technical report 2

angelica santana | lighting/electrical

princeton neuroscience and psychology complex, princeton, new jersey

Technical Report 2: Electrical Existing Conditions Report

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October 7, 2010

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. Executive Summary .

. Summary Description of Distribution System .

The Neuroscience & Psychology complex has an intricate electrical system design due to its large area and complicated laboratory spaces. The electricity supplied by the utility company to Princeton University's main distribution system enters the building through the northwest corner where there are two service entrances. These supply power to two double ended substations. Emergency power comes from an exterior generator.

. Utility Company Information .

Name: Public Service Electric and Gas Company (PSE&G)
Address: 15 West State Street, Trenton, New Jersey 08604
Website: http://www.pseg.com/companies/pseandg/overview.jsp

(Jamie's)
Generation
Day
June to September - 11.1044¢ per kwh
October to May - 9.3099¢ per kwh
Night
June to September - 8.2579¢ per kwh
October to May - 7.8027¢ per kwh
Transmission
June to September - 0.452¢ per kwh
October to May - 0.452¢ per kwh
Distribution Service
June to September - 1.2056¢ per kwh
October to May - 0.6126¢ per kwh

Electric Tariff PDF: get contact in PU to see what applies

Look at pages 65,66, and 109

. Service Entrance .

Service entrance location and where it ties to campus: The service entrance is located on the northeast corner of the Neuroscience Building. There is an existing electric manhole very close by and from this (8) 5" conduits 4 KV service run through a new electric manhole that feeds both

service entry tap boxes each with two(2) sets of (3)#750+1/OG-5"C MV 105 and two(2) 5"RSC type stub outs. Each service entry tap box has four (4) sets of (3)#500-4"C MV 105 that feed two double-ended substations; one with 480/277V system and the other with 208/120V system.

Description of equipment at service entrance location: Two (2) 5" rigid galvanized steel (RGS) conduits 9'-3" above the floor enter the building through the exterior concrete wall and connect to the service entry pull box which feeds the service entry tap box with four (4) 5" RGS conduits. Both service entry tap boxes are 60" x 60" and 36" wide and are 18" off the floor and have four (4) 4" RGS conduits coming out the top of the box.

Description of campus electrical system (metering, distribution, components): Utility Company provides electricity to campus at main location. Each building is then fed through the campus distribution system. Princeton purchases primary service at 4160V. All service entrance components are provided and owned by university. Individual electric use of each building is monitored by university.

. Voltage System .

Identification and description of general types of loads connected to each: There are two voltage systems within the complex: 480/277V and 208/120V. Each voltage system has its own double-ended substation fed from both service entrances for redundancy. The 480/277V system includes the following loads: lighting, AHUs, and mechanical. The 208/120V system feeds the following loads: receptacles, server racks, and VAV boxes (single-fed). Lighting that is on the dimmer panels (LPDs) is fed from transformers that bring down the 480/277 to 208/120. There is also a buck-boost transformer fed from a receptacle panel that feeds a coffee brewer 240V single phase.

. Emergency Power System .

Life safety loads power: Life safety loads are powered by the emergency generator when the power runs out.

Emergency system and its components: On the northwestern end of the Neuroscience building, close to the service entrance, is a set of (8) 5" conduit that enters the building and feeds the emergency transformers, switchboard, and the fire pump. The 4160V emergency generator is located in the exterior of the building in a weather acoustic enclosure and it feeds the generator switchboard (4160V) in the emergency switchboard room. This then feeds the fire pump (480Y/277), the emergency switchboard (480Y/277) and a Camlock enclosure for a temporary generator connection in case the existing generator where to fail.

. Location of Switchgear .

Riser Diagram vs. Floor plans:

Locations of main gear and electrical closet: The main switchgear (two double-ended substations) is located in Level C/B on the northwestern corner of the Neuroscience building where the electricity from the utility enters in the Electrical Room C04ELR. There is another electrical room directly south of it, C05ELR, which has the emergency equipment and other switchgear.

Switchboards, distribution panel boards, motor control centers, transformers, generators, and transfer switches:

Tag	Type	Floor Level	Room Number	Room Name	Drawing Numbers
MSWGR A	switchgear	C/B	C04ELR	Electrical RM	E5-B01
MSWGR B	switchgear	C/B	C04ELR	Electrical RM	E5-B01
MSWGR C	switchgear	C/B	C04ELR	Electrical RM	E5-B01
MSWGR D	switchgear	C/B	C04ELR	Electrical RM	E5-B01
4KV-480, 3Ø, 4W XFMR	transformer	C/B	C04ELR	Electrical RM	E5-B01
4KV-480, 3Ø, 4W XFMR	transformer	C/B	C04ELR	Electrical RM	E5-B01
4KV-208, 3Ø, 4W XFMR	transformer	C/B	C04ELR	Electrical RM	E5-B01
4KV-208, 3Ø, 4W XFMR	transformer	C/B	C04ELR	Electrical RM	E5-B01
SWBD-LVB	switchboard	C/B	C04ELR	Electrical RM	E5-B01
SWBD-LVC	switchboard	C/B	C04ELR	Electrical RM	E5-B01
SWBD-HVB	switchboard	C/B	C04ELR	Electrical RM	E5-B01
SWBD-HVC	switchboard	C/B	C04ELR	Electrical RM	E5-B01
SWBD-SB1	switchboard	C/B	C05ELR	Electrical RM	E5-B01
SWBD-LS	switchboard	C/B	C05ELR	Electrical RM	E5-B01
ATS-LS	automatic transfer switch	C/B	C05ELR	Electrical RM	E5-B01
T-SWBD-EMERG	transformer, 1500kVA dry type	C/B	C05ELR	Electrical RM	E5-B01
SWBD-EMERG	switchboard	C/B	C05ELR	Electrical RM	E5-B01
T-FIRE-PUMP	transformer, 150kVA dry type	C/B	C05ELR	Electrical RM	E5-B01
ATS-SB1	automatic transfer switch	C/B	C05ELR	Electrical RM	E5-B01
ATS-SB2	automatic transfer	C/B	C05ELR	Electrical RM	E5-B01

	switch				
SWBD-SB2	switchboard	C/B	C05ELR	Electrical RM	E5-B01
T-SB-BB2	transformer, T-3	C/B	C05ELR	Electrical RM	E5-B01
SWBD-MRI	switchboard	C/B	B10ELR		E5-B06
T-MRI	transformer	C/B	B10ELR		E5-B06
T-BB	transformer	C/B	B10ELR		E5-B06
SWBD-BB	switchboard	C/B	B10ELR		E5-B06
T-SB-BC	transformer, T-6	C/B	B12ELR		E5-B06
T-EAL	transformer, T-1	A	A05ELR		E5-A02
T-EAA	transformer, T-1	A	A05ELR		E5-A02
T-SB-BA	transformer, T-6	A	A05ELR		E5-A02
9.75kVA BUCK-BOOST	transformer	A	A05ELR		E5-A02
T-CABINET	transformer	A	A05A	UPS	E5-A02
T-SB-BA	transformer, T-8	A	A30ELR		E5-A03
T-EAB	transformer, T-2	A	A30ELR		E5-A03
T-EAC	transformer, T-1	A	A81ELR		E5-A06
T-E2B	transformer, T-2	2	230ELR		E5-203
T-E4A	transformer, T-1	4	230ELR		E5-402
T-E2A	transformer, T-1	2	210ELR		E5-202
DP-BB	distribution panel	C/B	C04ELR	Electrical RM	E5-B01
SB-DP-BBE	distribution panel	C/B	C05ELR		E5-B01
DP-BBM	distribution panel	C/B	C04MEC	MEC	E5-B02
T-BB	transformer	C/B	B10ELR		E5-B06
DP-LS-BC	distribution panel	C/B	B12ELR		E5-B06
MDP-BC	distribution panel	C/B	B12ELR		E5-B06
DP-BLC	distribution panel	C/B	B12ELR		E5-B06
DP-SB-BA	distribution panel	A	A05ELR		E5-A02
DP-LS-BA	distribution panel	A	A05ELR		E5-A02
DP-AA	distribution	A	A05ELR		E5-A02

	panel				
DP-SB-AB	distribution panel	A	A30ELR		E5-A03
DP-SB-1B	distribution panel	1	130ELR		E5-103
DP-1B	distribution panel	1	130ELR		E5-103, E5-104
DP -1C	distribution panel	1	181ELR		E5-105, E5-106
DP-2B	distribution panel	2	230ELR		E5-201, E5-203, E5-204
SB-DP-2C	distribution panel	2	280ELR		E5-205, E5-206
DP-2C	distribution panel	2	280ELR		E5-206
DP -AB	distribution panel	A	A30ELR		E5-A03
SB-DP-3BM	distribution panel	3	Penthouse, roof		E5-303
SB-DP-3BM1	distribution panel	3	Penthouse, roof		E5-303
DP-3BM	distribution panel	3	Penthouse, roof		E5-303
DP-AC	distribution panel	A	A81ELR		E5-A06
SB-DP-AC	distribution panel	A	A81ELR		E5-A06
SB-DP -1C	distribution panel	1	181ELR		E5-106
DP-SB-BC	distribution panel	C/B	B12ELR		E5-B06
DP-BCH	distribution panel	C/B	B12ELR		E5-B06
SB-DP-BCM	distribution panel	C/B	B12ELR		E5-B06
T-E2C	transformer, T-1	2	280ELR		E5-206

The following do not appear on the plans, but are on the single line/riser diagram.

SWBD-SB-ELEV	switchboard				E3-002
T-EM-SITE	transformer, T-2				E3-002
EMERGENCY GENERATOR	generator				E3-002

Lighting panels:

Tag	Voltage System	Main Size/Type	Floor Level	Room Name and Number	Drawing Numbers
LP-BB	480Y/277V, 3P, 4W	225A MLO	C/B	C04ELR, Electrical RM	E5-B01
LP-BC	480Y/277V, 3P, 4W	225A MLO	C/B	B12ELR	E5-B06
ELP-AB	480Y/277V, 3P, 4W	225A MCB	A	A30ELR	E5-A01, E5-A03, E5-A04
ELP-AA	480Y/277V, 3P, 4W	225A MLO	A	A05ELR	E5-A02
LP-AA	480Y/277V, 3P, 4W	225A MLO	A	A05ELR	E5-A02
LP-AB	480Y/277V, 3P, 4W	225A MLO	A	A30ELR	E5-A03
LPD-AB	480Y/277V, 3P, 4W	200A MLO	A	A30ELR	E5-A03
ELP-AC	480Y/277V, 3P, 4W	225A MCB	A	A81ELR	E5-A06
LP-AC	480Y/277V, 3P, 4W	225A MLO	A	A81ELR	E5-A06
LP-1A	480Y/277V, 3P, 4W	225A MLO	1	111ELR	E5-102
LP-1B	480Y/277V, 3P, 4W	225A MLO	1	130ELR	E5-103
LP-1C	480Y/277V, 3P, 4W	225A MLO	1	181ELR	E5-105, E5-106
ELP-2B	480Y/277V, 3P, 4W	225A MCB	2	230ELR	E5-201, E5-203
LP-2A	480Y/277V, 3P, 4W	225A MLO	2	210ELR	E5-202
ELP-2A	480Y/277V, 3P, 4W	225A MCB	2	210ELR	E5-202
LP-2B	480Y/277V, 3P, 4W	225A MLO	2	230ELR	E5-203
LP-2C	480Y/277V, 3P, 4W	225A MLO	2	281ELR	E5-205, E5-206
ELP-2C	480Y/277V, 3P, 4W	225A MCB	2	281ELR	E5-206
LP-3A	480Y/277V, 3P, 4W	225A MLO	3	312ELR	E5-302
LP-3B	480Y/277V, 3P, 4W	225A MLO	3	341VES	E5-304
LP-4A	480Y/277V, 3P, 4W	225A MLO	4	412ELR	E5-402
ELP-4A	480Y/277V, 3P, 4W	225A MCB	4	412ELR	E5-402
LP-5A	480Y/277V, 3P, 4W	225A MLO	5	512ELR	E5-502
LPD-AAL	208Y/120V, 3P, 4W	175A MCB	A	A05ELR	E5-A02

ELPD-AAL	208Y/120V, 3P, 4W	175A MCB	A	A05ELR	E5-A02
LPD-1B	480Y/277V, 3P, 4W	200A MLO	A	130ELR	E5-103
LPD-2B	480Y/277V, 3P, 4W	200A MLO	A	230ELR	E5-203

Receptacle panels:

Tag	Voltage System	Main Size/Type	Floor Level	Room Name and Number	Drawing Numbers
RP-BB3	208Y/120V, 3P, 4W	225A MCB	C/B	C04ELR, Electrical RM	E5-B01
RP-UA1	208Y/120V, 3P, 4W	225A MCB	C/B	C01, Server	E5-B02
RP-UA2	208Y/120V, 3P, 4W	225A MCB	C/B	C01, Server	E5-B02
RP-BB1	208Y/120V, 3P, 4W	225A MCB	C/B	C43COR	E5-B03
RP-BB2	208Y/120V, 3P, 4W	225A MCB	C/B	C42, Optics	E5-B03
RP-UA4	208Y/120V, 3P, 4W	225A MCB	C/B	C01, Server	E5-B04
RP-UA3	208Y/120V, 3P, 4W	225A MCB	C/B	C01, Server	E5-B04
RP-BC1	*	*	C/B	B10ELR	E5-B06
RP-BC2	*	*	C/B	B10ELR	E5-B06
RP-BC3	208Y/120V, 3P, 4W	225A MCB	C/B	B10ELR	E5-B06
RP-BC4	208Y/120V, 3P, 4W	225A MCB	C/B	B12ELR	E5-B06
RP-AB5	208Y/120V, 3P, 4W	225A MCB	A	A35, Teaching Lab	E5-A01
ERP-AB	208Y/120V, 3P, 4W	100A MCB	A	A30ELR	E5-A01, E5-A03, E5-A04
ERP-AA	208Y/120V, 3P, 4W	100A MCB	A	A05ELR	E5-A02
RP-AA	208Y/120V, 3P, 4W	225A MLO	A	A05ELR	E5-A02
RP-BA	208Y/120V, 3P, 4W	225A MLO	A	A05ELR	E5-A02
RP-CA	208Y/120V, 3P, 4W	400A MCB	A	A05ELR	E5-A02
RP-DA	208Y/120V, 3P, 4W	225A MLO	A	A05ELR	E5-A02
RP-AB1	208Y/120V, 3P, 4W	225A MCB	A	A00COR	E5-A04
RP-AB2	208Y/120V, 3P, 4W	225A MCB	A	A64COR	E5-A03

RP-AB3	208Y/120V, 3P, 4W	225A MCB	A	A64COR	E5-A03
RP-AB4	208Y/120V, 3P, 4W	225A MCB	A	A30ELR	E5-A030
RP-AC1	208Y/120V, 3P, 4W	225A MCB	A	A64COR	E5-A03
RP-AC3	208Y/120V, 3P, 4W	225A MCB	A	A87COR	E5-A05
RP-AC4	208Y/120V, 3P, 4W	225A MCB	A	A87COR	E5-A05
RP-AC5	208Y/120V, 3P, 4W	225A MCB	A	A87COR	E5-A05
RP-AC6	208Y/120V, 3P, 4W	225A MCB	A	A87COR	E5-A05
RP-AC7	208Y/120V, 3P, 4W	225A MCB	A	A87COR	E5-A05
ERP-AC	208Y/120V, 3P, 4W	100A MCB	A	A81ELR	E5-A06
RP-AC8	208Y/120V, 3P, 4W	225A MCB	A	A81ELR	E5-A06
RP-1B4	208Y/120V, 3P, 4W	225A MCB	1	130ELR	E5-101, E5-103
RP-1A	208Y/120V, 3P, 4W	225A MLO	1	111ELR	E5-102
RP-1B2	208Y/120V, 3P, 4W	225A MCB	1	187COR	E5-103
RP-1B3	208Y/120V, 3P, 4W	225A MCB	1	187COR	E5-103
RP-1C2	208Y/120V, 3P, 4W	225A MCB	1	187COR	E5-103
RP-1C1	208Y/120V, 3P, 4W	225A MCB	1	187COR	E5-103
RP-1B1	208Y/120V, 3P, 4W	225A MCB	1	167VES	E5-104
RP-1C3	208Y/120V, 3P, 4W	225A MCB	1	187COR	E5-105
RP-1C4	208Y/120V, 3P, 4W	225A MCB	1	187COR	E5-105
RP-1C5	208Y/120V, 3P, 4W	225A MCB	1	187COR	E5-105
RP-1C6	208Y/120V, 3P, 4W	225A MCB	1	187COR	E5-105
RP-1C7	208Y/120V, 3P, 4W	100A MCB	1	187COR	E5-105
RP-1C8	208Y/120V, 3P, 4W	225A MCB	1	181ELR	E5-106
RP-2B4	208Y/120V, 3P, 4W	225A MCB	2	230ELR	E5-201, E5-203
RP-2A	208Y/120V, 3P, 4W	225A MLO	2	210ELR	E5-202

ERP-2A	208Y/120V, 3P, 4W	100A MCB	2	210ELR	E5-202
RP-2B2	208Y/120V, 3P, 4W	225A MCB	2	272COR	E5-203
RP-2B1	208Y/120V, 3P, 4W	100A MCB	2	272G, Operating Room	E5-203
RP-2B3	208Y/120V, 3P, 4W	225A MCB	2	264I, Anterm	E5-203
RP-2B5	208Y/120V, 3P, 4W	225A MCB	2	265I, Anterm	E5-203
ERP-2B	208Y/120V, 3P, 4W	100A MCB	2	230ELR	E5-203
RP-2C1	208Y/120V, 3P, 4W	225A MCB	2	266I, Anterm	E5-205
RP-2C2	208Y/120V, 3P, 4W	225A MCB	2	267G, Anterm	E5-205
RP-2C3	208Y/120V, 3P, 4W	225A MCB	2	284COR	E5-205
RP-2C4	208Y/120V, 3P, 4W	225A MCB	2	284COR	E5-205
RP-2C5	208Y/120V, 3P, 4W	225A MCB	2	280ELR	E5-206
ERP-2C	208Y/120V, 3P, 4W	100A MCB	2	280ELR	E5-206
RP-3A	208Y/120V, 3P, 4W	225A MLO	3	312ELR	E5-302
RP-3B	208Y/120V, 3P, 4W	225A MCB	3	341VES	E5-304
RP-3C	208Y/120V, 3P, 4W	225A MCB	3	Penthouse MER	E5-306
RP-4A	208Y/120V, 3P, 4W	225A MLO	4	412ELR	E5-402
ERP-4A	208Y/120V, 3P, 4W	100A MCB	4	412ELR	E5-402
RP-5A	208Y/120V, 3P, 4W	225A MLO	5	512ELR	E5-502

*RP-BC1 and RP-BC2 panel board schedules are missing from construction documents pages E9 because they are for the future and were not in the current contract.

. Over-current Devices .

Main switchgear/service entrance gear: The first double ended substation is protected with two 5000A main drawout type circuit breakers with a tie 5000A drawout type circuit breaker in the

center. The second substation has the same set up but with drawout circuit breakers sized at 4000A instead of 5000A. Transient voltage surge protectors (TVSS) are located immediately after the main circuit breakers for further protection. The substations feed main switchboards that are protected with drawout type circuit breakers as well.

Distribution panelboards: Common over current devices for emergency switchgear includes drawout type circuit breakers. Non-emergency switchboards and distribution panels are protected with molded case circuit breakers of various frame and trip sizes ranging from 100AF/100AT to 1600AF/1600AT. Meters at main switchboards and substations measure power for further protection. Panels branching from these are also protected with molded case circuit breakers. Switchboard transformers are protected with main disconnects.

Branch circuit panelboards: Most receptacle panels have MCB because they are fed from a distribution panel and some MLO because they are fed directly from the busway that has a circuit breaker before reaching the panel. Most lighting panels have MLO and some MCB, the opposite of the receptacle ones. The main type of over current devices for branch panelboards and transformers are molded case circuit breakers with ranging frame and trip sizes.

. Transformers .

Introductory paragraph: Most transformers have the same characteristics with varying sizes except for the transformers located in the service entry substations. They are mostly dry-type converting from 480V, 3P, 3W to 208Y/120V, 3P, 4W with an 80% temperature rise and two 2.5% taps. There is a one buck-boost transformer that feeds a coffee brewer.

Individual Transformer Schedule:

Tag	Primary Voltage	Secondary Voltage	Size (KVA)	Type	Temp. Rise	Taps	Mounting	Remarks
T-MSWGR-C	4160V, 3P, 3W	208Y/120V, 3P, 4W	1.5/1.75 MVA (OA/FA)	liquid-filled	55 deg C	(4)3.0%	Pad mounted on floor	
T-MSWGR-D	4160V, 3P, 3W	208Y/120V, 3P, 4W	1.5/1.75 MVA (OA/FA)	liquid-filled	55 deg C	(4)3.0%	Pad mounted on floor	
T-MSWGR-A	4160V, 3P, 3W	480Y/277, 3P, 4W	2.5/2.875 MVA (OA/FA)	liquid-filled	55 deg C	(4)2.5%	Pad mounted on floor	
T-MSWGR-B	4160V, 3P, 3W	480Y/277V, 3P, 4W	2.5/2.875 MVA (OA/FA)	liquid-filled	55 deg C	(4)2.5%	Pad mounted on floor	
T-FIRE PUMP	4160V, 3P, 3W	480Y/277V, 3P, 4W	150	dry-type	80 deg C	(2)2.5%	Pad mounted on floor	
T-SWBD-	4160V,	480Y/277V,	1500	dry-	80	(2)2.5%	Pad	With fan

EMERG	3P, 3W	3P, 4W		type	deg C		mounted on floor	assist.
T-EM-SITE	480V, 3P, 3W	208Y/120V, 3P, 4W	30	dry-type	80 deg C	(2)2.5%	Pad mounted on floor	
T-SB-BB2	480V, 3P, 3W	208Y/120V, 3P, 4W	45	dry-type	80 deg C	(2)2.5%	Trapeze from structure	
T-COFFEE	208V, 3P, 3W	240V, 1P	9.75				Wall mounted	Buck-boost
T-SB-BA	480V, 3P, 3W	208Y/120V, 3P, 4W	300	dry-type	80 deg C	(2)2.5%	Trapeze from structure	
T-EAA	480V, 3P, 3W	208Y/120V, 3P, 4W	15	dry-type	80 deg C	(2)2.5%	Pad mounted on floor	
T-EAL	480V, 3P, 3W	208Y/120V, 3P, 4W	15	dry-type	80 deg C	(2)2.5%	Trapeze from structure	
T-E2A	480V, 3P, 3W	208Y/120V, 3P, 4W	15	dry-type	80 deg C	(2)2.5%	Pad mounted on floor	
T-E4A	480V, 3P, 3W	208Y/120V, 3P, 4W	15	dry-type	80 deg C	(2)2.5%	Pad mounted on floor	
T-BB	480V, 3P, 3W	240V, 1P	30				Pad mounted on floor	
T-EAB	480V, 3P, 3W	208Y/120V, 3P, 4W	30	dry-type	80 deg C	(2)2.5%	Trapeze from structure	
T-E2B	480V, 3P, 3W	208Y/120V, 3P, 4W	30	dry-type	80 deg C	(2)2.5%	Trapeze from structure	
T-SB-AB	480V, 3P, 3W	208Y/120V, 3P, 4W	150	dry-type	80 deg C	(2)2.5%	Trapeze from structure	
T-MRI	480V, 3P, 3W	480Y/277V, 3P, 4W	300					
T-SB-BC	480V, 3P, 3W	208Y/120V, 3P, 4W	150	dry-type	80 deg C	(2)2.5%		
T-EAC	480V, 3P, 3W	208Y/120V, 3P, 4W	15	dry-type	80 deg C	(2)2.5%	Trapeze from structure	
T-E2C	480V, 3P, 3W	208Y/120V, 3P, 4W	15	dry-type	80 deg C	(2)2.5%	Trapeze from structure	

. Grounding .

There is a grounding electrode riser diagram that shows the grounding system in the complex. The main grounding busbar connects to two main cold water pipes, building steel, grounding ring, lightning protection system, substation transformer busbars, service entrance boxes, and electrical room busbars, including the emergency electrical room. The riser diagram is located in sheet E3-011 and is titled Electrical Ground Riser Diagram.

. Special Equipment .

Uninterrupted Power Supply (UPS): There is one 100kVA Galaxy 500 UPS system and one 300kVA EPS 6000 Single Module UPS system both with a 208V input and output to PDU. They have 14-17 minutes of battery run time at full load. They include a bypass cabinet, three-phase UPS, and PDU suitable for multiple 3-pole 225AF circuit breakers.

Transient Voltage Surge Suppressor (TVSS): TVSS have an AIC rating of 200 thousand amperes and provide overvoltage protection of >1800 cycles at 180% rated voltage to 0.7 ohm load. They have a field replaceable module with EMI Filtering. The peak single-impulse surge current rating is 259kA per mode/500kA per phase for service entrance TVSS. There are distribution panelboards/motor control center and branch panelboard suppressors. There are also suppressors for electronic-grade panelboard extensions.

. Lighting Loads .

Typical lighting systems description: There

Luminaire table introduction: There

Luminaire table:

Tag	Light Source	Lamp Type	Wattage /Lamp	# Lamps	Ballast Type	Input Voltage	Input Watts	Ballast Factor	Current (start/ operating)	Power Factor (start/ operating)
FA	FLUOR	F32T8/830	32	1	ELEC, DIM	120/277	8/LF			
FA-1	FLUOR	F32T8/830	32	1	ELEC, DIM	120/277	8/LF			
FA-2	FLUOR	F32T8/830	32	1	ELEC, DIM	120/277	8/LF			
FC	LED	3000K HIGH CRI		-	-	24	7.2, 14.5	-		
FD	FLUOR	F17, F25, OR	17, 25, OR 32	1	ELEC, PS	120/277	7/LF	0.88		

		F32T8/830								
FD-1	FLUOR	F17, F25, OR F32T8/830	17, 25, OR 32	1	ELEC, DIM	120/277	8/LF			
FD-2	FLUOR	F17, F25, OR F32T8/830	17, 25, OR 32	1	ELEC, PS	120/277	7/LF	0.88		
FE	FLUOR	(1)TL5C 22W/830, (1)TL5C 40W/830	22, 40	2	ELEC	120/277	66			
FE-1	FLUOR	TL5C 40W/830	40	3	ELEC	120/277	126			
FE-2	FLUOR	(1)TL5C 22W/830, (1)TL5C 40W/830	22, 40	2	ELEC	120/277	66			
FF	FLUOR	F26TBX/ 830/A/ ECO	26	1	ELEC	120/277	28			
FF-1	FLUOR	F26TBX/ 830/A/ ECO	26	2	ELEC	120/277	56			
FF-2	FLUOR	F18TBX/ 830/A/ ECO	18	2	ELEC	120/277	40			
FF-3	FLUOR	F26TBX/ 830/A/ ECO	26	2	ELEC	120/277	56			
FG	FLUOR	PL-T 26W/ 830/4P	26	1	ELEC	120/277	26.4	1.00		
FG-1	FLUOR	PL-T 26W/ 830/4P	26	1	ELEC	120/277	23	1.00		
FH	FLUOR	F25, OR F32T8/830	25 OR 32	1	ELEC, PS	120/277	7/LF	0.88		
FH-1	FLUOR	F25, OR F32T8/830	25 OR 32	1	ELEC, PS	120/277	7/LF	0.88		
FK	INCAN	Q100T3/ 12V/CL	100	1	-	120/12	100	-		
FL	FLUOR	PL-T 26W/ 830/4P	26	1	ELEC, DIM	120/277	26.4	1.00		
FP	MH	CDM35/ TC/830	35	1	ELEC	120/277	45			
FQ	FLUOR	F26TBX/ 830/A/ ECO	26	3	ELEC, DIM			1.00		
FR	FLUOR	TL5C 22W/830	22	1	ELEC					
FT	FLUOR	PL-T 26W/ 830/4P	26	1	ELEC			1.00		
FX	FLUOR	(1)TL5C 22W/830, (1)TL5C 40W/830	22, 40	2	ELEC					
FY	LED	3000K 242LMS/ FT, 83 CRI		-	-	120	6/LF	-		
FZ	INCAN	Q10T3/CL	10	1	-	12	10	-		
FAA	-	-	-	-	-	-	-	-	-	-
FAB	INCAN	75PAR30	75	1	-	120/277	75	-		

		S/HAL/FL 25								
FAC	FLUOR	F17, F25, OR F32T8/830	17, 25, OR 32	1	ELEC, DIM	120/277	8/LF			
FAF	FLUOR	F32T8/830	32	1	ELEC, DIM	120/277	8/LF	1.00		
FAK	FLUOR	F17, F25, OR F32T8/830	17, 25, OR 32	1	ELEC, DIM	120/277	8/LF	1.00		
FEA	LED	3000K		-	-	120/277	20	-		
A1.1	FLUOR	40W FT	40	1	MAG TS	118				
A1.2	FLUOR	40W FT	40	2	MAG TS	118				
A2.1	FLUOR	40W FT	40	1	MAG TS	118				
A2.2	FLUOR	40W FT	40	2	MAG TS	118				
A2.4	FLUOR	40W FT	40	4	ELEC	118		1.00		
A3	FLUOR	32W T8	32	2	ELEC	118				
A4	FLUOR	32W T8	32	1						
A5	FLUOR	26W CFQ	26	2						
A6	FLUOR	32W T8	32	4						
A7	LED	LED		-			60			
A8	LED	LED		-			3			
A9a	FLUOR	32W T8	32	6	ELEC IS/RS	118				
A9b	FLUOR	40W FT	40	3	ELEC IS/RS	118				
A10	FLUOR	32W T8	32	2	ELEC			1.00		
A10.1	FLUOR	32W T8	32	1						
A11	FLUOR	32W T8	32	2						
A12	FLUOR	32W T8	32	1						
A13	FLUOR	26W CFQ	26	2						
A14	FLUOR	32W T8	32	6	ELEC			1.00		
A15	LED	LED		-						
A16	FLUOR	42W CFTR	42	1						
A17	LED	LED		-			3/LF			
A18	LED	LED		-			3/LF			
A19	LED	LED		-			9			
AX	LED	LED		-						

. Lighting Control .

. Mechanical and Other Loads .

. Service Entrance Size .

. Environmental Stewardship Design .

All new construction in Princeton University is expected to comply with LEED Silver Certification. They will comply with MR 5.1 and 5.2 Regional Materials, EA 6 Green Power, part

of EA 1 Optimized Energy Performance but not with EA 2 On-site Renewable Energy, EQ 8 Daylight and Views, and SS 8 Light Pollution Reduction.

The existing lighting controls includes dimmers, outdoor photoelectric switches, photoelectric sensors, indoor occupancy sensors, lighting contactors, and timeclocks all of which help reduce energy consumption. The emergency generator is on-site but the electricity for normal power comes from a utility company; it is not generated on-site.

. Design Issues .

Information from Deanna Schmidt, Senior Electrical Engineer from Arup:

Emergency power loads | In designing any system one must be cognizant of the loads and the size of the distribution, utility or generator to support those loads. At Neuroscience it was a program directive to provide generator power backup to the animal watering, feeding and bedding systems, as well as to the HVAC that serves those animal rooms. But what this did was consume a lot of the capacity of the generator. The University wanted to keep the generator size to 1500kW and so one design issue was determining what other than the above described would be carried by the generator. The most obvious example of this design issue is on sheet E3-003. UPS-N is not connected to the generator (see left side) but UPS-SB is connected (right side). This means the users will connect their most critical server room equipment to the panels fed from UPS-SB, while equipment connected to UPS-N will have battery backup but not generator backup.

Lighting Power/Energy Use | In pursuit of LEED Silver equivalent, design issues were encountered in being better than ASHRAE 90.1 Lighting Power Density/Energy Use values.

High Ceilings | The architectural design of Neuroscience focuses on high ceilings and skylights throughout the facility. We have modeled this facility using 3D CAD software. It became apparent during design that all of the building systems were not going to be able to route to the rooms they served as directly as would be preferred. In this way, the lengths of conductors were impacted which factors into, especially, the voltage drop calculation and therefore the size of the conductor(s).

. Single-line Diagram .

Drawing list:
E3-001 Single Line Diagram
E3-002 Single Line Diagram
E3-003 Single Line Diagram, Riser A
E3-004 Single Line Diagram, Riser B
E3-005 Single Line Diagram, Riser C