



Wisconsin Chapter
International Association of Electrical Inspectors

International Association of Electrical Inspectors

Proudly Presents:
Distributed Generation and the Code
Based on the
2017 National Electrical Code®
& SPS 316

Bill Neitzel
Wisconsin Chapter IAEI
Education Chairman

Chapter SPS 316
ELECTRICAL




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NEC 705 - Interconnected Electric Power Production Sources



705.12 Point of Connection. The output of an interconnected electric power source shall be connected as specified in 705.12(A) or (B).

(A) Supply Side. An electric power production source shall be permitted to be connected to the supply side of the service disconnecting means as permitted in **230.82(6)**. The sum of the ratings of all overcurrent devices connected to power production sources shall not exceed the rating of the service.

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NEC 230.82(6)

230.82 Equipment Connected to the Supply Side of Service Disconnect. Only the following equipment shall be permitted to be connected to the supply side of the service disconnecting means:

(6) Solar photovoltaic systems, fuel cell systems, wind electric systems, energy storage systems, or interconnected electric power production sources.

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Connection Details

230.46 Spliced Conductors. Service-entrance conductors shall be permitted to be spliced or tapped in accordance with 110.14, 300.5(E), 300.13, and 300.15.

110.14 – Listed Connectors

300.5(E) – Direct Buried Splice

300.13 – No Tap in Raceway

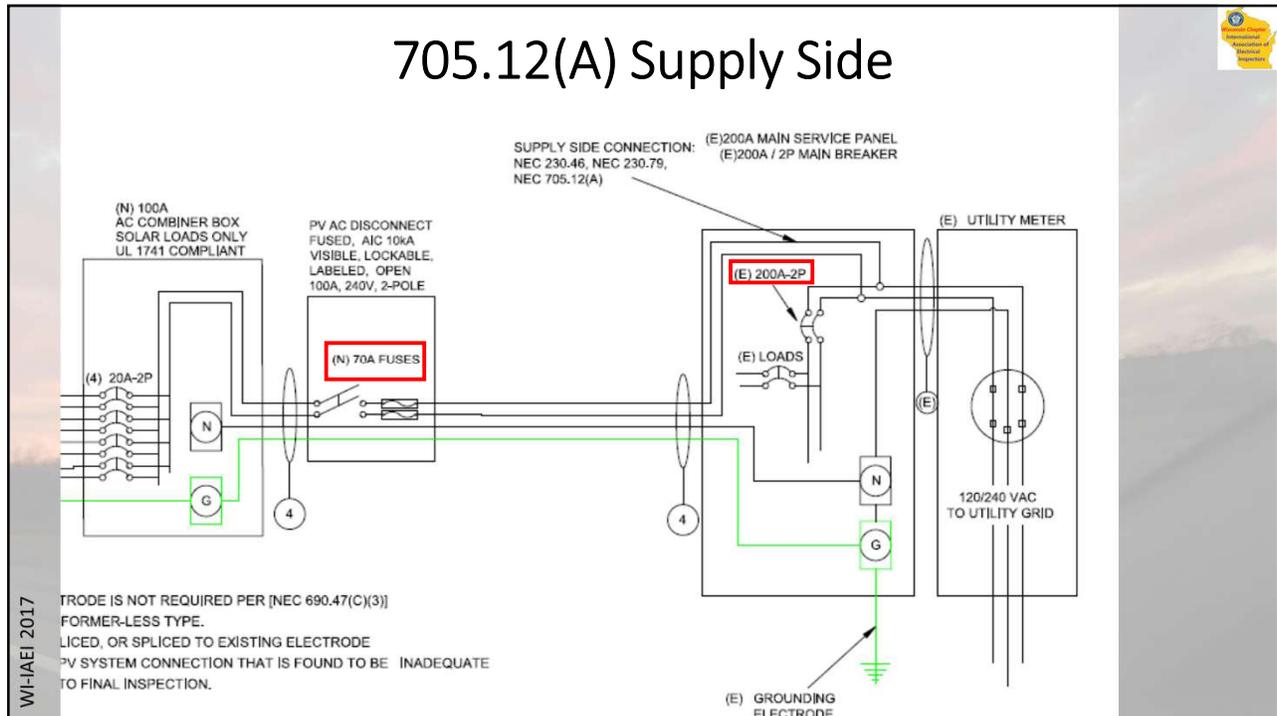
300.15 – Within a Box, Cabinet, Enclosure...

230.79 – Proper Rating of Service Disconnecting Means

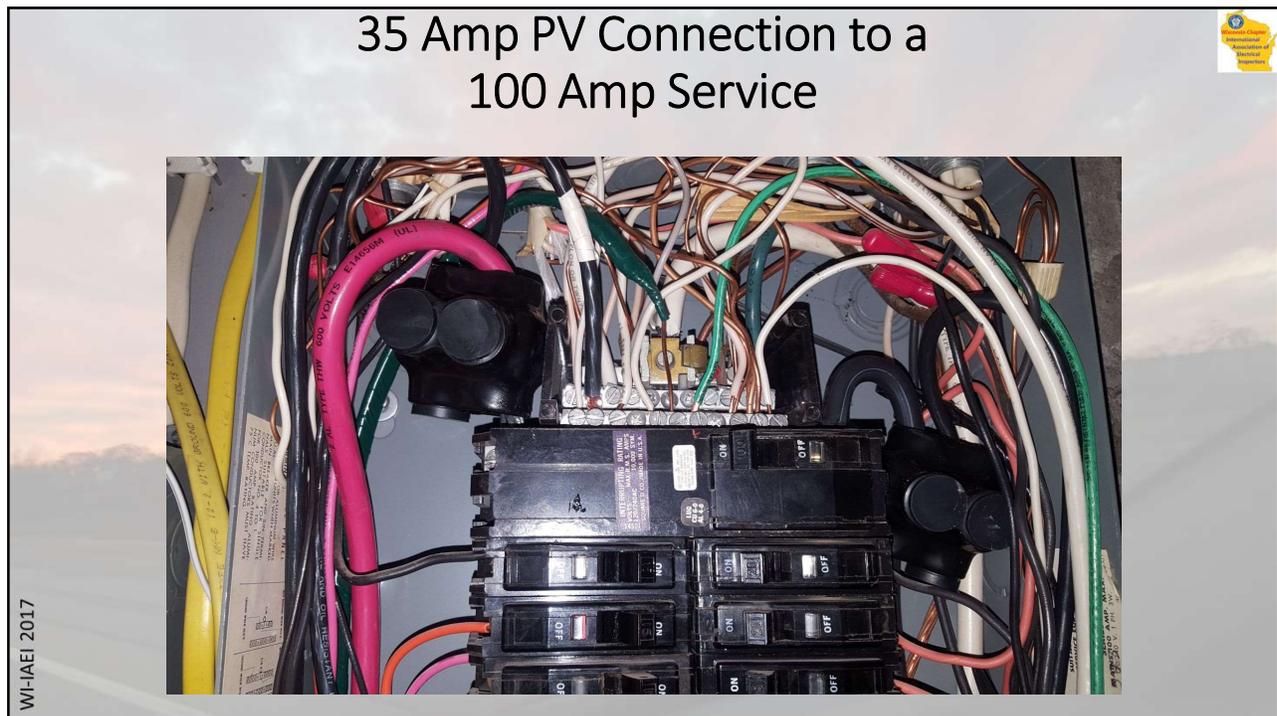
705.12(A) - Interconnected Electric Power Production Sources

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Testing Standards

CSA File Number LR-29601

CSA Standard C22.2 No. 65-03

Prop65 Compliance WARNING: Cancer and Reproductive Harm - www.P65warnings.ca.gov

ROHS Indicator RES

UL / CULUS Specification UL 486A/B Listed

UL File Number E6207

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Insulation Piercing Connector for Cu/Al, Run: #1-250, Tap: #4-4/0
By Burndy
Catalog ID: BIP2504SC
Insulation Piercing Connector for Copper and Aluminum, Run: #1-250, Tap: #4-4/0, ideal for splicing, tapping and dead-ending aluminum and copper conductor with shearing installation technology. 6-point socket impact driver for easy installation and removal, no torque wrench required.
Flexibility! One connector allows for tap, splice or dead-end configurations
Time Savings! Requires no cable stripping, conductor brushing, inhibitor application or after installation taping
Engineered shear bolt technology applies consistent torque for efficient and reliable connectors
Easy installation and removal - only requires 6-point socket impact driver

cULus Listed Splicing Wire Connector, AL9CU Rated, for copper and aluminum conductor combinations up to 90 degrees C, *600 Volt applications

Insulation piercing design for use in multiple applications - overhead covered and bare taps, service and metering connections, and lighting system work

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Description: The insulation piercing connectors are applicable for all types of LV-ABC conductors as well as connections in service line system, building electrical system and street lighting. Insulation piercing connectors can be easily done by tightening the connector. The teeth penetrate the insulation of main line and tap line. No stripping of insulation is avoided for both lines.

- Main line and tap line
- TTD 201 F is suitable for Insulated copper cable
- TTD 201 F is made of high quality and weather resistant materials
- TTD 201 F uses a hex head bolt allows efficient installation under controlled torque
- TTD 201 F ensures the contact teeth properly penetrate the conductor
- TTD 201 F maintains the mechanical strength of the conductor
- TTD 201 F provides watertightness at the voltage of 6kV for 1min under water
- TTD 201 F is suitable for live-line installation
- TTD 201 F uses seals and grease are applied to prevent moisture entering the cable and connector which guarantees excellent waterproof and corrosion resistant performance
- End cap is attached to the body. No loose parts could fall to ground during installation

• Standard: EN 50483-4, NFC 33-020, NFC 33-004



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Another Option?



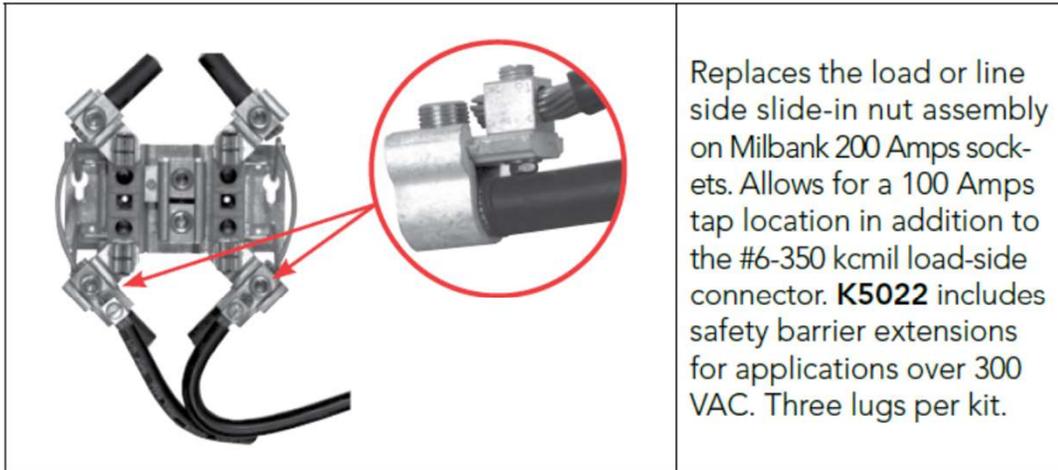

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Upper Midwest Catalog
Meter Mounting Equipment

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Tap Connectors (3 per set)



Replaces the load or line side slide-in nut assembly on Milbank 200 Amps sockets. Allows for a 100 Amps tap location in addition to the #6-350 kcmil load-side connector. **K5022** includes safety barrier extensions for applications over 300 VAC. Three lugs per kit.

K4977-INT - Internal Hex

K4977-EXT - External Hex

K5022-INT - Internal Hex (set of 4 w/ barrier)

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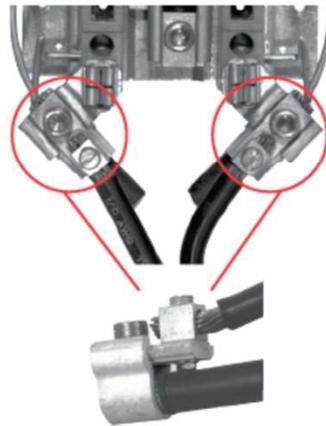


Milbank Accessories

Tap Connectors



K4977-EXT



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Specifications

- #6-350 kcmil connectors with 100 Amps #12-1/0 tap.
- Replaces the existing slide-in nut assembly on Milbank 200 Amps sockets and allows for up to 100 Amps tap connection in addition to the #6-350 kcmil connectors.
- Connectors designed for either line-side or load-side installation.
- Available with both internal and external hex set screws.
- Ideal for line-side connection when incorporating renewable energy net metering that utilizes two meters.
- Also perfect for load-side 100 Amps feeds to outdoor lighting, water well pumps, hot tubs, outbuildings, whole house surge suppressors and swimming pools.
- Contact Milbank for additional applications and details.

Tap Connectors

Catalog Number	Description	VAC
K4977-INT	Set of 3 tap connectors with internal hex set screw	Under 300
K4977-EXT	Set of 3 tap connectors with external hex set screw	Under 300
K5022-INT	Set of 3 tap connectors with internal hex set screw	Over 300
K5022-EXT	Set of 3 tap connectors with internal hex set screw	Over 300

Please consult serving utility for their requirements prior to ordering or installing, as specifications and approvals vary by utility, and may require local electrical inspector approval. All installations must be installed by a licensed electrician and must comply with all national and local codes, laws and regulations. Milbank reserves the right to make changes in specifications and features shown without notice or obligation.

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VAC. Three lugs per kit.

K4977-INT - Internal Hex
K4977-EXT - External Hex
K5022-INT - Internal Hex (set of 4 w/ barrier)

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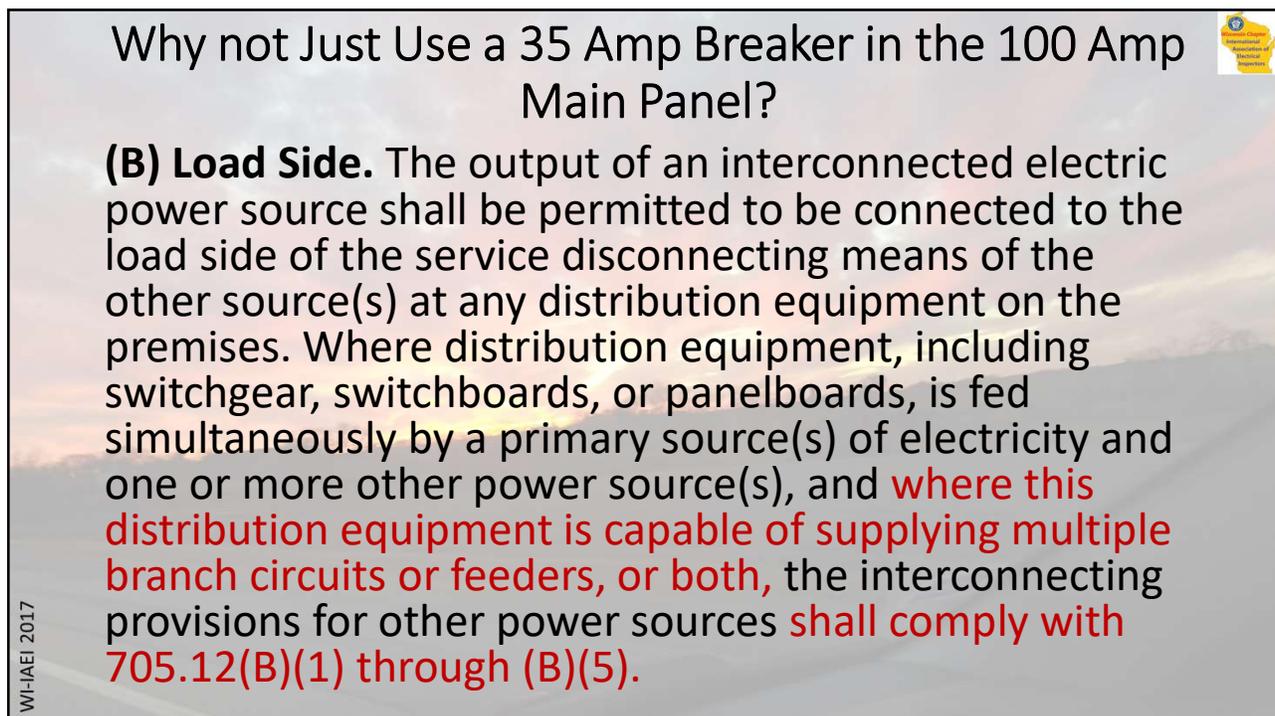


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Currently the State of Wisconsin DSPS Electrical Division Accepts Both Methods

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Why not Just Use a 35 Amp Breaker in the 100 Amp Main Panel?

(B) Load Side. The output of an interconnected electric power source shall be permitted to be connected to the load side of the service disconnecting means of the other source(s) at any distribution equipment on the premises. Where distribution equipment, including switchgear, switchboards, or panelboards, is fed simultaneously by a primary source(s) of electricity and one or more other power source(s), and **where this distribution equipment is capable of supplying multiple branch circuits or feeders, or both**, the interconnecting provisions for other power sources **shall comply with 705.12(B)(1) through (B)(5).**

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705.12(B)(1) through (B)(5)



(1) Dedicated Overcurrent and Disconnect. Each source interconnection of one or more power sources installed in one system shall be made at a dedicated circuit breaker or fusible disconnecting means.

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705.12(B)(1) through (B)(5)



(2) Bus or Conductor Ampere Rating.

One hundred twenty five percent of the power source output circuit current shall be used in ampacity calculations for the following:

(1) Feeders. Where the power source output connection is made to a feeder at a location other than the opposite end of the feeder from the primary source overcurrent device, that portion of the feeder on the load side of the power source output connection shall be protected by one of the following:

- a. The feeder ampacity shall be not less than the sum of the primary source overcurrent device and 125 percent of the power source output circuit current.
- b. An overcurrent device on the load side of the power source connection shall be rated not greater than the ampacity of the feeder.

(2) Taps. In systems where power source output connections are made at feeders, any taps shall be sized based on the sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the feeder conductors as calculated in 240.21(B).

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705.12(B)(1) through (B)(5)



(2)(3) Busbars. One of the methods that follows shall be used to determine the ratings of busbars in panelboards.

(a) The sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed the ampacity of the busbar.

Informational Note: This general rule assumes no limitation in the number of the loads or sources applied to busbars or their locations.

Busbar Rating = Main OCPD of Panel + 125% of PV Output Circuit Current

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This Would Require The Busbar To Be Rated To Handle Both Loads



Example:

100 Amp Main Breaker for House Service

35 Amp PV Breaker

Requires a minimum 135 Amp busbar
(150 Amp Panelboard?)

Under this scenario, there is no requirement for breaker location within the panelboard

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705.12(B)(1) through (B)(5)

(2)(3) Busbars. One of the methods that follows shall be used to determine the ratings of busbars in panelboards.

(b) Where two sources, one a primary power source and the other another power source, are located at opposite ends of a busbar that contains loads, **the sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed 120 percent of the ampacity of the busbar.** The busbar shall be sized for the loads connected in accordance with Article 220. A permanent warning label shall be applied to the distribution equipment adjacent to the back-fed breaker from the power source that displays the following or equivalent wording:

WARNING:

POWER SOURCE OUTPUT CONNECTION —
DO NOT RELOCATE THIS OVERCURRENT DEVICE.

The warning sign(s) or label(s) shall comply with 110.21(B).

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705.12(B)(1) through (B)(5)

(2)(3) Busbars. One of the methods that follows shall be used to determine the ratings of busbars in panelboards.

(b) Examples –

200 Amp Busbar x 1.2 = 240 Amps

200 Amp Main + 40 Amp PV at opposite end of panel

175 Amp Main + 65 Amp PV at opposite end of panel –
Calculated load cannot exceed 175 Amp

225 Amp Busbar x 1.2 = 270 Amps

100 Amp Busbar x 1.2 = 120 Amps

100 Amp Main + 20 Amp PV at opposite end of panel

125 Amp Busbar x 1.2 = 150 Amps

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COMMON RESIDENTIAL INTERCONNECTION SCENARIOS					
Service	Busbar	Main Service Breaker	Maximum Inverter Supply Breaker	Maximum Inverter Output Circuit Current	Approximate Maximum Inverter Power
240 V Single	100 A	100 A	20 A	16 A*	3,840 W
240 V Single	125 A	100 A	50 A	40 A*	9,600 W
240 V Single	200 A	200 A	40 A	32 A*	7,680 W
240 V Single	400 A	400 A	80 A	64 A*	15,360 W

*** Verify manufacturer data for inverter continuous output current rating and minimum and maximum allowable inverter breaker size**

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LOAD SIDE: 240V Single-Phase

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Reason For This Requirement

In a fault condition, not implementing these requirements would risk an inrush that the busbar may not be able to adequately withstand.

Through testing, this method has proven to be acceptable.

Otherwise:

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Advanced Systems

- Photovoltaic
- Generator
- Wind
- Battery
- Electric Vehicle
- More???

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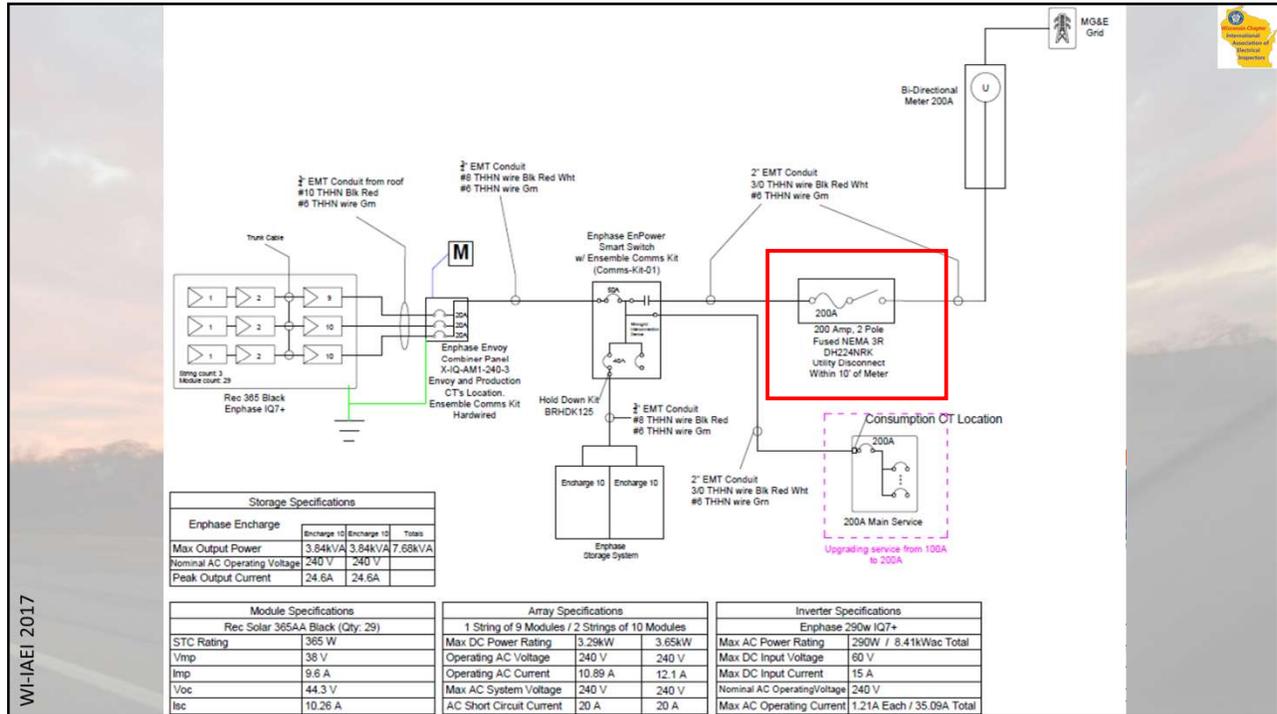
NEC 705.23 Interactive System Disconnecting Means

A readily accessible means shall be provided to disconnect the interactive system from all wiring systems including power systems, energy storage systems, and utilization equipment and its associated premises wiring.

Note: There is no requirement that this disconnect needs to be installed outdoors.

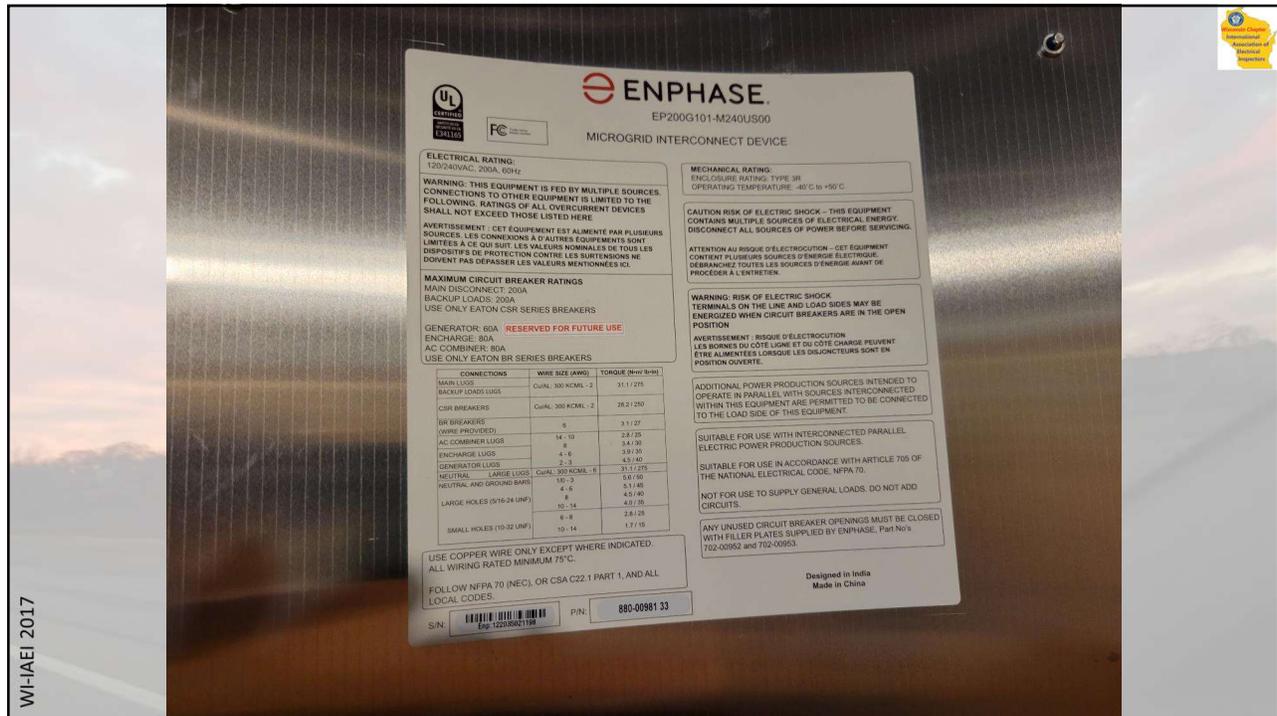
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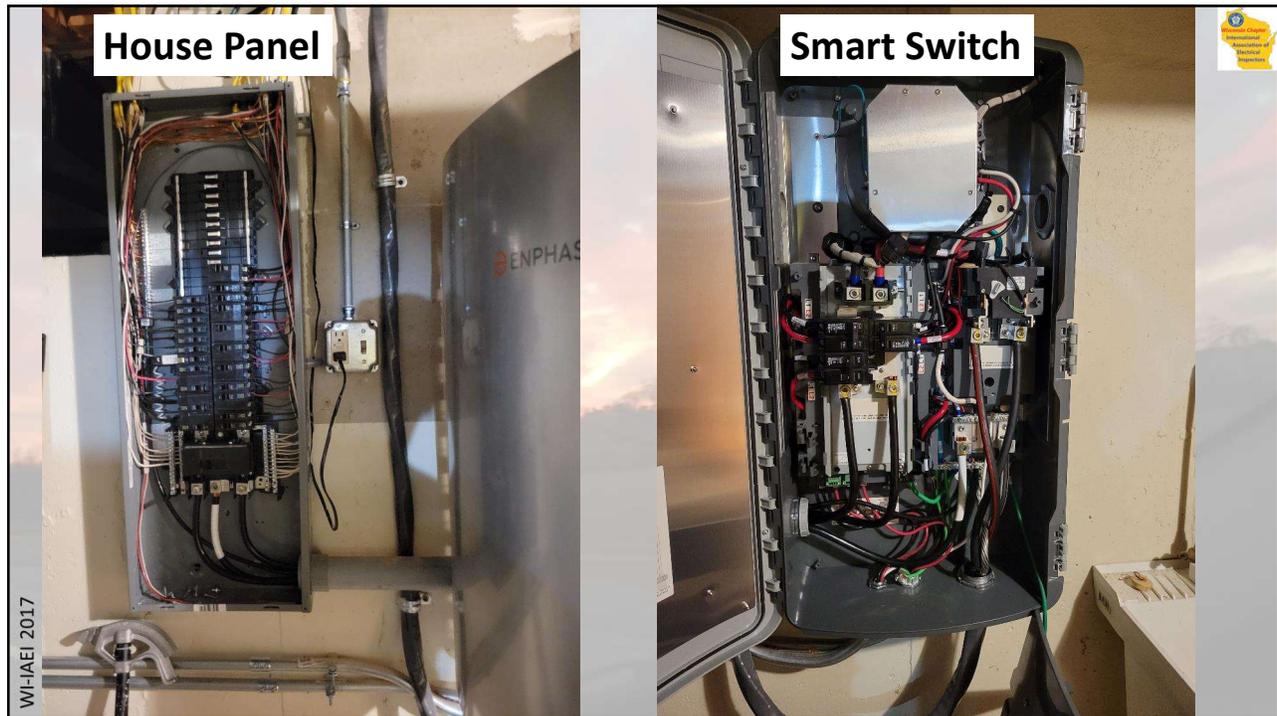


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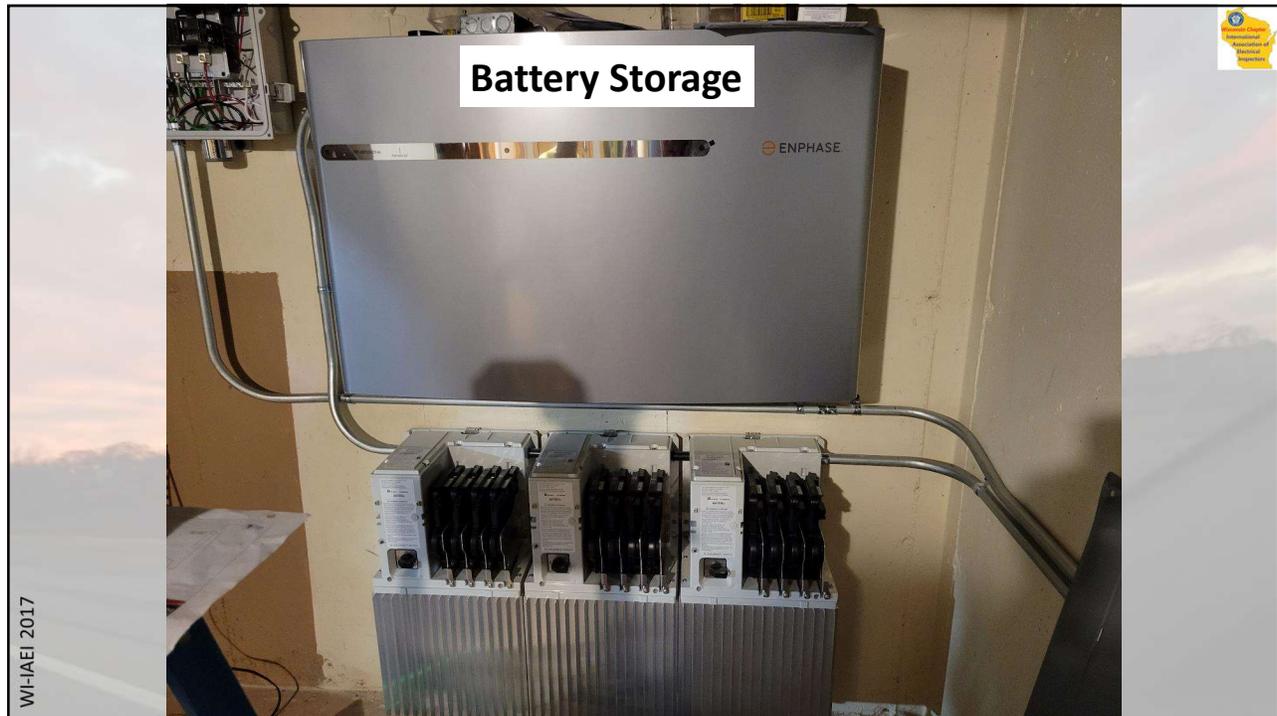
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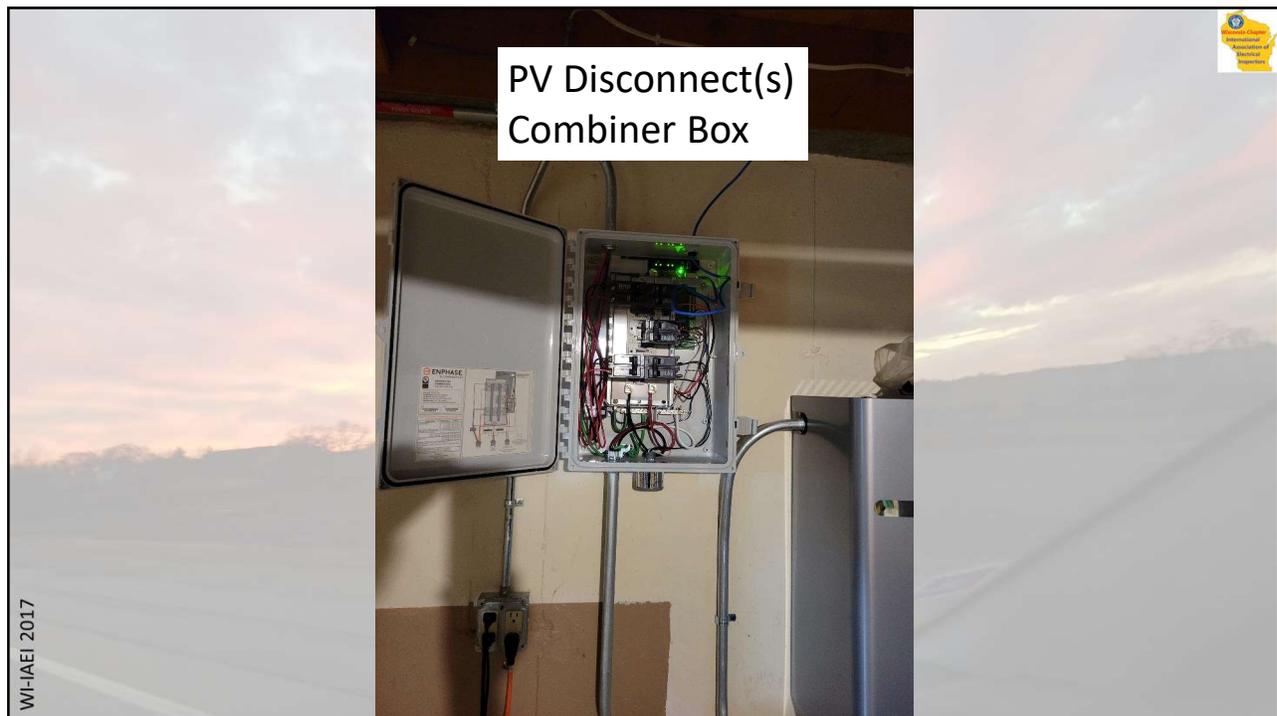
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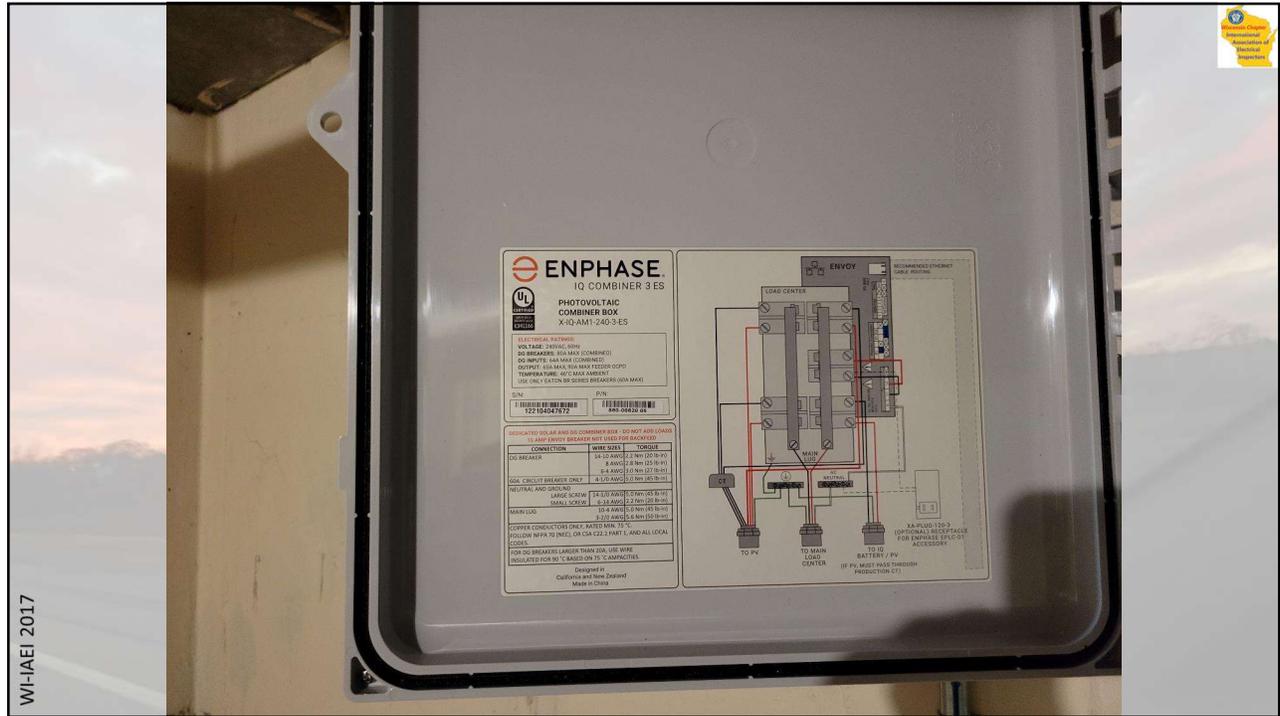
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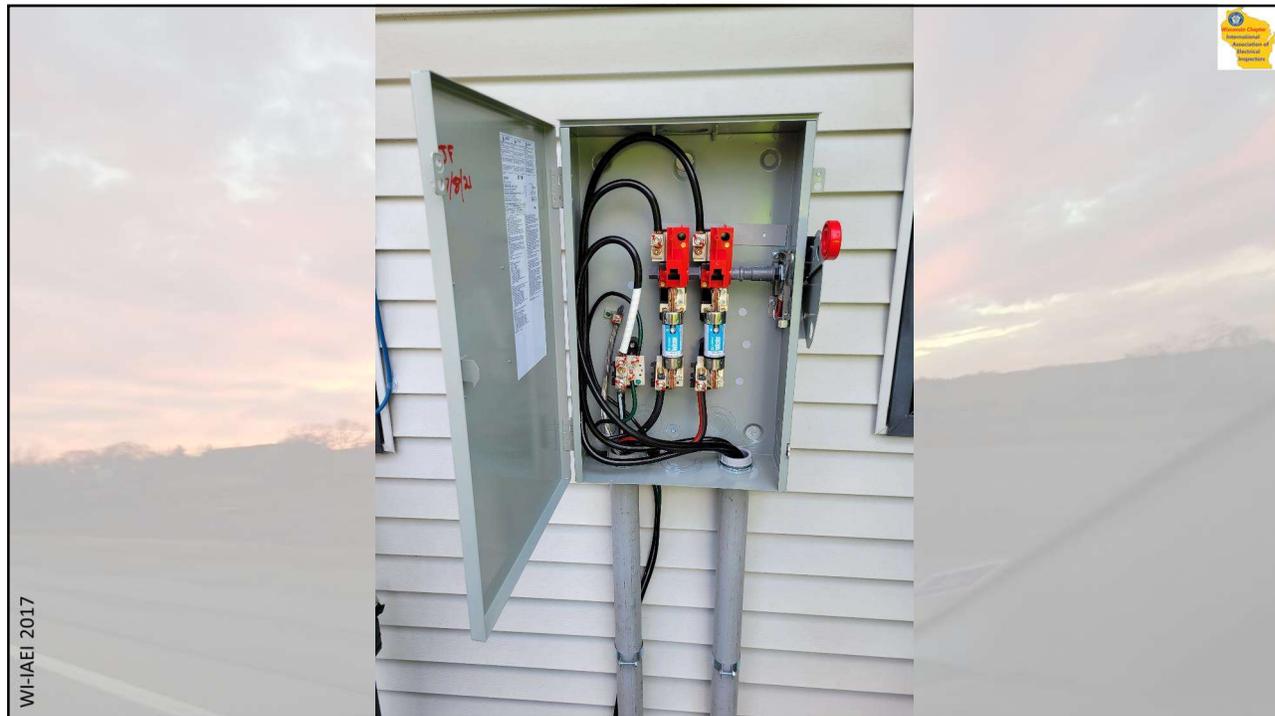
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Future Concerns?

2020 NEC

230.46 Spliced and Tapped Conductors. Service-entrance conductors shall be permitted to be spliced or tapped in accordance with 110.14, 300.5(E), 300.13, and 300.15. Power distribution blocks, pressure connectors, and devices for splices and taps shall be listed. Power distribution blocks installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent.

Effective January 1, 2023, pressure connectors and devices for splices and taps installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent

2023 NEC (Proposed)

Sunset clause disappears and becomes Code

No apparent requirement that the disconnect for the "Microgrid" system needs to be outdoors.

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Current State Requirements For Inspections



Governor Evers Executive Order Allowing Affidavits for Electrical Service Connections Was Declared Unconstitutional.

All Commercial Electrical Services Are Required To Be Inspected By A Local Inspector, Inspection Agency or a State Electrical Inspector. Affidavits Are Not Allowed By State Law

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State Electrical Code



SPS 316.230 Services. (1) NUMBER OF SERVICES (a) This is a department informational note to be used under 2011 and 2017 NEC 230.2 (intro.): Note: It is recommended that the electric utility or cooperative supplying electric current be contacted prior to service equipment installations for any special requirements.

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Distributed Generation Code
2017

Bill
Wisconsin
Education

**Chapter SPS 316
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2014
National Electrical Code

NFPA 70[®]
nec
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2017

Questions?

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