



NEC – PERMENANT DIMMER INSTALLATIONS

Introduction First note that the NEC® is a not "the law." It is a model code published by the National Fire Protection Association (NFPA), which revises it every 3 years through a public consensus process. Local municipalities actually enact and enforce electrical codes, and in the United States, most adopt the NEC®, with some additional requirements – California, Illinois and New York are some of the few states that modify the code to make it more stringent. In some instances, the edition of the Code that is adopted is not the currently published edition. Therefore, be sure which edition is applicable and what other rules may apply in your area. Enforcement is the responsibility of the local Authority Having Jurisdiction (AHJ).

The NEC® is divided into an Introduction and 9 chapters. The first 4 chapters apply generally. The next 3 are specific amendments, restrictions, or exceptions to these general rules. Chapter 8 covers communications systems and essentially stands alone except where it specifically refers to other chapters. Chapter 9 is tables. The 1999 edition, published in September of 1998, underwent numerous changes, many just to try and make the Code more user friendly. Therefore, when reviewing the 1999 edition, be aware that some items noted as changed just had language revisions, but other portions are significantly different. One example – Article 250 on Grounding was totally rewritten.

Loading One subject that frequently comes up concerns the loading of branch circuits and receptacles. A common situation is the need to load a circuit to 2000 watts. In most instances, the Code limits loads on branch circuits to 80% of the rating of the overcurrent protection. For a 20 amp circuit, this means a maximum of 16 amps or 1920 watts of load.

In the case of occupancies falling under Article 520 – Theaters, Audience Areas of Motion Picture and Television Studios, and Similar Locations – this situation is specifically addressed:

520-9. Branch Circuits. A branch circuit of any size supplying one or more receptacles shall be permitted to supply stage set lighting. The voltage rating of the receptacles shall not be less than the circuit voltage. Receptacle ampere ratings and branch-circuit conductor ampacity shall not be less than the branch-circuit overcurrent device ampere rating. Table 210-21(b)(2) shall not apply.

What happens if your facility doesn't fall into this category, such as a church or a hotel ballroom? These areas are normally covered by Article 518 – Places of Assembly. First note that Section 518-2 does emphasize that when ". . . any such building structure, or portion thereof, contains a projection booth or stage platform or area for the presentation of theatrical or musical productions, either fixed or portable, the wiring for that area and all equipment that is used in the referenced area, and portable equipment and wiring for use in the production that will not be connected to permanently installed wiring, shall comply with Article 520."



Remember that Article 210 – Branch Circuits applies generally, and Section 520-9 amends the Code for the appropriate occupancy. Section 210-20(a) [210-22(c) in 1996] address the loading of branch circuits. If Article 520 does not apply, you need to look at the first 4 chapters, including Article 210.

210-20(a) Continuous and Non-continuous Loads. Where a branch-circuit supplies continuous loads or any combination of continuous and non-continuous loads, the rating of the overcurrent device shall not be less than the non-continuous load.

Exception: Where the assembly, including the overcurrent devices protecting the branch circuit(s), is listed for operation at 100 percent of its rating, the ampere rating shall not be less than the sum of the continuous load plus the non-continuous load.

The wording 210-22(c) in the 1996 edition is similar.

Since the ETC dimmers are rated at 1200 or 2400 watts, and if your overcurrent protection is a branch circuit breaker listed for 100% operation, you can fully load the dimmer. If your loads operate in a non-continuous manner (continuous is defined as "A load where the maximum current is expected to continue for three hours or more"), you should also be able to load the dimmer beyond the 80% limit.

Feeder Calculations One of the most common questions manufacturers get asked is the required feed to their dimmer racks. The requirement for the size of a feeder is determined by the connected load. The dimmers are not loads, they are essentially fancy switches or circuit breakers. Section 220-10 states: "The computed load of a feeder or service shall not be less than the sum of the loads on the branch circuits supplied, . . ." The 1996 edition of the Code stated "Feeder conductors shall have sufficient ampacity to supply the load served. In no case shall the computed load of a feeder be less than the sum of the loads on the branch circuits supplied as . . ."

The only challenge for the engineer, consultant, or user, is determining a "worst case" light plot that would represent the heaviest load the system would likely carry. This is not something that a manufacturer is normally in a position to do. However, in Article 520 occupancies, please note that paragraph 520-27(c) (520-27(b) in the 1996 edition) state:

520-27. Stage Switchboard Feeders. (c) Supply Capacity. For the purposes of computing supply capacity to switchboards, it shall be permissible to consider the maximum load that the switchboard is intended to control in a given installation, provided that:

- (1) All feeders supplying the switchboard shall be protected by an overcurrent device with a rating not greater than the ampacity of the feeder.
- (2) The opening of the overcurrent device shall not affect the proper operation of the egress or emergency lighting systems.

(FPN): For computation of stage switchboard feeder loads, see Section 220-10.

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Pay particular attention to sub-paragraph (2). If your houselight dimmers are fed off of the same overcurrent device as the stage dimmers, one basic step to meeting this requirement could be feeding the dimmer rack at full capacity. An Automatic Transfer Switch (ATS – UL924) or a Emergency Lighting Transfer Switch (ELTS – UL 1008) could also be a part of complying with this rule.

Article 530 – Motion Picture and Television Studios and Similar Locations (without audience areas) provides another method for determining the size of feeders for Television Studios. Note that this is only applicable if the space does not have an audience area. Article 520 applies as it includes specific audience seating areas within motion picture or television studios. So if it is conceivable that there may be an audience in the studio at any time during its life, feeder sizing cannot use Section 530-19.

Conclusion This article addresses some of the most common questions regarding the National Electrical Code®, dimming, and ETC. The information in this article is not a formal interpretation of the NEC® – this can only be done by the NFPA and your local Authority Having Jurisdiction.