



P100 2021

The Facilities
Standards for the
Public Buildings
Service

This session is being recorded.

Training





Electrical Engineering

6

ELECTRICAL ENGINEERING

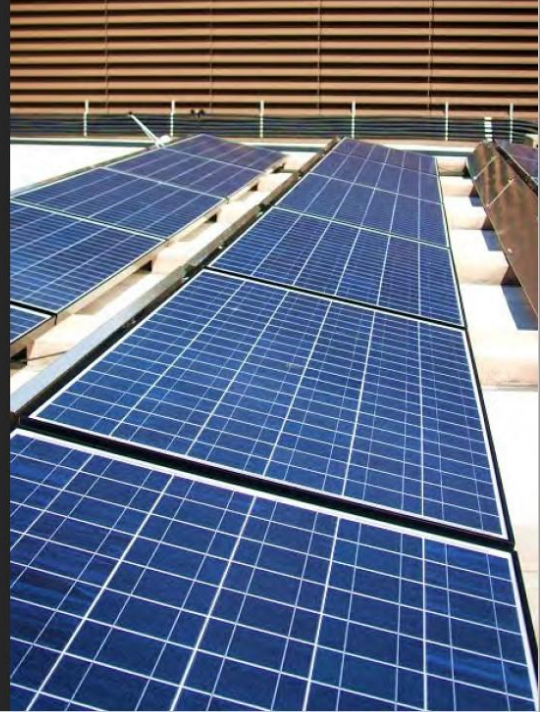


Figure 13: Thomas P. O'Neill,
Jr., Federal Building Solar
Boston, MA

←

→

Jeff Schetrompf

Electrical Engineer



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Ben Pisarcik

Electrical Engineer





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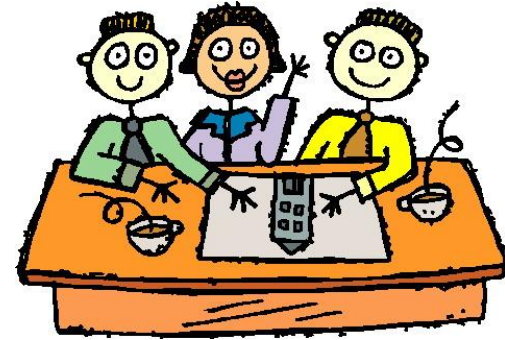
01

P100

Electrical Committee Members

The intent is that each zone across the country is represented

- Ben Pisarcik (CO-Chair)
- Jeff Schetrompf (CO)
- Steve Dunn (R3)
- Corey Berry (R4)
- Nathan Ingersoll (R5)
- Phil Inman (R8)



This training session is for Chapter 6 Electrical Engineering

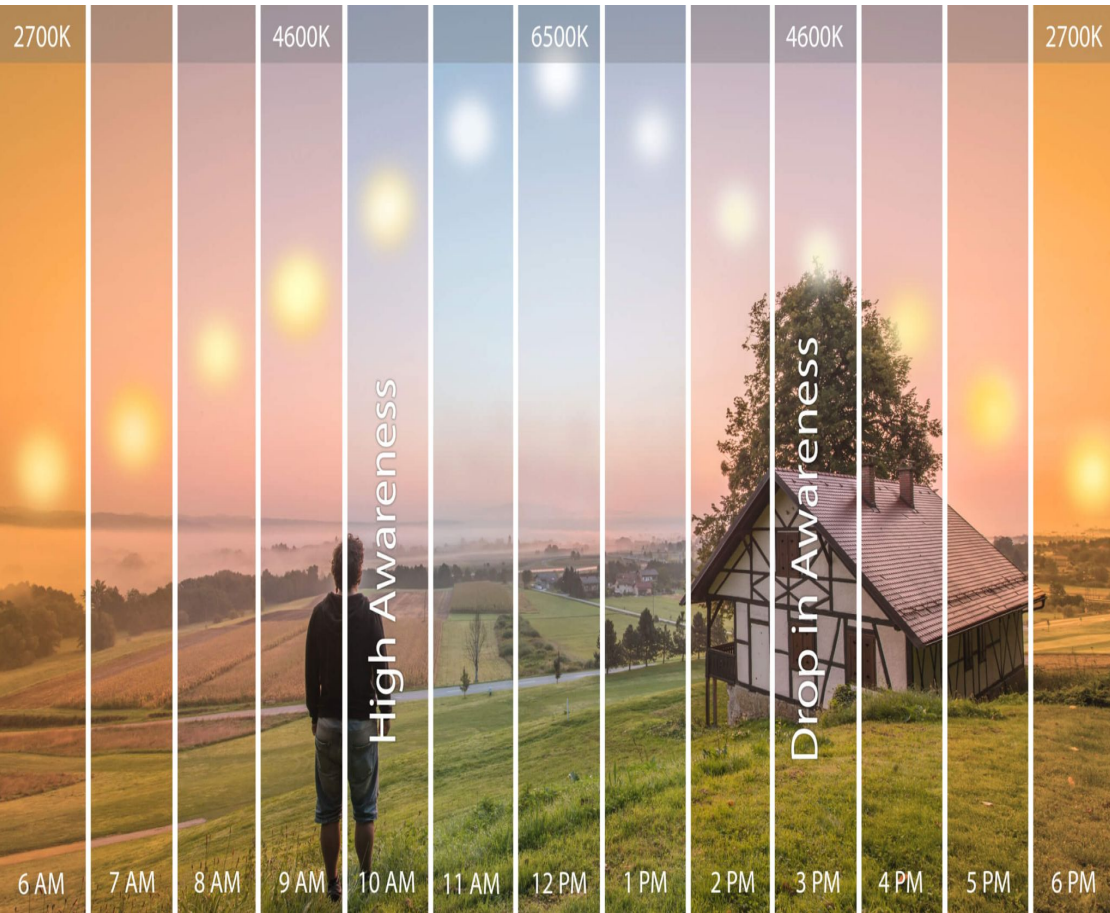
- Compliance with P100 is mandatory GSA owned buildings.
- P100 waivers are considered for unique project specific circumstances.
- Waivers are not granted to save cost or for value engineering.
- The P100 Electrical Committee maintains a running log of potential changes that will be discussed during the next revision. Anyone may reach out to committee members and ask that topics be added to the log for future discussion.



Lighting



Modifications were made to both the performance and prescriptive requirements



Circadian Effective Lighting

As defined by IES, the color and intensity of light can be used to regulate the timing of our biological clocks, or circadian rhythms.

Circadian Effective Lighting (New)

Section 6.2.1



Circadian Effective Lighting

Is required for Tier 1



How to Achieve

It can be achieved by tuning the color of the light source



How to Achieve

It can be achieved by dimming the intensity of the light source

Performance Tables (Old)

6.2.4 Power Quality									
Power Factor (Full Light Output)	>0.90	>0.90	>0.90	>0.95		Yes		Describe power factor accepted values in basis of design for lighting at full brightness	Use power meter to confirm ratio of total active to reactive power to confirm the power factor of the system. Measure input power on light fixtures circuits to confirm the parameter and verify compliance.
Power Factor (Fully Dimmed)	>.75	>.80	>.85	>.85		Yes		Describe power factor accepted values in basis of design for lighting at lowest lighting levels	Use power meter to confirm ratio of total active to reactive power to confirm the power factor of the system. Measure input power on light fixture circuits to confirm the parameter and verify compliance
Total Harmonic Distortion at the LED driver (Full Light Output)	<20%	<15%	<10%	<5%	Yes	Yes		Describe acceptable percentages of total harmonic distortion in drivers.	
Total Harmonic Distortion at the LED driver (Fully Dimmed)	<30%	<30%	<20%	<20%	Yes	Yes			
Wiring	Run separate neutral for each circuit	Run separate neutral for each circuit	Run separate neutral for each circuit	Run separate neutral for each circuit		Yes		Indicate provision of a separate neutral for each lighting circuit in basis of design.	Provide in Lighting specifications and confirm by inspecting during installation to verify compliance.
6.2.5 Maintenance									

Performance Tables (New)

Power Quality	
Power Factor (Full Light Output)	
Baseline	>0.90
Tier 1	>0.90
Tier 2	>0.90
Tier 3	>0.95
M & V	
Plans & Specs	Yes
Calculations & Analysis	
References	
Basis of Design	Describe power factor accepted values in basis of design for lighting at full brightness
Construction Verification	Use power meter to confirm ratio of total active to reactive power to confirm the power factor of the system. Measure input power on light fixtures circuits to confirm the parameter and verify compliance.
Power Factor (Fully Dimmed)	
Baseline	.>.75
Tier 1	.>.80
Tier 2	.>.85
Tier 3	.>.85
M & V	
Plans & Specs	Yes
Calculations & Analysis	
References	
Basis of Design	Describe power factor accepted values in basis of design for lighting at lowest lighting levels
Construction Verification	Use power meter to confirm ratio of total active to reactive power to confirm the power factor of the system. Measure input power on light fixture circuits to confirm the parameter and verify compliance

Interior Light Levels

Table 6.1 Interior Lighting Requirements (Unless otherwise required by agency design guides)

Area/Activity	Illuminance Lux	Illuminance Fc
Office Enclosed (Ambient)	323	30
Office Open (Ambient)	323	30
Conference/Meeting	323	30
Classroom/Lecture	323	30
Lobby	108	10
Atrium	108	10
Lounge/Recreation	108	10
Dining Area	108	10
Food Preparation	538	50
Restrooms	108	10
Corridor/Transition	108	10
Stairs	108	10
Active Storage	108	10
Inactive Storage	54	5
Electrical/Mechanical/Technology	323	30

Energy Use

Section 6.3

If life cycle cost-effective, new federal buildings must be designed to be 30% more efficient than ASHRAE 90.1 energy consumption levels.

DesignLights Consortium (DLC)

Section 6.3.2.2



Removed DLC Premium

The DLC Premium requirement was removed due to the limited pool of fixtures available



Fixtures DLC Ratings do not Cover

The project lighting practitioner shall evaluate on a case by case basis to ensure lighting quality and efficiency levels are met

Lighting Control Section 6.3.2.5



Removed Individual
Luminaire
control/addressable



Controls shall be
provided in
accordance with
ASHRAE 90.1

LED Retrofit Requirements, Review and Approval Section 6.3.2.2

Proposed installation facility and LED retrofit have been reviewed and approved by regional engineering staff prior to purchase (new)

UL rating is maintained for entire fixture to include UL 1598C and UL 1993

LED retrofit kits must be DLC and be published on their "Qualified Products" website

Power



Modifications were made to both the performance and prescriptive requirements

Spare Capacity

Section 6.5.2.3.5



All panelboards must be fully populated with both active and spare breakers of a size and rating of breakers used in the panelboard (minimum spare circuit breakers of two of each type excluding subpanel feeds) or as directed by GSA.



Switchboards must be provided with spare circuit breakers, minimum one per each size or as directed by GSA.



Switchgear must be provided with enclosed, drawout-type breakers, minimum spare circuit breakers of one per each frame size fully equipped spare breaker or as directed by GSA.

Service Entrance Voltage

Section 6.5.3.3.1



For buildings greater than **25,000** gsf and less than 250,000 gsf, electrical secondary service must be a minimum of 480Y/277V. For buildings 250,000 gsf and larger, or for campus sites, secondary electrical service must be provided to the building, at medium-voltage distribution, up to 34.5kV, for primary power distribution to substations.



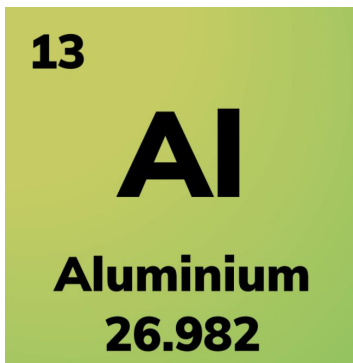
For renovated buildings greater than 25,000 gross square feet where the local utility only has network voltage of 120/208 volt primary service available, the normal and emergency voltages upon entering the building must be stepped up to 480/277 volt.

Aluminum Conductors

Sections 6.5.3.3.2 & 6.5.7.6.1



Feeder conductors 1/0 and larger may be either aluminum or copper for low and medium voltage. All other conductors must be copper.



Duct Banks

Sections 6.5.3.3.3 & 6.5.3.3.4



Direct bury conduit must be schedule 80 if PVC is used.



Concrete encased PVC Schedule 40 must be used for all services entering the building (power, communications, and/or life safety) and a minimum conduit diameter of 100mm [4in] shall be utilized.



Where redundant service is required, alternate and diverse paths must be provided.



Concrete-encased ducts must be provided with a cover that is at least 750 mm (30 in.) thick.



Ductbanks under railroads must be reinforced.



Ducts must slope toward manholes and all entries into buildings must have watertight seals. Changes in direction must be by sweeps with a radius of 1.2 m (4 ft.) or more.

Secondary Distribution

Sections 6.5.4.2



Switchgear must meet **UL 1558**, include mimic bus, and be provided for the service entrance of any building **1200 amperes or greater**.



Switchgear **shall have enclosed, drawout-type circuit breakers**, one per each size fully equipped spare cubicle, a breaker lifting device, and a ground and test device.



The ground and test device must be stored in a spare switchgear cubicle.



If the switchboards are used for service entrance equipment below 1200 amperes, they shall be constructed in accordance with **UL 891**.



This is applicable for normal and emergency power distribution systems.



IR camera inspection ports shall be provided for **low and medium voltage** on the enclosure of all switchgear for ease of inspecting switchgear for thermal problems while under load.

Electric Rooms

Sections 6.5.5.2



Shall be located in core areas and **shall** be stacked.



A minimum of two perimeter walls of each electrical room shall be accessible for conduit penetration. **(New)**



Electric rooms are no longer distinguished from closets. If the rooms/closet contains heat generating equipment it must be ventilated appropriately.



Our minimum sizing for Electrical Rooms is 6'x10' with call out for 30% spare wall space. This is to allow future growth for both panelboards and transformers.



Electrical Rooms shall serve no more than 10,000 square feet.

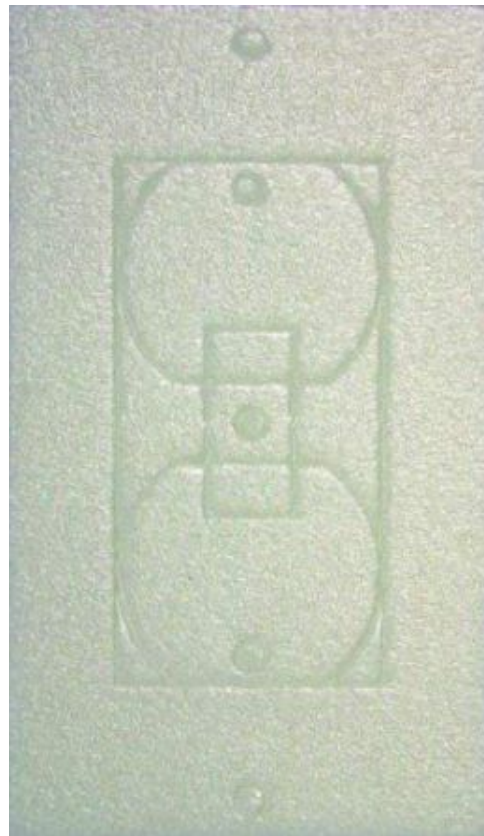
Receptacles

Sections 6.5.7.2



Provide gasket seals at receptacles/switches on exterior walls and along interior walls between conditioned and non-conditioned spaces.

(New)



Panelboards

Sections 6.5.7.5



Panelboards are required to have type-written directories. If the new feed is being installed, a new type-written directory shall be included...no pen and ink changes.



Additionally, NEC requires that each separate load be distinguishable from any other load on that panel.

Conductors & Conduit Systems

Section 6.5.7.6



Minimum conduit size shall be $\frac{3}{4}$ ".
(New)



Conductors #10 and below shall be solid conductors. **(New)**



MC Cable

Section 6.5.7.6.1



MC cable shall not terminate at a panelboard. Conduit shall be used between a panelboard and the first terminated device.



Not allowed in highly finished areas or when serving critical infrastructure.





Equipment Labeling

Sections 6.5.7.7



All electrical equipment installed must be provided with exterior, typewritten, machine-made labels indicating the panel and circuit number from which they are electrically fed.

Voice and Data Distribution System (New)

Sections 6.5.8



All voice and data cabling located throughout the building shall be required to be in a cable management system equivalent to a tray, conduit, etc. Hooks shall be allowed on data circuits of 20 or less. Cabling supported by ceiling tiles is not permitted.



Generator System Sections 6.5.9.2 (New)



Diesel fuel, natural gas or propane are permitted as energy sources for building emergency generators up to 350kW. Diesel fuel must be used for generators above 350kW.

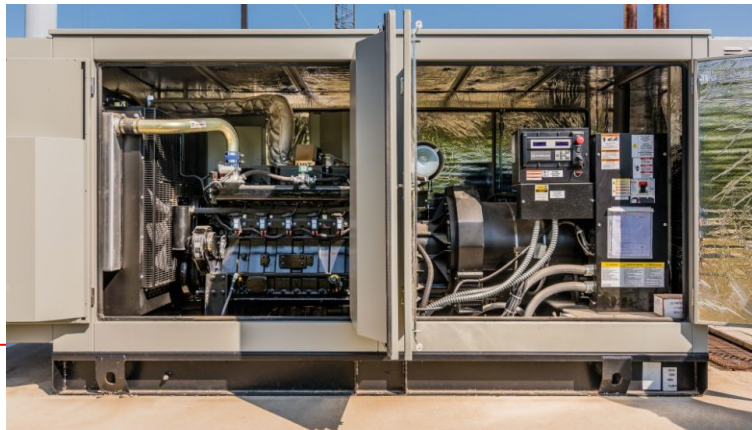


Generator Enclosures

Sections 6.5.9.2.1



If possible, locate the generators outside and on grade. If installed outdoors, they must be provided with a suitable **reach-in** acoustic enclosure and jacket water heaters to ensure reliable starting in cold weather. **In harsh weather environments, walk-in enclosures should be considered.**



Lightning Protection Systems

Sections 6.5.12.1



If a decision is made to provide a lightning protection system, specify that it be installed in compliance with NFPA 780, the components meet the requirements of UL 96 and provide **UL Master Label certification.**



Short Circuit, Coordination & Arc Flash

Sections 6.5.12.3



Updates to existing power system models shall be incorporated into any modifying project.



The building power system model shall be provided in a format coordinated by the region. GSA shall be provided the source code for the analysis and have rights to the source native files at no additional cost to the Government.

Rebate Programs

Section 6.5.16 (New)



The Energy Act of 2020 includes extended product system rebate programs to encourage replacement of energy inefficient electric motors and transformers. Additionally, there are often utility or locality-based rebate programs that are available. These rebate programs should be utilized to both improve GSA's energy performance as well as to reduce installation costs.





Thanks!

Do you have any questions?

