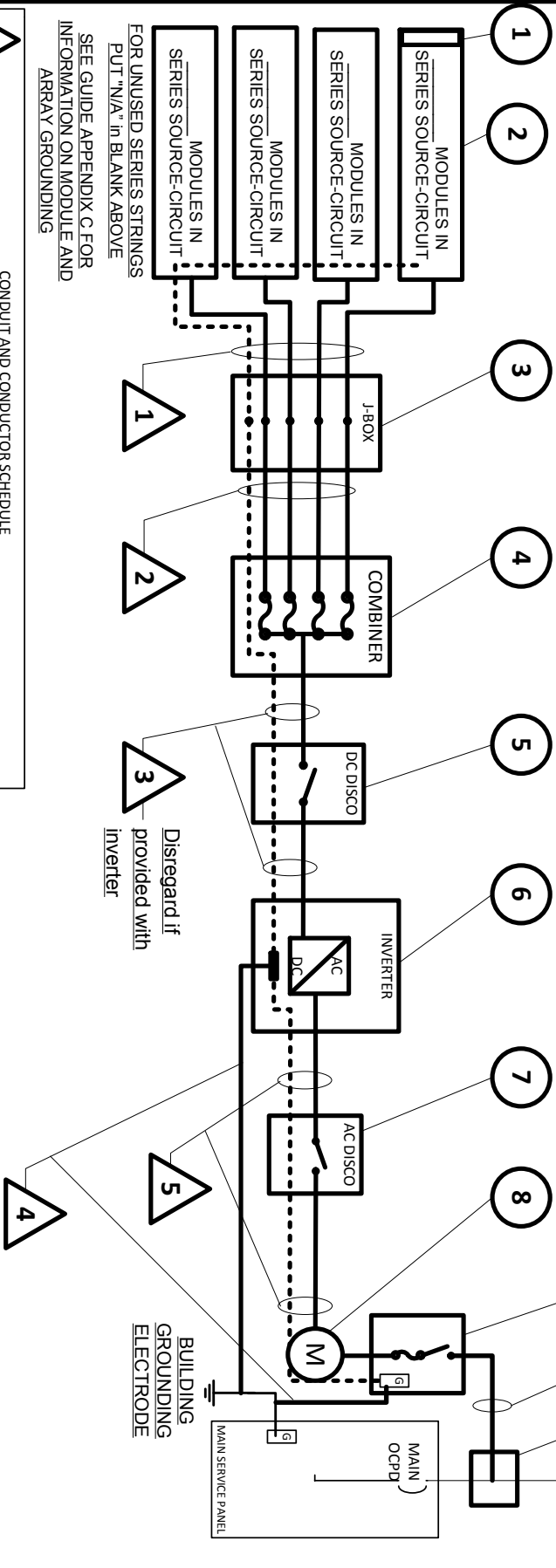
CONDUIT AND CONDUCTOR SCHEDULE

TAG	DESCRIPTION OR CONDUCTOR TYPE	COND.	NUMBER OF CONDUCTORS	CONDUIT TYPE	CONDUIT SIZE
1	USE-2 <input type="checkbox"/> or PV WIRE <input type="checkbox"/>	GAUGE	MFG Cable	N/A	N/A
2	GEC <input type="checkbox"/> EGC <input type="checkbox"/> X ALL THAT APPLY	MFG	MFG Cable	N/A	N/A
3	EXTERIOR CABLE LISTED W/INV.	MFG	MFG Cable	N/A	N/A
4	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>				
	GEC <input type="checkbox"/> EGC <input type="checkbox"/> X ALL THAT APPLY				
	NO DC GEC. IF 690.35 SYSTEM				
5	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>				
	GEC <input type="checkbox"/> EGC <input type="checkbox"/> X ALL THAT APPLY				

Contractor Name, Address and Phone:		One-Line Standard Electrical Diagram for AC Module PV Systems	
Site Name: Site Address: System AC Size:		SIZE ESCMNO	REV DWGNO E1.1b
Drawn By:	Checked By:	SCALE NTS	Date:
			SHEET

SUPPLY-SIDE CONNECTED ELECTRICAL DIAGRAM

EQUIPMENT SCHEDULE			
TAG	DESCRIPTION	PART NUMBER	NOTES
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



CONDUIT AND CONDUCTOR SCHEDULE					
TAG	DESCRIPTION OR CONDUCTOR TYPE	COND. GAUGE	NUMBER OF CONDUCTORS	CONDUIT TYPE	CONDUIT SIZE
1	USE 2- <input type="checkbox"/> or PV WIRE <input type="checkbox"/>				
2	BARE COPPER EQ. GRD. COND. (EGC)				
3	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>				
4	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>				
5	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>				
6	THWN-2 <input type="checkbox"/> or XHHW-2 <input type="checkbox"/> or RHW-2 <input type="checkbox"/>				

Contractor Name: Address and Phone:		One-Line Electrical Diagram for Supply-Side Connected Single-Phase PV Systems	
Site Name: Site Address: System AC Size:		DWG NO E1.1c	
Drawn By:		SCALE	
Checked By:		NTS	
Date:		Date:	
SHEET		REV 0	