New York Solar Guidebook for Local Governments

Chapter 4 Field Inspection Checklist

The Field Inspection Checklist in this chapter can be used directly by the authorities having jurisdiction (AHJ) The Village of Mount Morris or provided to a third-party inspection agency, where applicable. The checklist is intended to highlight key system characteristics and common installation errors. Completing the checklist should take approximately 20 minutes per field inspection. Not all sections may apply to a given installation.

A "rough inspection" (which occurs when all boxes and wires are installed to the point when walls or trenches are ready to be closed) is not necessary on most small residential installations with existing construction.

When a field inspection is necessary, inspectors should consider bringing the following items:

- Ladder with non-conductive sides.
- Binoculars for surveying inaccessible roof-mounted equipment.
- Screwdriver for opening enclosures.
- A copy of the contractor's submitted design.

Code enforcement officers should consider asking solar PV contractors for a set of construction photos. Contractors typically document their installation progress with photos, which are sometimes required by their internal quality assurance team or financing partners. NY-Sun also requires construction photos from participating contractors. Code enforcement officers can use such photos to review hard-to-access parts of the installation (such as roof-mounted racking).

References to construction and equipment photos in Chapter 5 are included in the following checklist, where applicable.

4.1 Array (All photos are located in Appendix C)

1. Circuit conductors are properly supported and are not touching the roof surface [NEC 338.10(B)(4) and NEC 334.30] (Photo 10)	N	Y	N/A
2. Circuit conductors are same conductor type/size as on plan set	N	Y	N/A
3. Module count matches plan set. If no, investigate stringing configuration (Photo 3)	N	Y	N/A
4. Module manufacturer/model matches plan set (Photo 4)	N	Y	N/A
5. Modules are effectively grounded using lugs, WEEBs, or a racking integrated grounding method [NEC 690.43] (Photo 9)	N	Y	N/A
6. Modules and racking are properly secured (Photos 5, 6, 7)	N	Y	N/A
7. DC optimizers are properly grounded [NEC 690.43 and NEC 110.3(B)]	N	Y	N/A
8. Wire ties are UV-rated (generally black) (Photo 10)	N	Y	N/A
9. All electrical connections are secured to ensure no arcing	N	Y	N/A
10. Racking system is properly grounded (EGC bonding the rails, [NEC 690.43]) (Photo 8)	N	Y	N/A
11. Conductors are properly identified (ungrounded, grounded, grounding) [NEC 200.7, NEC 200.6, NEC 250.119] (Photo 13)	N	Y	N/A
12. Outdoor components are UL-listed for the environment [NEC 110.3(B)]	N	Y	N/A
13. Roof vents are not covered by the modules (2015 IRC/2015IBC) (Photo 3)	N	Y	N/A
14. DC conduit is labeled "WARNING: PHOTOVOLTAIC POWER SOURCE" every 10 feet, and is reflective, and meets color and size requirements [NEC 690.31(G)(3) and (4)]	N	Y	N/A

4.2 DC Optimizer (All photos are located in Appendix C)

1. DC Optimizer chassis is properly grounded per manufacturer's instructions [NEC 690.43, NEC 250 NEC 110.3(B)]	N	Y	N/A
2. EGC is protected if smaller than #6AWG [NEC 690.46 and NEC 250.120] (Photo 9)	N	Y	N/A
3. DC Optimizer GEC is sufficiently sized per manufacturer instructions [NEC 690.47(C), NEC 250.66, NEC 250.122, NEC 250.166]	N	Y	N/A
4. Rapid Shutdown label is present and meets the requirements of NEC 690.56(C).	N	Y	N/A
5. DC Output circuit conductor insulation type is rated for environment (Shall not be type: USE-2, THWN-2, RHW-2) [NEC 310.10]	N	Y	N/A

Note 1: Many violations from the "Array" section also apply to the "DC Optimizer" section.

Note 2: DC optimizer can have an integrated ground, or not. Bring the specifications sheet to the inspection for quick reference.

4.3 Structural (Roof-Mounted Only) (All photos are located in Appendix C)

1. All roof penetrations are properly flashed and sealed 2015 IRC/ 2015 IBC (Photos 6, 12)	N	Y	N/A
2. Rafter spacing/material matches construction documents	N	Y	N/A
3. Roof appears to be in good condition, with no signs of leaking or damage; Roof is free of debris (Photo 3)	N	Y	N/A
4. All racking splices are properly supported per manufacturer requirements (generally splices must be supported on both sides of the joint by a structural attachment)	N	Y	N/A
5. Modules cannot be moved by pushing or pulling with one hand (Photo 7)	N	Y	N/A

4.4 Junction Box (All photos are located in Appendix C)

1. Wire nuts and splices are suitable for the environment [NEC 110.3(B), NEC 110.14, NEC 110.28] (Photo 13)	N	Y	N/A
2. Junction box is UL listed for the environment [NEC 110.3(B)] (Photo 14)	N	Y	N/A
3. Junction box is properly grounded [NEC 690.43(A), NEC 250.4, NEC 110.3(B)]	N	Y	N/A
4. Grounding equipment is properly installed (NEC 690.43, NEC 250.8, NEC 250.12) (Photo 13)	N	Y	N/A

4.5 Inverter (All photos are located in Appendix C)

1. The number of strings match the plan set (Photo 18)	N	Y	N/A
2. The conductors have sufficient ampacity for each string	N	Y	N/A
3. DC conductors in metal when on or inside a building [NEC 690.31(G)] (Photos 11, 12)	N	Y	N/A
5. Conduit penetrations are properly sealed between conditioned and unconditioned space [NEC 300.7(A)]	N	Y	N/A
6. Conduit is properly supported e.g., [LFMC NEC 350.30, EMT NEC 358.30, PVC NEC 352.30] (Photo 15)	N	Y	N/A
7. Conduit is not being used as conductor support [NEC 300.11(B)] (Photo 15)	N	Y	N/A
8. The enclosure is properly grounded [NEC 690.43, NEC 250.8, NEC 250.12] (Photo 16)	N	Y	N/A
9. Grounding equipment is properly installed [NEC 690.43, NEC 250.8, NEC 250.12] (Photos 16, 19)	N	Y	N/A
10. Enclosure is labeled as a PV disconnect [NEC 690.13(B)]	N	Y	N/A
11. DC characteristics label is present [NEC 690.53]	N	Y	N/A
12. The ungrounded DC conductors are properly identified (shall not be white, gray, or white striped) [NEC 200.7(A)] (Photo 16)	N	Y	N/A
13. Max string voltage below inverter max [NEC 110.3(B) and NEC 690.7]	N	Y	N/A
14. Inverter string fuses are rated for use in application [NEC 690.9]	N	Y	N/A
15. DC and AC disconnecting means are located within sight of or in each inverter [NEC 690.15 (A)] (Photos 15, 18)	N	Y	N/A
16. AFCI protection is present and enabled [NEC 690.11]	N	Y	N/A
17. System is equipped with Rapid Shutdown [NEC 690. 12]	N	Y	N/A
18. System is marked with a permanent label with the following wording: “PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN” [NEC 690.56(C)]	N	Y	N/A

4.6 Microinverter (All photos are located in Appendix C)

1. Microinverter chassis is properly grounded per manufacturer's instructions [NEC 690.43(A), 250.4, 110.3(B)]	N	Y	N/A
2. EGC is protected if smaller than #6 AWG [NEC 690.46 and 250.120(C)] (Photo 5)	N	Y	N/A
3. Microinverter GEC is sufficiently sized per manufacturer instructions [NEC 690.47(C), NEC 250.66, NEC 250.122, NEC 250.166]	N	Y	N/A
4. Rapid Shutdown label is present and meets the requirements of [NEC 690.56(C)]	N	Y	N/A

Note 1: Many items from the "Array" section also apply to the "Microinverter" section.

Note 2: Microinverters can have an integrated ground, or not. This information is found on the specification sheet.

Note 3: As long as the microinverters are listed, they are inherently equipped with rapid shutdown, which is required by NEC Article 690.12. This does not negate the label requirement in 690.56(C).

4.7 AC Combiner (All photos are located in Appendix C)

1. The number of branch circuits match the plan set. (Photo 20)	N	Y	N/A
2. The conductors have sufficient ampacity for each branch circuit.	N	Y	N/A
3. The Overcurrent Protective Device (OCPD) for the conductors have a rating sufficient to protect them [NEC 240.4] (Photo 20)	N	Y	N/A
5. Conduit penetrations are properly sealed between conditioned and unconditioned space [NEC 300.7(A)]	N	Y	N/A
6. Conduit is properly supported e.g., [LFMC NEC 350.30, EMT NEC 358.30, PVC NEC 352.30] (Photo 15)	N	Y	N/A
7. Conduit is not being used as conductor support [NEC 300.11(B)] (Photo 15)	N	Y	N/A
8. The enclosure is properly grounded [NEC 690.43, NEC 250.8, NEC 250.12] (Photo 20)	N	Y	N/A
9. Grounding equipment is properly installed [NEC 690.43, NEC 250.8, NEC 250.12] (Photo 20)	N	Y	N/A
10. Enclosure is labeled as a disconnect [NEC 690.13]	N	Y	N/A
11. AC characteristics label is present (voltage and amperage), [NEC 690.54]	N	Y	N/A
12. "Multiple Sources" indication label is present [NEC 705.12(D)(3)]	N	Y	N/A
13. The sum of all overcurrent devices (excluding main) do not exceed the rating of the buss bar [NEC 705.12(D)(2)(3)(c)]	N	Y	N/A
14. The enclosure is labeled "Do Not Add Loads" [NEC 705.12(D)(2)(3)(c)]	N	Y	N/A
15. The main breaker is fastened in place [NEC 408.36(D)]	N	Y	N/A
16. Grounded conductors are isolated from enclosure [NEC 250.24(A)(5)] (Photo 20)	N	Y	N/A

4.8 Load-Side Connection (All photos are located in Appendix C)

1. Circuit conductors have sufficient ampacity [NEC 690.8, 310.15]	N	Y	N/A
2. The OCPD is sufficient to protect the circuit conductors [NEC 240.4]	N	Y	N/A
3. Grounded conductors properly identified [NEC 200.6(A)&(B)]	N	Y	N/A
4. The GEC is present and sufficiently sized [NEC 690.47(C), NEC 250.66, NEC 250.122, NEC 250.166]	N	Y	N/A
5. The GEC is continuous (or irreversibly spliced) [NEC 250.64(C), 690.47(C)]	N	Y	N/A
6. Ferrous conduit and the enclosure are appropriately bonded to the GEC [NEC 250.64(E), NEC 250.4(A)(5)]	N	Y	N/A
7. PV breakers are properly identified [NEC 408.4(A)] (Photo 23)	N	Y	N/A
8. AC characteristics label is present and suitable for the environment (voltage and amperage) [NEC 690.54, NEC 110.21]	N	Y	N/A
9. Dissimilar metals are separated and will not cause a galvanic reaction [(NEC 110.14, RMC NEC 344.14, EMT NEC 358.12(6)]	N	Y	N/A
10. Inverter directory present [NEC 690.15(A) and NEC 705.10]	N	Y	N/A
11. Backfed breaker sized to protect circuits [NEC 690.8(B)(1) and/or NEC 310.15]	N	Y	N/A
12. Source breakers follow 120% rule [NEC 705.12(D)(2)(3)(b)]	N	Y	N/A
13. Backfed breaker properly located in panel [NEC 705.12(D)(2)(3)(b)] (Photo 23)	N	Y	N/A
14. Clearances maintained/live parts secured [NEC 110.27(A) and NEC 110.26] (Photo 18)	N	Y	N/A

4.9 Supply Side Connection (All photos are located in Appendix C)

1. Disconnect is service-rated and has a current rating of at least 60 Amp [NEC 230.79(D)] (Photo 22)	N	Y	N/A
2. Circuit conductors have sufficient ampacity [NEC 690.8, NEC 310.15]	N	Y	N/A
3. New service entrance conductors are less than 10 feet [NEC 705.31] (Photo 18)	N	Y	N/A
4. The OCPD is sufficient to protect the circuit conductors [NEC 240.4] (Photo 21)	N	Y	N/A
5. The disconnect utility conductors are on LINE terminals [NEC 110.3(B), NEC 240.40(if fusible)]	N	Y	N/A
6. There is no OCPD in the grounded conductor [NEC 230.90(B)] (Photo 21	N	Y	N/A
7. The AIC rating on the OCPD meets, or exceeds the rating of other main OCPD on the premises [NEC 110.9, NEC 110.10]	N	Y	N/A
8. The neutral is bonded to the PV disconnect enclosure/GEC [NEC 250.24(C)]	N	Y	N/A
9. The GEC is present and sufficiently sized [NEC 690.47(C), NEC 250.66, NEC 250.122, NEC 250.166] (Photo 24)	N	Y	N/A
10. The GEC is continuous (or irreversibly spliced) [NEC 250.64(C), NEC 690.47(C)]	N	Y	N/A
11. Ferrous conduit and the enclosure are appropriately bonded to the GEC [NEC 250.64(E), NEC 250.4(A)(5)] (Photo 24)	N	Y	N/A
12. AC characteristics label is present and suitable for the environment (voltage and amperage) [NEC 690.54, NEC 110.21]	N	Y	N/A
13. Power source directory is present, denoting all locations of power sources and disconnects on premises, at each service equipment location [NEC 110.21, NEC 690.56, NEC 705.10]	N	Y	N/A
14. AC disconnect label is present and suitable for the environment (NEC 690.13(B), NEC 110.21]	N	Y	N/A
15. Dissimilar metals are separated and will not cause a galvanic reaction [NEC 110.14, RMC NEC 344.14, EMT NEC 358.12(6)]	N	Y	N/A

4.10 General

1. Work is done in a neat and workmanlike manner [NEC 110.12] (Photos 5, 10, 13, 28)	N	Y	N/A
2. Working clearances are observed per NEC 110.26 (Photo 18)	N	Y	N/A

5 Resources

5.1 NY-Sun and PV Trainers Network

As part of the NY-Sun initiative, NYSERDA is committed to providing resources to local governments to help them better understand the solar PV contracting and construction process. General information on solar electric, including Community Solar and Solarize, and NY-Sun's initiatives, is available at nyserda.ny.gov/All-Programs/Programs/NY-Sun

Of particular relevance is the PV Trainers Network page (training.ny-sun.ny.gov), which contains:

- Free videos of trainings on solar electric-related topics, such as zoning, installing shared solar,
- and fire and safety considerations.
- A Municipal Solar Procurement Toolkit for towns interested in developing their own solar PV project.
- Information on zoning and land use planning for solar PV systems.
- Frequently Asked Questions.
- A section for local governments to request an in-person training session.

5.2 Residential Rooftop Access and Ventilation Requirements

Section 324 in the 2015 International Residential Code concerns roof top access and ventilation requirements for solar PV systems. New York State has adopted the 2017 Uniform Code Supplement with changes to Section 324. The purpose of these requirements is to provide firefighters and first responders access to the rooftop for ventilation purposes during a fire.

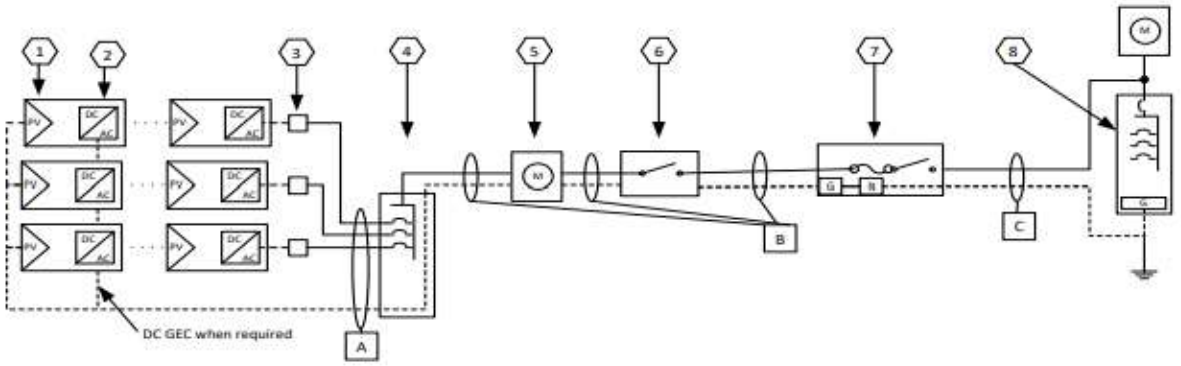
NYSERDA has developed an illustrated guide to these new requirements, called Residential Roof Top Access and Ventilation Requirements. Find it at nyserda.ny.gov/All-Programs/Programs/NY-Sun/Project-Developers/ResidentialSmall-Commercial-MW-Block/Resources-Residential-Small-Commercial-MW-Block

5.3 Sample Wiring Diagram 1: Microinverters with Supply Side Connection

Equipment Schedule	
TAG	DESCRIPTION: (Provide manufacturer and model number if applicable)
1	Solar PV Module or ACM: (45) Trina TSM250PA05: (3) strings of (15)
2	Microinverter (if not ACM): (45) Enphase M250
3	Junction Box(es): (3) Soladeck NEMA 3R, on roof
4	Solar Load Center, Yes / No: YES, 60 amps with (3) 20 amp breakers.
5	Performance Meter Yes / No: YES, online monitoring through Enphase Envoy unit
6	*Utility External Disconnect Switch Yes / No: Yes
7	Supply Side Disconnect with OCPD: Disconnect rating 60 amps. OCPD Rating 60 amps
8	Main Electrical Service Panel: Cutler-Hammer 200-amp bus, 200-amp main breaker

Single Line Diagram for Microinverters or ACMs

Check a box for DC system grounding: ___ Isolated, ___ Non-Isolated
For Isolated DC power systems, EGC & GEC are required.
For Non-Isolated DC power systems, EGC is required.
Refer to NEC 250.120 for EGC installation & Table 250.122 for sizing.
DC Rapid Disconnect (NEC690.12) not required for microinverter systems, as DC conductors are under 5 feet.



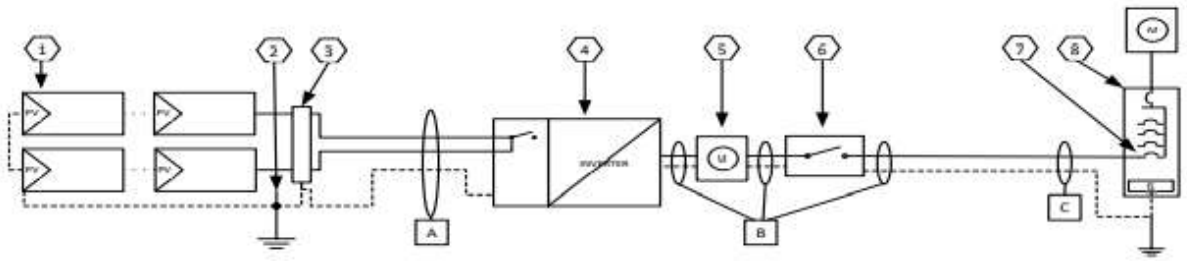
Conductor, Cable, and Conduit Schedule													
Tag	Description and Conductor Type: (Table 3)	Conductor Size			Number of Conductors			Conductor/Cable Type			Conduit Size and Type		
A	Current carrying conductors (for each branch circuit):	#10	#10	#10	2Hot 1N	2Hot 1N	2Hot 1N	THW N-2	THW N-2	THW N-2	½ inch EMT	½ inch EMT	½ inch EMT
	EGC:	#8AWG Cu											
	GEC (when required):	n/a											
B	Current carrying conductors:	#6AWG Cu			(2) plus (1) Neutral			THWN-2			¾ inch PVC		
	EGC:	#8AWG Cu											
	GEC (when required):	n/a											
C	Current carrying conductors:	#6AWG Cu			(2) plus (1) Neutral			THWN-2			¾ inch EMT		
	EGC	#8AWG Cu			(1)								
	GEC (when required):	n/a											

5.4 Sample Wiring Diagram 2: String Inverter with Supply Side Connection

Equipment Schedule	
TAG	DESCRIPTION: (Provide manufacturer and model # if applicable)
1	Solar PV Module: (24) SolarWorld SW280 Mono, (2) strings of (12)
2	Grounding Electrode for Array
3	Junction Box(es): Soladeck NEMA 3R, on roof
4	Inverter Model: (1) Fronius Primo 6.0-1, Transformerless
5	Performance Meter Yes / No
6	*Utility External Disconnect, or AC disconnect grouped with inverter if not grouped with main service panel
7	Backfed AC breaker in Main Service Panel rating: 35 amps
8	Main Service Panel Main Breaker rating:200 amps; Bus Bar rating: 200 amps

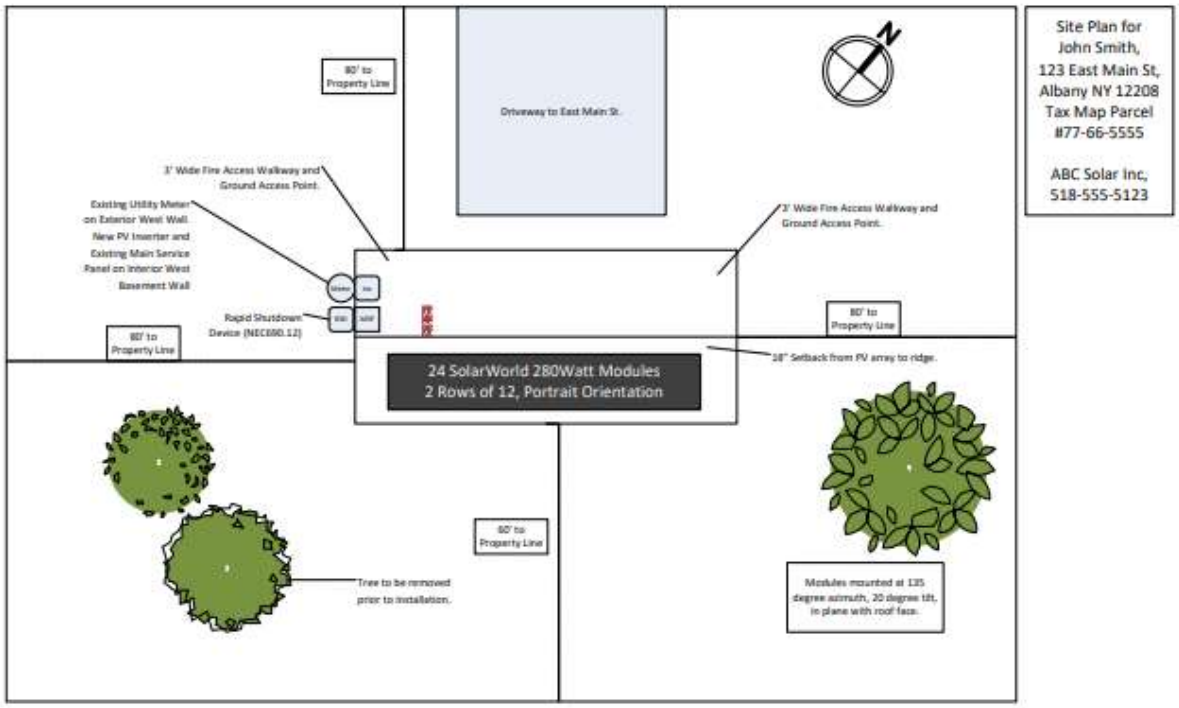
Single Line Diagram for String Inverter

Check a box for DC system grounding: q Isolated, q Non-Isolated
For Isolated DC power systems, EGC & GEC are required.
For Non-Isolated DC power systems, EGC is required.
Refer to NEC 250.120 for EGC installation & Table 250.122 for sizing.



Conductor, Cable, and Conduit Schedule					
Tag	Description and Conductor Type:				
	Description and Conductor Type:	Conductor Size	Number of Conductors	Conductor/Cable Type	Conduit Size and Type
A	Current carrying conductors:	#10AWG Cu	2	THWN-2	½ inch EMT
	EGC:	#10AWG Cu 1	1		
	GEC (when required):	n/a			
B	Current carrying conductors:	#8AWG Cu	(2) plus (1) Neutral	THWN-2	¾ inch PVC
	EGC:	#10AWG Cu			
	GEC (when required):	n/a			
C	Current carrying conductors:	#8AWG Cu	(2) plus (1) Neutral	THWN-2	¾ inch EMT
	EGC:	#10AWG Cu	(1)		
	GEC	(when required):	n/a		

5.5 Sample Site Map



Third-party inspection agency

Inspection signoff page

Third-party inspection agency signoff for inspection verification of Field Inspection Checklist. Please complete and submit with your inspection on Company letterhead.

_____ _____

(Inspector Signature) (Date)

_____ _____

(Company Name) (Phone)