International Association of Electrical Inspectors

Western Section Meeting

Louisville, KY

September 19, 2011

Equipment Marking Requirements

Thomas Domitrovich **David Bredhold**

EATON
Powering Business Worldwide


FAIL!
THIS END UP
THIS END UP


IF YOU ARE READING
THIS
YOUR PIZZA IS UPSIDE
DOWN
12”

DANGER

HAZARDOUS VOLTAGE WILL CAUSE SEVERE INJURY OR DEATH

THE LINE SIDE OF MAIN IS ENERGIZED WHEN OFF.

TURN OFF POWER AT SOURCE BEFORE WORKING BEHIND THIS BARRIER.

BOTH SIDES OF THIS DEVICE MAY BE ENERGIZED.

DE-ENERGIZE BEFORE SERVICING THIS EQUIPMENT.

TURN OFF POWER SUPPLYING THIS EQUIPMENT BEFORE WORKING INSIDE.

BREAKER PARTS MAY BE ENERGIZED UNLESS WITHDRAWN TO DISCONNECTED POSITION.

THIS DEVICE DOES NOT DISCONNECT CONTROL AND INSTRUMENT CIRCUITS.

ISO-LV-30005

Effective Labels Are . . .

- Prominent
- Sufficient Size
- Graphics/Color
- Contrast
- Novel
- “Graphic”
- Comprehensive
- Relevant

110.9 Interrupting Rating

Equipment intended to interrupt current at fault levels shall have an interrupting rating not less than the nominal circuit voltage and the current that is available at the line terminals of the equipment.

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Interrupting vs. Withstand

Article 100 – Interrupting Rating

The highest current at rated voltage that a device is identified to interrupt under standard test conditions.

IEEE Std 1015-2006
Interrupting Rating:

The ability of a circuit breaker to interrupt the actual flow of fault current in a circuit having a given prospective fault-current level and to protect the conductors connected to the circuit breaker.

Withstand:

Current assigned by the manufacturer that the device can carry without damage to itself

Breaker Type	Withstand	System Coordination	Interruption
 High Withstand — LS Trip Functions with Trip Unit Instantaneous Off	Up to 65 kA (Narrow Frame) Up to 85 kA (Standard Frame) Up to 100 kA (Double Frame)	Up to 100 kA	Up to 100 kA at 635 Vac
 Current Limiting — Fast Opening Reverse Loop Contacts with Trip Unit Instantaneous Off	30 kA (Standard Frame) 50 kA (Double Frame)	Up to the Withstand Rating Based on Trip Unit Settings	200 kA at 508 Vac Test Pending for 130 kA at 635 Vac
 Current Limiting — Integral Current Limiters with Trip Unit Instantaneous Off	Based on Current Limiter Selected	Based on Current Limiter Selected and Trip Unit Settings	Up to 200 kA at 600 Vac
with Trip Unit Instantaneous On	Per Breaker Type Applied	Trip Unit Instantaneous Settings Affect System Coordination and Continuity	Per Breaker Type Applied

Source: IEEE Std 1015-2006 "Blue Book" / 2011 National Electrical Code

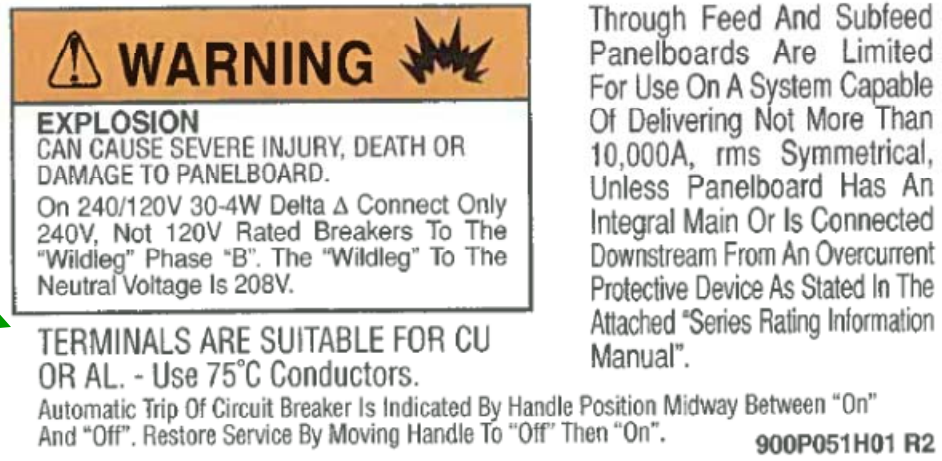
110.14(C) Electrical Connections

(1)Equipment Provisions

(a)(1) Conductors rated 60^0C (140^0F).

(3) Conductors with higher temperature ratings if the equipment is listed and identified for use with such conductors.

Terminals identified for use with 75^0C conductors



DANGER: HAZARD OF ELECTRICAL SHOCK OR BURN

WARNING INSTRUCTIONS

Turn OFF switch before removing or installing fuses. Turn OFF power ahead of switch before doing any work on switch. Replace all parts, install line shield on switch base. Close cover before turning power ON.

E-5239-G

UL LISTED

ENCLOSED SWITCH

ISSUE NO. AL-72

Continuous load current not to exceed 80% of the rating of fuses employed in other than motor circuits.

This switch is suitable for use on a circuit capable of delivering not more than 10,000 amperes, 600VDC maximum. Use Class R fuses.

Experience has shown that renewable fuses can cause overheating problems and thus the use of renewable fuses is not recommended.

TORQUE WIRE PRESSURE SCREWS AS FOLLOWS

Slotted head screws		Socket head screws	
Wire size	Torque Lb.-In.	Socket size Across flats	Torque Lb.-In.
14-10 AWG	35	1/8	45
8 AWG	40	5/32	100
6-4 AWG	45	3/16	120
3-2 AWG	50	7/32	150

The following crimp type lugs may be field installed in place of line and load terminals. These lugs are suitable for Copper wire only.

Remove clear plastic line shield and rear plastic arc shield prior to installing lugs and replace both after lugs are installed.

Lug Wire Size	Burndy	Thomas-Betts		
12-10	YAV10			
8	YAV8C-L	54104		
6	YAV6C-L1	54105		

Torque All Lug Mounting Screws to 24 lb.-in.

For Copper bodied lugs order lug kit DS16CL. Suitable for Copper conductors only.

CAUTION

Information regarding performance under unusual service conditions should be obtained from Eaton Corporation. Examples of unusual service conditions are:

(1) Temperatures below -30 degrees C (-22 degrees F)
(2) Temperatures above +40 degrees C (104 degrees F)
(3) Altitudes over 6600 feet
(4) Corrosive or explosive environments
(5) Abnormal vibration, shock, or tilting
(6) Unusual operating duties
(7) Mounting the switch in a non-Vertical position.

ACCESSORIES	Catalog Number
Electrical Interlock, 1 N.O., 1 N.C.	DS200EK1
Electrical Interlock, 2 N.O., 2 N.C.	DS200EK2
Control Pole	DS16CP
Fuse Puller	DS30FP

INSTALL PER INSTRUCTIONS SUPPLIED WITH KIT

STANDARD TERMINALS SUITABLE FOR ALUMINUM OR COPPER WIRE

This switch may be wired with either 60 or 75 Degrees C conductors.

76982

110.15 High-Leg Marking

Four-wire delta systems, where one leg is grounded.

Only the leg having the higher voltage to ground—marked by orange color or other effective means.

110.16 Arc-Flash Warning

Other than dwelling units:

Equipment likely to require examination, adjustment, servicing, or maintenance while energized– **field-marked** to warn qualified persons of potential arc flash hazards.


WARNING
ARC FLASH HAZARD
LABEL # 043
LINE SIDE of MAIN
FLASH PROTECTION BOUNDARY: 267 inches
HAZARD RISK CATEGORY: DANGER
INCIDENT ENERGY RANGE: > 40 cal/cm^2 at 18 " WORKING DISTANCE
LOAD SIDE of MAIN
FLASH PROTECTION BOUNDARY: 58 inches
HAZARD RISK CATEGORY: 2
INCIDENT ENERGY RANGE: 4 – 8 cal/cm^2 at 18 " WORKING DISTANCE
0.48 kV
PSE TQS# 5860.2 Date Issued: JAN 2006
Study Rev.: 0
LOCATION: SWBD1
PROTECTIVE DEVICE: DLCO – FU
Digitrip 115
Edit Values
Save
11PLSIG
Catalog
Test Kit
Long Delay Trip


Cutler-Hammer
DANGER
LISTED
BUSWAY
845L
Cutler-Hammer
For Factory Assistance,
Renewal Parts or
24 hour Engineering Service
in the US or Canada
Call: 1-800-498-2678
BUS DUCT 013
208 VOLT
WARNING
ARC FLASH HAZARD
NO LOCAL MAIN CONSIDERED FOR ARC FLASH CALCULATIONS.
UPSTREAM PROTECTIVE DEVICE APPLIES
FLASH PROTECTION BOUNDARY: 0' 5"
HAZARD RISK CATEGORY: #0
INCIDENT ENERGY RANGE: 0 - 1.2 cal/cm2 at 18" WORKING DISTANCE
208V
LOCATION: BD 012-013

110.21 Marking

Manufacturer's name, trademark, or other descriptive marking.

110.21 Challenges in PV Installations

110.21 Manufacturer's *Marking*

- **Compliance**:
  Factory-installed manufacturer's name, trademark…to show who is responsible for the product.
- **Note**:
  - All manufactured equipment
  - **Do not cover existing labels.**

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110.22 Identification of Disconnecting Means

(A) **General.** Each disconnecting means shall be legibly marked to indicate its purpose…

110.22 Identification of Disconnecting Means

(A) General. Each disconnecting means shall be legibly marked to indicate its purpose

unless located and arranged so the purpose is evident.

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Disconnecting Means Labeling for PV

690.64(B)(4)Point of Connection Marking

Compliance:

All disconnecting means shall be marked to indicate its purpose

Example:

- Main Service Disconnect
- PV System Disconnect 690.14 C

(needs label even if evident)

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110.22 (B) Engineered Series Combination Systems

Equipment enclosures for circuit breakers or fuses applied in compliance with series combination ratings selected under engineering supervision in accordance with 240.86(A) shall be legibly marked in the field as directed by the engineer to indicate the equipment has been applied with a series combination rating. The marking shall be readily visible and state the following:

CAUTION — ENGINEERED SERIES COMBINATION SYSTEM RATED _____ AMPERES. IDENTIFIED REPLACEMENT COMPONENTS REQUIRED.

Series Ratings

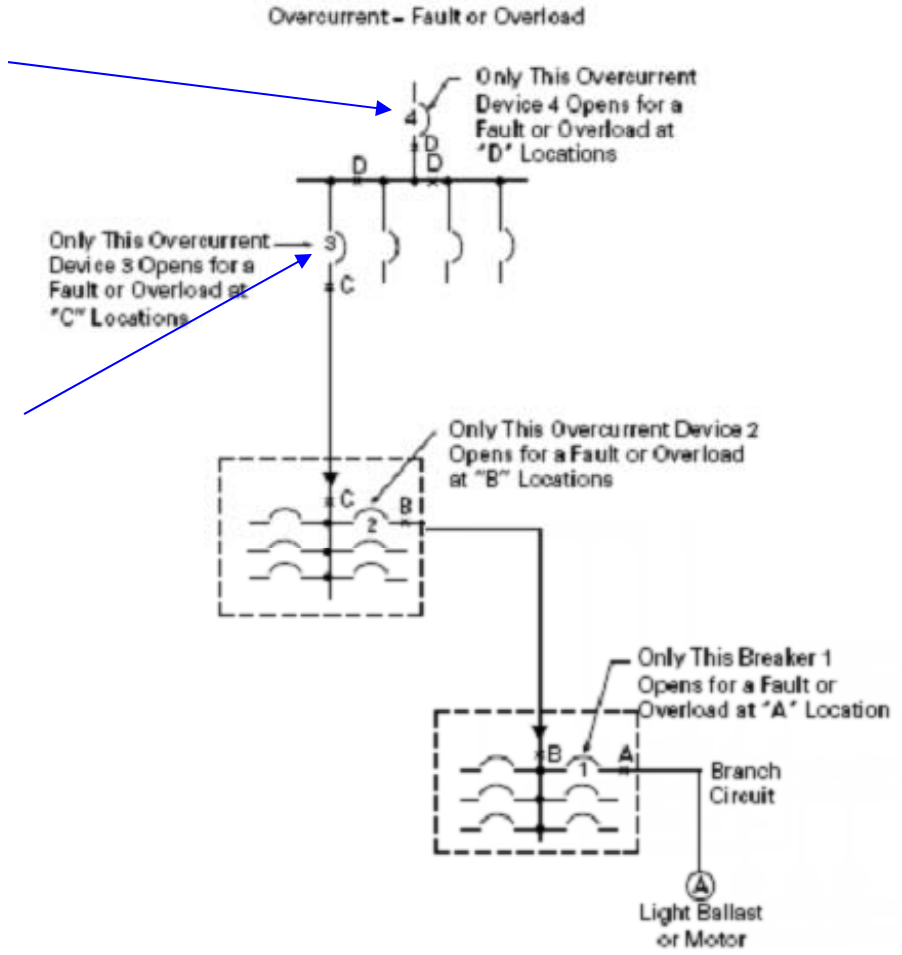
Example

Available Fault Current = 50KA

- Breaker A Rated For 65KA
- Breaker B Rated For 10KA

Breaker A

Breaker B



Under Normal Circumstances, Breaker B Would Not Be Acceptable. A Series Rated Combination Would Be Acceptable

110.22(C)Tested Series Combination Systems

Equipment enclosures for circuit breakers or fuses applied in compliance with the series combination ratings marked on the equipment by the manufacturer in accordance with 240.86(B)

- Legibly marked in the field
- Indicate equipment applied with a series combination rating
- Readily visible and state the following

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110.24 Available Fault Current

Section 110.24, Available Fault Current

- Electrical equipment now required to be marked, in the field, with the maximum available fault current
- Date must be included
- Intended to ensure the interrupting rating is equal to or greater than the available fault current (Section 110.9)
- This is NOT related to Arc Flash calculations

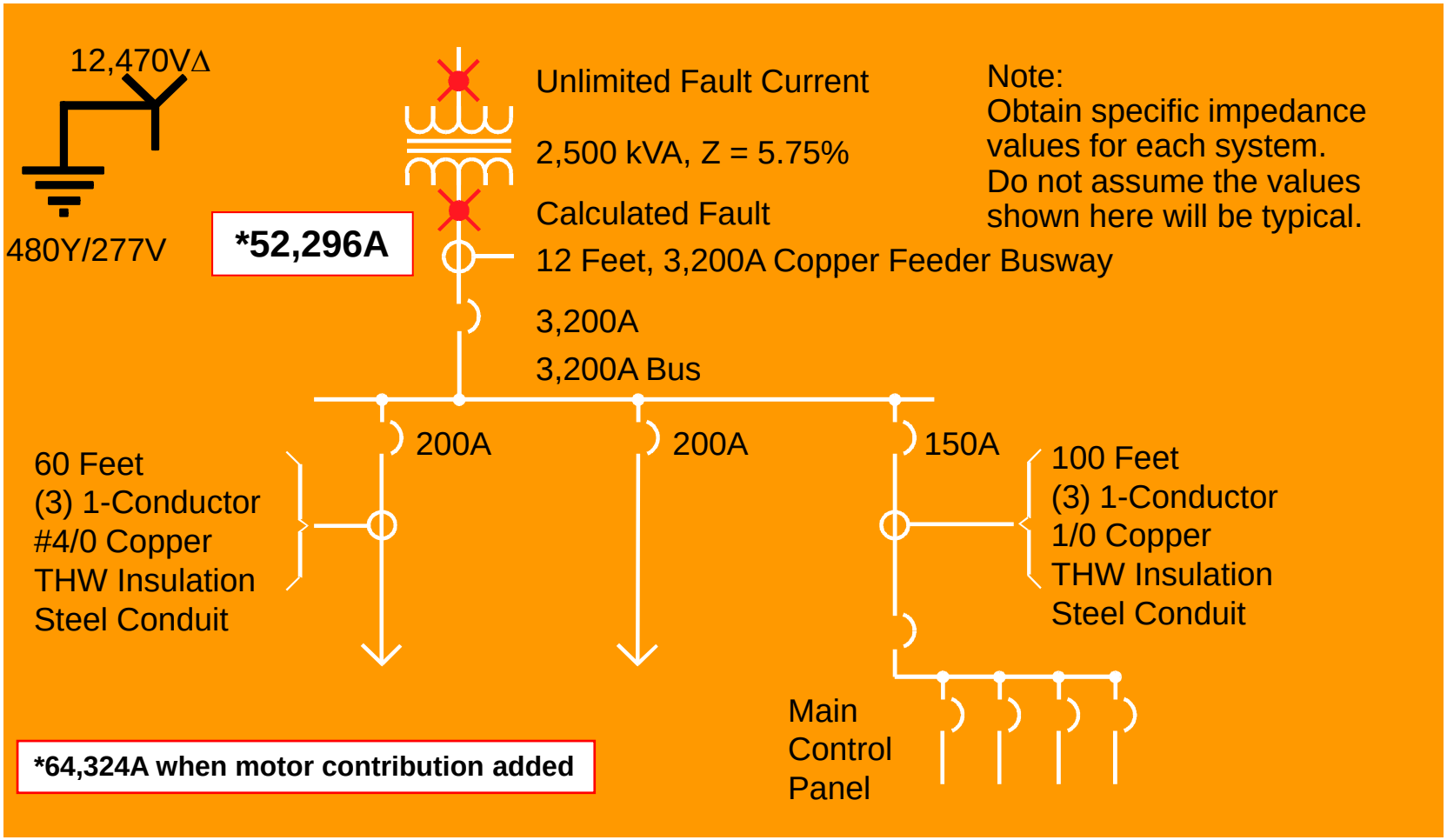
Markings of available fault current must not be incorrectly applied

110.24 Available Fault Current (contd.)

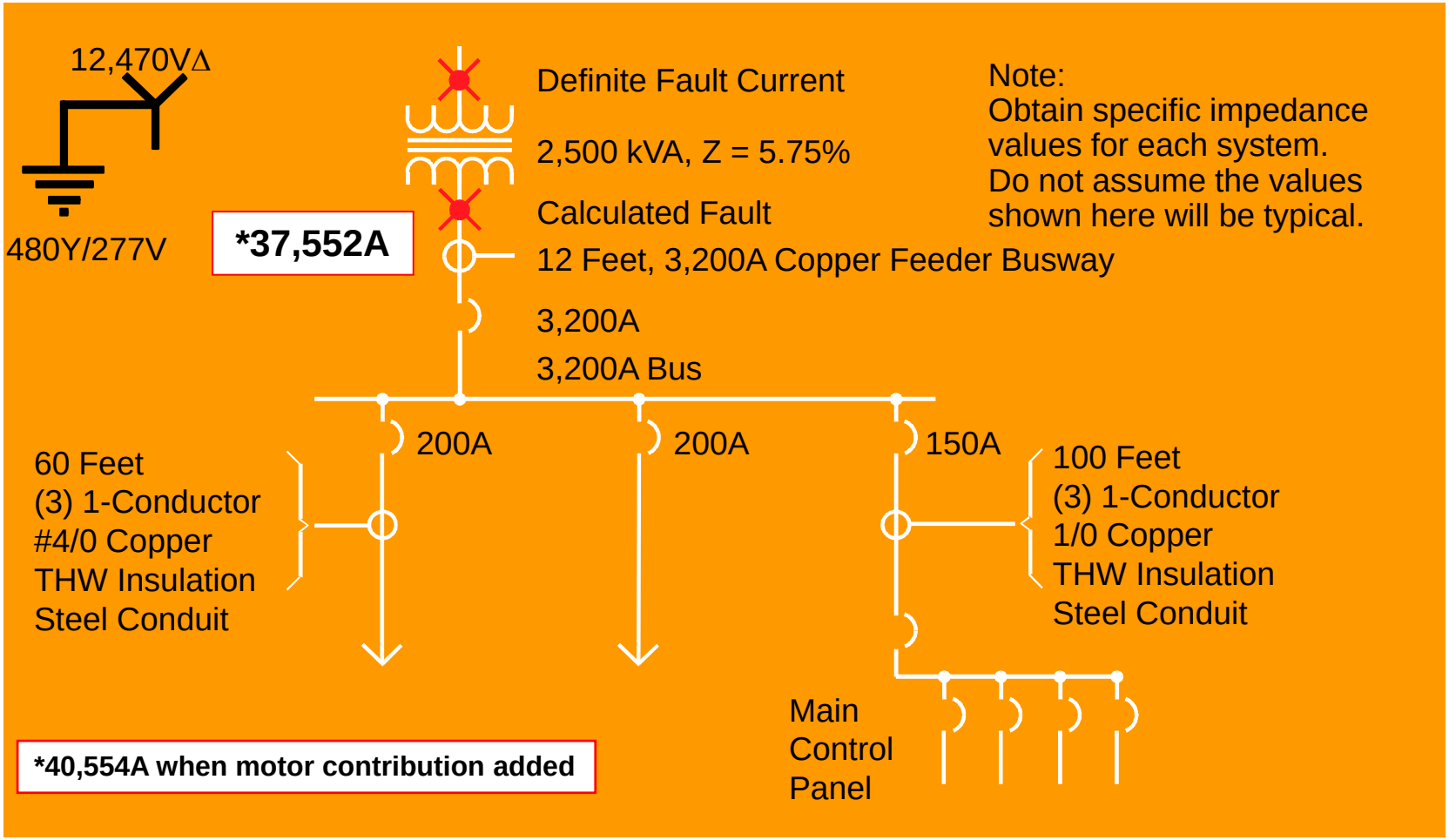
(B) Modifications. When modifications to the electrical installation occur that affect the maximum available fault current at the service, the maximum available fault current shall be verified or recalculated... The required field marking(s) in 110.24(A) shall be adjusted to reflect the new level of maximum available fault current.

(What happens when new fault current level exceeds rating of equipment??)

Fault Current in a System
Infinite Bus Calculation



Using Through-Fault Current (Definite Bus) 10,000A Primary Fault Current

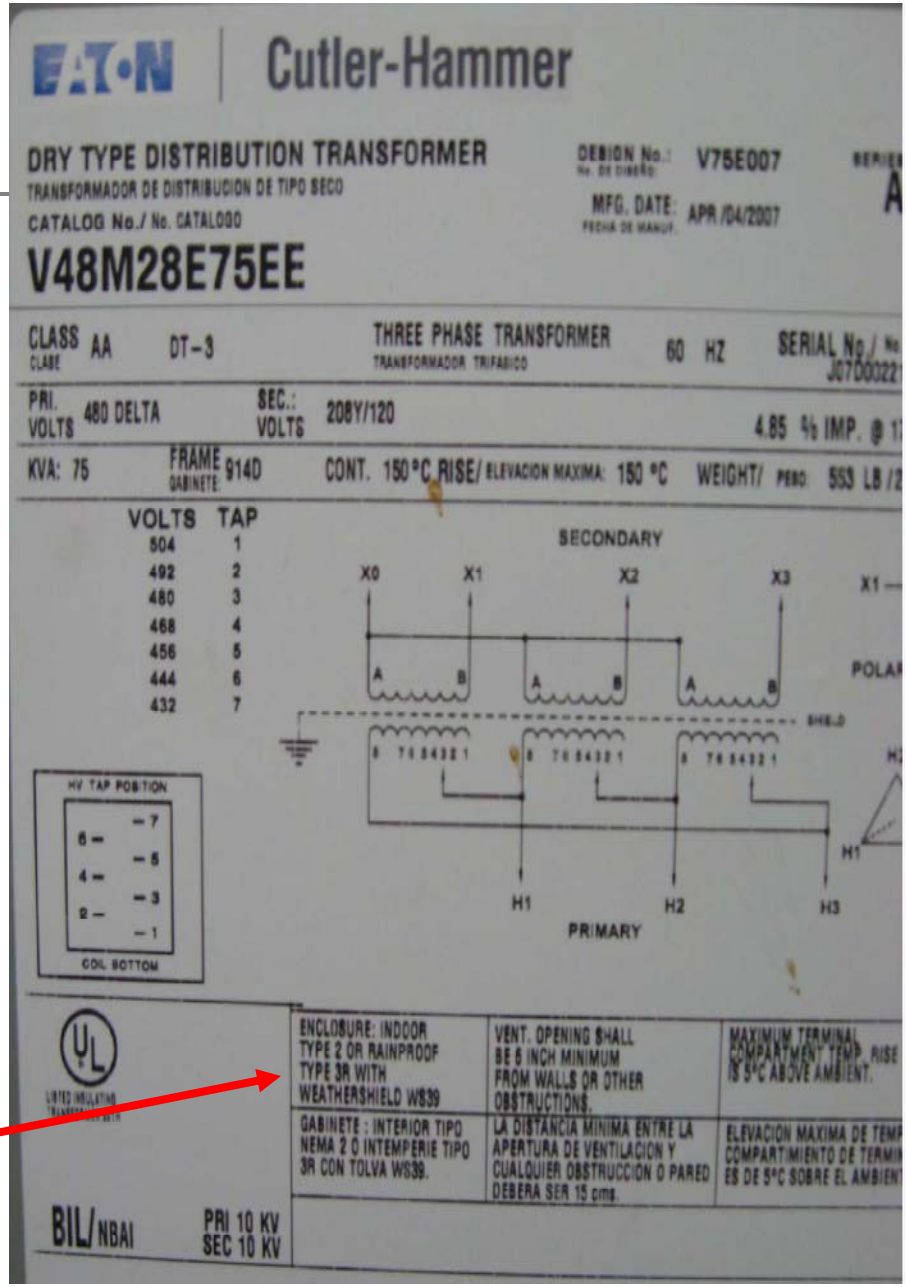


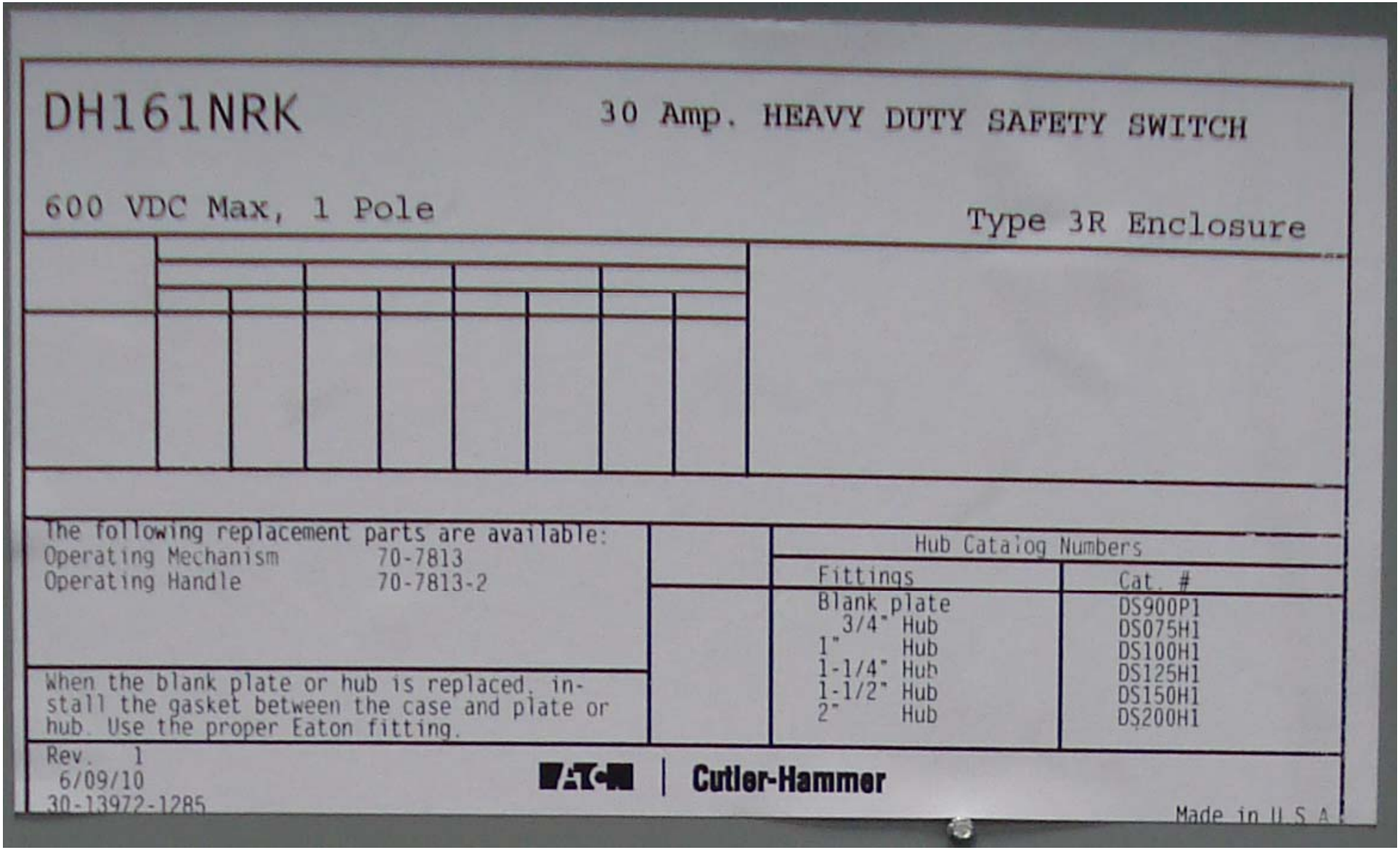
Definite Bus Needed for Arc Flash Calculation

110.28 Enclosure Types

Enclosures …of switchboards, panelboards…general-purpose transformers…not rated over 600 Volts nominal…shall be marked with an enclosure-type number as shown in Table 110.28.

Type 2 or Type 3R with weathershield





DH161NRK

30 Amp. HEAVY DUTY SAFETY SWITCH

600 VDC Max, 1 Pole

Type 3R Enclosure

The following replacement parts are available:

Operating Mechanism	70-7813
Operating Handle	70-7813-2

When the blank plate or hub is replaced, install the gasket between the case and plate or hub. Use the proper Eaton fitting.

Hub Catalog Numbers

Fittings	Cat. #
Blank plate	DS900P1
3/4" Hub	DS075H1
1" Hub	DS100H1
1-1/4" Hub	DS125H1
1-1/2" Hub	DS150H1
2" Hub	DS200H1

Rev. 1
6/09/10
30-13972-1285

Cutler-Hammer

Made in U.S.A.

110.34(C)Locked Rooms or Enclosures (Over 600 Volts)

Where the voltage exceeds 600 volts, nominal, permanent and conspicuous signs shall be provided, reading as follows:

DANGER—HIGH VOLTAGE—KEEP OUT

(Who is responsible for providing signage?? NEC is not specific.)

NEC 225.70 Substations

(A) Warning Signs

(1) General

Warning notice “DANGER—HIGH VOLTAGE”

(1) At all entrances

(2) At points of access to conductors on all high-voltage conduit and cable systems

(3) On all cable trays

NEC 225.37 Outside Circuit Identification

Where a building or structure has any combination of feeders, branch circuits, or services passing through it or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location denoting all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.

NEC 230.2 Number of Services—Identification

230.2(E) Where a building or structure is supplied by more than one service, or any combination of branch circuits, feeders, and branch circuits, a permanent plaque or directory shall be installed at each location denoting all other services, feeders, and branch circuits supplying that building or structure. See 225.37

NEC PV System Directory Labeling

705.10 Directory

Compliance:

Must have a plaque or directory giving the location of the other power source disconnecting means.

Label Location:

At the AC service disconnecting means and the DC disconnect(s)

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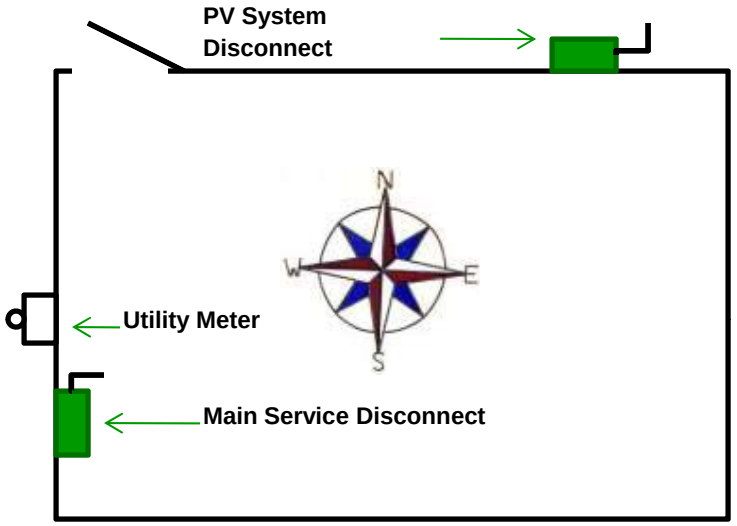

Label Wording (Example):

AC Service Disconnect

PV System disconnecting means located outside on the north wall.

PV System Disconnect

Utility service disconnect is located Inside on the Southwest corner wall.

NEC 230.44 Services
Cable Trays

Such cable trays shall be identified with permanently affixed labels with the wording "Service-Entrance Conductors." The labels shall be located so as to be visible after installation and placed so that the service-entrance conductors are readily traced through the entire length of the cable tray.

NEC 230.66 Service Equipment—Marking

Service equipment rated at 600 volts or less shall be marked to identify it as being suitable for use as service equipment.

NEC 230.72 Grouping of Disconnects

(A) General.

The two to six disconnects as permitted in 230.71 shall be grouped. Each disconnect shall be marked to indicate the load served.

NEC 250.21(C)

Marking. Ungrounded systems shall be legibly marked “Ungrounded System” at the source or first disconnecting means of the system.

NEC 310.120 Conductor and Cable Marking

(A) Required Information.

(1) Maximum rated voltage

(2) Proper type letter or letters for type of wire

(3) Manufacturer's name, trademark, or other distinctive marking

(4) AWG size or circular mil area.

(5) Cable assemblies where the neutral conductor is smaller than the ungrounded conductors.

NEC 392.18(H) Cable Tray Marking

Cable trays containing conductors rated over 600 volts shall have a permanent, legible warning notice carrying the wording “DANGER—HIGH VOLTAGE—KEEP AWAY” placed on all cable trays, with the spacing of warning notices to exceed 10 ft.

NEC 400.6 Flexible Cords

(A) Standard Markings. Flexible cords and cable shall be marked by means of a printed tag attached to the coil reel or carton. The tag shall contain the information required in 310.120(A).

(B) Optional Markings. Flexible cords and cable types listed in Table 400.4 shall be permitted to be surface marked…

NEC 408.3 Switchboards and Panelboards

(F) Switchboard and Panelboards Identification.

(1)High-Leg Identification. Switchboards or panel board containing a 4-wire, delta-connected system where the mid-point of one phase winding is grounded shall be legibly and permanently field marked as follows: “Caution____Phase Has____Volts to Ground”

NEC 408.4 Switchboards and Panelboards Field Identification Required

(A) Circuit Directory or Circuit Identification.

Every circuit and circuit modification shall be legibly identified as to its clear, evident, and specific purpose.

(B) Source of Supply. All switchboards and panelboards supplied by a feeder in other than one- or two-family dwellings shall be marked to indicate the device or equipment where the power supply originates.

PV Systems Also Require Identification

408.4 Circuit Directory or Circuit Identification

Compliance:
All new circuits and modified circuits shall have,

- The specific purpose shall be legibly clear
- Enough detail to distinguish from all others

Label Location:

The face or inside cover of all Panel Boards and Switch Boards

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409.110 Industrial Control Panels

Marking

1. Manufacturer
2. Supply information
3. Multiple power sources
4. Short-circuit rating
5. Service entrance use
6. Wiring diagram
7. Enclosure type

NEC 409.110 Industrial Control Panels

(1) Manufacturer's name…

(2) Supply voltage, number of phases, frequency, and full-load current for each incoming supply circuit.

NEC 409.110 Marking

(3) Industrial control panels supplied **by more than one power source** …shall be marked to indicate that more than one disconnecting means is required to de-energize the equipment. (Added in NEC 2011)

[Note: 408.4(B) requires field-marking for source of power.]

NEC 409.110 Marking

(4) Short-circuit current rating of the industrial control panel…

Exception to (4): Short-circuit current ratings are not required for industrial control panels containing only control circuit components.

NEC 409.110 Marking

(5) If the industrial control panel is intended as service equipment, it shall be marked to identify it as being suitable for use as service equipment.

[Consistent with 230.66 marking requirement for service equipment.]

NEC 409.110 Marking

(6) Electrical wiring diagram or the identification number of a separate electrical wiring diagram or a designation referenced in a separate wiring diagram.

(7) An enclosure type number shall be marked on the industrial control panel enclosure.

Photovoltaic Installations

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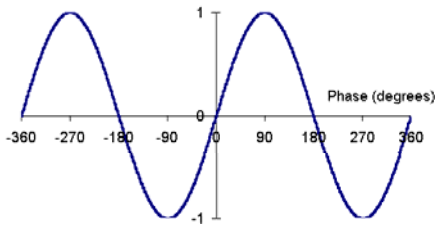
Direct Current vs. Alternating Current

Alternating Current

- Electron flow alternates in two directions backward to forward n-times per Second
- Can change potential through use of transformers
- Easy to produce and AC generators come in many forms
- Zero-crossings key for switching devices (120 times each second)

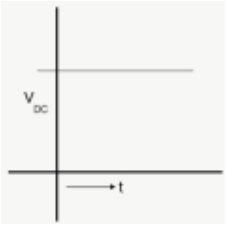


Direct Current

- Electrons flow in one direction

Supposed to?

- Cannot change potential through use of transformers
- DC is produced by batteries and other sources
- No zero-crossings present challenges for switching devices



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Direct Current vs. Alternating Current

Safety Discussion

- If you touch . . . EITHER TYPE CAN KILL YOU
- Work de-energized
- Safety equipment will have an AC or DC rating: check it

Example:

It is important to select gloves & other safety equipment rated for their particular applications.

CLASS	TEST AC VOLTS	USE AC VOLTS	USE DC VOLTS	LABEL COLOR
00	2,500	500	750	Beige
0	5,000	1,000	1,500	Red
1	10,000	7,500	11,250	White
2	20,000	17,000	25,500	Yellow
3	30,000	26,500	39,750	Green
4	40,000	36,000	54,000	Orange

http://www.supplylinedirect.com/tech_info/article.asp?ARTICLE_ID=21&F_CATEGORY_ID=3

DC/AC Ratings – Electrical Equipment

Product Selection Is Important

- If you touch . . . EITHER TYPE CAN KILL YOU
- Work de-energized
- Safety equipment will have an AC or DC rating: check it

Example:

It is important to select electrical equipment rated for the application.

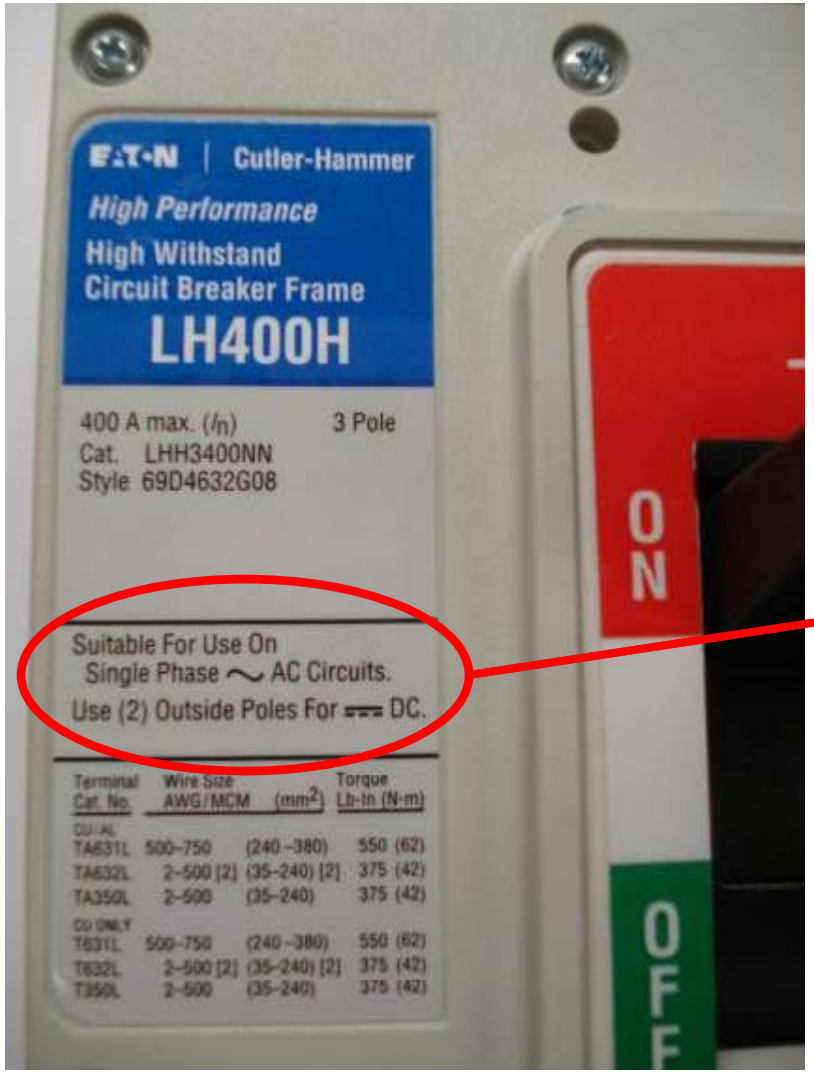
Table 28.1-6. Plug-in, Bolt-on, Cable-in/Cable-out (Continued)

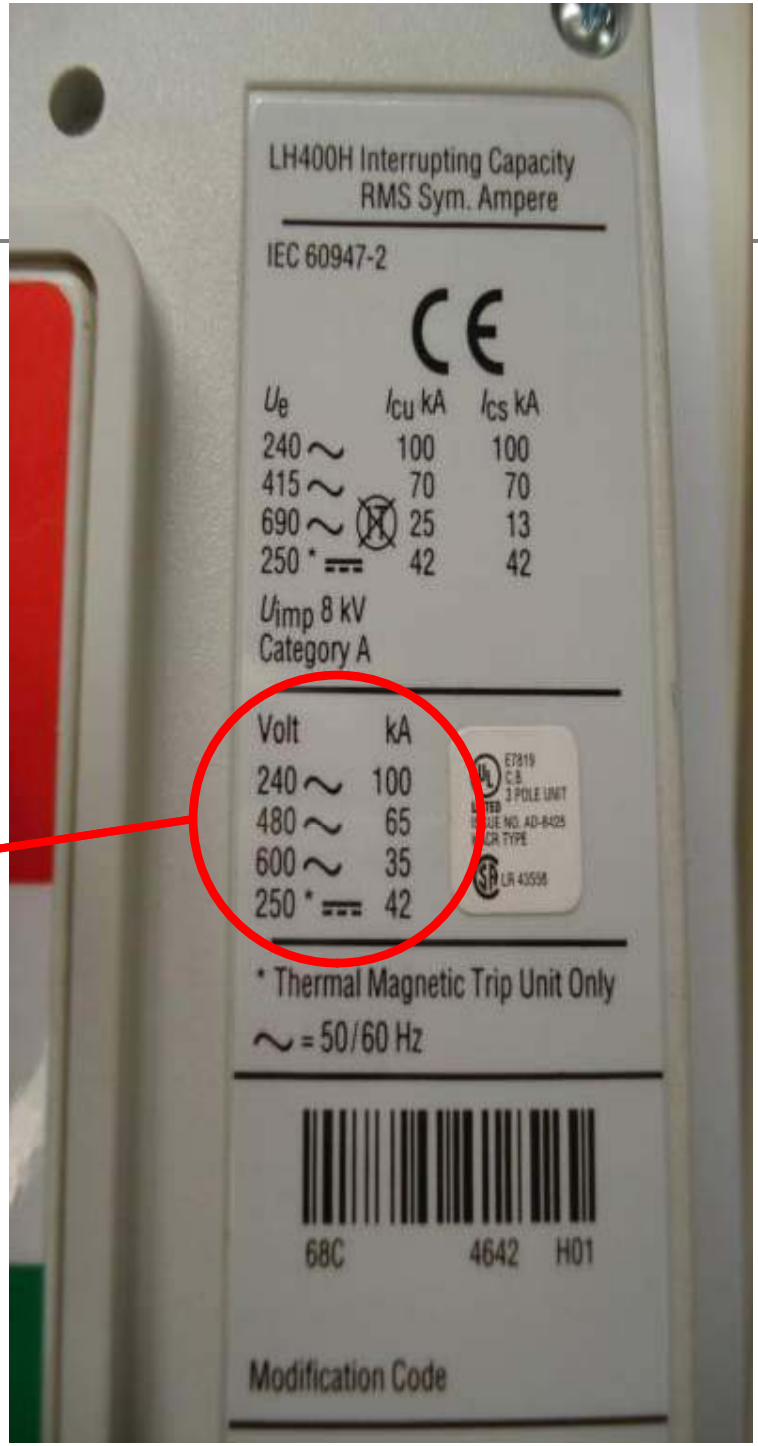
Circuit Breaker Type	Circuit Breaker Type Code	Continuous Ampere Rating at 40°C	Number of Poles	Volts		Federal Specification W-C-375b	Interrupting Ratings (rms Symmetrical Amperes)					
				ac	dc		ac Ratings Volts			dc ①		
							120	120/240	240	24 – 48	62.5	80
QBGF	B, GF	15 – 40	1	120	—	10a, 11a, 12a	10,000	—	—	—	—	—
QBGF		15 – 50	2	120/240	—	10a, 11a, 12a	—	10,000	—	—	—	—
QC	C	10 – 70	1	120/240	24, 48, 62.5	10a, 11a, 12a	—	10,000	—	5,000	②	—
QC		10 – 100	2	120/240	24, 48, 80	10a, 12a	—	10,000	—	5,000	5,000	5,000
QC		10 – 100	2, 3, 4	240	—	10b, 11b, 12b	—	—	10,000	—	—	—
QBHGF	B, GF	15 – 30	1	120	—	10a, 11a, 12a	22,000	—	—	—	—	—
QBHGF		15 – 30	2	120/240	—	10a, 11a, 12a	—	22,000	—	—	—	—

① Two-pole dc interrupting ratings based on 2 poles connected in series.
② 62.5 Vac interrupting rating is 3800 AIC 10 – 50 amperes and 2500 AIC 55 – 100 amperes continuous.

http://www.supplylinedirect.com/tech_info/article.asp?ARTICLE_ID=21&F_CATEGORY_ID=3

Read the Label






Cutler-Hammer
Industrial
Circuit Breaker
Frame
HJD-DC
250 Amp Max.
600 VDC
3 Pole
Cat. HJDDC3250F
Use Only With
Thermal Magnetic Trip Unit
Terminal Cat. No.
Wire Size
Torque Lb. In.
CU/AL TA250KB 4 – 350 275
CU ONLY T250KB 4 – 350 180
60/75°C Wire – 125 Amp & Lower Only
Westinghouse
Cir. No.
6641 C83 H30
Modification Code
HJD-DC Interrupting Capacity
Poles In Series
Max. VDC
Amps
ms*
1 125 42k 8
2 250 42k 8
3 600 35k 8
* ms = Time Constant
This Frame May Be Used With
Rating –
Nom. VDC
Max. VDC
Amps
ms*
500 600 35k 8
3 Poles In Series
LOAD
LOAD
For Use On Ungrounded Systems Only
Cutler-Hammer
Made in U.S.A.

DC Arc Interruption Techniques

Multiple Poles

- Multiple Poles Break Current
- Works for currents flowing in both directions
- Un-used poles
- One circuit per device

Magnetic Fields

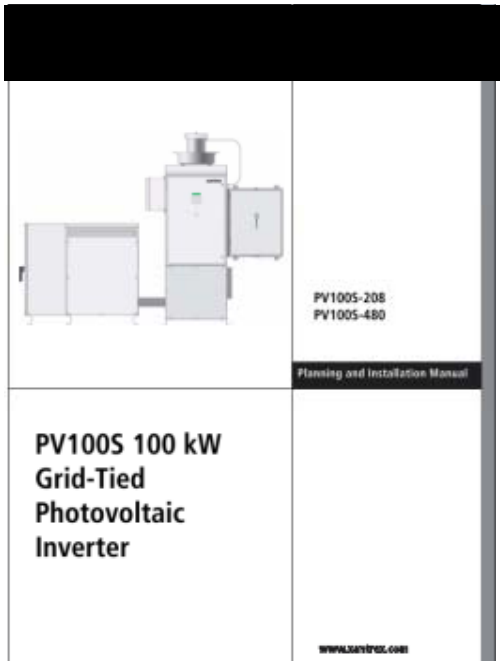
- Single Pole Breaks Current
- Normally Works for currents flowing in one direction (Read Instructions)
- No un-used poles
- Multiple circuits per device

Ensure You Read The Manufacturer's Instructions & Understand The Limitations

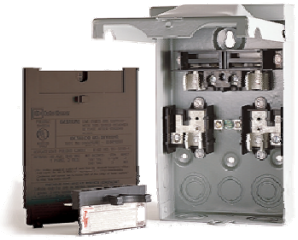
Equipment Identification

110.3 (B) ***Identification of Equipment***

Listed and labeled equipment must be installed in accordance with any instructions included in the listing or labeling.



690.4(D) Inverters, Motor Generators, Photovoltaic Modules, Source Circuit Combiners, Charge Controllers, shall be identified and listed for the application.



Testing agency will label equipment and that label must be maintained.

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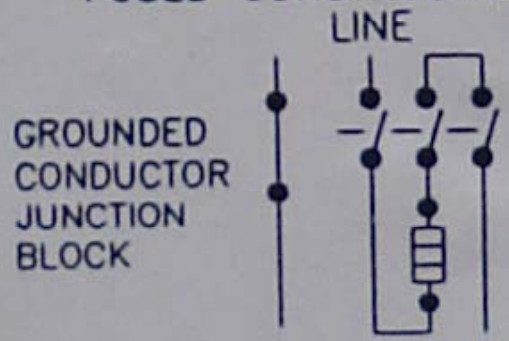
THIS SWITCH IS SUITABLE FOR USE IN ACCORDANCE WITH NEC ARTICLE 690 PHOTOVOLTAIC INSTALLATIONS.

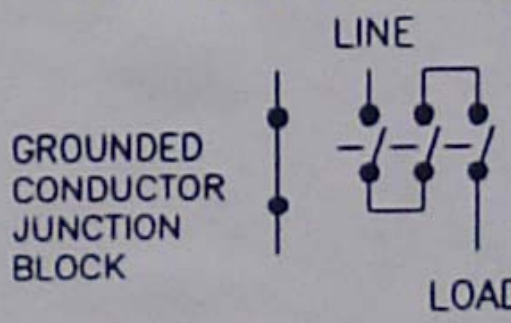
BASIC SWITCH NAMEPLATE RATING, 600VDC	ISC RATING, 600VDC
30A	19.2A
60A	38.4A
100A	64.0A
200A	128.0A
400A	256.0A
600A	384.0A

TYPICAL WIRING DIAGRAM

FUSED CONSTRUCTION



NON-FUSED CONSTRUCTION



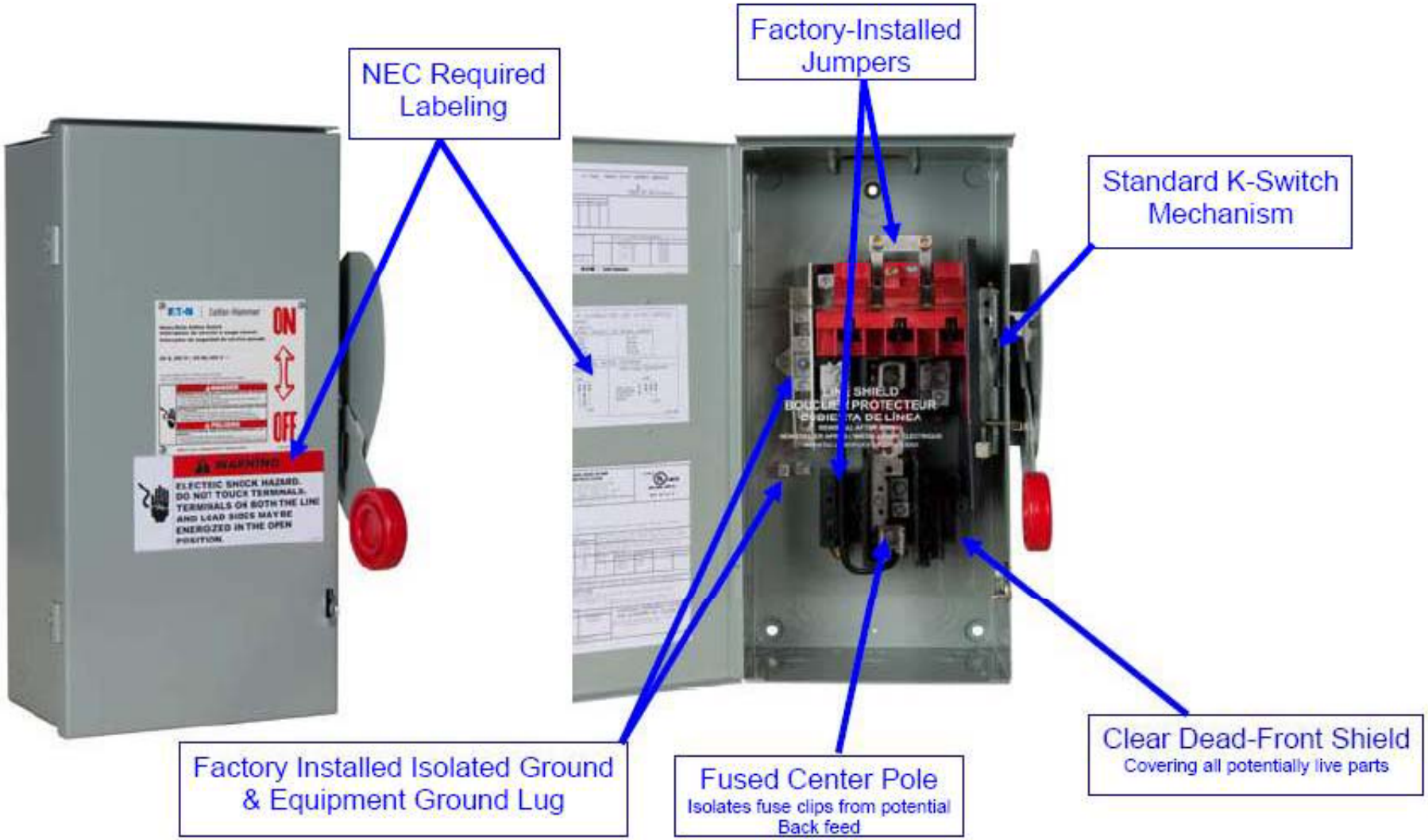
PUB52244

REV C

Identified and Listed

- **NEC Part I. 690. 4(D) Equipment**
  - All equipment intended for use in photovoltaic power systems shall be **identified** and **listed** for the application. Module, Inverters, Combiners, and Disconnects.

Do Not Modify The Switch



Arc Flash Labeling Also Required for DC

110.16 Arc Flash Protection

Compliance:

Other than dwelling occupancies.

When equipment is likely to require examination, adjusting, servicing, or maintenance while energized.

Note: Commercial only

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NEC Labeling Review

- **690.17 Switch or circuit breaker**
  - **Compliance:**

    Where the terminals of an AC or DC disconnecting means may be energized in the open position
  - **Label Location:**

    On or adjacent to the disconnect

Warning: Electrical Shock Hazard

Do Not Touch Terminals

Terminals On Both Line and Load

Sides May Be Energized

In the Open Position

NEC Labeling Review

690.53 Direct Current Photovoltaic Power Source

- **Compliance:** Needs to be installed on all DC Photovoltaic power source disconnecting means

Rated maximum power-point current:	A
Rated maximum power-point voltage:	V
Maximum System Voltage:	V
Rated Short-Circuit Current:	A

(Add) Maximum rated output current of the charge controller (If used)

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NEC Labeling Review

690.64(B)(4)Point of Connection Marking

Compliance:

All disconnecting means shall be marked to indicate it purpose

Example:

- Main Service Disconnect
- PV System Disconnect 690.14 C

(needs label even if evident)

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NEC Labeling Review

690.14 (C)(2) Marking of Disconnecting Means
705.12(D)(4)Point of Connection Marking

- **Compliance:**
- All disconnecting means shall be marked to indicate its purpose
- **Example:**
- Main Service Disconnect
- PV System Disconnect 690.14(C)(2)
- (needs label even if evident)

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CAUTION:SOLAR CIRCUIT
DC Disconnect
Powering Business Worldwide


CAUTION: SOLAR ELECTRIC SYSTEM CONNECTED
Solar Disconnect
WARNING – Electric Shock Hazard
DO NOT TOUCH TERMINALS
Terminals on both Line and Load sides
may be energized in the Open Position.
WARNING – Electric Shock Hazard
No user serviceable parts inside
Contact authorized servicer for assistance
WARNING
CAUTION
ST6US
SMA
Serial Number: 0000000514
Date of manufacture 08/2010
EATON
Powering Business Worldwide


CAUTION: SOLAR ELECTRIC SYSTEM CONNECTED
WARNING – Electric Shock Hazard
DO NOT TOUCH TERMINALS
Terminals on both the Line and Load sides
may be energized in the Open Position.
DC VOLTAGE IS ALWAYS PRESENT WHEN
SOLAR MODULES ARE EXPOSED TO SUNLIGHT
Inverter C String 10 to 17
EATON
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EATON
S-Max™ Series
250 kW Solar Grid Tied Inverter
Maximum Continuous Output Power AC (kW) 250
Maximum Input Voltage Open Circuit, (Vdc) 600
Maximum DC Input Operating Range (Vdc) 300 - 600
Maximum Peak Power Tracking Range, MPPT, (Vcc) 300 - 500
Maximum Continuous Output Current AC (A) 312
Maximum Branch Circuit Over Protection (AC) A 400
Nominal DC Operating Current DC (A) 860
Nominal Operating Voltage (Vac) 3-Ø, 480
Operating Voltage Range (Vac) 423 to 528
Nominal Operating Frequency (Hz) 60
Enclosure Rating UL Type 3R
Operating Temperature Range (C) -20 to 50
Power Factor > 0.99
Isolation Transformer Delta - Delta
Utility Connection Delta 3-Wire / WYE 4-Wire
Safety Listing and Certification
UL 1741 2nd ED. Jan 2010
IEEE 1547
Eaton Corporation
Electrical Sector
877-ETN-CARE (877-386-2273)
c UL us
LISTED
CATALOG NO.: SMX23111B3300M106
DATE CODE: W11/04/20
SERIAL NO: 12819793
ORDER NO.: MV05216-5
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NEC Labeling Review

690.5(C) Inverter Label with Ground-fault protection

- **Compliance:**

  All grid-tied inverters with ground-fault protection

- **Label Location:**

  Near the ground-fault indicator at a visible location

- **Label Wording**

WARNING

ELECTRIC SHOCK HAZARD

IF A GROUND FAULT IS INDICATED,

NORMALLY GROUNDED CONDUCTORS

MAY BE UNGROUNDED AND ENERGIZED


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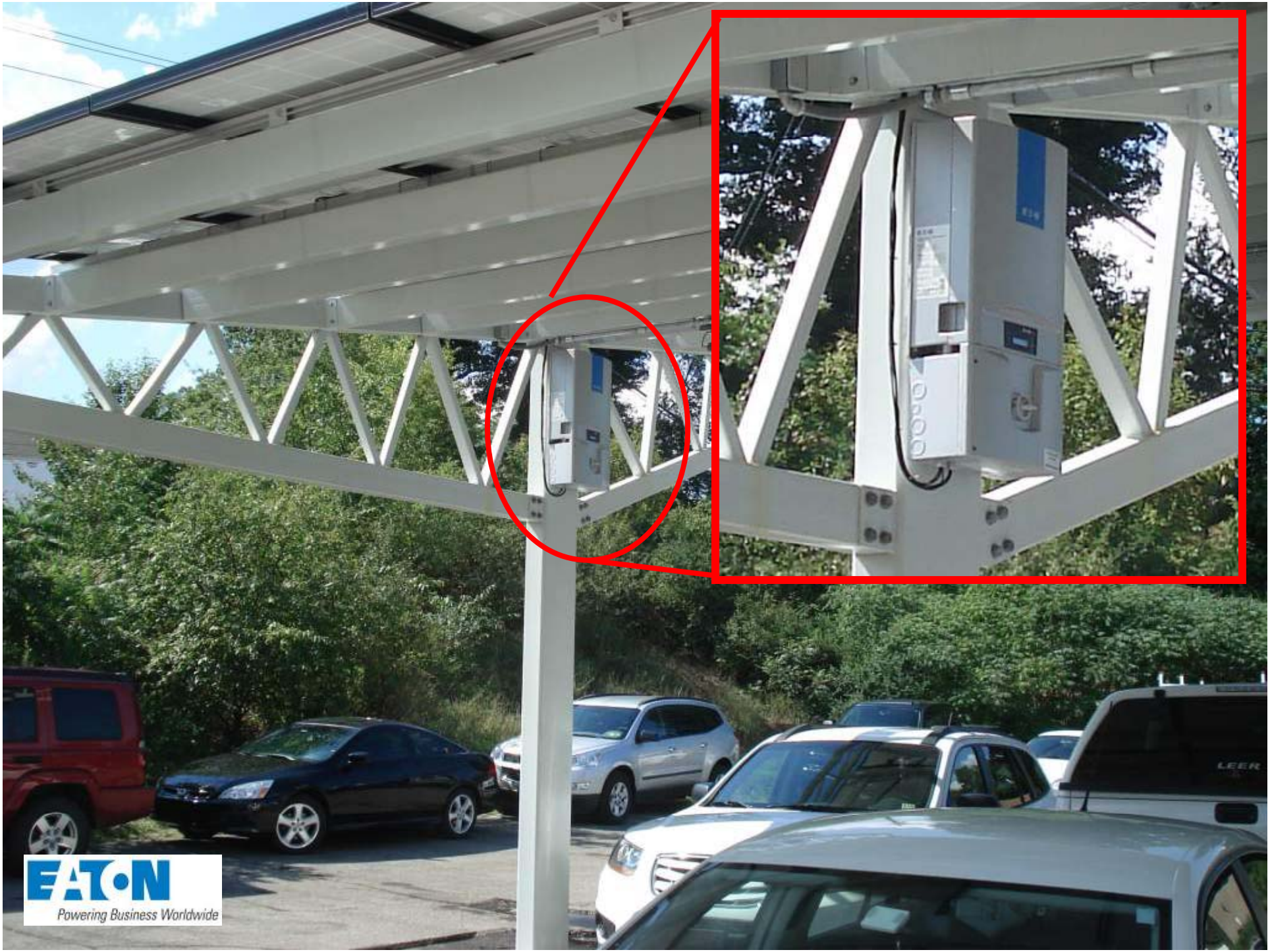
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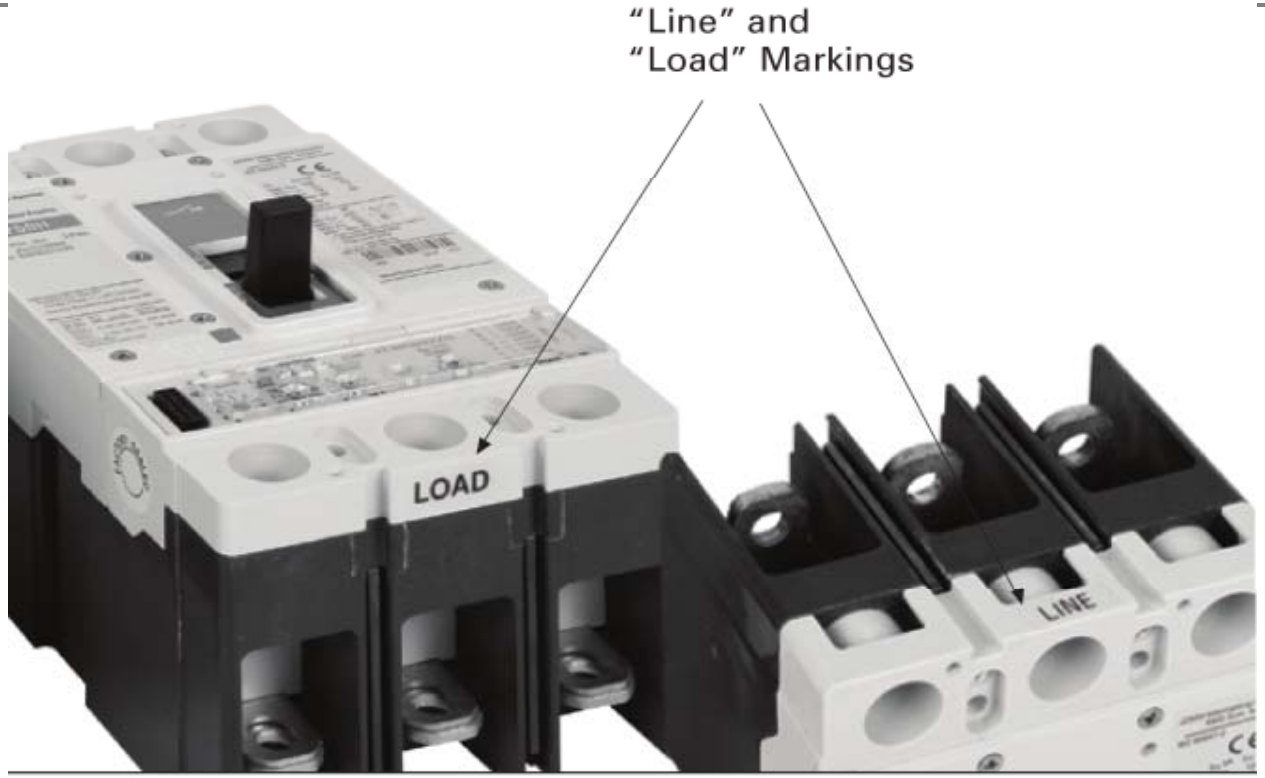
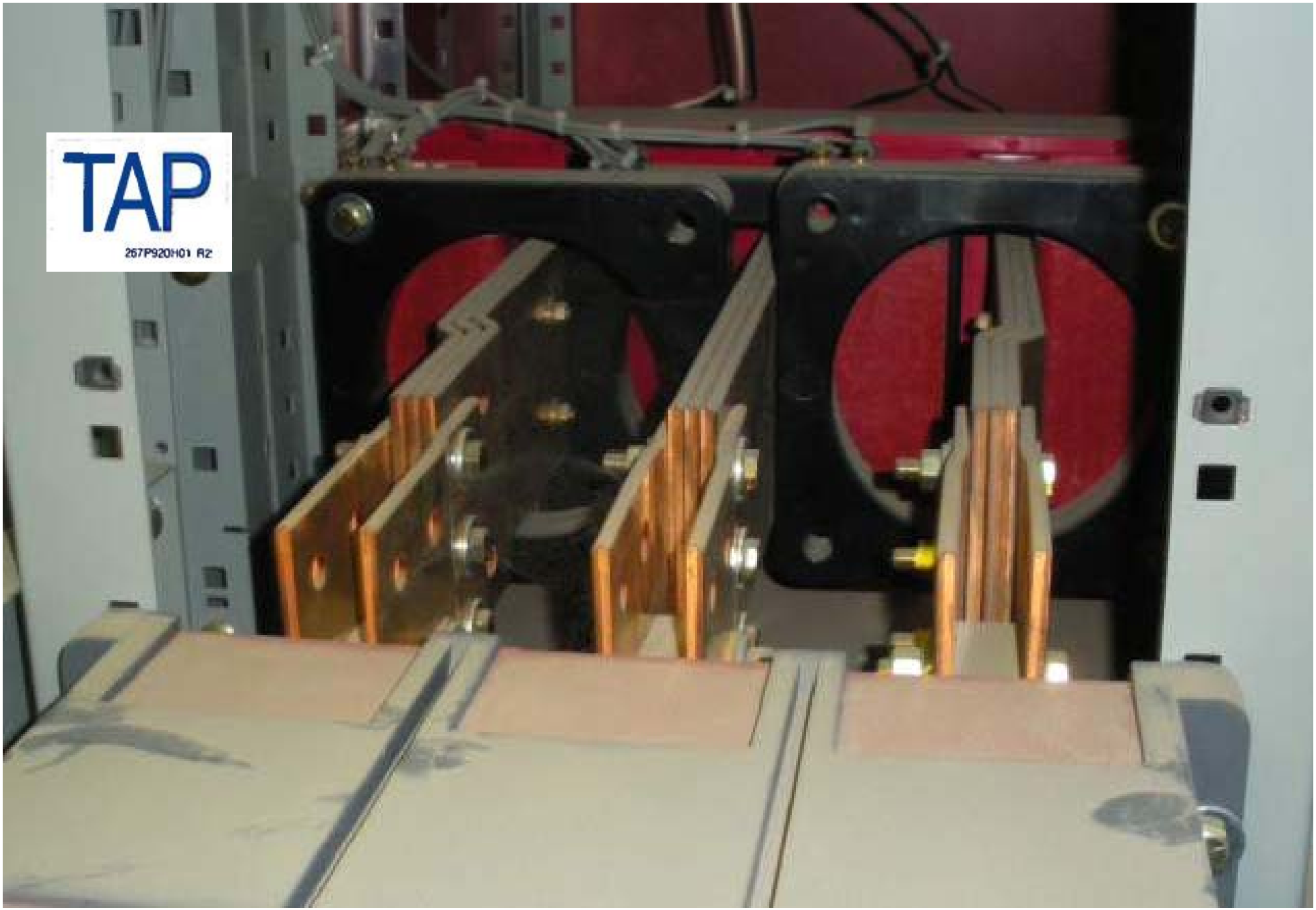
Reverse Feed Situations



- Not All Circuit Breakers Can Be Reverse fed
- If Marked LINE/LOAD – DO NOT REVERSE FEED

Connections / Terminations

- Tapping of Bus Bar
  - If Not Listed for Field Tapping – A Field Evaluation May Be Warranted – Your Label Could be at Risk
  - Panelboards and deadfront switchboards are not Listed to have busbars tapped unless existing holes are marked with the word “Tap” adjacent to them
  - Other holes in busbar not marked with “Tap” are intended for overcurrent devices or other devices
  - Watch for product markings and read installation instructions


TAP
267P920H01 R2

PV Systems

690.54 Interactive System Point of Interconnection

Compliance:

At the AC interconnection point. Need to post rated AC output current and nominal voltage.

E.g. The Main Service Panel or MDP

Photovoltaic System AC Disconnect

Rated AC Output Current : ___ A

Nominal Operating AC Voltage:___ V

PV Systems

690.64(B)(7) Marking of Overcurrent Devices

Note: 2011 NEC Moved to 705.12(D)(7)

Compliance:

Where a panel's bus bar rating is exceeded by 20% per 690.64(B)The breaker at the AC interconnection point shall be marked.

Label Location:

Where the AC interconnection overcurrent protection device is located.

Questions?

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