

technical report 2

angelica santana | lighting/electrical

princeton neuroscience and psychology complex, princeton, new jersey

Technical Report 2: Electrical Existing Condition and Building Load Summary Report

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▪ *Executive Summary* ▪

Technical Report 2 is a compilation and analysis of all the existing electrical systems within the Princeton Neuroscience & Psychology Complex. It explains how the distribution system works and breaks down all its components. It includes tables that address all the loads and switchgear within the building and at the end a single-line diagram ties everything together. The report begins with information from the utility company and then moves on to explain how the service entrance functions and how electricity is fed to all parts of the building.

. 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 with difference voltage systems. From here, power is distributed to the entire building through switchboards and distribution panels. There are approximately 65 pieces of switchgear equipment, 30 lighting panelboards, 65 receptacle panelboards, 25 transformers, 60 different luminaires, and 200 mechanical equipment (including plumbing and cafeteria equipment). Most of the lighting loads are part of the 480Y/277V system and the mechanical equipment is in the 208Y/120V system.

The emergency electricity is supplied by a generator on the exterior of the building that feeds three transfer switches and the fire pump. Special equipment includes Uninterrupted Power Supply and Transient Voltage Surge Suppressor systems. A very complex grounding system runs through the entire complex as well as a security and fire alarm system.

. 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>

Basic Generation Service – Fixed Pricing (LPL-Large Power and Lighting Service)

October through May

On-peak: \$ 0.115242

Off-peak: \$ 0.077759

June through September

On-peak: \$ 0.130465

Off-peak: \$ 0.081768

Transmission

\$ 2.0251 kW of transmission obligation, applicable in all months

. 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 with 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 a 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): The utility company provides electricity to the campus at a 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 Systems .

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 reduce the 480/277 voltage system to 208/120. There is also a buck-boost transformer fed from a receptacle panel that feeds a coffee brewer that is rated 240V single-phase.

. Emergency Power System .

Life safety loads are powered by the emergency generator when the normal power fails. 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 on 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 were to fail.

. Location of Switchgear .

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 switch	C/B	C05ELR	Electrical RM	E5-B01
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	Electrical RM	E5-B06
T-MRI	transformer	C/B	B10ELR	Electrical RM	E5-B06
T-BB	transformer	C/B	B10ELR	Electrical RM	E5-B06
SWBD-BB	switchboard	C/B	B10ELR	Electrical RM	E5-B06
T-SB-BC	transformer, T-6	C/B	B12ELR	Electrical RM	E5-B06

Tag	Type	Floor Level	Room Number	Electrical RM	Drawing Numbers
T-EAL	transformer, T-1	A	A05ELR	Electrical RM	E5-A02
T-EAA	transformer, T-1	A	A05ELR	Electrical RM	E5-A02
T-SB-BA	transformer, T-6	A	A05ELR	Electrical RM	E5-A02
9.75kVA BUCK-BOOST	transformer	A	A05ELR	Electrical RM	E5-A02
T-CABINET	transformer	A	A05A	UPS	E5-A02
T-SB-BA	transformer, T-8	A	A30ELR	Electrical RM	E5-A03
T-EAB	transformer, T-2	A	A30ELR	Electrical RM	E5-A03
T-EAC	transformer, T-1	A	A81ELR	Electrical RM	E5-A06
T-E2B	transformer, T-2	2	230ELR	Electrical RM	E5-203
T-E4A	transformer, T-1	4	230ELR	Electrical RM	E5-402
T-E2A	transformer, T-1	2	210ELR	Electrical RM	E5-202
DP-BB	distribution panel	C/B	C04ELR	Electrical RM	E5-B01
SB-DP-BBE	distribution panel	C/B	C05ELR	Electrical RM	E5-B01
DP-BBM	distribution panel	C/B	C04MEC	MEC	E5-B02
T-BB	transformer	C/B	B10ELR	Electrical RM	E5-B06
DP-LS-BC	distribution panel	C/B	B12ELR	Electrical RM	E5-B06
MDP-BC	distribution panel	C/B	B12ELR	Electrical RM	E5-B06
DP-BLC	distribution panel	C/B	B12ELR	Electrical RM	E5-B06
DP-SB-BA	distribution panel	A	A05ELR	Electrical RM	E5-A02
DP-LS-BA	distribution panel	A	A05ELR	Electrical RM	E5-A02
DP-AA	distribution panel	A	A05ELR	Electrical RM	E5-A02
DP-SB-AB	distribution panel	A	A30ELR	Electrical RM	E5-A03
DP-SB-1B	distribution panel	1	130ELR	Electrical RM	E5-103
DP-1B	distribution panel	1	130ELR	Electrical RM	E5-103, E5-104

Tag	Type	Floor Level	Room Number	Room Name	Drawing Numbers
DP -1C	distribution panel	1	181ELR	Electrical RM	E5-105, E5-106
DP-2B	distribution panel	2	230ELR	Electrical RM	E5-201, E5-203, E5-204
SB-DP-2C	distribution panel	2	280ELR	Electrical RM	E5-205, E5-206
DP-2C	distribution panel	2	280ELR	Electrical RM	E5-206
DP -AB	distribution panel	A	A30ELR	Electrical RM	E5-A03
SB-DP-3BM	distribution panel	3	Penthouse, roof	Penthouse, roof	E5-303
SB-DP-3BM1	distribution panel	3	Penthouse, roof	Penthouse, roof	E5-303
DP-3BM	distribution panel	3	Penthouse, roof	Penthouse, roof	E5-303
DP-AC	distribution panel	A	A81ELR	Electrical RM	E5-A06
SB-DP-AC	distribution panel	A	A81ELR	Electrical RM	E5-A06
SB-DP -1C	distribution panel	1	181ELR	Electrical RM	E5-106
DP-SB-BC	distribution panel	C/B	B12ELR	Electrical RM	E5-B06
DP-BCH	distribution panel	C/B	B12ELR	Electrical RM	E5-B06
SB-DP-BCM	distribution panel	C/B	B12ELR	Electrical RM	E5-B06
T-E2C	transformer, T-1	2	280ELR	Electrical RM	E5-206

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

Tag	Type	Floor Level	Room Number	Room Name	Drawing Numbers
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	100A MLO	C/B	C04ELR, Electrical RM	E5-B01
LP-BC	480Y/277V, 3P, 4W	125A 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	100A MLO	A	A05ELR	E5-A02
LP-AA	480Y/277V, 3P, 4W	100A MLO	A	A05ELR	E5-A02
LP-AB	480Y/277V, 3P, 4W	150A MLO	A	A30ELR	E5-A03
LPD-AB	480Y/277V, 3P, 4W	150A MLO	A	A30ELR	E5-A03
ELP-AC	480Y/277V, 3P, 4W	150A MCB	A	A81ELR	E5-A06
LP-AC	480Y/277V, 3P, 4W	100A MLO	A	A81ELR	E5-A06
LP-1A	480Y/277V, 3P, 4W	100A MLO	1	111ELR	E5-102
LP-1B	480Y/277V, 3P, 4W	150A MLO	1	130ELR	E5-103
LP-1C	480Y/277V, 3P, 4W	100A MLO	1	181ELR	E5-105, E5-106
ELP-2B	480Y/277V, 3P, 4W	60A MCB	2	230ELR	E5-201, E5-203
LP-2A	480Y/277V, 3P, 4W	100A MLO	2	210ELR	E5-202
ELP-2A	480Y/277V, 3P, 4W	100A MCB	2	210ELR	E5-202
LP-2B	480Y/277V, 3P, 4W	150A MLO	2	230ELR	E5-203
LP-2C	480Y/277V, 3P, 4W	100A MLO	2	281ELR	E5-205, E5-206
ELP-2C	480Y/277V, 3P, 4W	150A MCB	2	281ELR	E5-206
LP-3A	480Y/277V, 3P, 4W	100A MLO	3	312ELR	E5-302
LP-3B	480Y/277V, 3P, 4W	100A MLO	3	341VES	E5-304
LP-4A	480Y/277V, 3P, 4W	100A MLO	4	412ELR	E5-402
ELP-4A	480Y/277V, 3P, 4W	100A MCB	4	412ELR	E5-402

Tag	Voltage System	Main Size/Type	Floor Level	Room Name and Number	Drawing Numbers
LP-5A	480Y/277V, 3P, 4W	100A MLO	5	512ELR	E5-502
LPD-AAL	208Y/120V, 3P, 4W	50A MCB	A	A05ELR	E5-A02
ELPD-AAL	208Y/120V, 3P, 4W	50A MCB	A	A05ELR	E5-A02
LPD-1B	480Y/277V, 3P, 4W	150A MLO	A	130ELR	E5-103
LPD-2B	480Y/277V, 3P, 4W	150A 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	*	100A *	C/B	B10ELR	E5-B06
RP-BC2	*	100A *	C/B	B10ELR	E5-B06
RP-BC3	208Y/120V, 3P, 4W	100A MCB	C/B	B10ELR	E5-B06
RP-BC4	208Y/120V, 3P, 4W	200A 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	50A MCB	A	A05ELR	E5-A02
RP-AA	208Y/120V, 3P, 4W	200A MLO	A	A05ELR	E5-A02
RP-BA	208Y/120V, 3P, 4W	150A MLO	A	A05ELR	E5-A02

Tag	Voltage System	Main Size/Type	Floor Level	Room Name and Number	Drawing Numbers
RP-CA	208Y/120V, 3P, 4W	250A MCB	A	A05ELR	E5-A02
RP-DA	208Y/120V, 3P, 4W	150A MLO	A	A05ELR	E5-A02
RP-AB1	208Y/120V, 3P, 4W	150A MCB	A	A00COR	E5-A04
RP-AB2	208Y/120V, 3P, 4W	150A MCB	A	A64COR	E5-A03
RP-AB3	208Y/120V, 3P, 4W	225A MCB	A	A64COR	E5-A03
RP-AB4	208Y/120V, 3P, 4W	200A MCB	A	A30ELR	E5-A030
RP-AC1	208Y/120V, 3P, 4W	100A MCB	A	A64COR	E5-A03
RP-AC3	208Y/120V, 3P, 4W	225A MCB	A	A87COR	E5-A05
RP-AC4	208Y/120V, 3P, 4W	100A 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	100A MCB	A	A87COR	E5-A05
ERP-AC	208Y/120V, 3P, 4W	50A MCB	A	A81ELR	E5-A06
RP-AC8	208Y/120V, 3P, 4W	200A MCB	A	A81ELR	E5-A06
RP-1B4	208Y/120V, 3P, 4W	200A MCB	1	130ELR	E5-101, E5-103
RP-1A	208Y/120V, 3P, 4W	175A MLO	1	111ELR	E5-102
RP-1B2	208Y/120V, 3P, 4W	150A 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	100A MCB	1	187COR	E5-103
RP-1B1	208Y/120V, 3P, 4W	150A MCB	1	167VES	E5-104
RP-1C3	208Y/120V, 3P, 4W	225A MCB	1	187COR	E5-105
RP-1C4	208Y/120V, 3P, 4W	100A MCB	1	187COR	E5-105

Tag	Voltage System	Main Size/Type	Floor Level	Room Name and Number	Drawing Numbers
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	200A MCB	2	230ELR	E5-201, E5-203
RP-2A	208Y/120V, 3P, 4W	175A MLO	2	210ELR	E5-202
ERP-2A	208Y/120V, 3P, 4W	50A MCB	2	210ELR	E5-202
RP-2B2	208Y/120V, 3P, 4W	150A MCB	2	272COR	E5-203
RP-2B1	208Y/120V, 3P, 4W	60A MCB	2	272G, Operating Room	E5-203
RP-2B3	208Y/120V, 3P, 4W	150A MCB	2	264I, Anterm	E5-203
RP-2B5	208Y/120V, 3P, 4W	150A MCB	2	265I, Anterm	E5-203
ERP-2B	208Y/120V, 3P, 4W	100A MCB	2	230ELR	E5-203
RP-2C1	208Y/120V, 3P, 4W	100A MCB	2	266I, Anterm	E5-205
RP-2C2	208Y/120V, 3P, 4W	100A MCB	2	267G, Anterm	E5-205
RP-2C3	208Y/120V, 3P, 4W	100A MCB	2	284COR	E5-205
RP-2C4	208Y/120V, 3P, 4W	225A MCB	2	284COR	E5-205
RP-2C5	208Y/120V, 3P, 4W	200A MCB	2	280ELR	E5-206
ERP-2C	208Y/120V, 3P, 4W	100A MCB	2	280ELR	E5-206
RP-3A	208Y/120V, 3P, 4W	175A MLO	3	312ELR	E5-302
RP-3B	208Y/120V, 3P, 4W	150A MCB	3	341VES	E5-304
RP-3C	208Y/120V, 3P, 4W	150A MCB	3	Penthouse MER	E5-306
RP-4A	208Y/120V, 3P, 4W	175A MLO	4	412ELR	E5-402
ERP-4A	208Y/120V, 3P, 4W	100A MCB	4	412ELR	E5-402

Tag	Voltage System	Main Size/Type	Floor Level	Room Name and Number	Drawing Numbers
RP-5A	208Y/120V, 3P, 4W	175A MLO	5	512ELR	E5-502
ERP-GEN	208Y/120V, 3P, 4W	100A MCB	C/B		

*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: Both substations are protected with fuses from each side. The first double-ended substation is protected first with 30E fuses and then 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 50E fuses and 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 MCBs because they are fed from a distribution panel and some MLOs 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 applies for 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

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 voltage 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-EMERG	4160V, 3P, 3W	480Y/277V, 3P, 4W	1500	dry-type	80 deg C	(2)2.5%	Pad mounted on floor	With fan 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	

Tag	Primary Voltage	Secondary Voltage	Size (KVA)	Type	Temp. Rise	Taps	Mounting	Remarks
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 200,000 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 | The general lighting of the Neuroscience & Psychology Complex includes two different systems. One was done by Fisher Marantz Stone and covers all the public areas and spaces that will be visible from the outside. The other lighting system was design by Arup and it includes most laboratory space, classrooms, and offices.

The most common light source is fluorescent with the exception of some halogen downlights in important spaces, metal halide source in the light monitors, and certain LED highlights. Most of the laboratory spaces have linear fluorescent fixtures while most of the public spaces are illuminated with downlights. The most common fixture in the circulation spaces is the Louis Poulsen Cirkul fixtures in several sizes and mountings.

The public spaces have mostly uniform lighting with some emphasize on the perimeter wooden walls. All luminaires used have lamps with a CRI in the 80s and a CCT of 3000K. This warm color temperature is good to bring out the wooden tones and the 80 CRI is enough for good color rendering. The private spaces have mostly downlight. The exterior is lacking a lighting design with the exception on the fixtures in the canopy and vestibules.

Luminaire table | The following table includes all the luminaires in the Neuroscience & Psychology Complex beginning with those chose by FMS (tag begins with letter F) followed by the Arup chosen ones.

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	0.94	0.12	0.95
FA-1	FLUOR	F32T8/830	32	1	ELEC, DIM	120/277	8/LF	0.94	0.12	0.95
FA-2	FLUOR	F32T8/830	32	1	ELEC, DIM	120/277	8/LF	0.94	0.12	0.95
FC	LED	3000K HIGH CRI	1	-	-	24	7.2, 14.5	-	0.03	1.00
FD	FLUOR	F17, F25, OR F32T8/830	17, 25, OR 32	1	ELEC, PS	120/277	7/LF	0.88	0.11	0.98
FD-1	FLUOR	F17, F25, OR F32T8/830	17, 25, OR 32	1	ELEC, DIM	120/277	8/LF	0.94	0.12	0.98
FD-2	FLUOR	F17, F25, OR F32T8/830	17, 25, OR 32	1	ELEC, PS	120/277	7/LF	0.88	0.11	0.98
FE	FLUOR	(1)TL5C 22W/830, (1)TL5C 40W/830	22, 40	2	ELEC	120/277	66	1.11 0.96	0.11 0.14	0.93 0.95
FE-1	FLUOR	TL5C 40W/830	40	3	ELEC	120/277	126	0.84	0.35	0.95
FE-2	FLUOR	(1)TL5C 22W/830, (1)TL5C 40W/830	22, 40	2	ELEC	120/277	66	1.11 0.96	0.11 0.14	0.93 0.95
FF	FLUOR	F26TBX/ 830/A/ ECO	26	1	ELEC	120/277	29	1.10	0.11	0.98
FF-1	FLUOR	F26TBX/ 830/A/ ECO	26	2	ELEC	120/277	54	1.00	0.20	0.99
FF-2	FLUOR	F18TBX/ 830/A/ ECO	18	2	ELEC	120/277	40	1.05	0.26	0.97
FF-3	FLUOR	F26TBX/ 830/A/ ECO	26	2	ELEC	120/277	54	1.00	0.20	0.97
FG	FLUOR	PL-T 26W/ 830/4P	26	1	ELEC	120/277	27	1.00	0.10	0.98
FG-1	FLUOR	PL-T 26W/ 830/4P	26	1	ELEC	120/277	27	1.00	0.10	0.98
FH	FLUOR	F25, OR F32T8/830	25 OR 32	1	ELEC, PS	120/277	7/LF	0.88	0.11	0.98
FH-1	FLUOR	F25, OR F32T8/830	25 OR 32	1	ELEC, PS	120/277	7/LF	0.88	0.11	0.98
FK	INCAN	Q100T3/ 12V/CL	100	1	-	120/12	100	-	0.36	1.00
FL	FLUOR	PL-T 26W/ 830/4P	26	1	ELEC, DIM	120/277	26.4	1.00	0.10	0.98
FP	MH	39W T4 G8.5 MH	39	1	ELEC	120/277	45	1.00	0.16	0.95
FQ	FLUOR	F26TBX/ 830/A/ ECO	26	3	ELEC, DIM	120/277	79.2	1.00	0.30	0.95

Tag	Light Source	Lamp Type	Wattage /Lamp	# Lamps	Ballast Type	Input Voltage	Input Watts	Ballast Factor	Current (start/ operating)	Power Factor (start/ operating)
FR	FLUOR	TL5C 22W/830	22	1	ELEC			1.11	0.11	0.93
FT	FLUOR	PL-T 26W/ 830/4P	26	1	ELEC	120/277	27	1.00	0.10	0.98
FX	FLUOR	(1)TL5C 22W/830, (1)TL5C 40W/830	22, 40	2	ELEC	120/277	66	1.11 0.96	0.11 0.14	0.93 0.95
FY	LED	3000K 242LMS/ FT, 83 CRI	6	-	-	120	6/LF	-	0.03	0.99
FZ	INCAN	Q10T3/CL	10	1	-	12	10	-	-	1.00
FAA	-	-	-	-	-	-	-	-	-	-
FAB	INCAN	75PAR30 S/HAL/FL 25	75	1	-	120/277	75	-	-	1.00
FAC	FLUOR	F17, F25, OR F32T8/830	17, 25, OR 32	1	ELEC, DIM	120/277	8/LF	0.94	0.12	0.98
FAF	FLUOR	F32T8/830	32	1	ELEC, DIM	120/277	8/LF	1.00	0.12	0.98
FAK	FLUOR	F17, F25, OR F32T8/830	17, 25, OR 32	1	ELEC, DIM	120/277	8/LF	1.00	0.12	0.98
FEA	LED	3000K		-	-	120/277	20	-	-	1.00
A1.1	FLUOR	40W FT	40	1	MAG TS	118	35	0.85	0.53	0.90
A1.2	FLUOR	40W FT	40	2	MAG TS	118	72	0.85	1.10	0.90
A2.1	FLUOR	40W FT	40	1	MAG TS	118	35	0.85	0.53	0.90
A2.2	FLUOR	40W FT	40	2	MAG TS	118	72	0.85	1.10	0.90
A2.4	FLUOR	40W FT	40	4	ELEC	120	140	0.87	0.60	0.98
A3	FLUOR	32W T8	32	2	ELEC	120	55	0.88	0.47	0.98
A4	FLUOR	32W T8	32	1	ELEC	120	28	0.88	0.25	0.98
A5	FLUOR	26W CFQ	26	2	ELEC	120	51	1.00	0.43	0.99
A6	FLUOR	32W T8	32	4	ELEC	120	110	0.88	1.00	0.98
A7	LED	LED		-	-		60	-	-	1.00
A8	LED	LED		-	-		3	-	-	1.00
A9a	FLUOR	32W T8	32	6	ELEC IS/RS	120	221	1.18	1.94	0.99
A9b	FLUOR	40W FT	40	3	ELEC IS/RS	120	146	1.22	1.27	0.99
A10	FLUOR	32W T8	32	2	ELEC	120	55	0.88	0.47	0.98
A10.1	FLUOR	32W T8	32	1	ELEC	120	28	0.88	0.25	0.98
A11	FLUOR	32W T8	32	2	ELEC	120	55	0.88	0.47	0.98
A12	FLUOR	32W T8	32	1	ELEC	120	28	0.88	0.25	0.98
A13	FLUOR	26W CFQ	26	2	ELEC	120	51	1.00	0.43	0.99
A14	FLUOR	32W T8	32	6	ELEC			1.00	1.94	
A15	LED	LED		-	-			-	-	1.00
A16	FLUOR	42W CFTR	42	1	ELEC	120	46	0.98	0.38	0.98
A17	LED	LED	1	-	-		3/LF	-	0.03	1.00
A18	LED	LED	1	-	-		3/LF	-	0.03	1.00
A19	LED	LED	1	-	-		9	-	0.03	1.00
AX	LED	LED	1	-	-			-		1.00

. Lighting Controls .

ASHRAE 90.1 2007 requires spaces to have at least one control device to independently control the general lighting. Classrooms and conference rooms need a control device that will turn off the lighting automatically 30 minutes after the occupants leave. For the rest of the spaces, the control device needs to be either activated manually or automatically. Each can control up to 10,000 sq.ft. and be capable of overriding time scheduled controls for no more than 4 hours.

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. For example, in the main lecture hall, there will be one locally programmable wall station with timeclock capabilities. Three keypad controls with four preset scenes, off and lower/raise will be located at the entrances and at the lectern.

. Mechanical and Other Loads .

There are a total of nine air handling units that provide air conditioning to the entire complex with a total flow rate capacity of 137,000 cubic feet per minute (cfm). Seven are located in Level 3 (penthouse MER) and serve the following areas: south variable air volume (VAV) system, laboratories, Neuroscience building chilled beams, and north VAV system. The remaining two are located in level C/B (MER) serve the following areas: Psychology Building chilled beams, and Lecture Hall. The air handling units include a supply fan, preheat coil, cooling coil, heating coil, return fan, glycol hr (heat recovery) coil, humidifier, pre-filter, and a final filter.

Labs are required to have 100% outside air. The rest of the spaces have return air or heat recovery wheels. There are 25 fan coil units from International Environmental (IEC). Variable air volume boxes capacities range from 0-4500 cfm. Their sizes range from 5"-16" diameters and up to 24x16 rectangular areas. There are a total of four chilled beam types, three hot water cabinet/unit heaters, and 13 chillers. The mechanical system also includes three radiators with a total capacity of 1400 BTUH/LF.

Plumbing and Fire Protection Equipment											
Load Tag	Description	Magnitude	Units	NEC Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW	Qty.	Total Load in KW
CP-1	condensate pump	0.4	HP	9.8	120	1	0.75	1.176	0.882	1	0.882
CP-2	condensate pump	0.4	HP	9.8	120	1	0.75	1.176	0.882	1	0.882
CP-3	condensate pump	0.4	HP	9.8	120	1	0.75	1.176	0.882	1	0.882
WBP-1	booster pump	4	HP	7.6	480	3	0.75	6.318	4.739	2	9.4775
RW-1	CO3MEC	47.4	KVA	-	480	3	0.95	47.4	45.03	-	45.03
GWP-1 (RW-1)	water pump	15	HP	21	480	3	0.95	17.46	16.59	1	16.586
GWP-2 (RW-1)	water pump	15	HP	21	480	3	0.95	17.46	16.59	1	16.586
GWP-3 (RW-1)	water pump	0.08	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
RO-1	CO3MEC	28.5	KVA	40	480	3	0.95	28.5	27.08	-	27.075
RGWP-1 (RO-1)	water pump	7.5	HP	11	480	3	0.95	9.145	8.688	1	8.6877
RGWP-2 (RO-1)	water pump	7.5	HP	11	480	3	0.95	9.145	8.688	1	8.6877
SE-1	sewage ejector pump	5	HP	7.6	480	3	0.75	6.318	4.739	2	9.4775
SE-2	sewage ejector pump	1	HP	2.1	480	3	0.75	1.746	1.309	2	2.6188

Load Tag	Description	Magnitude	Units	NEC Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW	Qty.	Total Load in KW
SE-3	sewage ejector pump	1	HP	2.1	480	3	0.75	1.746	1.309	2	2.6188
SP-1	sump pump	2	HP	3.4	480	3	0.75	2.827	2.12	2	4.2399
SP-2	sump pump	0.5	HP	1.1	480	3	0.75	0.914	0.686	2	1.3717
SP-3	sump pump	0.3	HP	7.2	120	1	0.75	0.864	0.648	1	0.648
ESP-1	sump pump	0.5	HP	9.8	120	1	0.75	1.176	0.882	1	0.882
ESP-2	sump pump	0.5	HP	9.8	120	1	0.75	1.176	0.882	1	0.882
ESP-3	sump pump	0.5	HP	9.8	120	1	0.75	1.176	0.882	1	0.882
ESP-4	sump pump	0.5	HP	9.8	120	1	0.75	1.176	0.882	1	0.882
AC-1	air cond	15	HP	21	480	3	0.95	17.46	16.59	4	66.343
AD-1	CO3MEC	0.1	KW	-	120	3	-	-	0.1	1	0.1
VP-1	vacuum pump	10	HP	14	480	3	0.95	11.64	11.06	3	33.171
LWH-1	water heater	0.08	HP	4.4	120	3	0.75	0.914	0.686	1	0.6859
LWH-2	water heater	0.08	HP	4.4	120	3	0.75	0.914	0.686	1	0.6859
DWH-1	water heater	0.08	HP	4.4	120	3	0.75	0.914	0.686	1	0.6859
SHW-1	CO3MEC	0.08	HP	4.4	120	3	0.75	0.914	0.686	1	0.6859
AFWP-1	water pump	2	HP	3.4	480	3	0.75	2.827	2.12	2	4.2399
AFWP-2	water pump	2	HP	3.4	480	3	0.75	2.827	2.12	2	4.2399
Fire Pump	CO2MEC	75	HP	96	480	3	0.95	79.81	75.82	1	75.82
Jockey Pump	CO2MEC	2	HP	3.4	480	3	0.75	2.827	2.12	1	2.12
Total Load											348.45

Mechanical Equipment											
Load Tag	Description	Magnitude	Units	NEC Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW	Qty.	Total Load in KW
FCU-1	fan coil unit	0.17	HP	4.4	120	1	0.75	0.528	0.396	4	1.584
FCU-2	fan coil unit	0.2	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
FCU-3	fan coil unit	0.4	HP	9.8	120	1	0.75	1.176	0.882	1	0.882
FCU-4	fan coil unit	0.33	HP	7.2	120	1	0.75	0.864	0.648	1	0.648
FCU-5	fan coil unit	0.17	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-6	fan coil unit	0.5	HP	9.8	120	1	0.75	1.176	0.882	1	0.882
FCU-7	fan coil unit	0.33	HP	7.2	120	1	0.75	0.864	0.648	1	0.648
FCU-8	fan coil unit	0.08	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-9	fan coil unit	0.17	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-10	fan coil unit	0.08	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-11	fan coil unit	0.08	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-12	fan coil unit	0.03	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-13	fan coil unit	0.08	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-14	fan coil unit	0.08	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-15	fan coil unit	0.03	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-16	fan coil unit	0.03	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-17	fan coil unit	0.08	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-18	fan coil unit	0.08	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-19	fan coil unit	0.03	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-20	fan coil unit	0.03	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-21	fan coil unit	0.17	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-22	fan coil unit	0.08	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-23	fan coil unit	0.2	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
FCU-24	fan coil unit	0.75	HP	13.8	120	1	0.75	1.656	1.242	1	1.242

Load Tag	Description	Magnitude	Units	NEC Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW	Qty.	Total Load in KW
FCU-25	fan coil unit	0.75	HP	13.8	120	1	0.75	1.656	1.242	1	1.242
SF-1	supply fan	0.33	HP	7.2	120	1	0.75	0.864	0.648	1	0.648
SF-2	supply fan	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
SF-3	supply fan	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
SF-4	supply fan	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
SF-5	supply fan	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
SF-6	supply fan	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
SF-7	supply fan	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
SF-8	supply fan	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
SF-9	supply fan	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
CUH-1	cabinet unit heater	0.1	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
EPF-4	PENT MER ROOF	7.5	HP	11	480	3	0.95	9.134	8.678	1	8.6777
EMRF-1	return fan	0.07	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
EMRF-2	return fan	0.03	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
EMRF-3	return fan	0.03	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
EMRF-4	return fan	0.03	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
PU-1	MEC MEZZ	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929
PU-2	MEC MEZZ	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929
SAC-1	air cond server	7.5	HP	24.2	208	3	0.95	8.718	8.282	2	16.565
SAC-2	air cond server	7.5	HP	24.2	208	3	0.95	8.718	8.282	2	16.565
SAC-3	air cond server	7.5	HP	24.2	208	3	0.95	8.718	8.282	2	16.565
SAC-4	air cond server	0.3	KVA	-	120	1	0.75	0.3	0.225	1	0.225
SAC-5	air cond server	0.3	KVA	-	120	1	0.75	0.3	0.225	1	0.225
SAC-6	air cond server	0.3	KVA	-	120	1	0.75	0.3	0.225	1	0.225
SAC-7	air cond server	0.3	KVA	-	120	1	0.75	0.3	0.225	1	0.225
SAC-8	air cond server	0.3	KVA	-	120	1	0.75	0.3	0.225	1	0.225
SAC-9	air cond server	0.3	KVA	-	120	1	0.75	0.3	0.225	1	0.225
SAC-10	air cond server	0.3	KVA	-	120	1	0.75	0.3	0.225	1	0.225
SAC-11	air cond server	0.3	KVA	-	120	1	0.75	0.3	0.225	1	0.225
SAC-12	air cond server	0.3	KVA	-	120	1	0.75	0.3	0.225	1	0.225
SAC-13	air cond server	0.3	KVA	-	120	1	0.75	0.3	0.225	1	0.225

Load Tag	Description	Magnitude	Units	NEC Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW	Qty.	Total Load in KW
SAC-14	air cond server	0.3	KVA	-	120	1	0.75	0.3	0.225	1	0.225
UAC-1	air cond ups rm	1.5	HP	3	480	3	0.75	2.491	1.868	1	1.8684
UAC-2	air cond ups rm	1.5	HP	3	480	3	0.75	2.491	1.868	1	1.8684
AHU-1	air handling unit	5	HP	7.6	480	3	0.75	6.311	4.733	2	9.4666
AHU-2	air handling unit	7.5	HP	11	480	3	0.95	9.134	8.678	9	78.099
AHU-3	air handling unit	7.5	HP	11	480	3	0.95	9.134	8.678	9	78.099
AHU-4	air handling unit	7.5	HP	11	480	3	0.95	9.134	8.678	9	78.099
AHU-5	air handling unit	7.5	HP	11	480	3	0.95	9.134	8.678	9	78.099
AHU-6	air handling unit	7.5	HP	11	480	3	0.95	9.134	8.678	6	52.066
AHU-7	air handling unit	5	HP	7.6	480	3	0.75	6.311	4.733	8	37.866
AHU-8	air handling unit	7.5	HP	11	480	3	0.95	9.134	8.678	8	69.421
AHU-9	air handling unit	7.5	HP	11	480	3	0.95	9.134	8.678	1	8.6777
RF-1	return fan	10	HP	14	480	3	0.95	11.63	11.04	1	11.044
HV-1	heating unit	3	HP	4.8	480	3	0.75	3.986	2.989	1	2.9894
HWP-1	hot water pump	1.5	HP	3	480	3	0.75	2.491	1.868	1	1.8684
HWP-2	hot water pump	1.5	HP	3	480	3	0.75	2.491	1.868	1	1.8684
HWP-3	hot water pump	5	HP	7.6	480	3	0.75	6.311	4.733	1	4.7333
HWP-4	hot water pump	5	HP	7.6	480	3	0.75	6.311	4.733	1	4.7333
SCP-3	ciculating pump	7.5	HP	11	480	3	0.95	9.134	8.678	2	17.355
SCP-2	ciculating pump	0.75	HP	1.6	480	3	0.75	1.329	0.996	2	1.993
SCP-1	ciculating pump	1	HP	2.1	480	3	0.75	1.744	1.308	2	2.6158
CHWP-1	chilled water pump	15	HP	21	480	3	0.95	17.44	16.57	1	16.566

Load Tag	Description	Magnitude	Units	NEC Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW	Qty.	Total Load in KW
CHWP-2	chilled water pump	15	HP	21	480	3	0.95	17.44	16.57	1	16.566
SCHWP-1	chilled water pump	15	HP	21	480	3	0.95	17.44	16.57	1	16.566
SCHWP-2	chilled water pump	15	HP	21	480	3	0.95	17.44	16.57	1	16.566
PCHWP-1	chilled water pump	10	HP	14	480	3	0.95	11.63	11.04	1	11.044
PCHWP-2	chilled water pump	10	HP	14	480	3	0.95	11.63	11.04	1	11.044
LEX-1	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3
LEX-2	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3
LEX-3	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3
LEX-9	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3
LEX-8	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3
LEX-7	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3
LEX-6	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3
LEX-5	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3
LEX-4	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3
HDX-1	heat exchanger pump	25	HP	34	480	3	0.95	28.23	26.82	1	26.822
HDX-2	heat exchanger pump	25	HP	34	480	3	0.95	28.23	26.82	1	26.822
HDX-3	heat exchanger pump	25	HP	34	480	3	0.95	28.23	26.82	1	26.822
HDX-4	heat exchanger pump	25	HP	34	480	3	0.95	28.23	26.82	1	26.822
HRCP-1	heating return circulation pump	10	HP	14	480	3	0.95	11.63	11.04	1	11.044
HRCP-2	heating return circulation pump	10	HP	14	480	3	0.95	11.63	11.04	1	11.044
CH-1	chiller	415.7	KVA	-	480	3	0.95	415.7	394.9	1	394.92
CH-1	chiller	145.5	KVA	-	480	3	0.95	145.5	138.2	1	138.23
EF-1	exhaust	0.17	HP	4.4	120	1	0.75	0.528	0.396	1	0.396
EF-2	exhaust	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929

Load Tag	Description	Magnitude	Units	NEC Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW	Qty.	Total Load in KW
EF-3	exhaust	0.33	HP	7.2	120	1	0.75	0.864	0.648	1	0.648
EF-4	exhaust	1.5	HP	3	480	3	0.75	2.494	1.871	1	1.8706
EF-5	exhaust	0.33	HP	7.2	120	1	0.75	0.864	0.648	1	0.648
EF-6	exhaust	0.75	HP	13.8	120	1	0.75	1.656	1.242	1	1.242
EF-7	exhaust	0.75	HP	13.8	120	1	0.75	1.656	1.242	1	1.242
EF-8	exhaust	0.75	HP	13.8	120	1	0.75	1.656	1.242	1	1.242
EF-9	exhaust	10	HP	14	480	3	0.95	11.64	11.06	1	11.057
EF-10	exhaust	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929
EF-11	exhaust	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929
EF-12	exhaust	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
EF-13	exhaust	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
EF-14	exhaust	0.5	HP	9.8	120	1	0.75	1.176	0.882	1	0.882
EF-15	exhaust	1.5	HP	3	480	3	0.75	2.494	1.871	1	1.8706
EF-16	exhaust	0.33	HP	1.6	480	3	0.75	1.33	0.998	1	0.9976
EF-17	exhaust	1	HP	2.1	480	3	0.75	1.746	1.309	1	1.3094
EF-18	exhaust	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
EF-19	exhaust	0.5	HP	9.8	120	1	0.75	1.176	0.882	1	0.882
EF-20	exhaust	1	HP	2.1	480	3	0.75	1.746	1.309	1	1.3094
EF-21	exhaust	7.5	HP	11	480	3	0.95	9.145	8.688	1	8.6877
EF-22	exhaust	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929
EF-23	exhaust	0.5	HP	9.8	208	1	0.75	2.038	1.529	1	1.5288
EF-24	exhaust	0.33	HP	7.2	120	1	0.75	0.864	0.648	1	0.648
EF-25	exhaust	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
EF-26	exhaust	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
EF-27	exhaust	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
EF-28	exhaust	0.33	HP	7.2	120	1	0.75	0.864	0.648	1	0.648
EF-29	exhaust	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
EF-30	exhaust	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
EF-31	exhaust	0.25	HP	5.8	120	1	0.75	0.696	0.522	1	0.522
HAC-1	air cond	3	HP	4.8	480	3	0.75	3.991	2.993	3	8.9787
HRM-1	AHU-6	30	HP	40	480	3	0.95	33.25	31.59	1	31.592
HRM-2	AHU-6	40	HP	52	480	3	0.95	43.23	41.07	1	41.069
HRM-3	AHU-9	5	HP	7.6	480	3	0.75	6.318	4.739	1	4.7388
GLY-1	LEVEL 3 MER	0.33	HP	7.2	120	1	0.75	0.864	0.648	1	0.648
CA-1	C03MER	7.5	HP	11	480	3	0.95	9.145	8.688	2	17.375
CA-1	Air Dryer			-	120	1				1	
EPF-1	LVL5 PENT ROOF	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929
EPF-2	LVL3 ROOF	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929

Load Tag	Description	Magnitude	Units	NEC Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW	Qty.	Total Load in KW
EPF-3	LVL6 BLKHD ROOF	10	HP	14	480	3	0.95	11.64	11.06	1	11.057
SPF-1	TOP STR 7	2	HP	3.4	480	3	0.75	2.827	2.12	1	2.12
SPF-2	LVL6 BLKHD ROOF	2	HP	3.4	480	3	0.75	2.827	2.12	1	2.12
FPP-1	freeze protection pump	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929
FPP-2	freeze protection pump	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929
FPP-3	freeze protection pump	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929
FPP-4	freeze protection pump	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929
FPP-5	freeze protection pump	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929
FPP-6	freeze protection pump	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929
FPP-7	freeze protection pump	3	HP	4.8	480	3	0.75	3.991	2.993	1	2.9929
Total Load											1773.8

Cafeteria Equipment											
Load Tag	Description	Magnitude	Units	NEC Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW	Qty.	Total Load in KW
C-02	Refrigerator	8.5	Amps	-	115	1	0.75	0.978	0.733	1	0.7331
C-07	Display Case	7.3	Amps	-	115	1	0.75	0.84	0.63	2	1.2593
C-10	Heated Shelf	6.1	Amps	-	115	1	0.75	0.702	0.526	1	0.5261
C-11	Lights and Warmers	0.65	Amps	-	115	1	0.75	0.075	0.056	1	0.0561
C-12	Food Warmers	6.9	Amps	-	115	1	0.75	0.794	0.595	2	1.1903
C-14	Reach-in Freezers	13	Amps	-	115	1	0.75	1.495	1.121	1	1.1213
C-15	Vert. Air Curtains	12	Amps	-	208	1	0.75	2.496	1.872	2	3.744
C-16	Microwave	15.3	Amps	-	208	1	0.75	3.182	2.387	1	2.3868
C-17	Bagel Toaster	9.2	Amps	-	208	1	0.75	1.914	1.435	1	1.4352
C-18	Cash Register			-	115	1				1	
C-19	Coffee Machine	23.1	Amps	-	208	1	0.75	4.805	3.604	1	3.6036
C-20	Coffee Brewer	25.8	Amps	-	208	1	0.75	5.366	4.025	1	4.0248
C-21	Beverage Machine			-	115	1	0.75			1	
Total Load											20.08046

Architectural Equipment											
Load Tag	Description	Magnitude	Units	NEC Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW	Qty.	Total Load in KW
ELEV 1	elevator	30	HP	40	480	3	0.95	33.25	31.59	1	31.592
ELEV 2	elevator	30	HP	40	480	3	0.95	33.25	31.59	1	31.592
ELEV 3	elevator	30	HP	40	480	3	0.95	33.25	31.59	1	31.592
ELEV 4	elevator	30	HP	40	480	3	0.95	33.25	31.59	1	31.592
ELEV 5	elevator	30	HP	40	480	3	0.95	33.25	31.59	1	31.592
ELEV 6	elevator	30	HP	40	480	3	0.95	33.25	31.59	1	31.592
Total Load											189.5501

. Service Entrance Size .

The service entrance size can be calculated several ways depending on the construction phase the project is on. Following are the calculations done for the Conceptual/Schematic, Design Development, and Working Drawings Phases.

Step 1 – Conceptual/Schematic Phases – Load per Square Foot

Building Type: College Building - Lab = 30VA/sq.ft.

Square footage of Princeton Neuroscience & Psychology Complex = 248,000 sq.ft.

Total Conceptual Loading = 7,440,000VA = **7,440 KVA**

Step 2 – Design Development – NEC Loading

Lighting | NEC Table 220.12 General Lighting Loads by Occupancy

Type of Occupancy: Schools -> Unit Load = 3VA/sq.ft.

3VA/sq.ft. x 248,000 *1.25 = 930,000VA = **930 KVA**

NEC Table 220.42 Lighting Load Demand Factors

Type of Occupancy: All Others -> Demand Factor = 100%

930KVA x 100% = **930 KVA**

Receptacles | 1VA/sq.ft. x 248,000sq.ft. = 248,000VA

NEC Table 220.44 Demand Factor for Receptacles

10KVA x 100% + 238KVA x 50% = **129 KVA**

Mechanical, Plumbing, and Other | Table 2 – Demand Loading Information

HVAC Equipment: Electric Heating = 15VA/sq.ft.

15VA/sq.ft. x 248,000 sq.ft. = 3,720,000VA = **3,720 KVA**

HVAC Equipment: Cooling = 8VA/sq.ft.

8VA/sq.ft. x 248,000 sq.ft. = 1,984,000VA = **1,984 KVA**

Kitchen Equipment: 600sq.ft. x 20VA/sq.ft. = 12000VA = **12 KVA**

Architectural: 6 Elevators: 6 x 50kw = **300 KVA**

Total NEC Loading = **8005 KVA**

Step 3 – Working Drawings – Actual Loading

Lighting Loads:

Lighting Panel Tags	Ampacity of Feeder	Voltage	VA	65% VA	KVA
LP-BB	100	480	83136	54038.4	54.0384
LP-BC	125	480	103920	67548	67.548
ELP-AB	225	480	187056	121586.4	121.5864
ELP-AA	100	480	83136	54038.4	54.0384
LP-AA	100	480	83136	54038.4	54.0384
LP-AB	150	480	124704	81057.6	81.0576
LPD-AB	150	480	124704	81057.6	81.0576

Lighting Panel Tags	Ampacity of Feeder	Voltage	VA	65% VA	KVA
ELP-AC	150	480	124704	81057.6	81.0576
LP-AC	100	480	83136	54038.4	54.0384
LP-1A	100	480	83136	54038.4	54.0384
LP-1B	150	480	124704	81057.6	81.0576
LP-1C	100	480	83136	54038.4	54.0384
ELP-2B	60	480	49881.6	32423.04	32.42304
LP-2A	100	480	83136	54038.4	54.0384
ELP-2A	100	480	83136	54038.4	54.0384
LP-2B	150	480	124704	81057.6	81.0576
LP-2C	100	480	83136	54038.4	54.0384
ELP-2C	150	480	124704	81057.6	81.0576
LP-3A	100	480	83136	54038.4	54.0384
LP-3B	100	480	83136	54038.4	54.0384
LP-4A	100	480	83136	54038.4	54.0384
ELP-4A	100	480	83136	54038.4	54.0384
LP-5A	100	480	83136	54038.4	54.0384
LPD-AAL	50	208	18012.8	11708.32	11.70832
ELPD-AAL	50	208	18012.8	11708.32	11.70832
LPD-1B	150	480	124704	81057.6	81.0576
LPD-2B	150	480	124704	81057.6	81.0576
Total Load					1649.972

Receptacle Loads:

Receptacle Panel Tags	Ampacity of Feeder	Voltage	VA	65% VA	KVA
RP-BB3	225	208	81057.6	52687.44	52.68744
RP-UA1	225	208	81057.6	52687.44	52.68744
RP-UA2	225	208	81057.6	52687.44	52.68744
RP-BB1	225	208	81057.6	52687.44	52.68744
RP-BB2	225	208	81057.6	52687.44	52.68744
RP-UA4	225	208	81057.6	52687.44	52.68744
RP-UA3	225	208	81057.6	52687.44	52.68744
RP-BC1	100	208	36025.6	23416.64	23.41664
RP-BC2	100	208	36025.6	23416.64	23.41664
RP-BC3	100	208	36025.6	23416.64	23.41664
RP-BC4	200	208	72051.2	46833.28	46.83328
RP-AB5	225	208	81057.6	52687.44	52.68744
ERP-AB	100	208	36025.6	23416.64	23.41664

Receptacle Panel Tags	Ampacity of Feeder	Voltage	VA	65% VA	KVA
ERP-AA	50	208	18012.8	11708.32	11.70832
RP-AA	200	208	72051.2	46833.28	46.83328
RP-BA	150	208	54038.4	35124.96	35.12496
RP-CA	250	208	90064	58541.6	58.5416
RP-DA	150	208	54038.4	35124.96	35.12496
RP-AB1	150	208	54038.4	35124.96	35.12496
RP-AB2	150	208	54038.4	35124.96	35.12496
RP-AB3	225	208	81057.6	52687.44	52.68744
RP-AB4	200	208	72051.2	46833.28	46.83328
RP-AC1	100	208	36025.6	23416.64	23.41664
RP-AC3	225	208	81057.6	52687.44	52.68744
RP-AC4	100	208	36025.6	23416.64	23.41664
RP-AC5	225	208	81057.6	52687.44	52.68744
RP-AC6	225	208	81057.6	52687.44	52.68744
RP-AC7	100	208	36025.6	23416.64	23.41664
ERP-AC	50	208	18012.8	11708.32	11.70832
RP-AC8	200	208	72051.2	46833.28	46.83328
RP-1B4	200	208	72051.2	46833.28	46.83328
RP-1A	175	208	63044.8	40979.12	40.97912
RP-1B2	150	208	54038.4	35124.96	35.12496
RP-1B3	225	208	81057.6	52687.44	52.68744
RP-1C2	225	208	81057.6	52687.44	52.68744
RP-1C1	100	208	36025.6	23416.64	23.41664
RP-1B1	150	208	54038.4	35124.96	35.12496
RP-1C3	225	208	81057.6	52687.44	52.68744
RP-1C4	100	208	36025.6	23416.64	23.41664
RP-1C5	225	208	81057.6	52687.44	52.68744
RP-1C6	225	208	81057.6	52687.44	52.68744
RP-1C7	100	208	36025.6	23416.64	23.41664
RP-1C8	225	208	81057.6	52687.44	52.68744
RP-2B4	200	208	72051.2	46833.28	46.83328
RP-2A	175	208	63044.8	40979.12	40.97912
ERP-2A	50	208	18012.8	11708.32	11.70832
RP-2B2	150	208	54038.4	35124.96	35.12496
RP-2B1	60	208	21615.36	14049.98	14.04998
RP-2B3	150	208	54038.4	35124.96	35.12496
RP-2B5	150	208	54038.4	35124.96	35.12496
ERP-2B	100	208	36025.6	23416.64	23.41664
RP-2C1	100	208	36025.6	23416.64	23.41664
RP-2C2	100	208	36025.6	23416.64	23.41664

Receptacle Panel Tags	Ampacity of Feeder	Voltage	VA	65% VA	KVA
RP-2C3	100	208	36025.6	23416.64	23.41664
RP-2C4	225	208	81057.6	52687.44	52.68744
RP-2C5	200	208	72051.2	46833.28	46.83328
ERP-2C	100	208	36025.6	23416.64	23.41664
RP-3A	175	208	63044.8	40979.12	40.97912
RP-3B	150	208	54038.4	35124.96	35.12496
RP-3C	150	208	54038.4	35124.96	35.12496
RP-4A	175	208	63044.8	40979.12	40.97912
ERP-4A	100	208	36025.6	23416.64	23.41664
RP-5A	175	208	63044.8	40979.12	40.97912
ERP-GEN	100	208	36025.6	23416.64	23.41664
Total Load					2425.964

Mechanical Loads:

Plumbing and Fire Protection Equipment (from above) = 348.45 KVA

Mechanical Equipment = 1773.8 KVA

Cafeteria Equipment = 20.08 KVA

Architectural Equipment = 189.55 KVA

Total Actual Loading = 349 + 1774 + 20 + 190 + 1650 + 2426 = 6409KVA x 1.25 (spare capacity)
 = 8011.25 KVA

Step 4 – Summary Tables

Phase	Load - kVA	Voltage System	Load - Amps
Conceptual/Schematic Design	7440	480Y/277V and 208Y/120V	26,859
Design Development	8005	480Y/277V and 208Y/120V	28,899
Working Drawings	8011	480Y/277V and 208Y/120V	28,921

Service Entrance	Size - Amps	Voltage System	Capacity - KVA
Actual Conditions – Service Entrance 1	4000	480Y/277V 3P, 4W	3,324
Actual Conditions – Service Entrance 2	5000	208Y/120V 3P, 4W	1,800
Total Actual Conditions – All Services	-	-	5,124
Summary - VA/Sq.Ft.	20.67	-	-

. 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 at 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).

. Communication Systems .

Fire Alarm System | To ensure the safety of all the occupants of the complex, a fire alarm alerts the occupants and the fire department in case of an emergency. The fire system includes manual fire alarm pull stations, bells, horns, wall and ceiling-mounted speakers, visual strobe lights, heat detectors, smoke detectors, flow and tamper switches, break glass stations, telephone jack for use by fire department, monitor/control modules, combination magnetic door holders and smoke detectors furnished with door hardware, control panels, and smoke detectors.

Security System | Because of all the special laboratory equipment located in this building for experimentation and research, an intricate security system is required to protect all of it. The security system includes access controls, door contacts, electrical locks, transfer hinges, intercoms, CCTV monitors, and network video recorders. All the parts of the system stem out from the Security Room (B08) and get distributed though all floors up to level 4.

Single-line Diagram

FEEDER SCHEDULE																	
TAG	FROM	TO	NO. OF SETS	CONDUIT (PER SET)		CONDUCTORS (PER SET)									SIZE OF OVERCURRENT PROTECTION	FRAME OR SWITCH SIZE	REMARKS
				SIZE	TYPE	PHASE CONDUCTORS			NEUTRAL CONDUCTORS			GROUND CONDUCTORS					
						No.	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE			
1	PU DIST.	SERVICE ENTRY TAP BOX	2	5"	EMT	3	750MCM	CU XHHW	0	-	-	1	1/0	CU XHHW	-	-	BY UTILITY
2	SERVICE ENTRY TAP BOX	MSWGR	4	4"	EMT	3	500MCM	CU XHHW	0	-	-	0	-	-	-	-	
3	SWBD-EMERG	ATS-SB2	1	4"	EMT	4	500MCM	CU XHHW	0	-	-	1	1/0	CU XHHW	1600A	1600A/3P	P420D
4	ATS-LS	SWBD-LS	1	4"	EMT	4	500MCM	CU XHHW	0	-	-	1	1/0	CU XHHW	400A	400A/4P	P380D
5	ATS-SB2	SWBD-SB2	4	4"	EMT	4	500MCM	CU XHHW	0	-	-	1	1/0	CU XHHW	1600A	1600A/4P	P420D
6	SWBD-LS	DP-LS-BA	1	3 1/2"	EMT	4	250MCM	CU XHHW	0	-	-	1	2	CU XHHW	250A	250A/3P	P255D
7	SWBD-SB-ELEV	ELEV 1	1	2"	EMT	3	1/0	CU XHHW	0	-	-	1	6	CU XHHW	125A	150A/3P	P150B
8	SWBD-SB-ELEV	ELEV 4	1	2 1/2"	EMT	3	4/0	CU XHHW	0	-	-	1	2	CU XHHW	200A	200A/3P	P230B
9	SWBD-SB-ELEV	ELEV 2	1	3"	EMT	3	300MCM	CU XHHW	0	-	-	1	2	CU XHHW	125A	150A/3P	P285B
10	SWBD-SB2	SB-DP-BCM	1	2"	EMT	4	1/0	CU XHHW	0	-	-	1	6	CU XHHW	100A	225A/3P	P150D
11	A2 BUSWAY	RP-5A	1	2 1/2"	EMT	4	4/0	CU XHHW	0	-	-	1	2	CU XHHW	175A	225A/3P	P230D
12	A2 BUSWAY	RP-4A	1	2 1/2"	EMT	4	4/0	CU XHHW	0	-	-	1	2	CU XHHW	175A	225A/3P	P230D
13	A2 BUSWAY	RP-3A	1	2 1/2"	EMT	4	4/0	CU XHHW	0	-	-	1	2	CU XHHW	175A	225A/3P	P230D
14	A2 BUSWAY	RP-2A	1	2 1/2"	EMT	4	4/0	CU XHHW	0	-	-	1	2	CU XHHW	175A	225A/3P	P230D
15	A2 BUSWAY	RP-1A	1	2 1/2"	EMT	4	3/0	CU XHHW	0	-	-	1	2	CU XHHW	150A	225A/3P	P200D
16	A1 BUSWAY	LP-5A	1	1 1/2"	EMT	4	2	CU XHHW	0	-	-	1	6	CU XHHW	100A	100A/3P	P95D
17	A1 BUSWAY	LP-4A	1	1 1/2"	EMT	4	2	CU XHHW	0	-	-	1	6	CU XHHW	100A	100A/3P	P95D
18	A1 BUSWAY	LP-3A	1	1 1/2"	EMT	4	2	CU XHHW	0	-	-	1	6	CU XHHW	100A	100A/3P	P95D
19	A1 BUSWAY	LP-2A	1	1 1/2"	EMT	4	2	CU XHHW	0	-	-	1	6	CU XHHW	100A	100A/3P	P95D
20	A1 BUSWAY	LP-1A	1	1 1/2"	EMT	4	2	CU XHHW	0	-	-	1	6	CU XHHW	100A	100A/3P	P95D
21	A1 BUSWAY	LP-AA	1	1 1/2"	EMT	4	2	CU XHHW	0	-	-	1	6	CU XHHW	100A	100A/3P	P95D
22	DP-LS-BA	ELP-4A	1	2"	EMT	4	1/0	CU XHHW	0	-	-	1	6	CU XHHW	100A	250A/3P	P150D
23	DP-LS-BA	ELP-2A	1	2"	EMT	4	1	CU XHHW	0	-	-	1	6	CU XHHW	100A	225A/3P	P110D
24	DP-LS-BA	ELP-AA	1	2"	EMT	4	1	CU XHHW	0	-	-	1	6	CU XHHW	100A	225A/3P	P110D
25	C4 BUSWAY	DP-2C	2	3 1/2"	EMT	4	350MCM	CU XHHW	0	-	-	1	2	CU XHHW	600A	600A/3P	P310D

FEEDER SCHEDULE																	
TAG	FROM	TO	NO. OF SETS	CONDUIT (PER SET)		CONDUCTORS (PER SET)									SIZE OF OVERCURRENT PROTECTION	FRAME OR SWITCH SIZE	REMARKS
						PHASE CONDUCTORS			NEUTRAL CONDUCTORS			GROUND CONDUCTORS					
				SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE			
26	C4 BUSWAY	DP-1C	2	3 1/2"	EMT	4	350MCM	CU XHHW	0	-	-	1	2	CU XHHW	600A	600A/3P	P310D
27	C4 BUSWAY	DP-AC	2	3 1/2"	EMT	4	350MCM	CU XHHW	0	-	-	1	2	CU XHHW	600A	600A/3P	P310D
28	DP-2C	RP-3C	1	2 1/2"	EMT	4	3/0	CU XHHW	0	-	-	1	2	CU XHHW	150A	250A/3P	P200D
29	DP-2C	RP-2C5	1	2 1/2"	EMT	4	3/0	CU XHHW	0	-	-	1	2	CU XHHW	200A	250A/3P	P200D
30	DP-1C	RP-1C8	1	2 1/2"	EMT	4	3/0	CU XHHW	0	-	-	1	2	CU XHHW	225A	250A/3P	P200D
31	DP-AC	RP-AC8	1	2 1/2"	EMT	4	3/0	CU XHHW	0	-	-	1	2	CU XHHW	200A	250A/3P	P200D
32	C1 BUSWAY	LP-AC	1	2"	EMT	4	1	CU XHHW	0	-	-	1	6	CU XHHW	100A	100A/3P	P110D
33	C1 BUSWAY	LP-1C	1	2"	EMT	4	1	CU XHHW	0	-	-	1	6	CU XHHW	100A	100A/3P	P110D
34	C1 BUSWAY	LP-2C	1	2"	EMT	4	1	CU XHHW	0	-	-	1	6	CU XHHW	100A	100A/3P	P110D
35	C1 BUSWAY	AP-2C	1	2"	EMT	4	1	CU XHHW	0	-	-	1	6	CU XHHW	100A	225A/3P	P110D
36	DP-LS-BC	ELP-AC	1	2 1/2"	EMT	4	4/0	CU XHHW	0	-	-	1	2	CU XHHW	150A	225A/3P	P230D
37	DP-LS-BC	ELP-2C	1	2 1/2"	EMT	4	4/0	CU XHHW	0	-	-	1	2	CU XHHW	150A	225A/3P	P230D
38	SB-DP-2C	SB-2C3	1	1 1/2"	EMT	4	2	CU XHHW	0	-	-	1	6	CU XHHW	100A	250A/3P	P95D
39	SB-DP-2C	SB-2C1	1	1 1/2"	EMT	4	2	CU XHHW	0	-	-	1	6	CU XHHW	100A	250A/3P	P95D
40	SB-DP-2C	SB-3C	1	1 1/2"	EMT	4	2	CU XHHW	0	-	-	1	6	CU XHHW	150A	250A/3P	P95D
41	SB-DP-1C	SB-MAP-1C	1	1 1/2"	EMT	4	2	CU XHHW	0	-	-	1	6	CU XHHW	100A	250A/3P	P95D
42	SB-DP-1C	SB-1C1	1	1 1/2"	EMT	4	2	CU XHHW	0	-	-	1	6	CU XHHW	100A	250A/3P	P95D
43	SB-DP-1C	SB-1C2	1	1 1/2"	EMT	4	2	CU XHHW	0	-	-	1	6	CU XHHW	100A	250A/3P	P95D
44	SB-DP-1C	SB-1C3	1	1 1/2"	EMT	4	2	CU XHHW	0	-	-	1	6	CU XHHW	100A	250A/3P	P95D
45	DP-SB-BC	SB-DP-2C	1	3 1/2"	EMT	4	250MCM	CU XHHW	0	-	-	1	2	CU XHHW	250A	400A/3P	P255D
46	DP-SB-BC	SB-DP-1C	1	3 1/2"	EMT	4	250MCM	CU XHHW	0	-	-	1	2	CU XHHW	250A	400A/3P	P255D
47	DP-SB-BC	SB-DP-AC	1	3 1/2"	EMT	4	250MCM	CU XHHW	0	-	-	1	2	CU XHHW	250A	400A/3P	P255D
48	B11 BUSWAY	DP-2B	1	4"	EMT		500MCM	CU XHHW	0	-	-	1	1/0	CU XHHW	400A	400A/4P	P380D
49	B11 BUSWAY	DP-1B	2	3 1/2"	EMT	4	350MCM	CU XHHW	0	-	-	1	2	CU XHHW	600A	600A/3P	P310D
50	B11 BUSWAY	DP-AB	2	3 1/2"	EMT	4	350MCM	CU XHHW	0	-	-	1	2	CU XHHW	600A	600A/3P	P310D

NOTES:
 1. REFER TO SINGLE-LINE DIAGRAM FOR FEEDER TAGS
 2. THESE ARE ONLY 50 OF THE FEEDERS IN THE SINGLE LINE DIAGRAM, THERE ARE MANY MORE

AL=ALUMINUM
 CU=COPPER

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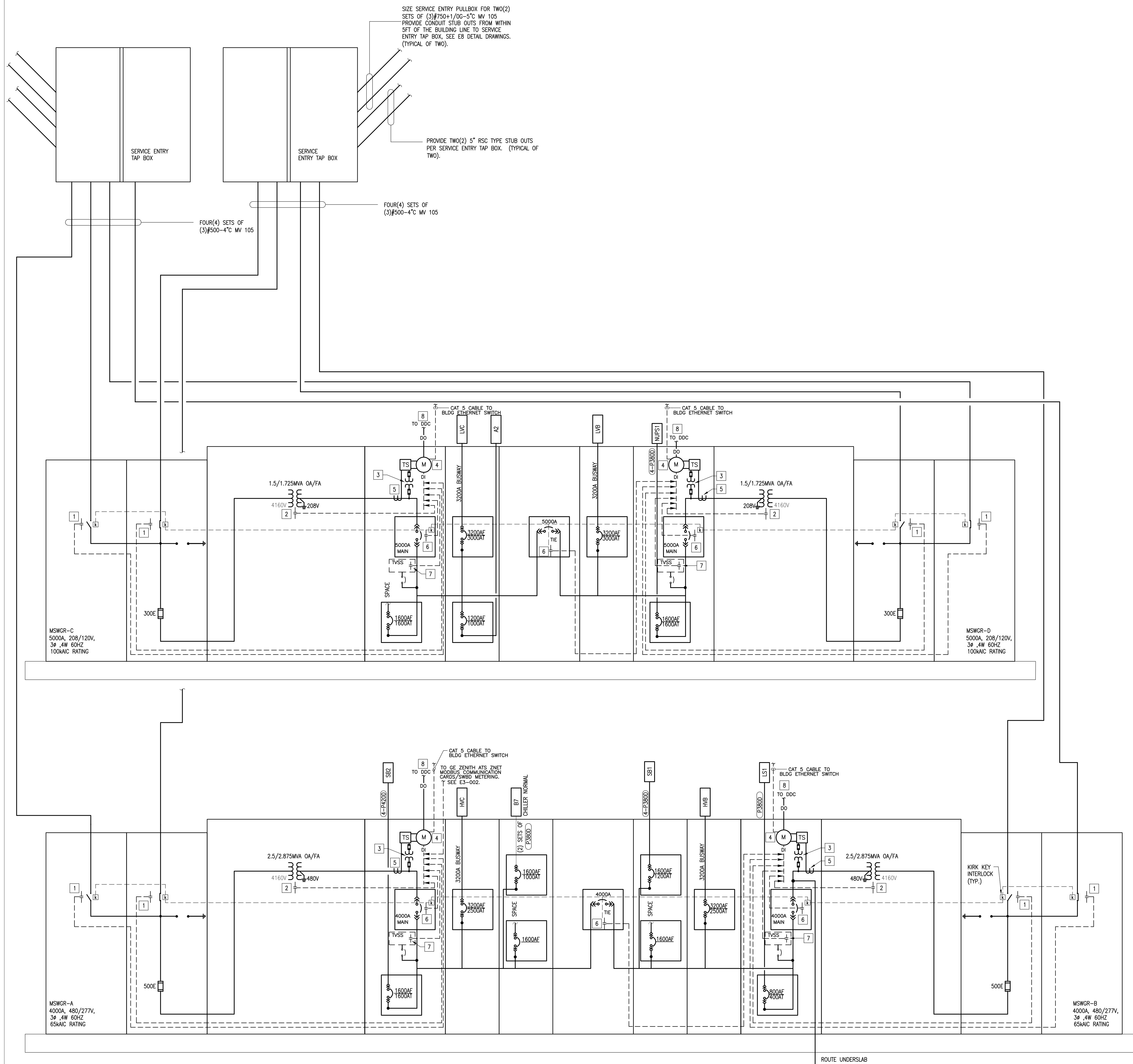
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GENERAL NOTES:

1. THE SWITCHGEAR LINEUP DESIGN INDICATED HERE IS DIAGRAMMATIC FOR SPACE PLANNING PURPOSES ONLY. CONTRACTOR IS RESPONSIBLE FOR EXACT LAYOUT AND ALL INTERNAL WIRE/BUS SIZING AND ROUTING.
2. INTERNAL SWITCHGEAR WIRE AND BUS TO BE SIZED BASED ON THE FORCED AIR RATING INDICATED FOR THE TRANSFORMERS.
3. SWITCHGEAR AND SWITCHGEAR BUS SHALL BE ISOLATED.
4. PROVIDE MIMC BUS ON SWITCHGEAR.
5. ALL FEEDERS ON THE PRIMARY SIDE SHALL BE 5/8KV RATED.
6. ALL TAPS SHALL NOT EXCEED 10 FEET
7. ALL MSWR-A, B, C AND D BREAKERS SHALL BE ELECTRONIC ADJUSTABLE TRIP, 100% RATED.
8. PROVIDE GROUND FAULT PROTECTION AT ALL MAINS, TIES AND FEEDERS IN MSWR-A, B, C AND D.
9. SUBSTATION LIQUID FILLED TRANSFORMERS SHALL BE PROVIDED WITH FAN COOLING.
10. PROVIDE UL LISTED POWER TERMINAL BLOCKS FOR TERMINATING CABLES.
11. PROVIDE AND INSTALL THE ELECTRICAL ION 7550 METER AS INDICATED ON THIS DRAWING WITH CAMPUS MONITORING POINTS CONNECTED TO COLLEGE LAN SYSTEM. REFER TO COMMUNICATION DRAWINGS FOR LOCATION OF DEDICATED IT OUTLETS ABOVE THE SWITCHGEAR LINEUP. INCLUDE ALL CONNECTIONS REQUIRED FOR SYSTEM TO BE MONITORED FROM MAIN CAMPUS CONTROL CENTER IN THE MACMILLAN BUILDING, USING THE SCADA SYSTEM.

REFERENCE NOTES

1. AUXILIARY POSITION SWITCH ON SKV INTERRUPTER SWITCH. POSITION SWITCH IS CLOSED WHEN MAIN SWITCH IS CLOSED.
2. GANGED TRANSFORMER ALARM CONTACT. CONTACT CLOSED ON HIGH TEMP, LOW LEVEL, ETC.
3. THREE VT'S WITH 120 VAC SECONDARIES.
4. POWER MEASUREMENT ION 7550 METER WITH TEST SWITCH. METER TO ACCEPT UP TO EIGHT DIGITAL INPUTS (DI).
5. THREE CT'S WITH 5 AMP SECONDARIES AND MULTI-RATIO TAPS. WIRE ALL TAPS OUT TO ACCESSIBLE TERMINATION BLOCKS.
6. AUXILIARY CONTACT ON POWER CIRCUIT BREAKER. CONTACT CLOSED WHEN CIRCUIT BREAKER IS CLOSED.
7. TVSS ALARM CONTACT. CONTACT IS CLOSED WHEN TVSS IS IN ALARM.
8. KWH PULSE OUTPUT TO NEAREST DDC CONTROL CABINET.



NEUROSCIENCE AND PSYCHOLOGY NORMAL SERVICE AND SUBSTATIONS

01 02/22/2010 100% CD SUBMISSION

NO.	DATE:	ISSUED:

LOCATION PLAN

ELECTRICAL SINGLE LINE DIAGRAM

SCALE: NTS

JOB NO: 131424-00

DRAWN BY: DS

E3-001

DWG NAME: X:\Project\131424-00\Internal Project Data\4-03 Drawings\4-03-15 Elec\Sheet\E3-001.dwg
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GENERAL NOTES

- 1. ALL TAPS SHALL NOT EXCEED 10 FEET.
2. PROVIDE ALL BREAKERS RATED FOR 1000A OR MORE WITH GROUND FAULT PROTECTION.
3. ON EMERGENCY/STANDBY SWITCHBOARDS, THE GFP SHOULD NOT TRIP THE BREAKERS BUT ACTIVATE ALARM ONLY.
4. PROVIDE UL LISTED POWER TERMINAL BLOCKS FOR TERMINATING CABLES.
5. EACH SWITCHBOARD SHALL HAVE A LOCAL POWER QUALITY METER INCORPORATED. BREAKERS FEEDING ELEVATORS SHALL BE PROVIDED WITH SHUNT TRIP FUNCTION TO BE ACTIVATED BY THE FIRE ALARM SYSTEM.

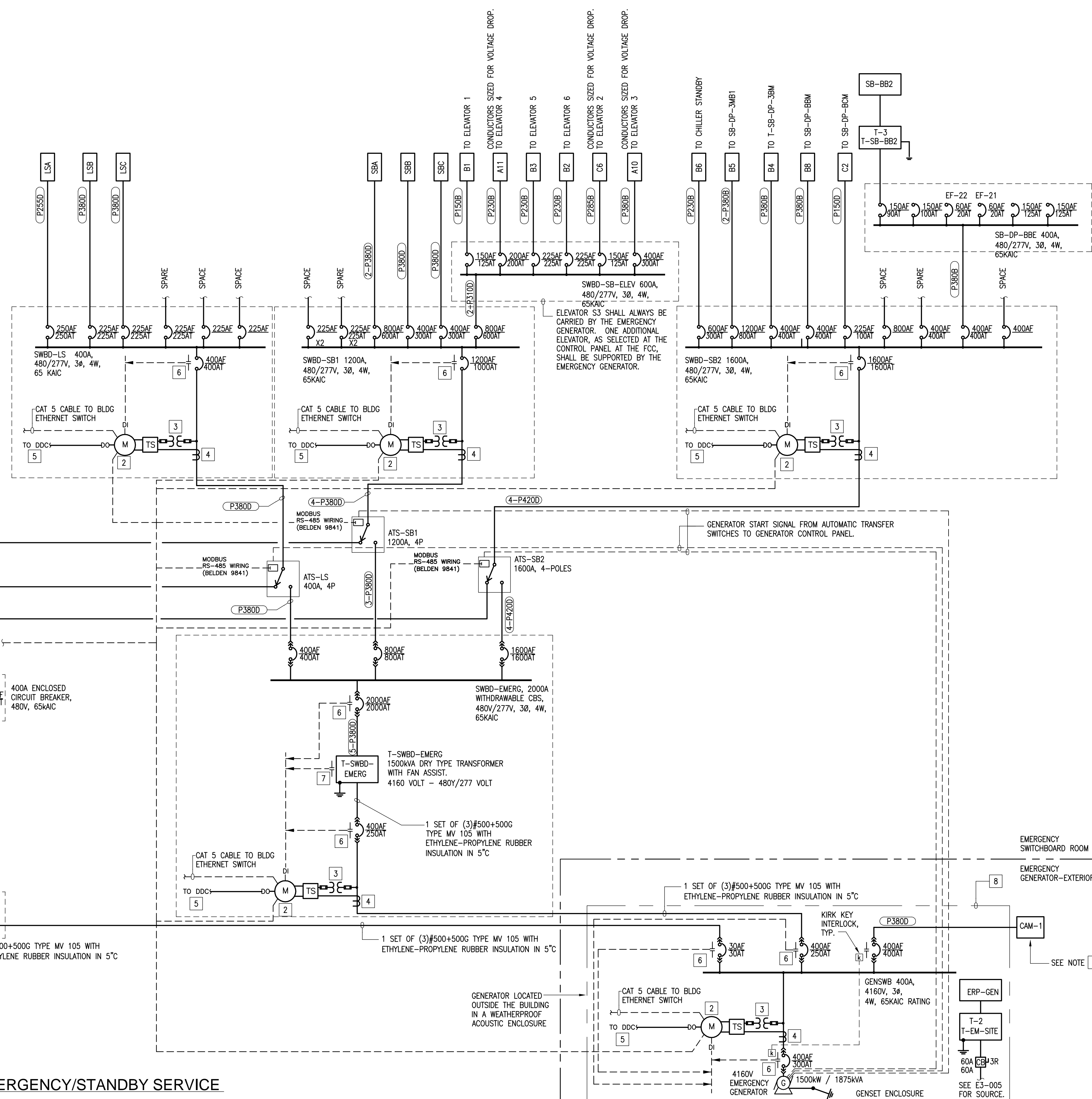
REFERENCE NOTES

- 1. PROVIDE A WEATHERPROOF CAMLOCK ENCLOSURE FOR CONNECTION TO A TEMPORARY GENERATOR. MAXIMUM RATING OF 1500KW AT 4160 VOLTS. THE ENCLOSURE SHALL BE HEAVY DUTY NEMA 4X, CONSTRUCTED OF STAINLESS STEEL. THE ENCLOSURE SHALL BE SIZED TO PERMIT A 400 AMP CONNECTOR PER PHASE, 400 AMP CONNECTOR FOR NEUTRAL AND A 400 AMP CONNECTOR FOR GROUND. PROVIDE CAMLOCKS WITH DISTINCT COLOR SCHEME FOR PHASE IDENTIFICATION AND LABEL AS 5KV. ALLOW 4" ON CENTER BETWEEN CAMLOCKS AND 3" TO THE SIDE OF THE BOX. THE CAM CONNECTORS SHALL BE PANEL RECEPTACLE TYPE, DOUBLE SET SCREW STYLE, INSTALLED ON 12 GAUGE STAINLESS STEEL, RECESSED 6" FROM THE OPENING OF THE ENCLOSURE COVER. THE ENCLOSURE DEPTH SHALL BE DEEP ENOUGH FOR THE RECESSED CAM PANEL ACCESS TO THE CAM, SPURCE AND BENDING RADIUS OF THE CONDUCTOR. THE ENCLOSURE DOOR SHALL BE GASKETED AND HAVE A STAINLESS STEEL PLANO-TYPE HINGE. THE DOOR SHALL BE EQUIPPED WITH STAINLESS STEEL DOOR CLAMPS TO ENSURE A WATERIGHT SEAL AND A HASP & STAPLE FOR PAD LOCKING. THE ENCLOSURE SHALL HAVE WATERIGHT BUSHINGS AT ALL OUTLETS. THE CAMLOCK ENCLOSURE SHALL BE LOCATED PER THE CIVIL ENGINEER'S SITE PLAN.
2. POWER MEASUREMENT ON 750V METER WITH TEST SWITCH. METER TO ACCEPT UP TO EIGHT DIGITAL INPUTS (DI).
3. THREE VTS WITH 120 VAC SECONDARIES.
4. THREE CT'S WITH 5 AMP SECONDARIES AND MULTI-RATIO TAPS. WIRE ALL TAPS OUT TO ACCESSIBLE TERMINATION BLOCKS.
5. KWH PULSE OUTPUT TO NEAREST DDC CONTROL CABINET.
6. AUXILIARY CONTACT ON POWER CIRCUIT BREAKER. CONTACT CLOSED WHEN CIRCUIT BREAKER IS CLOSED.
7. GANGED TRANSFORMER ALARM CONTACT. CONTACT CLOSED ON HIGH TEMP, LOW LEVEL, ETC.
8. REFER TO EB-006 AND EB-007 FOR ADDITIONAL GENERATOR INFORMATION.

FEEDER SCHEDULE table with columns for TAG, CONDUIT & WIRE, EGC FOR MULTIPLE SETS, and various conductor specifications.

DRY TYPE TRANSFORMER SCHEDULE table with columns for TYPE, RATING (KVA), PROTECTION, FEEDER, NOTE 3, SECONDARY, FEEDER, NEUTRAL GROUND CONDUCTOR.

FEEDER ROUTING SCHEDULE table with columns for FEEDER DESIGNATION, ORIGIN ROOM #, ORIGIN EQUIPMENT, DESTINATION ROOM #, DESTINATION EQUIPMENT, and COMMENTS.



EMERGENCY/STANDBY SERVICE

01 02/22/2010 100% CD SUBMISSION

NO. DATE: ISSUED:

LOCATION PLAN

ELECTRICAL SINGLE LINE DIAGRAM

SCALE: NTS

JOB NO: 1314240

DRAWN BY: DS

E3-002

NEUROSCIENCE & PSYCHOLOGY BUILDING COMPLEX



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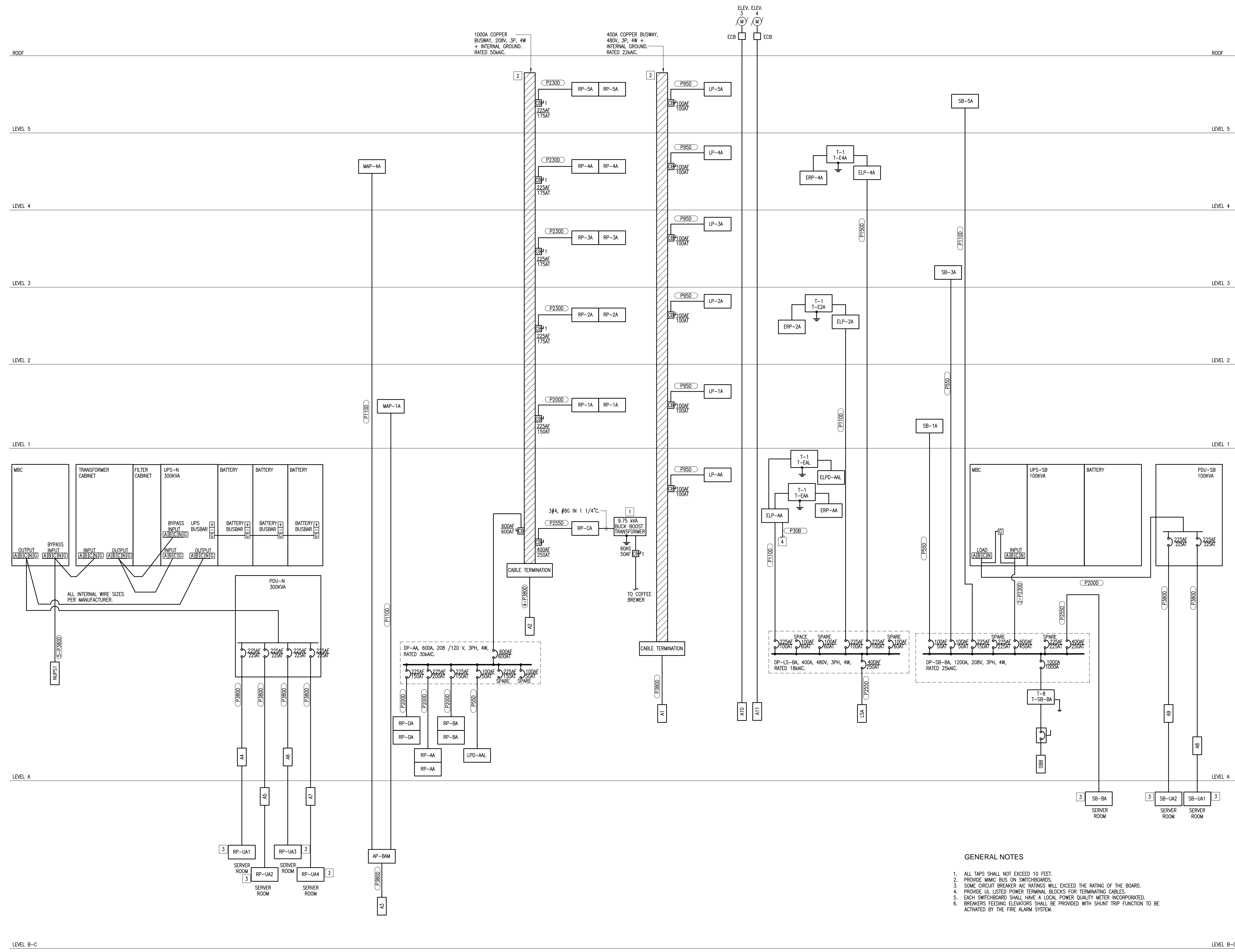
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RISER A

REFERENCE NOTES:

- 1 PROVIDE 9.75kVA (OUTPUT) 208V INPUT, 240V OUTPUT, SINGLE PHASE BUCK BOOST TRANSFORMER.
- 2 BUSDUCTS SHALL HAVE PROVISIONS FOR FUTURE CIRCUIT BREAKER TAPS.
- 3 SHUNT TRIP MAIN CIRCUIT BREAKER PANEL.

NOTES:

1. REFER TO SCHEDULES ON DRAWING E3-002.
2. PROVIDE MIMIC BUS ON SWITCHBOARDS.
3. SOME CIRCUIT BREAKER AIC RATINGS WILL EXCEED THE RATING OF THE BOARD.
4. PROVIDE UL LISTED POWER TERMINAL BLOCKS FOR TERMINATING CABLES.
5. EACH SWITCHBOARD SHALL HAVE A LOCAL POWER QUALITY METER INCORPORATED.
6. BREAKERS FEEDING ELEVATORS SHALL BE PROVIDED WITH SHUNT TRIP FUNCTION TO BE ACTIVATED BY THE FIRE ALARM SYSTEM.

GENERAL NOTES

1. ALL TAPS SHALL NOT EXCEED 10 FEET.
2. PROVIDE MIMIC BUS ON SWITCHBOARDS.
3. SOME CIRCUIT BREAKER AIC RATINGS WILL EXCEED THE RATING OF THE BOARD.
4. PROVIDE UL LISTED POWER TERMINAL BLOCKS FOR TERMINATING CABLES.
5. EACH SWITCHBOARD SHALL HAVE A LOCAL POWER QUALITY METER INCORPORATED.
6. BREAKERS FEEDING ELEVATORS SHALL BE PROVIDED WITH SHUNT TRIP FUNCTION TO BE ACTIVATED BY THE FIRE ALARM SYSTEM.

- 4 PROVIDE FEEDER TO 480V-230V TRANSFORMER TO SUPPORT THE LOADS OF BOTH TORMAX DOOR OPERATORS AT 801VES. PROVIDE ALL OVERCURRENT, DISCONNECTING MEANS AND TRANSFORMER REQUIRED. GROUND TRANSFORMER. COORDINATE WITH ARCHITECT FOR DOOR OPERATOR LOADS.

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01 02/22/2010 100% CD SUBMISSION

NO.	DATE:	ISSUED:

LOCATION PLAN

ELECTRICAL SINGLE LINE DIAGRAM RISER A

SCALE: NTS

JOB NO: 131624-00

DRAWN BY: DS

E3-003

NEUROSCIENCE & PSYCHOLOGY BUILDING COMPLEX



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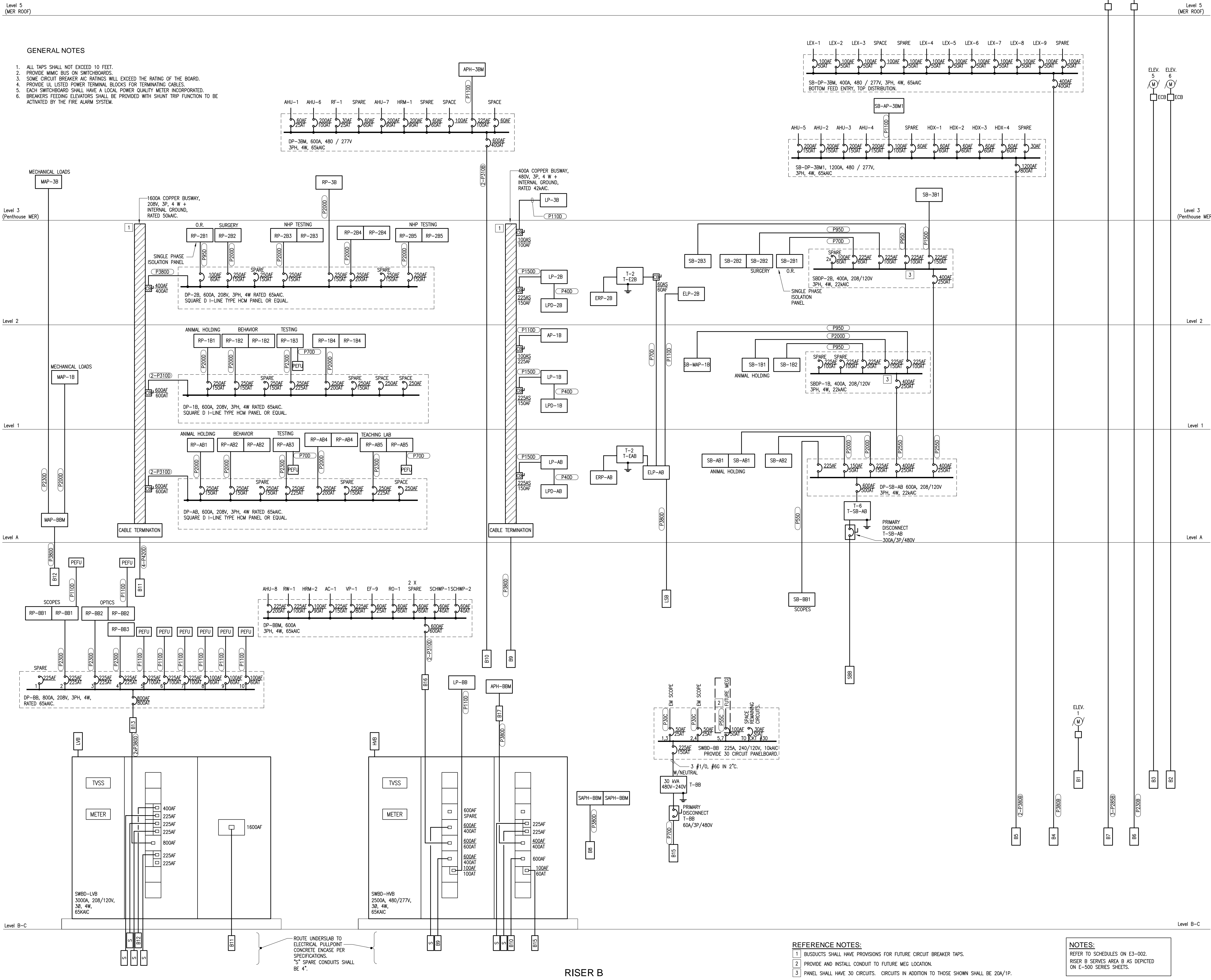
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GENERAL NOTES

1. ALL TAPS SHALL NOT EXCEED 10 FEET.
2. PROVIDE MIMIC BUS ON SWITCHBOARDS.
3. SOME CIRCUIT BREAKER AIC RATINGS WILL EXCEED THE RATING OF THE BOARD.
4. PROVIDE UL LISTED POWER TERMINAL BLOCKS FOR TERMINATING CABLES.
5. EACH SWITCHBOARD SHALL HAVE A LOCAL POWER QUALITY METER INCORPORATED.
6. BREAKERS FEEDING ELEVATORS SHALL BE PROVIDED WITH SHUNT TRIP FUNCTION TO BE ACTIVATED BY THE FIRE ALARM SYSTEM.

REFERENCE NOTES

- 1 BUSDUCTS SHALL HAVE PROVISIONS FOR FUTURE CIRCUIT BREAKER TAPS.
- 2 PROVIDE AND INSTALL CONDUIT TO FUTURE MEC LOCATION.
- 3 PANEL SHALL HAVE 30 CIRCUITS. CIRCUITS IN ADDITION TO THOSE SHOWN SHALL BE 20A/1P.

NOTES

- 1 REFER TO SCHEDULES ON E3-002.
- 2 RISER B SERVES AREA B AS DEPICTED ON E-500 SERIES SHEETS.

DWG NAME: X:\project\131624-30\A Internal Project Data\4-03 Drawings\4-03-15 Elec\riserB-E3-004.dwg
 PLOT BY: Vovet Electric
 PLOT TIME: 2/22/2010 1:24 PM
 MOD. BY: Dennis Schuch
 MOD. TIME: 2/22/2010 11:12 AM

01 02/22/2010 100% CD SUBMISSION
 NO. DATE: ISSUED:

ELECTRICAL SINGLE LINE DIAGRAM RISER B

SCALE: NTS
 JOB NO: 131424-00
 DRAWN BY: DS
E3-004

Level 5 (ROOF)

Level 4 (MER ROOF)

Level 3 (Penthouse MER)

Level 2

Level 1

Level A

Level B-C

Level 5 (ROOF)

Level 4 (MER ROOF)

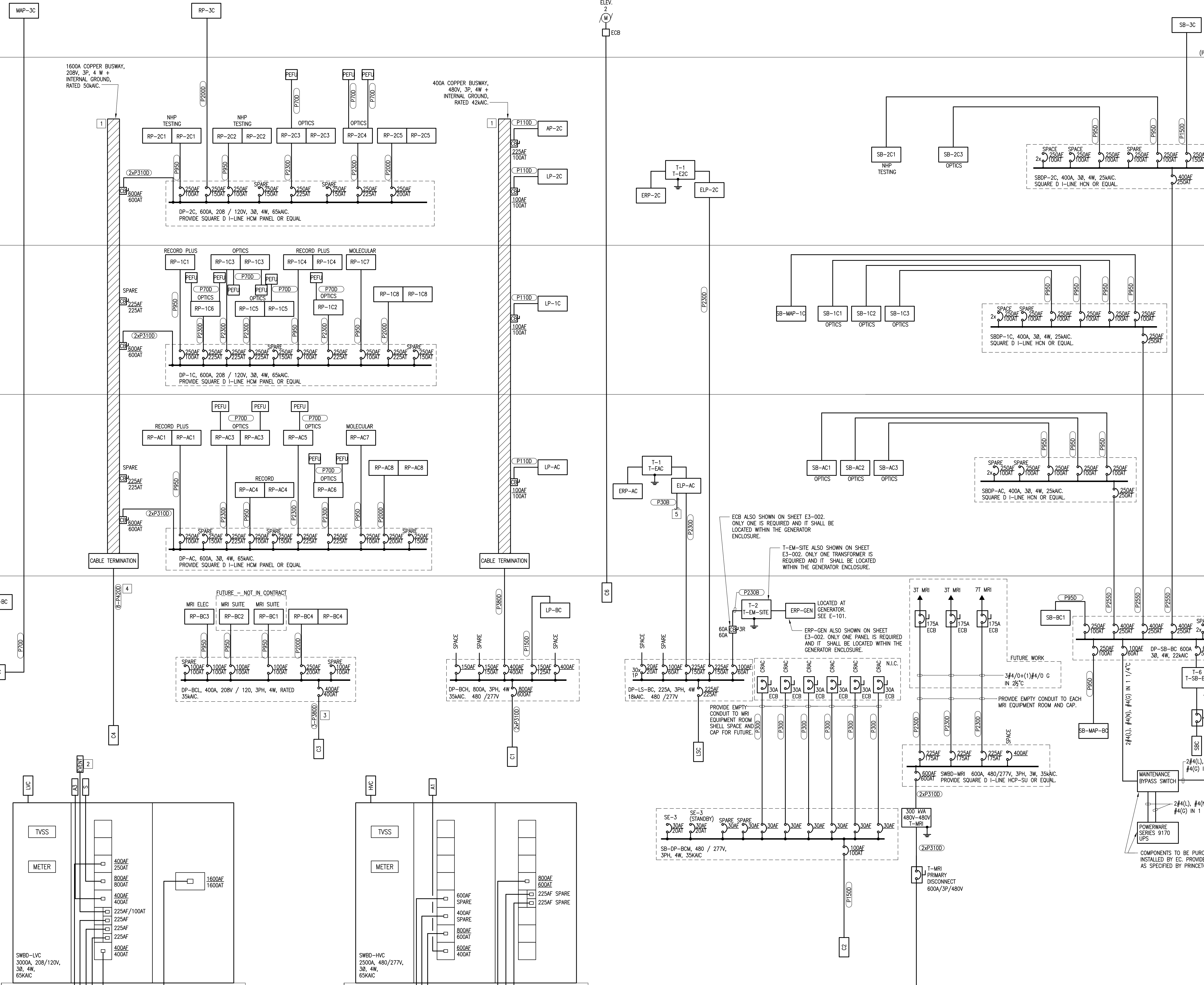
Level 3 (Penthouse MER)

Level 2

Level 1

Level A

Level B-C



ROUTE UNDERSLAB TO ELECTRICAL PULLPOINT CONCRETE ENCASE PER SPECIFICATIONS.
 PROVIDE 4" FOR "S" SPARE CONDUITS, (2) 4" FOR "S" OVER 400A.

PROVIDE FEEDER TO 480V-230V TRANSFORMER TO SUPPORT THE LOADS OF BOTH TORIAX DOOR OPERATORS AT B101YES. PROVIDE ALL COORDINATE CONDUIT EXIT POINT WITH CIVIL ENGINEER'S DRAWINGS.

REFERENCE NOTES:
 1 BUSDUCTS SHALL HAVE PROVISIONS FOR FUTURE CIRCUIT BREAKER TAPS.
 2 ROUTE EVENT POWER OUT NORTH FACE OF LEVEL BC TO SITE EVENT POWER BOX. COORDINATE CONDUIT EXIT POINT WITH CIVIL ENGINEER'S DRAWINGS.
 3 TRANSITION TO 4 SETS OF P2300 JUST BEFORE DP-BCL.
 4 TRANSITION TO 1 SETS OF P4200 JUST BEFORE CABLE TERMINATION.

NOTES:
 REFER TO NOTES ON DRAWING E301-1. RISER C SERVES AREA C AS DEPICTED ON E-500 SERIES SHEETS.

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NO.	DATE:	ISSUED:



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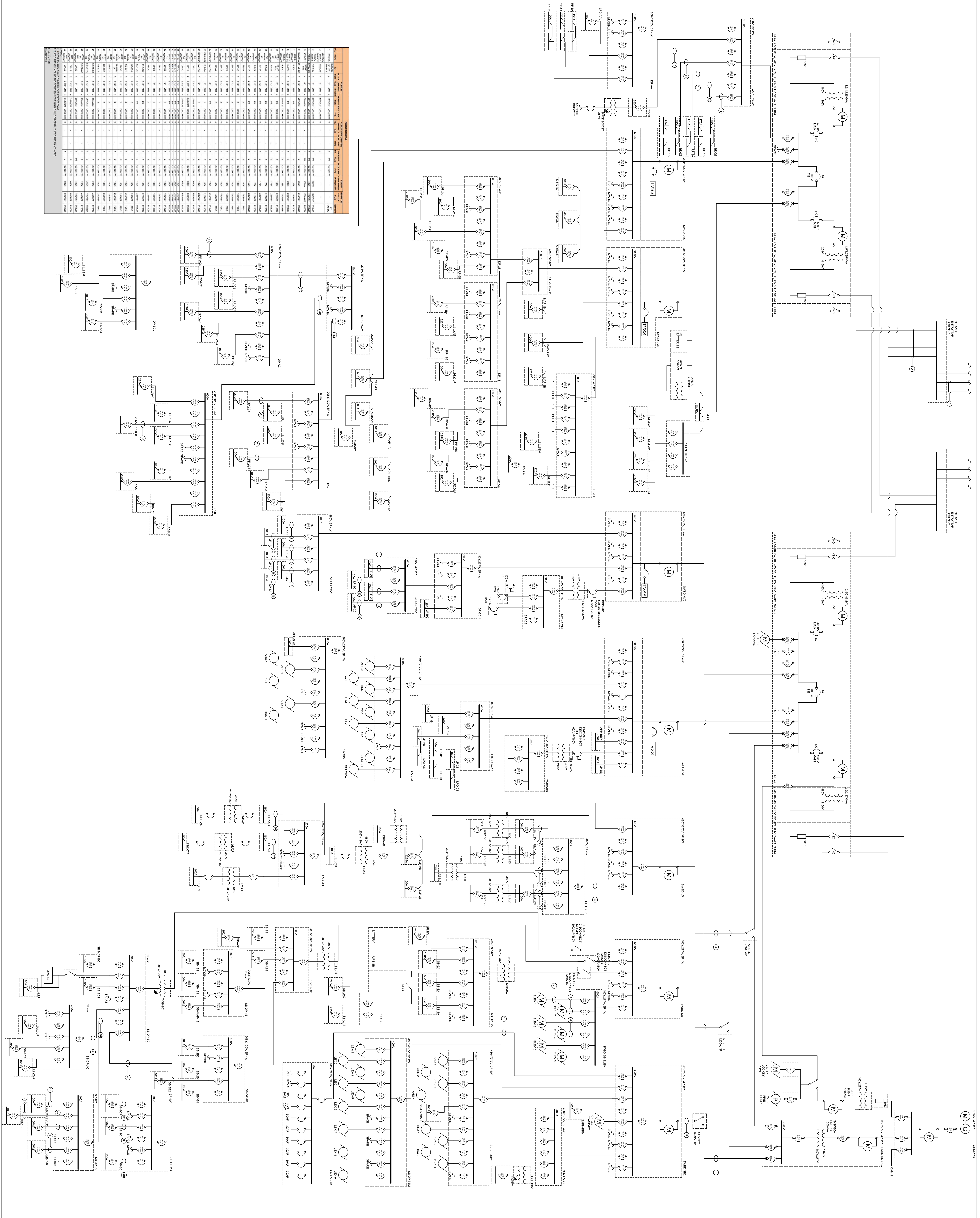
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NO.	DATE	ISSUED:
1	10/20/2010	100% CD SUBMISSION

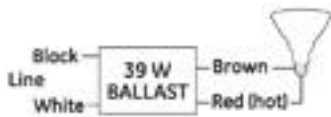
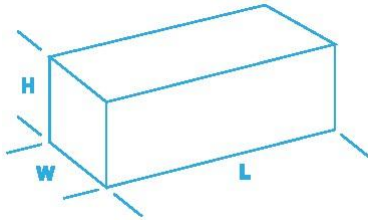


GE
Lighting

74116 - GEMH39-MC-120

GE HID UltraMax™ eHID Electronic Low Frequency Ballast

- Light-weight, Low Profile Housing
- Superior low frequency square wave frequency design maximizes performance and life of ceramic metal halide lamps.
- Ultra slim can size for fixture design flexibility



GENERAL CHARACTERISTICS

Application	1- 39W M130 120V Micro Electronic HID
Category	High Intensity Discharge
Ballast Type	Electronic - Low Frequency
Line Voltage Regulation (+/-)	10 %
Ambient Temperature (MAX)	55 °C(13 °C)
Case Temperature	80 °C(176 °F)
Ballast Factor	Normal-High (1.0)
Sound Rating	A (20-24 decibels)
Enclosure Type	Plastic
Distance to Lamp	8 ft
Additional Info	End of Life Protection (EOL)/ Thermally protected

PRODUCT INFORMATION

Product Code	74116
Description	GEMH39-MC-120
Standard Package	Case
Standard Package GTIN	10043168741160
Standard Package Quantity	10
Sales Unit	Case
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	10
UPC	043168741163

DIMENSIONS

Case dimensions			
Length (L)		3.0 in(75.95 mm)	
Width (W)		1.3 in(33.02 mm)	
Height (H)		1.1 in(27.94 mm)	
Mounting dimensions			
Weight		0.38 lb	
Exit Type		Side	
Remote Mounting Distance to Lamp		8 ft	
Remote Mounting Wire Gauge		18 AWG	
Lead lengths	Qty	Exit	Length (± 1 in.)
White	1	Left	6 (152mm)
Red	1	Left	6 (152mm)
Brown	1	Left	6 (152mm)
Black	1	Left	6 (152mm)

ELECTRICAL CHARACTERISTICS

Lamp Operating Frequency	133 Hz
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SAFETY & PERFORMANCE

- cUL Listed
- UL Listed
- RoHs Compliant
- ANSI - C82.14-2006
- UL94V0 Flame Retardant
- Short Circuit Protection
- Inherent Thermal Protection

SPECIFICATIONS BY LAMP & LINE VOLTAGE

Lamp # of Lamps by Line	Specifications by Line Voltage	System Wattage	Nominal Current	Ballast Factor	Ballast Efficiency	Max.Input Current	Starting Current	Open Circuit Voltage	Drop Out Voltage	Power factor	Min.starting temperature	Fuse rating	UL bench top rise
M130	1 120	43.0		1	0.907	0.39A		4000V	96V	0.99	0.0°F	1 1/2	

CAUTIONS & WARNINGS

- Caution
- Do not connect Brown or Red wires to ground
 - Not designed for recessed applications.

NOTES

- Not designed for recessed applications.
- 150C rated lead wires
- Short Circuit Protection
- Do not connect Brown or Red wires to ground

WARRANTY INFORMATION

GE Lighting warrants to the purchaser that each ballast will be free from defects in material or workmanship for period as defined in the attached documents from the date of manufacture when properly installed and under normal conditions of use.

Oct 24, 2010 3:11:44 PM

For additional information, visit www.gelighting.com

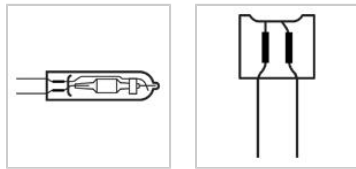


GE
Lighting

90352 - CMH39TCU830/G8.5

GE ConstantColor® PulseArc® CMH® Ceramic Metal Halide T4.5

a product of
ecomagination™



CAUTIONS & WARNINGS

R- WARNING: This lamp can cause serious skin burn and eye inflammation from shortwave ultraviolet radiation if outer envelope of the lamp is broken or punctured, and the arc tube continues to operate. Do not use where people will remain for more than a few minutes unless adequate shielding or other safety precautions are used. Certain types of lamps that will automatically extinguish when the outer envelope is broken or punctured are commercially available. Visit the FDA website for more information: <http://www.fda.gov/cdrh/radhealth/products/urburns.html>

Caution

- Lamp may shatter and cause injury if broken
 - Do not use excessive force when installing lamp.
 - Do not use lamp if outer glass is scratched or broken.

Warning

- Risk of Electric Shock
 - Do not use where directly exposed to water or outdoors without an enclosed fixture.
 - Turn power off before inspection, installation or removal.
- Risk of Fire
 - Keep combustible materials away from lamp.
 - Use fused or thermally protected ballast - see instructions.
 - Use in fixture rated for this product.
- Risk of Burn
 - Allow lamp to cool before handling.
 - Do not turn on lamp until fully installed.
- A damaged lamp emits UV radiation which may cause eye/skin injury
 - Turn power off if glass bulb is broken. Remove and dispose of lamp.
- Unexpected lamp rupture may cause injury, fire, or property damage
 - Do not exceed rated voltage.
 - Do not turn on lamp until fully installed.
 - Do not use beyond rated life.
 - Do not use lamp if outer glass is scratched or broken.
 - Do not use where directly exposed to water or outdoors without an enclosed fixture.
 - Operate lamp only in specified position.
 - Use in enclosed fixture rated for this product.
 - Use only properly rated ballast.

NOTES

- Rated life is 15,000 hours on magnetic ballasts.

GENERAL CHARACTERISTICS

Lamp Type	High Intensity Discharge - Ceramic Metal Halide
Bulb	T4.5
Base	Bi-Pin (G8.5)
Wattage	39
Rated Life	16500 hrs
Bulb Material	Quartz
Lamp Enclosure Type (LET)	Enclosed fixtures only
LEED-EB MR Credit	125 picograms Hg per mean lumen hour
Additional Info	UV control

PHOTOMETRIC CHARACTERISTICS

Initial Lumens	3400
Mean Lumens	2300
Nominal Initial Lumens per Watt	87
Color Temperature	3000 K
Color Rendering Index (CRI)	84

ELECTRICAL CHARACTERISTICS

Burn Position	Universal burning position
Warm Up Time to 90%	2 min
Warm Up Time to 90% (MAX)	2 min
Hot Restart Time to 90% (MIN)	10 min
Hot Restart Time to 90% (MAX)	15 min

DIMENSIONS

Maximum Overall Length (MOL)	3.37 cm
Bulb Diameter (DIA)	0.563 cm
Bulb Diameter (DIA) (MAX)	0.563 cm
Light Center Length (LCL)	2 cm

PRODUCT INFORMATION

Product Code	90352
Description	CMH39TCU830/G8.5
ANSI Code	C130/M130
Standard Package	Case
Standard Package GTIN	10043168903520
Standard Package Quantity	12
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	12
UPC	043168903523