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2017 NEC[®] 240.87 Arc Energy Reduction Product Solutions

What is NEC[®] 240.87?

NEC 240.87 requires a means of reducing the arc energy for any circuit breaker that can be set at 1200A and above. The code has been revised for 2017 with a new list of approved methods to implement arc energy reduction. An overview of these methods is provided below. For further information regarding the code, please reference document no. PDFL-NECQA-0217, available in the download center (usa.siemens.com/downloadcenter).

Methods to reduce clearing time:

1. Zone-selective interlocking
2. Differential relaying
3. Energy-reducing maintenance switching with local status indicator
4. Energy-reducing active arc flash mitigation system
5. An instantaneous trip setting that is less than the available arcing current (2017)
6. An instantaneous override that is less than the available arcing current (2017)
7. An approved equivalent means

The purpose of this brochure is to demonstrate different code-compliant options for the following products: PowerMod, Power Panels, Switchboards and Switchgear. These solutions are recommended by Siemens as options that can potentially result in cost savings when quoting these products. All of the following solutions are backward compatible with the 2014 code cycle unless otherwise stated.

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In an effort to improve the ease-of-use and provide a larger margin of safety, Siemens has initiated a project to enlarge the size of the black breaker cover on the front of all Power Mod 1200A-2000Amp main breaker modules. This change allows the user to access and view the instantaneous dials through the cover opening without having to take off the entire metal front cover. All products in this amperage range will have this change implemented in Spring of 2018. For more information on which catalog numbers have undergone this upgrade please contact customer support.

1. Electronic Trip Unit (ETU) with DAS®

The Siemens Power Mod product line now offers main breaker modules with Dynamic Arc Sentry (DAS). This DAS solution complies with NEC240.87 by providing an energy-reducing maintenance switch with local status indication. These modules incorporate the new Sentron Sensitrip IV, SND-Frame, solid state breaker and are identified as 1200 Amp WB(M) and WEB(M) units.

Modules with DAS will feature a blue, illuminated push-button under a clear cover mounted on the enclosure. To initiate maintenance mode – lowering the instantaneous settings – the user lifts the clear cover and presses the button. The button will illuminate – providing status indication – when the breaker has successfully transitioned into maintenance mode. The breaker will stay in maintenance mode until the push-button is depressed again and the light turns off.

Another benefit of the Siemens DAS solution is that the status indication may be clearly seen from across the room and in a variety of environments. Furthermore, the separate breaker cover is now larger than prior models, which allows the breaker handle extension to be stored inside the cover for easy access.

Power Mod offers multiple solutions to address NEC 240.87

- 1) Electronic Trip Unit (ETU) with DAS®
- 2) Thermal Magnetic Instantaneous Setting
- 3) Equivalent Means
- 4) Alternative Methods



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2. Thermal Magnetic Instantaneous Setting

Siemens experts have found that, in many applications, thermal magnetic breakers 1200 Amps and above meet 2017 NEC 240.87 (B)(5) code by confirming the application meets a few basic requirements:

- The secondary service voltage is 240V single phase (1Ø) or 208/120V three phase (3Ø).
- The distance from the transformer to the service entrance is 50 feet or less and uses at least four sets of 500MCM copper cable (or equivalent ampacity) in non-magnetic conduit.
- The actual available fault current at the transformer secondary (which accounts for the actual available fault current at the primary from the utility) must be at least 95% of the theoretical maximum available fault current.

By verifying that the impedance (%Z) of the utility transformer is equal to or lower than the maximum allowable impedance values for common transformer sizes, and selecting and maintaining the 'LO' instantaneous setting (Ii =5000A) on each of the three instantaneous setting adjustment knobs, the instantaneous trip setting will be less than the anticipated arcing current and will meet the requirements of 2017 NEC 240.87(B)(5). See Table 1 for details.

Furthermore, labels are being added to the thermal mag units with the enlarged breaker opening to help contractors and inspectors install, inspect, and understand compliance options for these units.

3. Equivalent Means

In many typical multi-tenant applications, the in-rush requirements may be below the lowest instantaneous setting of a thermal-magnetic molded case circuit breaker. In fact, it is common to find the main devices in these types of applications with their original factory settings functioning normally after many years of service (for safety purposes, Siemens always ships circuit breakers at their minimum settings).

In these cases - where the lowest instantaneous setting for the thermal magnetic circuit breaker can be used and maintained - permanently keeping the circuit breaker at its lowest instantaneous setting could be thought of as having the same safety effect as having an energy-reducing

Table 1: Maximum Allowable Impedance Values

Breaker Type:ND6, NXD6, HND6,HNXD6, CND6, PD6,HPD6, HPXD6, CPD6, RD6, RXD6, HRD6, HRXD6	
Breaker Setting	LO
Ii (A)	5000
Maximum %Z	
240V Single Phase	
100kVA	-
167kVA	4.3
250kVA	7.2
208V Three Phase	
150kVA	-
225kVA	-
300kVA	4.9
500kVA	7.5
750kVA	7.5

maintenance switch on all the time. In both cases the circuit breaker would act with no intentional delay and at the lowest available instantaneous setting. Based on the specific application, it is reasonable that keeping an instantaneous permanently at its lowest setting could be considered an approved equivalent means.

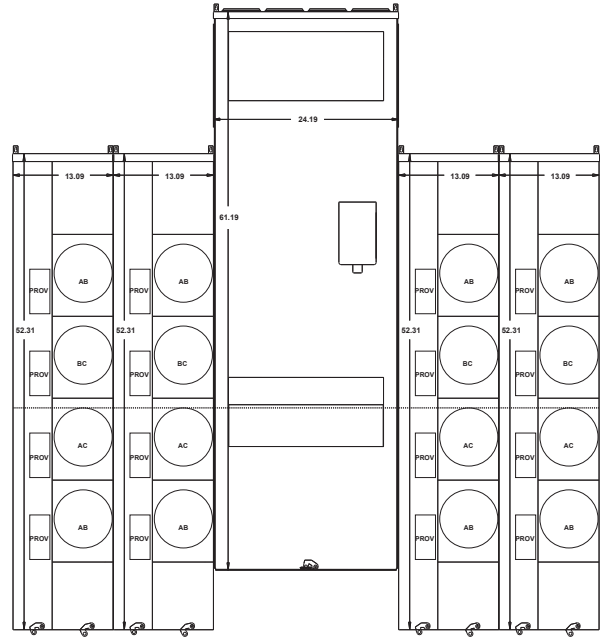
For this reason, it may be possible for the engineer or design-build designer to approach the AHJ, prior to the project bid, and discuss the possibility of meeting the requirement of an approved equivalent means with this method. The suitability of the settings and methods used and the application requirements are the responsibility of the engineer, and final approval as an equivalent means must be granted by the AHJ.

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4) Other Alternative Means

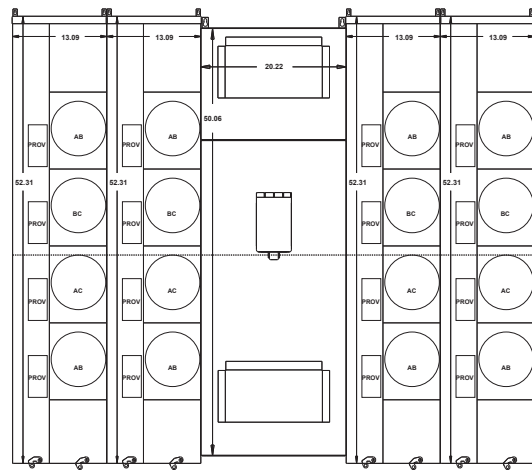
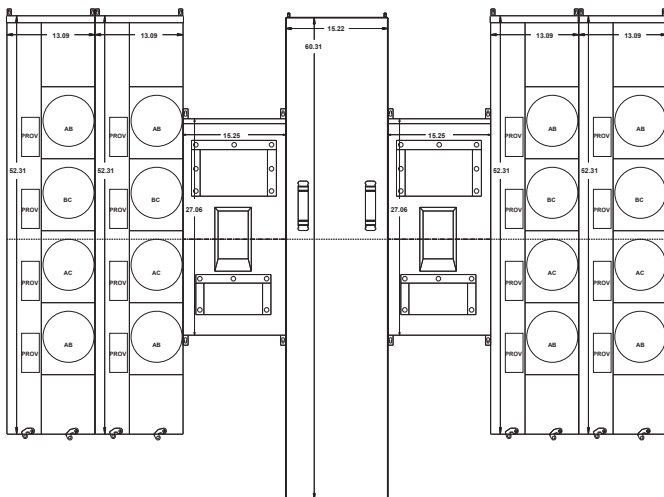
Did you know there are even more ways to be code compliant? Here are five ways to be code compliant without using the DAS or Thermal Mag Instantaneous options mentioned earlier in this document.

A 1200A PowerMod unit is shown on the right, followed by different solutions to meet arc energy reduction requirements. All Power Mod solutions below, with the exception of No. 2, can be scaled to 1600A and 2000A.



1. Use a 1200A Tapbox along with two 600A Cross Bus Main Breakers. NEC 240.87 only applies to breakers 1200A and above. Reducing the breaker size may also result in cost savings.

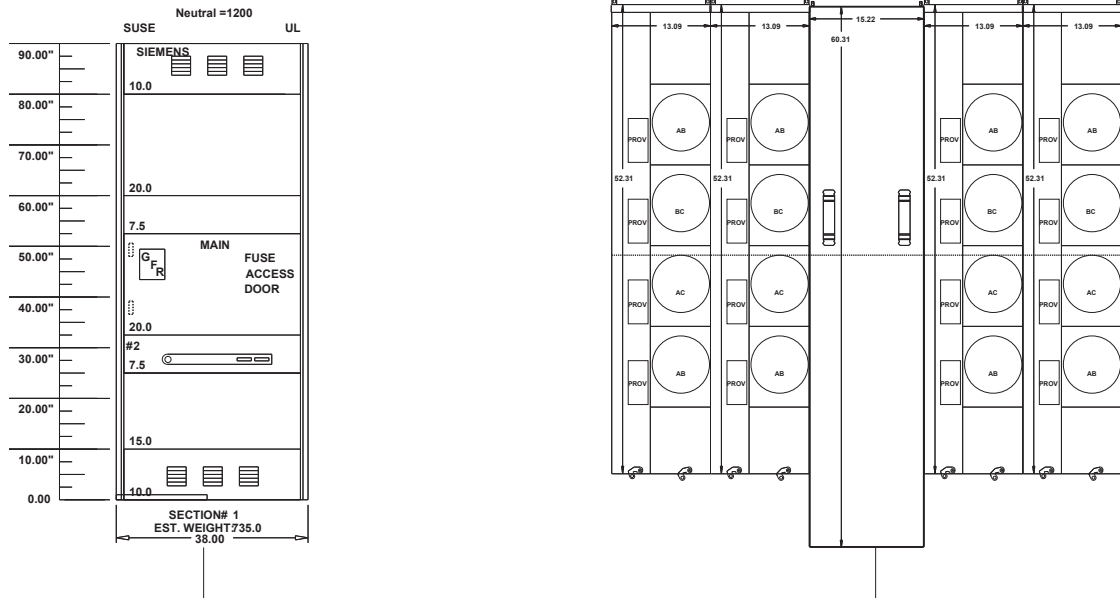
2. Use a 1200A Fused Switch in place of a breaker. NEC 240.87 does not apply to fuses - only breakers. NEC 240.67 will apply to switches in 2020. Note that this option is only available for 1200A applications, because Power Mod does not offer fused switches greater than this size.



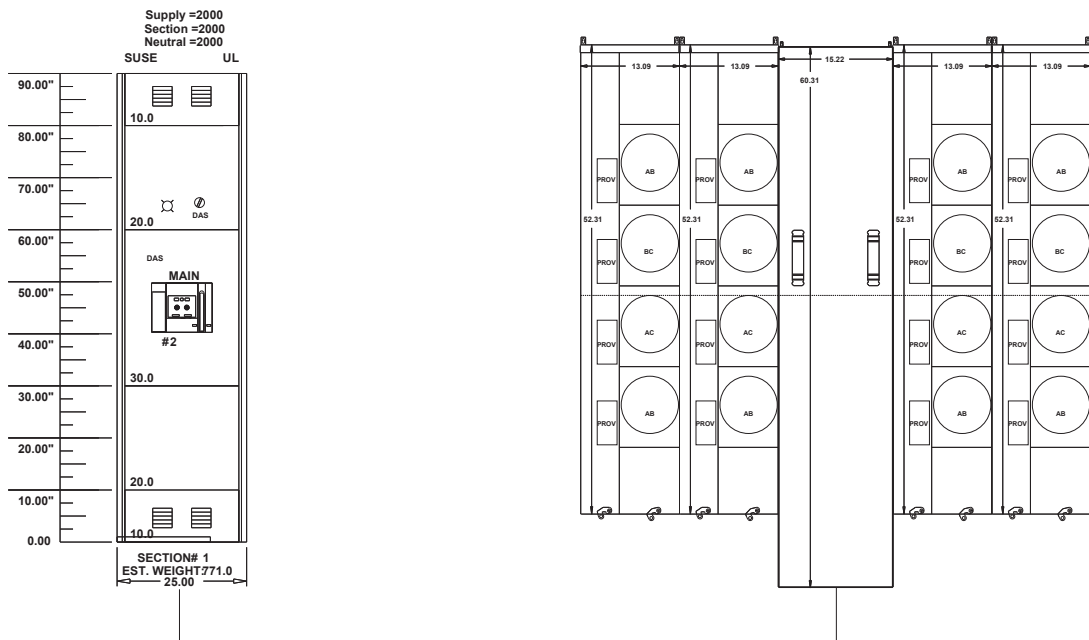
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3. Feed a 1200A tapbox using a 1200A fused switchboard section.



4. Feed a 1200A tapbox using a 1200A DAS breaker switchboard section. Note that ETU 776 is provided for use with DAS.



5. Feed a 1200A tapbox using a 1200A breaker switchboard section. Set instantaneous trip unit on main breaker to below the arcing current level by commissioning at this setting (this setting must be used at all times). Note that ETU 745 should be selected in COMPAS. Both ETU 745 and 776 allow a user to change the instantaneous setting; however, ETU 745 is a more cost effective option because it comes with dials, while ETU 776 comes with a LCD display. The Engineer of Record must determine whether IEEE 1584 calculations are sufficient or if a formal arc flash study is needed. The engineer must also determine the appropriate level below the calculated arc fault current that the instantaneous setting should be. Please note that this is compliant with the 2017 code, but not the 2014 version.

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Power Panel and Switchboard

This is a switchboard lineup with a 2000A main breaker, followed by solutions to meet Arc Energy Reduction requirements.

1. Set instantaneous trip unit on main breaker to below the arcing current level by physically turning the dial setting (this setting must be used at all times). Note that ETU 745 should be selected in COMPAS. Both ETU 745 and 776 allow a user to change the instantaneous setting; however, ETU 745 is a more cost-effective option because it comes with dials, while ETU 776 comes with a LCD display. The Engineer of Record must determine whether IEEE 1584 calculations are sufficient or if a formal arc flash study is needed. The Engineer must also determine the appropriate level below the calculated arc fault current that the instantaneous setting should be.

Please note that this is compliant with the 2017 code, but not the 2014 version unless approved by the authority having jurisdiction as an equivalent means.

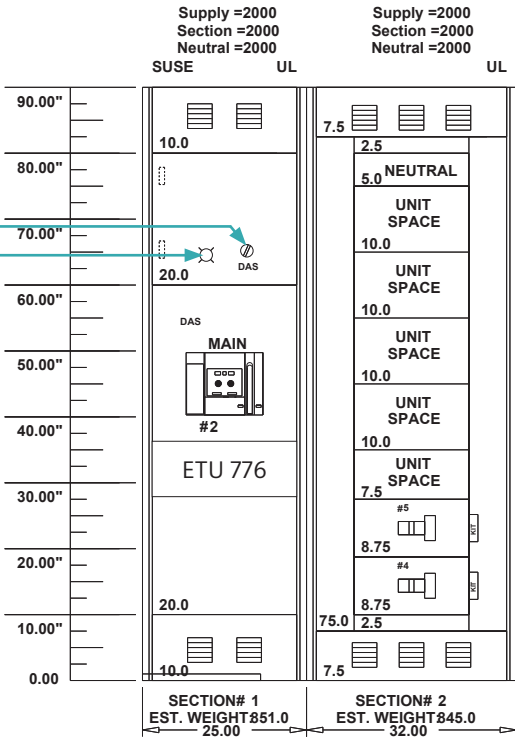
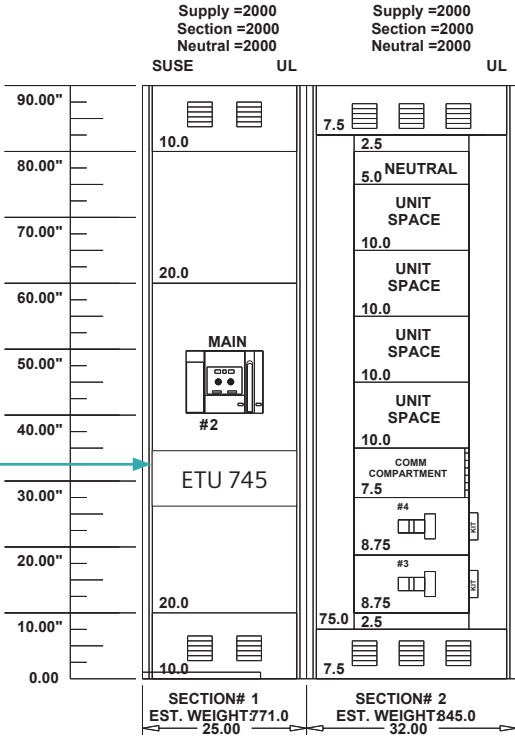
2. Use DAS as a method of arc energy reduction. Standard DAS is recommended for single WL breaker application or when Sentron Sensitrip IV circuit breakers are used in the system. Sm@rt DAS is used with one or more VL breakers or where multiple WL breakers are applied. Siemens competitive advantage is that we can adjust the instantaneous and short time settings of our VL breakers to any value required. Standard DAS with Sentron Sensitrip IV breakers and Sm@rt DAS with VL breakers is also available in panelboards. If only one WL breaker requires DAS, choose the standard option because no programming is required. Sm@rt DAS becomes more cost effective as the number of breakers increases.

Items that are included when DAS is selected:

- ETU 776
- External Selector Switch
- DAS-active Indicator Light
- Wiring
- Cubical BUS Modules

3. Zone Selective Interlocking. The ZSI scheme must include, at a minimum, the 1200A (or larger) circuit breaker and the circuit breaker in the tier above it or all the circuit breakers in the tier below it.
4. Energy Reducing Active Arc Flash Mitigation System. This option is costly because it is not tested in our equipment as a standard option. Nuisance tripping is possible. Bus Differential Relaying is another relay option available, but again is very costly. This solution requires multiple CTs and relays. Pricing for these options is not standard in COMPAS; please contact the Application Engineering team for pricing guidelines. Note that relaying solutions are available for switchboard, but not for power panels.

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Switchgear

This is a Switchgear section with a 2000A main breaker.
Possible solutions include the following:

1. Set instantaneous trip unit on main breaker to below the arcing current level by physically turning the dial setting (and this setting must be used at all times). Note that ETU 745 should be selected in COMPAS. Both ETU 745 and 776 allow a user to change the instantaneous setting; however, ETU 745 is a cheaper option because it comes with dials, while ETU 776 comes with a LCD display. Please note that the Engineer of Record must determine whether IEEE 1584 calculations are sufficient or a formal arc flash study is needed. The engineer must also determine the appropriate level below the calculated arc fault current that the instantaneous setting should be.

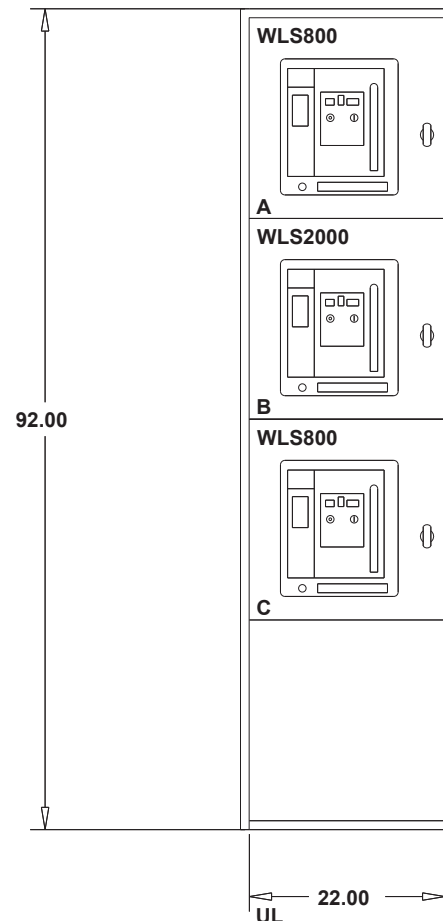
Please note that this is compliant with the 2017 code, but not the 2014 version unless signed off by the authority having jurisdiction as an approved equivalent means.

2. Use DAS as a means of arc energy reduction. Standard DAS is recommended for single WL breaker applications. Sm@rt DAS is used with one or more VL breakers or multiple WL breakers. Siemens competitive advantage is that we can adjust the instantaneous and short time settings of our VL breakers to any value required. If only one WL breaker requires DAS, choose the standard option, because no programming is required. Sm@rt DAS becomes more cost effective as the number of breakers increases.

Items that are included when DAS is selected:

- ETU 776
- External Selector Switch
- DAS-active Indicator Light
- Wiring
- Cubical bus modules

3. Zone Selective Interlocking. The ZSI scheme must include, at a minimum, the 1200A (or larger) circuit breaker and the circuit breaker in the tier above it or all the circuit breakers in the tier below it.
4. Energy Reducing Active Arc Flash Mitigation System. This option is costly and requires a SIPROTEC fiber optic flash relay. Bus Differential Relaying is another relay option available, but again is very costly. This solution require multiple CTs and relays. Pricing for these options are not standard in COMPAS; please contact the Systems' Application Engineering team for pricing guidelines.



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Siemens Industry, Inc.
5400 Triangle Parkway
Norcross, GA 30092

Siemens Technical Support: 1-800-333-7421
info.us@siemens.com

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