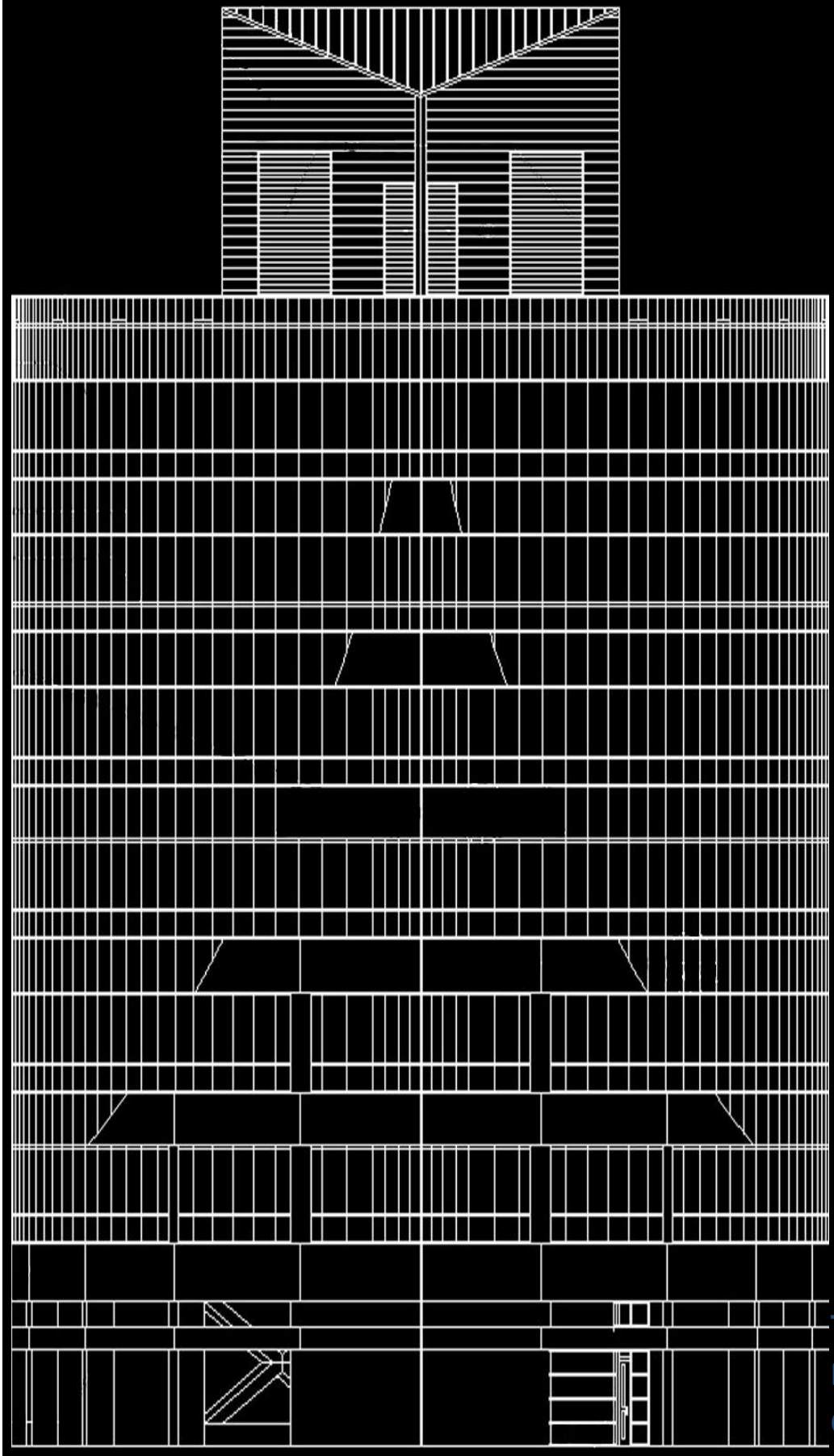

Virginia Advanced Shipbuilding Carrier and Integration Center

Technical Report 2 | Electrical Systems Existing Conditions and Building Load Summary | The VASCIC Building

Alyson Larimer
Lighting/Electrical

Executive Summary

The following report contains a technical analysis and summary of the existing electrical system for the Virginia Advanced Shibuilding Carrier and Integration Center. The 241,000 square foot building houses the research of the newest electronic systems within a carrier ship. Intensive laboratory testing takes place in the Electronic Integration Lab.

The analysis and documentation provides information pertaining to the power distribution system, service entrance, utility and company information, voltage systems, major equipment including switchgear and switchboards, special equipment, and a detailed list of panel boards and transformers found in the building.

A single line diagram was created to show the electrical path from the service entrance to branch circuit panel boards and bus ducts. Also, the service entrance was sized for three different phases of the design process.

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Summary Description of Distribution System

From the service entrance to the building, outside in Area D, the main switchgear SGA connects to the second switchgear SGB inside the building in room 272 through underground conduits. Switchgear SGB is in a main-tie-main configuration, which is left open for the majority of the time. It is only closed when specialty testing in the Laboratory Wing is being conducted. Switchgear SGB distributes power to switchboards SBPA, SBPB, and SBPC. SBPA provides power to another smaller switchboard TSB in the Office Tower. Switchboard TSB provides power to the left hand side Office Tower. SBPB provides power to main mechanical equipment located in the rooftop penthouse, a distribution panel PDP in the Office Tower providing for the right side of the Office Tower, and the emergency power system. SBPC provides power to all the receptacle loads of the Laboratory Wing on a bus duct riser system in the Electronic Integration Lab.

Utility Company Information

- Virginia Power, 801 Battlefield Blvd. S., Chesapeake, Virginia 23322
- Refer to attached rate schedule file provided from Virginia Power's website
- Electrical Utility Load Data for previous 12 months requested September 27, 2010 and October 5, 2010: Waiting for response.

Service Entrance

The VASCIC facility is provided directly from the Virginia Power plant at 23,000V in plastic conduit encased in concrete. The point at the service entrance where ownership is transferred from Virginia Power to Northrop Grumman is in building "Area D" along 23rd Street.

Virginia Power is responsible for providing metering equipment (2), transformers (5), and one main switchgear. Northrop Grumman is responsible for the generator, one switchgear (connected to the switchgear provided by Virginia Power), and three (3) switchboards.

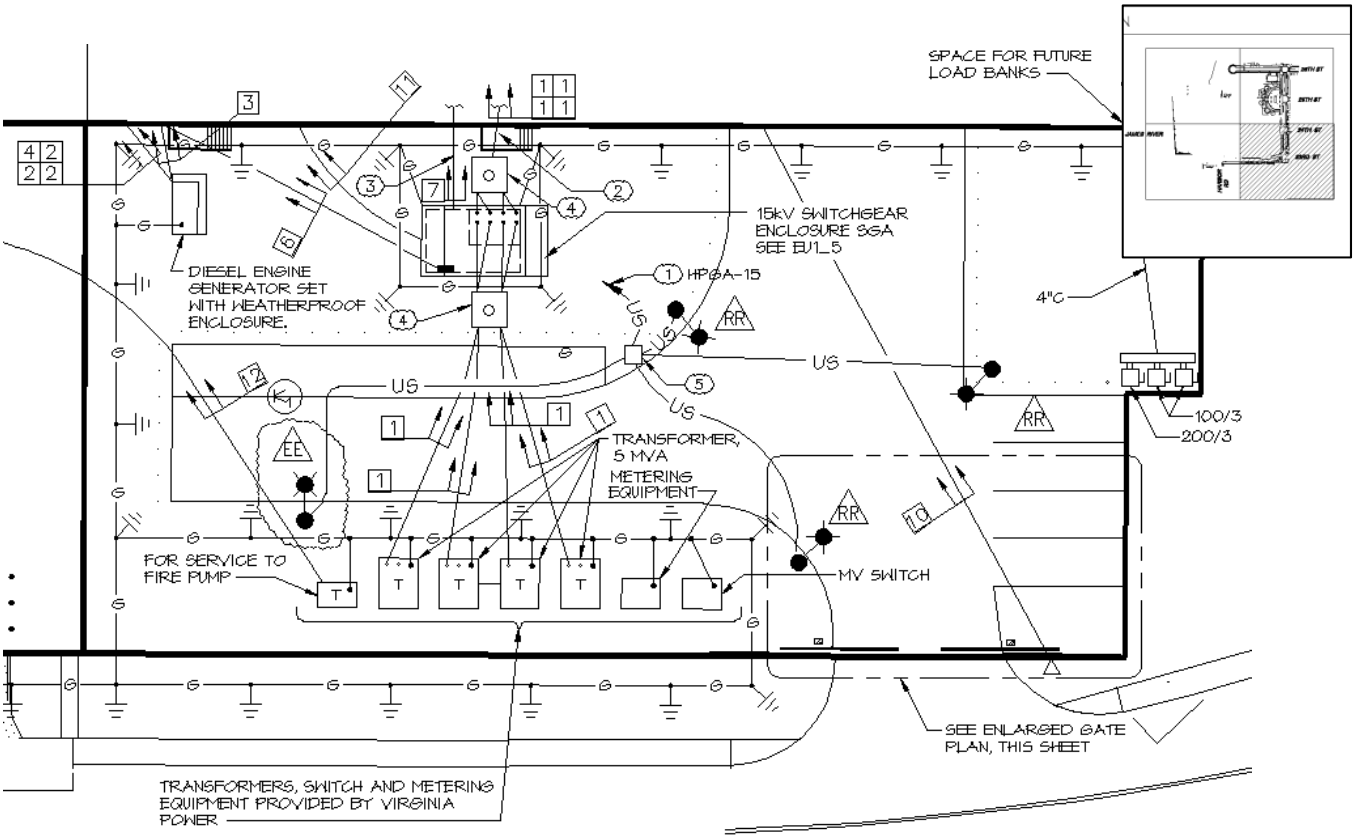


Figure A: Service Entrance Diagram (Outside)

Figure A illustrates the service entrance equipment located outside the building. There are five transformers, four of which supply the main switchgear and the fifth is designated for the fire pump station. The four transformers for building service are pad mounted 5 MVA, 23.0/12.2 KV, Y primary, 13.8/7.9 KV, Y secondary. The transformer for the fire pump station is a pad mounted transformer 23.0/13.2 KV, Y primary, 480/277, Y secondary. Two equipment meters, Square D Powerlogic, are located next to the five transformers. Four sets of 15 KV cables fed from the transformers pass through a precast manhole and connect to the main switchgear (SGA). Switchgear SGA is a metal clad type with draw out vacuum circuit breakers rated at 15 KV, 500 MVA, 1200 A continuous current and 18 KA RMS nominal short circuit current. Another set of four 15 KV cables pass through a precast manhole. These cables connect to the secondary switchgear that is located inside the building in Room 272-Elecectrical Integration Lab.

In Room 272, the secondary switchgear (SGB) is located on the north wall of the second floor and supplies the Electronic Integration Lab and Repair Integration Lab. Also in this room is

one of three switchboards, SBPC, metal-enclosed, low voltage that is individually mounted and compartmentalized.

Voltage Systems

All switchboards are 13.8 KV, 480Y/277, 3ϕ, 4 w.

- SBPA: Serves switchboard TSB in Office Tower (Room 210) serving lighting loads and 208Y/120V for small appliances. Four bus ducts are fed from this switchboard that step the voltage to 440 Δ, 115 Δ, or 208Y/120V. These loads are all receptacles for the Laboratory wing.
- SBPB: Serves all mechanical equipment, elevator equipment, automatic transfer switch, UPS system (communication and IT equipment), lighting loads on 1st-6th floor and stairwell.
- SBPC: Serves rooftop air handling units, Laboratory wing lighting, VAV boxes, and four bus ducts stepping voltage down to 440 Δ, 115 Δ, or 208Y/120V that serve all receptacle loads also in the Laboratory wing.

Emergency Power System

The emergency power system is provided by a 500 kW, 625 kVA diesel engine. The automatic transfer switch is connected to switchboard SBPB. On the emergency distribution panel, EDP, loads such as emergency lighting, UPS system protecting all IT and communications equipment, condenser mechanical equipment, Laboratory elevator system, and fire pump. Distribution panel EDP also serves the passenger and freight elevators of the Office Tower, as well as the emergency lighting and receptacles required by the Life Safety Code, NFPA 101, 1996.

Locations of Switchgear

In the Lab Wing, switchboard SBPC is located in room 272, Electronic Integration Lab. Switchboards SBPA and SBPB are located in room 367, electrical room. The automatic transfer switch for standby power, ATS-1 is located in room 364.

Along with ATS-1, the emergency switchboard fed from switchboard SBPB is also located in room 364. The emergency generator is located outside of the building in Area D.

The switchboard for the Office Tower, TSB, is located in room 210. On each floor of the Office Tower, there are three electrical closets. They are located in rooms 107, 110, and 125 (corresponds with floor level: 207, 210, and 225 for second floor, etc.).

The following table lists the pieces of equipment that makes up the distribution system, their locations within the building as well as their locations on the drawings.

Major Electrical Equipment:

MAJOR EQUIPMENT SCHEDULE						
TAG	TYPE	FLOOR LEVEL	ROOM NO.	ROOM NAME	1/8 SCALE DWG.	ENLARGED DWG.
SGB	SWITCHGEAR	2	272	ELECTRONIC INTEGRATION LAB	2E2_2	2E4_9
SBPA	SWITCHBOARD	3	367	ELECTRICAL ROOM	2E2_3	2E4_1
SBPB	SWITCHBOARD	3	367	ELECTRICAL ROOM	2E2_3	2E4_1
SBPC	SWITCHBOARD	2	272	ELECTRONIC INTEGRATION LAB	2E2_2	2E4_9
TSB	SWITCHBOARD	2	210	ELECTRICAL ROOM	1E3_2	1E4_1
FP-ATS	FIRE PUMP AUTOMATIC TRANSFER SWITCH	2	282	FIRE PUMP ROOM	2E1_3	2E1_3
E-ATS	EMERGENCY AUTOMATIC TRANSFER SWITCH	3	367	ELECTRICAL ROOM	2E2_3	2E4_1
DG	DIESEL ENGINE GENERATOR	OUTSIDE AREA D	N/A	OUTSIDE BUILDING AREA D	EU1_4	EU1_4
EDP	EMERGENCY DISTRIBUTION PANEL	3	364	PASSAGEWAY	2E2_3	2E2_3
PDP	DISTRIBUTION PANEL	8	801	PENTHOUSE	1E2_8	1E2_8
LDP	DISTRIBUTION PANEL	3	367	ELECTRICAL ROOM	2E4_1	2E4_1
T-1	TRANSFORMER	3	367	ELECTRICAL ROOM	2E4_1	2E4_1
T-2	TRANSFORMER	OUTSIDE	AREA D	N/A	EU1_4	EU1_4
T-3	TRANSFORMER	OUTSIDE	AREA D	N/A	EU1_4	EU1_4
T-4	TRANSFORMER	GROUND	184	GROUND FLOOR GARAGE	2E1_1	N/A
T-5	TRANSFORMER	3	364	PASSAGEWAY	2E2_3	N/A
T-6	TRANSFORMER	2	272	ELECTRONIC INTEGRATION LAB	2E1_7	N/A
T-7	TRANSFORMER	1	107	ELECTRICAL ROOM	1E1_1	N/A
T-8	TRANSFORMER	2	227	ELECTRICAL ROOM	1E2_2	N/A
T-9	TRANSFORMER	2	227	ELECTRICAL ROOM	1E2_2	N/A
T-10	TRANSFORMER	2	207	ELECTRICAL ROOM	1E2_2	N/A
T-11	TRANSFORMER	2	207	ELECTRICAL ROOM	1E2_2	N/A
T-12	TRANSFORMER	3	307	ELECTRICAL ROOM	1E2_3	N/A
T-13	TRANSFORMER	4	407	ELECTRICAL ROOM	1E2_4	N/A
T-14	TRANSFORMER	5	507	ELECTRICAL ROOM	1E2_5	N/A
T-15	TRANSFORMER	6	607	ELECTRICAL ROOM	1E2_6	N/A

MAJOR EQUIPMENT SCHEDULE						
TAG	TYPE	FLOOR LEVEL	ROOM NO.	ROOM NAME	1/8 SCALE DWG.	ENLARGED DWG.
T-16	TRANSFORMER	7	707	ELECTRICAL ROOM	1E2_7	N/A
T-17	TRANSFORMER	3	325	ELECTRICAL ROOM	1E2_3	N/A
T-18	TRANSFORMER	4	425	ELECTRICAL ROOM	1E2_4	N/A
T-19	TRANSFORMER	5	525	ELECTRICAL ROOM	1E2_5	N/A
T-20	TRANSFORMER	6	625	ELECTRICAL ROOM	1E2_6	N/A
T-21	TRANSFORMER	7	725	ELECTRICAL ROOM	1E2_7	N/A
T-22	TRANSFORMER	8	801	PENTHOUSE	1E2_8	N/A
T-23	TRANSFORMER	8	801	PENTHOUSE	1E2_8	N/A
T-24	TRANSFORMER	2	272	ELECTRONIC INTEGRATION LAB	2E2_2	2E2_2
T-25	TRANSFORMER	2	272	ELECTRONIC INTEGRATION LAB	2E2_2	2E2_2
T-26	TRANSFORMER	2	272	ELECTRONIC INTEGRATION LAB	2E2_2	2E2_2
T-27	TRANSFORMER	2	272	ELECTRONIC INTEGRATION LAB	2E2_2	2E2_2
T-28	TRANSFORMER	2	272	ELECTRONIC INTEGRATION LAB	2E2_2	2E2_2
T-29	TRANSFORMER	2	272	ELECTRONIC INTEGRATION LAB	2E2_2	2E2_2

PANEL BOARDS						
TAG	PANEL VOLTAGE	TYPE/MAIN SIZE	FLOOR LEVEL	ROOM NO.	ROOM NAME	1/8 SCALE DWG.
HMD	480Y/277V, 3PH, 4W	MLO/ 225 A	3	366	Mechanical Room	2E4_6
HMC	480Y/277V, 3PH, 4W	MLO/ 100 A	3	366	Mechanical Room	2E4_6
HMB	480Y/277V, 3PH, 4W	MLO/ 225 A	3	366	Mechanical Room	2E4_6
HMA	480Y/277V, 3PH, 4W	MCB/ 650 A	3	366	Mechanical Room	2E4_6
HPGA	480Y/277V, 3PH, 4W	MCB/ 125 A	1	138	Ground Floor Garage	2E1_1
LPGA	2080Y/120V 3PH, 4W	MCB/ 150 A	1	138	Ground Floor Garage	2E1_1
LLD	2080Y/120V 3PH, 4W	MCB/ 125 A	3	366	Mechanical Room	2E4_6
LLB	2080Y/120V 3PH, 4W	MCB/ 125 A	2	252	Auditorium	2E4_4
LKA	2080Y/120V 3PH, 4W	MCB/ 150 A	2	258	Kitchen	2E4_7
LKB	2080Y/120V 3PH, 4W	MCB/ 200 A	2	258	Kitchen	2E4_7
LLA	2080Y/120V 3PH, 4W	MLO/ 225 A	3	367	Electrical Room	2E4_1
LDP	2080Y/120V 3PH, 4W	MCB/ 750 A	3	367	Electrical Room	2E4_1
LLC	2080Y/120V 3PH, 4W	MCB/ 125 A	2	270	Kitchen	2E4_7
HHA	480Y/277V, 3PH, 4W	MLO/ 225 A	3	367	Electrical Room	2E4_1
EDP	480Y/277V, 3PH, 4W	MCB/ 1000 A	3	367	Electrical Room	2E4_1
EDHB	480Y/277V, 3PH, 4W	MLO/ 100 A	3	367	Electrical Room	2E4_1
EDLA	2080Y/120V 3PH, 4W	MCB/ 50 A	3	367	Electrical Room	2E4_1
EDHA	480Y/277V, 3PH, 4W	MCB/ 225 A	2	253	Computer Room	2E4_2
LCA	2080Y/120V 3PH, 4W	MCB/ 450 A	2	253	Computer Room	2E4_2
LCB	2080Y/120V 3PH, 4W	MLO/ 225 A	2	253	Computer Room	2E4_2
LCC	2080Y/120V 3PH, 4W	MLO/ 225 A	2	253	Computer Room	2E4_2
LCD	2080Y/120V 3PH, 4W	MLO/ 225 A	2	253	Computer Room	2E4_2
EH7B	480Y/277V, 3PH, 4W	MCB/ 100 A	2	272	Electronic Integration Lab	2E1_7
EL7D	2080Y/120V 3PH, 4W	MCB/ 100 A	2	272	Electronic Integration Lab	2E1_7
H7B2	480Y/277V, 3PH, 4W	MCB/ 150 A	2	272	Electronic Integration Lab	2E1_7
HCA	480Y/277V, 3PH, 4W	MCB/ 125 A	2	272	Electronic Integration Lab	2E1_7
HCB	480Y/277V, 3PH, 4W	MCB/ 125 A	2	272	Electronic Integration Lab	2E1_7
LGA	2080Y/120V 3PH, 4W	MCB/150 A	1	107	Electrical Room	1E1_1

PANEL BOARDS						
TAG	PANEL VOLTAGE	TYPE/MAIN SIZE	FLOOR LEVEL	ROOM NO.	ROOM NAME	1/8 SCALE DWG.
LGB	2080Y/120V 3PH, 4W	MCB/ 150 A	1	104	Computer Room	1E1_1
L1B1	2080Y/120V 3PH, 4W	MCB/ 150 A	2	277	Electrical Room	1E1_1
L1B2	2080Y/120V 3PH, 4W	MLO/ 225 A	2	277	Electrical Room	1E1_2
L2B1	2080Y/120V 3PH, 4W	MCB/ 150 A	3	325	Electrical Room	1E2_5
L2B2	2080Y/120V 3PH, 4W	MCB/ 150 A	3	325	Electrical Room	1E2_3
L3B1	2080Y/120V 3PH, 4W	MCB/ 150 A	4	425	Electrical Room	1E2_4
L3B2	2080Y/120V 3PH, 4W	MLO/ 225 A	4	425	Electrical Room	1E2_4
L4B1	2080Y/120V 3PH, 4W	MCB/ 150 A	5	525	Electrical Room	1E2_5
L4B2	2080Y/120V 3PH, 4W	MLO/ 225 A	5	525	Electrical Room	1E2_5
L5B1	2080Y/120V 3PH, 4W	MCB/ 150 A	6	625	Electrical Room	1E2_6
L5B2	2080Y/120V 3PH, 4W	MLO/ 225 A	6	625	Electrical Room	1E2_6
L6B1	2080Y/120V 3PH, 4W	MCB/ 150 A	7	725	Electrical Room	1E2_7
L6B2	2080Y/120V 3PH, 4W	MLO/ 225 A	7	725	Electrical Room	1E2_7
TPA1	155 V Δ, 3PH, 3W	MCB/ 200 A	2	207	Electrical Room	1E2_2
H1A	480Y/277V, 3PH, 4W	MLO/ 225 A	2	210	Electrical Room	1E2_2
H2A	480Y/277V, 3PH, 4W	MCB/ 200 A	3	310	Electrical Room	1E2_4
H3A	480Y/277V, 3PH, 4W	MCB/ 200 A	4	410	Electrical Room	1E2_4
H4A	480Y/277V, 3PH, 4W	MCB/ 200 A	5	510	Electrical Room	1E2_5
EH4A	480Y/277V, 3PH, 4W	MCB/ 70 A	5	510	Electrical Room	1E2_5
H5A	480Y/277V, 3PH, 4W	MCB/ 200 A	6	610	Electrical Room	1E2_6
H6A	480Y/277V, 3PH, 4W	MCB/ 200 A	7	710	Electrical Room	1E2_7
EHPA	480Y/277V, 3PH, 4W	MCB/ 250 A	8	801	Penthouse	1E2_8
ELPA	2080Y/120V 3PH, 4W	MCB/ 50 A	8	801	Penthouse	1E2_8
L1A2	2080Y/120V 3PH, 4W	MLO/ 225 A	2	207	Electrical Room	1E1_2
L1A1	2080Y/120V 3PH, 4W	MCB/ 150 A	2	207	Electrical Room	1E1_2
L2A2	2080Y/120V 3PH, 4W	MLO/ 225 A	3	307	Electrical Room	1E2_3
L2A1	2080Y/120V 3PH, 4W	MCB/ 150 A	3	307	Electrical Room	1E2_3
L3A2	2080Y/120V 3PH, 4W	MLO/ 225 A	4	407	Electrical Room	1E2_4
L3A1	2080Y/120V 3PH, 4W	MCB/ 150 A	4	407	Electrical Room	1E2_4

PANEL BOARDS						
TAG	PANEL VOLTAGE	TYPE/MAIN SIZE	FLOOR LEVEL	ROOM NO.	ROOM NAME	1/8 SCALE DWG.
L4A2	2080Y/120V 3PH, 4W	MLO/ 225 A	5	507	Electrical Room	1E2_5
L4A1	2080Y/120V 3PH, 4W	MCB/ 150 A	5	507	Electrical Room	1E2_5
L5A2	2080Y/120V 3PH, 4W	MLO/ 225 A	6	607	Electrical Room	1E2_6
L5A1	2080Y/120V 3PH, 4W	MCB/ 150 A	6	607	Electrical Room	1E2_6
L6A2	2080Y/120V 3PH, 4W	MCB/ 150 A	7	707	Electrical Room	1E2_7
L6A1	2080Y/120V 3PH, 4W	MLO/ 225 A	7	707	Electrical Room	1E2_7
PDP	480Y/277V, 3PH, 4W	MCB/ 700 A	8	801	Penthouse	1E2_8
TPB1	440 V Δ, 3PH, 3W	MCB/ 200 A	2	227	Electrical Room	1E2_2
HPA	480Y/277V, 3PH, 4W	MCB/ 225 A	8	801	Penthouse	1E2_8
HPB	480Y/277V, 3PH, 4W	MCB/ 450 A	8	801	Penthouse	1E2_8
P4A	2080Y/120V 3PH, 4W	MCB/ 200 A	2	277	Passageway	2E2_1
X4A	440 V Δ, 3PH, 3W	MCB/ 200 A	2	277	Passageway	2E2_1
Y4A	155 V Δ, 3PH, 3W	MCB/ 200 A	2	277	Passageway	2E2_1
HH4A	480Y/277V, 3PH, 4W	MCB/ 400 A	2	277	Electronic Integration Lab	2E2_1
X5A	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	MIA
Y5A	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	MIA
P5A	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	MIA
HH5A	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	MIA
X6A	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
Y6A	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
P6A	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
HH6A	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
X7A	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y7A	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P7A	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH7A	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X8A	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y8A	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P8A	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH8A	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X9A	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y9A	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P9A	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH9A	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2

PANEL BOARDS						
TAG	PANEL VOLTAGE	TYPE/ MAIN SIZE	FLOOR LEVEL	ROOM NO.	ROOM NAME	1/8 SCALE DWG.
X10A	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y10A	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P10A	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH10A	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X4B	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
Y4B	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
P4B	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
HH4B	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
X7B	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y7B	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P7B	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH7B	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X8B	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y8B	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P8B	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH8B	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X9B	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y9B	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P9B	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH9B	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X10B	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y10B	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P10B	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH10B	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X11B	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y11B	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P11B	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH11B	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X4C	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
Y4C	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
P4C	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
HH4C	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
X6C	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
Y6C	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
P6C	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
HH6C	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1

PANEL BOARDS						
TAG	PANEL VOLTAGE	TYPE/MAIN SIZE	FLOOR LEVEL	ROOM NO.	ROOM NAME	1/8 SCALE DWG.
X7C	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y7C	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P7C	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH7C	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X8C	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y8C	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P8C	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH8C	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X9C	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y9C	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P9C	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH9C	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X10C	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y10C	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P10C	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH10C	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X5D	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
Y5D	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
P5D	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
HH5D	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
X6D	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
Y6D	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
P6D	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
HH6D	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_1
X7D	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y7D	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P7D	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH7D	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X8D	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y8D	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P8D	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH8D	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X9D	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y9D	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P9D	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH9D	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2

PANEL BOARDS						
TAG	PANEL VOLTAGE	TYPE/MAIN SIZE	FLOOR LEVEL	ROOM NO.	ROOM NAME	1/8 SCALE DWG.
X10D	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
Y10D	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
P10D	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
HH10D	480Y/277V, 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
X1E	440 V Δ, 3PH, 3W	MCB/ 200 A	2	464822	Antenna Equipment Room	2E1_9
Y1E	155 V Δ, 3PH, 3W	MCB/ 200 A	2	464822	Antenna Equipment Room	2E1_9
P1E	2080Y/120V 3PH, 4W	MCB/ 200 A	2	464822	Antenna Equipment Room	2E1_9
HH1E	480Y/277V, 3PH, 4W	MCB/ 400 A	2	272	Electrical Integration Lab	2E2_2
XBP	440 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
YBP	155 V Δ, 3PH, 3W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2
PBP	2080Y/120V 3PH, 4W	MCB/ 200 A	2	272	Electrical Integration Lab	2E2_2

Over-current Devices

The main over-current protective device in the main switchgear is a draw out type fuse. The secondary switchgear utilizes the same protection device. The switchboard feeders are protected at both ends by draw-out type circuit breakers, insulated case with electronic trip rated 100%. Interrupting current capacity is not discussed in the specifications. The internal switchboard circuit protection devices are non-drawout type circuit breakers. Branch circuit panel boards are either main lugs only or main circuit breakers that are thermal-magnetic molded case type.

Transformers

There are three voltage systems that are applied to panels in the building. Transformers 480V Primary, 208Y/120V Secondary is the type of transformer found throughout the Office Tower. In the Laboratory Wing, there is 480V Primary, 208Y/120V Secondary, 480V Δ Primary, 440V Δ Secondary, and 480V Δ Primary, 115V Δ Secondary.

INDIVIDUAL TRANSFORMER SCHEDULE								
TAG	PRIMARY VOLTAGE	SECONDARY VOLTAGE	SIZE	TYPE	TEMP. RISE	TAPS	MOUNTING	REMARKS
T1	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	225KVA	DRY	115 C	(2) 2.5%	Pad Mounted	
T2	23.0/12.2 KV Y	13.8/7.9 KV Y	5MVA				Pad Mounted	Provided by Virginia Power
T3	23.0/13.2 KV Y	480Y/208V Y	5MVA	DRY			Pad Mounted	Provided by Virginia Power
T4	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	
T5	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	15 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	
T6	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	30 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	
T7	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	
T8	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	46 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	K-13 Rated
T9	480V Δ, 3PH, 3W	440V Δ, 3PH, 3W	150 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	

INDIVIDUATL TRANSFORMER SCHEDULE

TAG	PRIMARY VOLTAGE	SECONDARY VOLTAGE	SIZE	TYPE	TEMP. RISE	TAPS	MOUNTING	REMARKS
T10	480V Δ, 3PH, 3W	115V Δ, 3PH, 3W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	
T11	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	K-13 Rated
T12	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	K-13 Rated
T13	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	K-13 Rated
T14	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	K-13 Rated
T15	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	K-13 Rated
T16	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	K-13 Rated
T17	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	K-13 Rated
T18	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	
T19	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	K-13 Rated
T20	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	K-13 Rated
T21	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	45 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	K-13 Rated
T22	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	15 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	K-13 Rated
T23	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	15 KVA	DRY	115 C	(2) 2.5%	Pad Mounted	K-13 Rated
T24	480V Δ, 3PH, 3W	440V Δ, 3PH, 3W	150 KVA	DRY	115 C	(2) 2.5%	Rack Mounted	(18) on Switchboard SBPA
T25	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	75 KVA	DRY	115 C	(2) 2.5%	Rack Mounted	(18) on Switchboard SBPA
T26	480V Δ, 3PH, 3W	115V Δ, 3PH, 3W	45 KVA	DRY	115 C	(2) 2.5%	Rack Mounted	(18) on Switchboard SBPA
T27	480V Δ, 3PH, 3W	440V Δ, 3PH, 3W	150 KVA	DRY	115 C	(2) 2.5%	Rack Mounted	(14) on Switchboard SBPC
T28	480V Δ, 3PH, 3W	208Y/120V, 3PH, 4W	75 KVA	DRY	115 C	(2) 2.5%	Rack Mounted	(14) on Switchboard SBPC
T29	480V Δ, 3PH, 3W	115V Δ, 3PH, 3W	45 KVA	DRY	115 C	(2) 2.5%	Rack Mounted	(14) on Switchboard SBPC

Grounding

Grounding rods are copper-clad steel ¾" and 120" long buried 18" below grade and 24" from building perimeter. Grounding conductors, bare copper conductors #2/0AWG, are electrically connected to each grounding rod extending around the perimeter. Grounding is installed around manholes and handholes with #1/0 AWG bare, copper conductors in waterproof sleeves inside manhole walls. The lab has a bare copper grounding grid located in the concrete slab. Each intersection is exothermically welded and has copper ground plates flush in concrete slab.

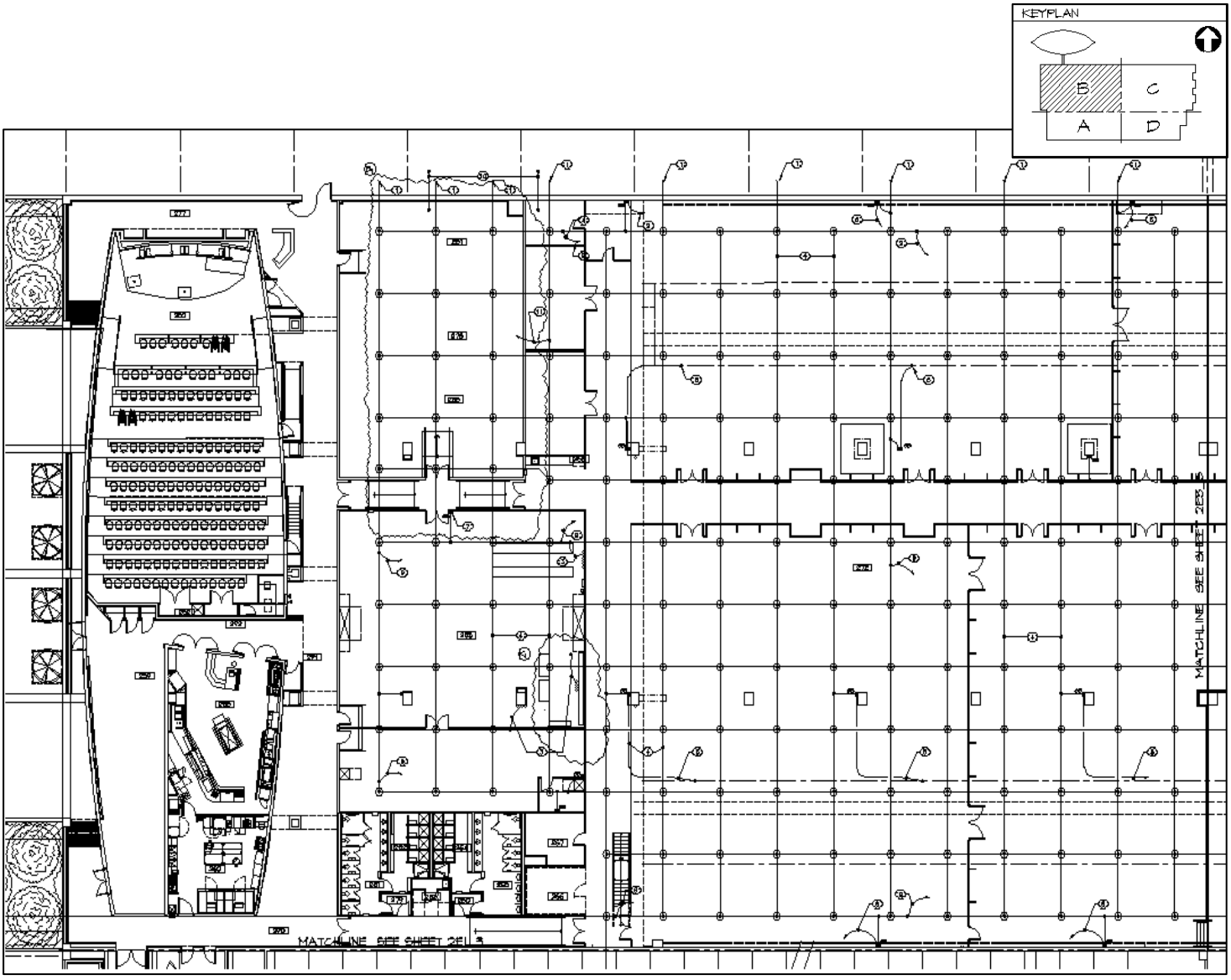


Figure B Partial Second Floor Grounding Plan

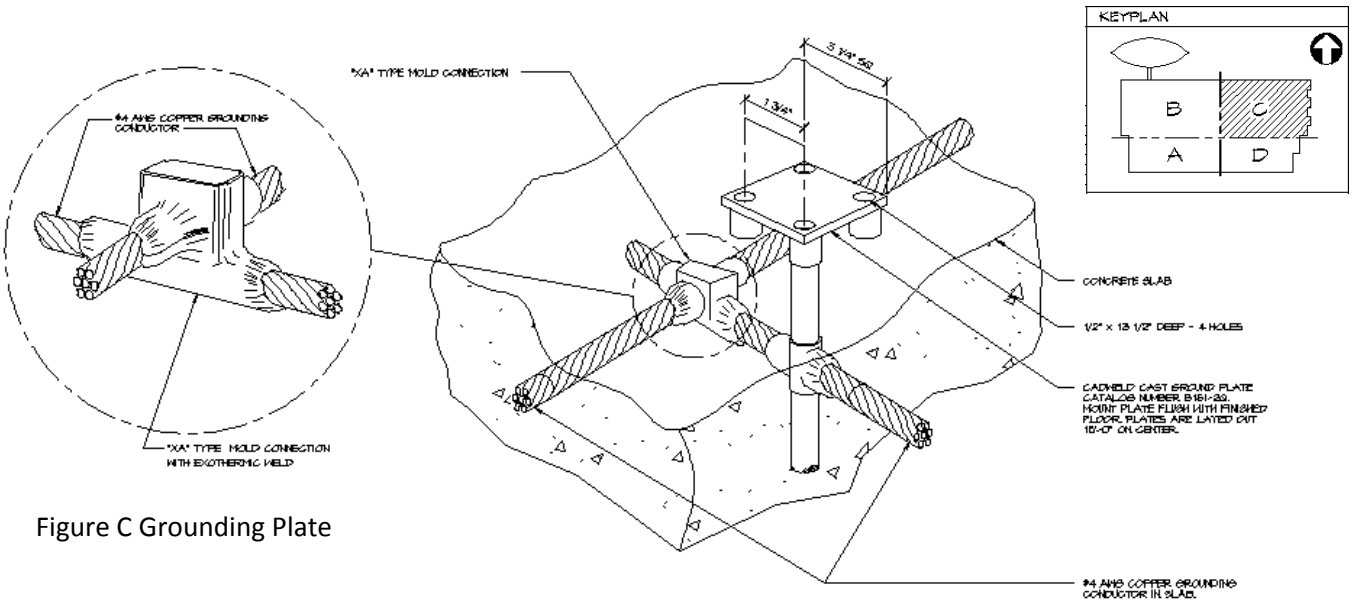


Figure C Grounding Plate

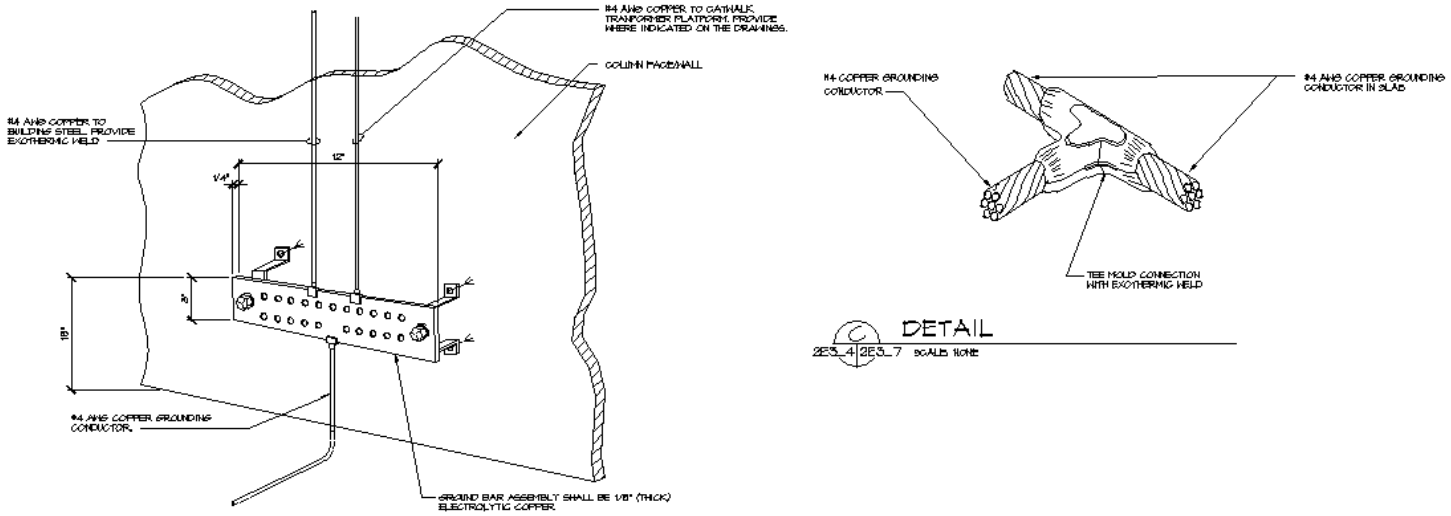


Figure D Grounding Bar Details

Special Equipment

The Virginia Advanced Shipbuilding Carrier and Integration Center is equipped with and uninterruptible power supply (UPS)m which is energized through the standby power automatic transfer switch, ATS-2. The 130 kVA UPS (480Y- 208Y/120V) is located in electrical room 367 of the Laboratory Wing. Batteries provide 15 minutes of 100% power and filters maximum harmonic distortion of 10% at 100% non-linear loading.

The UPS system distributes power to four panels providing power to I.T and communications equipment.

The equipment in the building that falls under special equipment are kitchen equipment appliances sheet 2E4_7, systems furniture, lighting contactors, lightning protection system, and a UPS. IT and communication loads are on the UPS which is on the riser diagram, but I cannot find it on the floor plans.

Lighting Loads

The lighting utilizes lamp types of linear fluorescent, compact fluorescent, incandescent, halogen, and metal halide. Linear fluorescent ballasts are multi-lamp electronic type with total harmonic distortion rating less than 20%. Compact fluorescent ballasts are electronic type with power factor greater than 90%. High intensity discharge ballasts are constant wattage autotransformer single-lamp type with starting temperature at a minimum of -22 degrees Fahrenheit.

The following Luminaire Schedule lists the luminaire tag, number or lamps, type of lamp, lamp wattage, ballast type, voltage, total input watts, ballast factor, operating current, and power factor.

All manufacturers' catalog cut sheets and specifications for HID lamps and ballasts are included in Appendix B.

LUMINAIRE SCHEDULE									
TYPE	LAMPS			BALLAST TYPE	INPUT VOLTS	INPUT WATTS	BALLAST FACTOR	OPERATING CURRENT	POWER FACTOR
	TYPE	WATTAGE	NO.						
A	MXR100	100W	1	ELECTRONIC	277	129.00	1.00	1.00	0.90
B	CMH400	400W	1	ELECTRONIC	277	475.00	1.00	1.00	0.90
C	F32T8/B	32W	2	ELECTRONIC	277	62.00	0.88	0.52	0.99
D	F32TBX	32W	2	ELECTRONIC	277	72.00	>.98	0.26	>.97
E	F32T8/B	32W	3	ELECTRONIC	277	62.00	0.88	0.52	0.99
F	F4030BX	40W	2	ELECTRONIC	277	75.00	0.98	0.27	0.95
G	F32T8/B	32W	3	ELECTRONIC	277	62.00	0.88	0.52	0.99
H	F42TBX	42W	1	ELECTRONIC	277	45	1.00	0.18	0.93
I	F32T8/B	32W	4	ELECTRONIC	277	62.00	0.88	0.52	0.99
J	MXR175	175W	1	ELECTRONIC	277	205.00	1.00	1.75	0.90
K	F32TBX	32W	1	ELECTRONIC	277	35.00	>.98	0.13	>.97
L	50MR16	50W	1	-	24	24.00	-	0.15	1.00
M	F32T8/B	32W	2	ELECTRONIC	277	62.00	0.88	0.52	0.99
N	F32TBX	32W	1	ELECTRONIC	277	35.00	>.98	0.13	>.97
O	F26TBX	26W	1	ELECTRONIC	277	28.00	1.00	0.10	0.96
P	F96T8	86W	2	ELECTRONIC	277	143.00	0.82	0.56	0.97
Q	MXR175	175W	2	ELECTRONIC	277	205.00	1.00	1.75	0.90
R	MXR70	70W	1	ELECTRONIC	277	81.00	1.00	0.32	0.98
S	F32T8/B	32W	2	ELECTRONIC	277	62.00	0.88	0.52	0.99
T	MXR175	175W	1	ELECTRONIC	277	205.00	1.00	1.75	0.90
U	F50BXSPX	50W	4	ELECTRONIC	277	230.00	1.05	0.43	0.98
V	MXR175	175W	1	ELECTRONIC	277	205.00	1.00	1.75	0.90
W	CMH100PAR3	100W	1	ELECTRONIC	277	125.00	1.00	1.10	0.90
X	LED	-	-	-	277	1.00	1.00	-	-
Y	F26DBX/835	26W	1	ELECTRONIC	277	28.00	1.00	0.10	0.96
Z	F50BXSPX	50W	3	ELECTRONIC	277	165.00	1.05	0.43	0.98
AA	F32T8/B	32W	2	ELECTRONIC	277	62.00	0.88	0.52	0.99
BB	MPR175/VBU	175W	2	MAGNETIC	277	210.00	1.00	0.80	0.90
CC	F32TBX	32W	1	ELECTRONIC	277	36.00	0.98	0.13	0.98
DD	F13BX	13W	2	ELECTRONIC	277	15.00	0.98	0.10	0.90
EE	MVR175	175W	1	MAGNETIC	277	205.00	1.00	1.75	0.90
FF	F32T8/B	32W	2	ELECTRONIC	277	62.00	0.88	0.52	0.99
GG	50AR70/SP8	50W	-	-	120	50.00	-	0.15	1.00
HH	CSD250	250W	1	ELECTRONIC	120	271.00	1.00	3.20	0.80
II	75A/CL	75W	1	-	120	75.00	-	0.13	1.00
JJ	F32T8/B	32W	6	ELECTRONIC	277	215.00	1.18	0.82	0.97
KK	F32T8/B	32W	6	ELECTRONIC	277	215.00	1.18	0.82	0.97
LL	50MR16/Q	50W	1	ELECTRONIC	24	50	-	0.15	1.00
MM	F32T8/B	32W	2	ELECTRONIC	120	62.00	0.88	0.52	0.99

LUMINAIRE SCHEDULE									
TYPE	LAMPS			BALLAST TYPE	INPUT VOLTS	INPUT WATTS	BALLAST FACTOR	OPERATING CURRENT	POWER FACTOR
	TYPE	WATTAGE	NO.						
NN	F26DBX/827	26W	1	ELECTRONIC	277	28.00	1.00	0.10	0.96
OO	F9BX/827	9W	1	ELECTRONIC	277	12.00	0.98	0.18	0.99
PP	F13T5/	13W	2	ELECTRONIC	120	32.00	0.99	0.27	0.99
QQ	MXR175	175W	1	ELECTRONIC	277	205.00	1.00	1.75	0.90
RR	MXR175	175W	1	ELECTRONIC	277	205.00	1.00	1.75	0.90
SS	F42TBX/835	42W	1	ELECTRONIC	277	45.00	1.00	0.18	0.93
TT	F32T8/B	32W	2	ELECTRONIC	277	62.00	0.88	0.23	0.99
UU	MXR70	70W	1	ELECTRONIC	277	90.00	1.00	0.35	0.90
XX	LED	-	-	-	277	1.00	1.00	-	-
YY	150PAR/FL	150W	1	ELECTRONIC	120	150.00	-	-	1.00
ZZ	F32T8/B	32W	3	ELECTRONIC	277	92.00	0.88	0.33	0.99
RF	F32T8/B	32W	3	ELECTRONIC	120	92.00	0.88	0.77	0.99
RV	F13BX/827	13W	2	ELECTRONIC	120	30.00	0.90	0.25	0.50
A1	MVR250/PAR 38	250W	1	ELECTRONIC	120	275.00	0.80	2.20	0.90

Lighting Control

ASHRAE/IESNA 90.1 shutoff requirement compliancy:

The Virginia Advanced Shipbuilding Carrier and Integration Center utilizes lighting controls such as programmable time switches, photoelectric relays, and lighting contactors for exterior control. Dimmer switches are utilized in all offices and conference rooms, as well as technology displays. Located in the auditorium of the Laboratory Wing is an intricate lighting control system consisting of two dimmer panels, three entry panels, and two lighting scene controllers.

Exterior

- Time switches are electronic dial-type, programmable for eight-day cycles including holidays or skip-day modes. Time switches control three separate circuits individually.
- Photoelectric relays are solid state, with single-pole, double-throw dry contacts rated to operate connected relay, contactor coils, or microprocessor input. Time delays are installed to prevent false operation.

- Lighting contactors are electrically operated and mechanically held and serve loads including tungsten filament, inductive, and high-inrush ballast. Control coil voltage matches the control power source voltage. There are four lighting contactors located on the ground floor of the Office Tower that control the reflecting pool lighting, walkway bollard lighting, and exterior ground floor lighting.

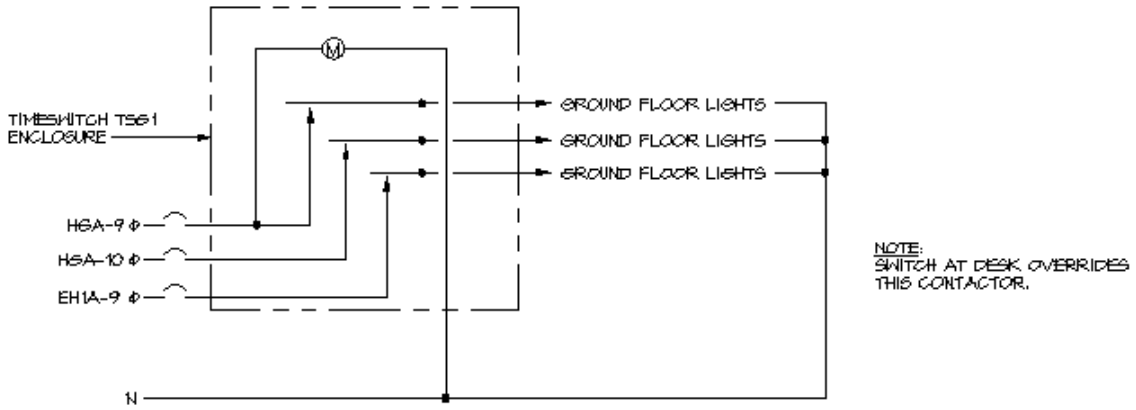


Figure E Lighting Control Diagram-Tower Ground Floor

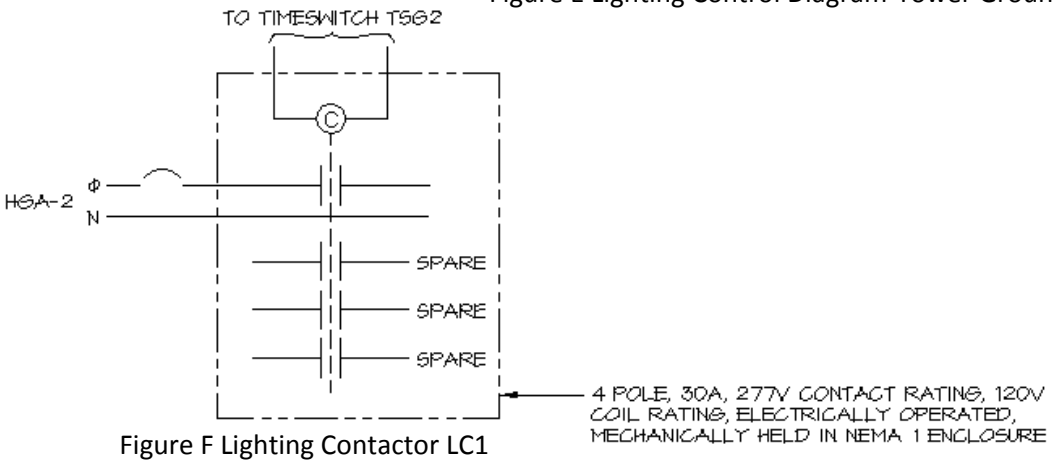


Figure F Lighting Contactor LC1

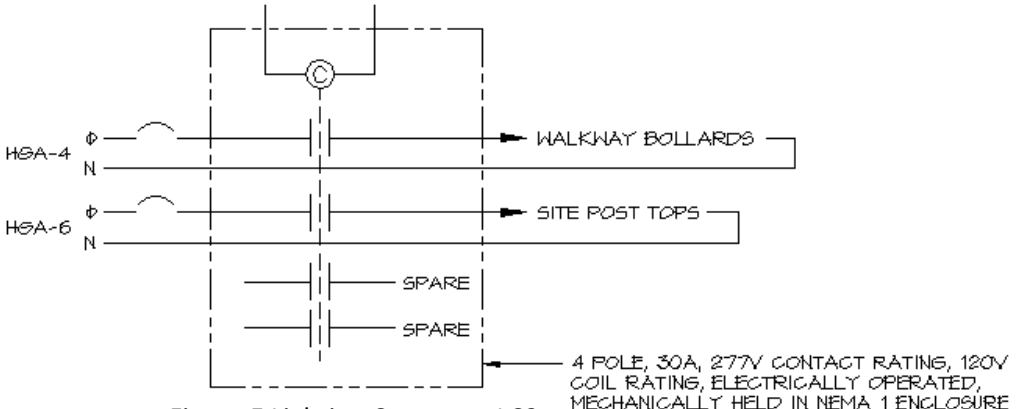


Figure E Lighting Contactor LC2

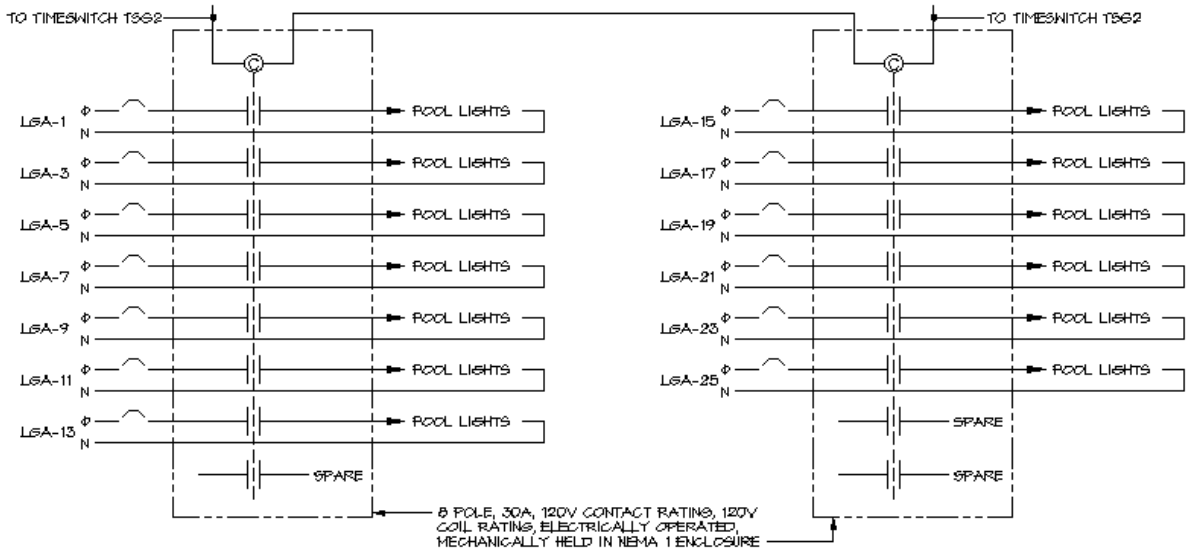


Figure F Lighting Contactor LC3 and LC4

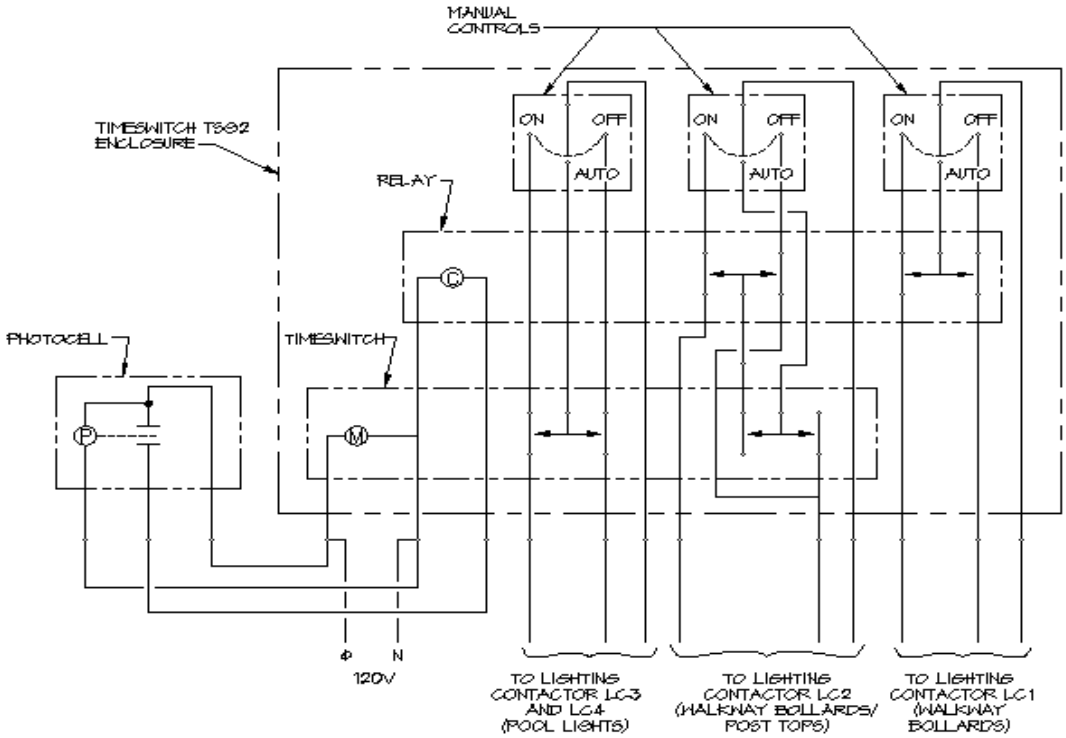


Figure G Lighting Control Diagram-Tower Site and Pool

Interior

- Dimmer switches are utilized throughout the building to provide a more comfortable environment for the occupant of the space.

- The dimming system for the auditorium utilizes dimmer panels, lighting scene controllers, and entry panels. The lighting scene controllers are programmable up to eight zones which are controlled by the dimmer panels. The entry panels are a single scene controller for on/off operation. All controls are manufactured by Lutron.

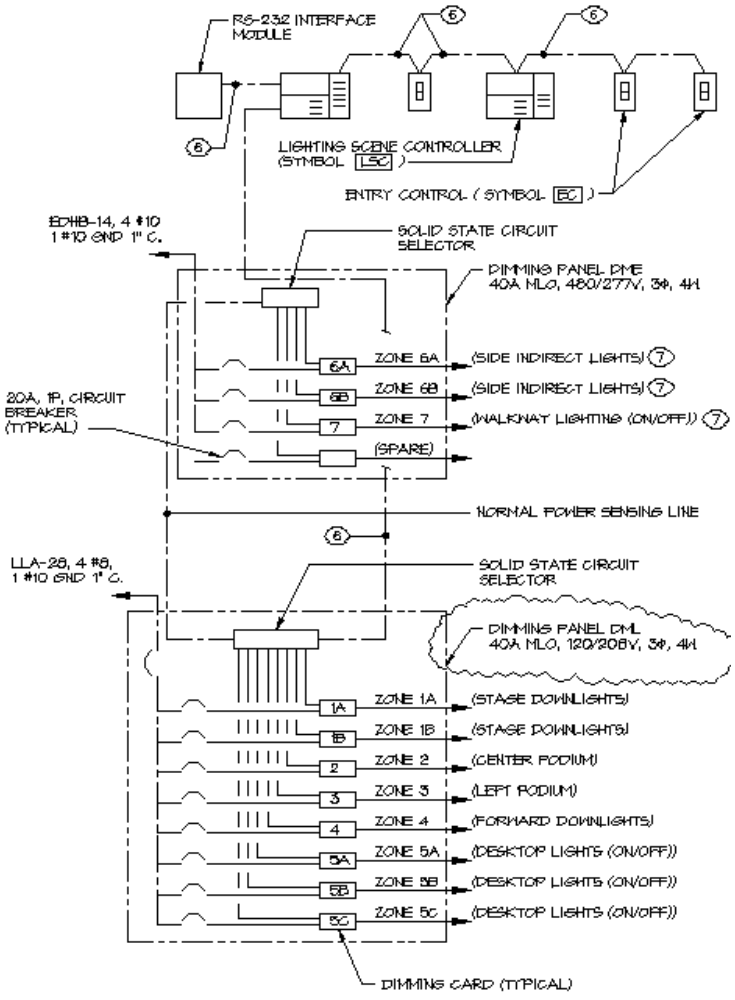


Figure H Lighting Control

DIMMER ZONE CONTROL SCHEDULE

CONTROL ZONE	DIMMER CARD(S)	ZONE DESCRIPTION
1	1	STAGE DOWNLIGHTS
2	2	CENTER PODIUM
3	3	LEFT PODIUM
4	4	FORWARD DOWNLIGHTS
5	5A, 5B, 5C	DESKTOP LIGHTS
6	5A, 6B	SIDE INDIRECTS
7	7	WALKWAY LIGHTS
8	8	STAGE DOWNLIGHTS

Figure I Dimmer Zone

ZONE INTENSITY SETTING								
SCENE SELECT	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ZONE 6	ZONE 7	ZONE 8
1	90%	90%	90%	70%	OFF	100%	OFF	N/A
2	90%	90%	90%	70%	ON	100%	OFF	N/A
3	OFF	OFF	OFF	OFF	OFF	OFF	ON	N/A
4	OFF	OFF	OFF	OFF	ON	20%	ON	N/A
5	OFF	OFF	ON	OFF	ON	20%	ON	N/A
6	SPARE	-	-	-	-	-	-	N/A
7	SPARE	-	-	-	-	-	-	N/A
8	SPARE							

Figure J Zone Intensity Setting

Mechanical / Other Loads

The Office Tower primary air is provided from the penthouse mechanical room located on the roof that houses 3 VAV AHU's. The required primary air is provided through round or oval duct utilizing a vertical chase.
The Laboratory/Parking Building primary air is provided from 4 VAV AHU's located in the center of this building. The required primary air is provided through galvanized, round straight runs of duct to each end of the Laboratory.

The estimated cooling load for the entire facility is 1000 tons, provided from high efficiency water-cooled centrifugal chillers. The design consists of one-350 ton chiller and one-650 ton chiller with a 12 degrees temperature difference.

The estimated heating load for the entire facility is 7,500,000 btu/hr. A gas hot water system is utilized with gas-fired boilers that are high efficiency condensing type to generate hot water. This hot water is distributed throughout the facility by two way valves at heating coils and perimeter hydronic heat at glass wall locations.

The following mechanical, plumbing, and kitchen equipment schedules include individual equipment tags, description, load in HP, kVA, and kW. Voltage and phase along with NEC motor amps and assumed power factors are also included.

MECHANICAL/PLUMBING EQUIPMENT SCHEDULE

Tag	Load Description	Load	Load Units	Motor Amps	Voltage/ Phase	Assumed P.F.	kVA	kW	Quantity	Total Load
AHU-SF-1	SUPPLY FAN	40	HP	52	480V/3φ	0.95	24.9	23.7	1	23.7
AHU-EF-1	EXHAUST FAN	20	HP	27	480V/3φ	0.95	12.9	12.3	1	12.3
AHU-SF-2	SUPPLY FAN	40	HP	52	480V/3φ	0.95	24.9	23.7	1	23.7
AHU-EF-2	EXHAUST FAN	15	HP	21	480V/3φ	0.95	10.1	9.6	1	9.6
AHU-SF-3	SUPPLY FAN	40	HP	52	480V/3φ	0.95	24.9	23.7	1	23.7
AHU-EF-3	SUPPLY FAN	15	HP	21	480V/3φ	0.95	10.1	9.6	1	9.6
AHU-SF-4	SUPPLY FAN	50	HP	65	480V/3φ	0.95	31.2	29.6	1	29.6
AHU-EF-4	EXHAUST FAN	15	HP	21	480V/3φ	0.95	10.1	9.6	1	9.6
AHU-SF-5	SUPPLY FAN	60	HP	77	480V/3φ	0.95	36.9	35.1	1	35.1
AHU-EF-5	EXHAUST FAN	25	HP	34	480V/3φ	0.95	16.3	15.5	1	15.5
AHU-SF-6	SUPPLY FAN	60	HP	77	480V/3φ	0.95	36.9	35.1	1	35.1
AHU-EF-6	EXHAUST FAN	20	HP	27	480V/3φ	0.95	12.9	12.3	1	12.3
AHU-SF-7	SUPPLY FAN	50	HP	65	480V/3φ	0.95	31.2	29.6	1	29.6
AHU-EF-7	EXHAUST FAN	20	HP	27	480V/3φ	0.95	12.9	12.3	1	12.3
AHU-SF-8	SUPPLY FAN	20	HP	27	480V/3φ	0.95	12.9	12.3	1	12.3
AHU-EF-8	EXHAUST FAN	7.5	HP	11	480V/3φ	0.95	5.3	5.0	1	5.0
AHU-SF-9	SUPPLY FAN	15	HP	21	480V/3φ	0.95	10.1	9.6	1	9.6
AHU-EF-9	EXHAUST FAN	5	HP	7.6	480V/3φ	0.75	3.65	2.7	1	2.7
EF-1	EXHAUST FAN	5	HP	7.6	480V/3φ	0.75	3.65	2.7	1	2.7
EF-2	EXHAUST FAN	0.5	HP	1.1	480V/3φ	0.75	0.53	0.4	1	0.4
EF-3	EXHAUST FAN	5	HP	7.6	480V/3φ	0.75	3.65	2.7	1	2.7
EF-4	EXHAUST FAN	5	HP	7.6	480V/3φ	0.75	3.65	2.7	1	2.7
EF-5	EXHAUST FAN	0.5	HP	1.1	480V/3φ	0.75	0.53	0.4	1	0.4
EF-6	EXHAUST FAN	2	HP	3.4	480V/3φ	0.75	1.63	1.2	1	1.2
EF-7	EXHAUST FAN	3	HP	4.8	480V/3φ	0.75	2.30	1.7	1	1.7
EF-8	EXHAUST FAN	5	HP	7.6	480V/3φ	0.75	3.65	2.7	1	2.7
SF-1	SUPPLY FAN	3	HP	4.8	480V/3φ	0.75	2.30	1.7	1	1.7
SF-2	SUPPLY FAN	3	HP	4.8	480V/3φ	0.75	2.30	1.7	1	1.7
SF-3	SUPPLY FAN	7.5	HP	11	480V/3φ	0.95	5.28	5.0	1	5.0
SF-4	SUPPLY FAN	7.5	HP	11	480V/3φ	0.95	5.28	5.0	1	5.0
SF-5	SUPPLY FAN	3	HP	4.8	480V/3φ	0.75	2.30	1.7	1	1.7
SF-6	SUPPLY FAN	3	HP	4.8	480V/3φ	0.75	2.30	1.7	1	1.7
FM-O	Fan Motor: Office	1/3	HP	3.6	277/1 φ	0.75	0.99	0.7	113	84.5
FM-L	Fan Motor: Lab	1/8	HP	1.5	277/1 φ	0.75	0.42	0.3	69	21.5

MECHANICAL/PLUMBING EQUIPMENT SCHEDULE										
Tag	Load Description	Load	Load Units	Motor Amps	Voltage/ Phase	Assumed P.F.	kVA	kW	Quantity	Total Load
CT-1	COOLING TOWER	40	HP	52	460V/3φ	0.95	24.9	23.7	1	23.7
CT-2	COOLING TOWER	40	HP	52	460V/3φ	0.95	24.9	23.7	1	23.7
CT-3	COOLING TOWER	40	HP	52	460V/3φ	0.95	24.9	23.7	1	23.7
CH-1	CHILLER	364	FLA		480V/3φ	0.95	174.7	166	1	166.0
CH-2	CHILLER	606	FLA		480V/3φ	0.95	290.8	276	1	276.3
ILH	IN-LINE HEATER	6	KW		480Y/3φ	0.95		6.0	1	6.0
PB-1	PRESSURE BOOST	10	HP	14	480V/3φ	0.95	6.72	6.4	1	6.4
AC-1	AIR COMPRESSOR	10	HP	14	480V/3φ	0.95	6.72	6.4	1	6.4
AC-2	AIR COMPRESSOR	10	HP	14	480V/3φ	0.95	6.72	6.4	1	6.4
PS-1	PUMP	95	HP	120	480V/3φ	0.95	57.6	54.7	1	54.7
PS-2	PUMP	225	HP	265	480V/3φ	0.95	127.2	121	1	120.8
PS-3	PUMP	20	HP	27	480V/3φ	0.95	12.9	12.3	1	12.3
PS-4	PUMP	15	HP	21	480V/3φ	0.95	10.1	9.6	1	9.6
SL-1	SCISSOR LIFT	5	HP	7.6	480V/3φ	0.75	3.65	2.7	1	2.7
MM-1	MILLING MACH.	3	HP	4.8	208Y/3φ	0.75	0.99	0.7	1	0.7
IW-1	IRON WORKER	5	HP	7.6	208Y/3φ	0.75	1.58	1.2	1	1.2
G-1	GRINDER	2	HP	3.4	208Y/3φ	0.75	0.71	0.5	1	0.5
L-1	LATHE	7.5	HP	11	208Y/3φ	0.75	2.29	1.7	1	1.7
BS-1	BANDSAW	1	HP	2.1	208Y/3φ	0.75	0.44	0.3	1	0.3
ELV-1	ELEVATOR	60	HP	77	480V/3φ	0.95	36.9	35.1	1	35.1

KITCHEN EQUIPMENT SCHEDULE

Tag	Load Description	Load	Load Units	Motor Amps	Voltage/ Phase	Assumed P.F.	kVA	kW	Total Load
5	Air Screen Display Case	20	A		120/1φ	0.75	2.40	1.80	4.32
7	Sneeze Guard Lights	5	A		120/1φ	0.75	0.60	0.45	0.27
9	Deli Case Receptacles	15	A		120/1φ	0.75	1.80	1.35	2.43
	Evaporator	15	A		120/1φ	0.75	1.80	1.35	2.43
11	Refrigerated Cold Pan	10	A		120/1φ	0.75	1.20	0.90	1.08
12	Breath Guard Lights	8	A		120/1φ	0.75	0.96	0.72	0.69
18	Soup Display Station	20	A		120/1φ	0.75	2.40	1.80	4.32
19	Hot Dog Roller	6.4	A		120/1φ	0.75	0.77	0.58	0.44
20	Counter and Trayslide	20	A		120/1φ	0.75	2.40	1.80	4.32
22	Sandwich Display Warmer	14.8	A		120/1φ	0.75	1.78	1.33	2.37
26	Under Counter Refrigerator	10	A		120/1φ	0.75	1.20	0.90	1.08
29	Microwave Oven	2.5	kW		120/1φ	0.75		2.50	2.50
31	Refrigerator, Reach-in, 1 dr.	8	A		120/1φ	0.75	0.96	0.72	0.69
33	Bakery Display	2	A		120/1φ	0.75	0.24	0.18	0.04
35	Ice Cube Dispenser	10	A		120/1φ	0.75	1.20	0.90	1.08
37	Drop-in Frost Top	6.8	A		120/1φ	0.75	0.82	0.61	0.50
38	Three Tier Display	8	A		120/1φ	0.75	0.96	0.72	0.69
40	Ice Cream Merchandiser	10	A		120/1φ	0.75	1.20	0.90	1.08
41	Coffee Urn	41	A		120/208/3φ	0.75	4.92/8.53	3.69/6.40	3.69/6.40
42	Twin Airpot Brewer	6.25	kW		120/1φ	0.75		6.25	6.25
43	Beverage Case	20	A		120/1φ	0.75	2.40	1.80	4.32
47	Condiment Counter	20	A		120/1φ	0.75	2.40	1.80	4.32
49	Toaster, Conveyor	1.5	A		208/1φ	0.75	0.31	0.23	0.07
50	Walk-In Refrigerator/Freezer	2	kW		120/1φ	0.75		2.00	2.00
51	Condensing Unit-Refrigerator	3/4	HP	7.6	208/1φ	0.75	1.58	1.19	1.87
52	Condensing Unit-Freezer	1 1/2	HP	11	208/1φ	0.75	2.29	1.72	3.93
53	Evaporator Coil-Refrigerator	2	A		120/1φ	0.75	0.24	0.18	0.04
54	Evaporator Coil-Freezer	1	kW		208/1φ	0.75		1.00	1.00
58	Scale	5	A		120/1φ	0.75	0.60	0.45	0.27
59	POS System	10	A		120/1φ	0.75	1.20	0.90	1.08
63	Kettle, Table Top, 10 Quart	15	KW		208/1φ	0.75		15.00	15.00
65	Steamer Counter Top	23	A		208/1φ	0.75	4.78	3.59	17.16

KITCHEN EQUIPMENT SCHEDULE									
Tag	Load Description	Load	Load Units	Motor Amps	Voltage/Phase	Assumed P.F.	kVA	kW	Total Load
67	Convection Oven-Double	11	kW		208/1φ	0.75		11.00	11.00
69	Cabinet-Heated	2	kW		120/1φ	0.75		2.00	2.00
74	Worktable	20	A		120/1φ	0.75	2.40	1.80	4.32
75	Worktable	20	A		120/1φ	0.75	2.40	1.80	4.32
76	Under Counter Dishwasher	12	A		208/1φ	0.75	2.50	1.87	4.67
	Waste Disposal	1/2	HP	5.4	120/1φ	0.75	0.65	0.49	0.31
80	Ice Maker	11.5	A		208/1φ	0.75	2.39	1.79	4.29

Service Entrance Size

The following summary breaks down the different calculations computed to size the service entrance. Method "A" sizing is designed for the Conceptual and Schematic phase of the design process. Here, the total square footage of the building is multiplied by a generalized demand load in VA/sq.ft determined by a generalized occupancy type of the building. Method "B" sizing is designed for the Design Development phase of the design process. In this method, the equipment loading along with lighting and receptacle loading is divided into separate categories also utilizing generalized demand loads in VA/sq.ft. The final method, Method "C", is sizing for the working drawings phase of the design process. Actual loading found on panel boards incorporating NEC demand factors for lighting and receptacle loads are taken into account in this phase. The breakdown of each calculation method is shown in the tables below followed by a summary table comparing the three methods of service entrance calculations.

Method A

Service Entrance Size Calculation - Conceptual/Schematic Design		
Building Square Footage	VA/sq.ft.	Load - VA
241,000	14	3374000

Method B

Service Entrance Size Calculation - Design Development			
Receptacles			
	VA/sq.ft.	Building Sq.ft.	Load- kVA
	0.5	241000	120.5
HVAC - cooling			
	VA/sq.ft.	Building Sq.ft.	Load- kVA
	8	241000	1928
Kitchen Equipment			
	VA/sq.ft.	Building Sq.ft.	Load- kVA
	20	1560	31.2
Shop Equipment- Industrial			
	VA/sq.ft.	Building Sq.ft.	Load- kVA
	25	155340	3883.5
Elevator			
50kW/elevator x	3 elevators = 150 kW		Load- kVA
Load - Amps			166.7
Lighting Demand Fators: NEC Table 220.12			
Load Type	VA/sq.ft.	Building Sq.ft.	Load- kVA
Office Building	3.5	241000	843.5
120.5 + 1928 + 31.2 + 3883.5 + 166.7 = 6806.9 kVA = **8187 A**			

Method C

Service Entrance Size Calculation - Working Drawings		
LOAD	Connected Load (kVA)	Demand Load (kVA)
Lighting	992.52	427.58
Receptacles	24180.8	17090.4
Mechanical/Plumbing Equip.	1184.5	1184.5
Kitchen Equipment	101.5	101.5
Total kVA		18803.98
Total Current		**22617.67**

Comparison

Service Entrance Size			
Phase	Load - kVA	Voltage System	Load - Amps
Conceptual/Schematic Design	3374	480Y/277V, 3P, 4W	4058.3
Design Development	6806.9	480Y/277V, 3P, 4W	8187.4
Working Drawings	18803.98	480Y/277V, 3P, 4W	22617.70

In comparing the three methods of service entrance sizing, you can see there is a vast different between the three types. The Conceptual/Schematic design phase was calculated as an office building occupancy. However, a large portion of the square footage is a laboratory. Though the volt-amps per square foot were adjusted to a higher value than regular office building loading, it may not have been adjusted high enough.

For the Design Development phase, the generalized loading was not adequate for this building. The Virginia Advanced Shipbuilding Carrier and Integration Center buildings, tests, and utilizes the most advanced technology for carrier ships. Depending on the types of testing they perform could be the reason for such low amperage to be calculated for general loading purposes.

The Working Drawings phase accounts for actual panel board loads, as well as adjusting for demand factors in lighting and receptacle loads. Also in this method, spares were considered on panel board

loads. This is the primary reason why this method shows a higher service entrance requirement and only supports ideology of special testing occurring.

Environmental Stewardship Design

Though the Virginia Advanced Shipbuilding Carrier and Integration Center develops the newest electronic system technologies, this building is not a LEED accredited building.

Design Issues

One of the main concerns for designing the electrical system of this building was the power requirement for running tests in the Laboratory. This is why the main switchgear is in a main-tie-main formation with the Office Tower. If tests need to be performed that require more power than the laboratory can provide, they close this tie to achieve loads up to 20 MVA.

Single-Line Diagram Drawing List

The single-line diagram is on sheet 1E4_4 for the Office Tower, and sheet 2E4_8 for the Laboratory Wing.

Communication System

Access Control

Access to the facility is controlled by a card access system. Card readers is either swipe or proximity type and is located on the entrance side of all exterior doors. Exit monitoring is not required in the facility. Access to the parking facility is controlled by card readers and motorized gates. This entire security system is placed on uninterruptible power supply (UPS-as mentioned earlier).

Another component of the access control system is video imaging system integration. This integration system provides a single database on the main host computer of every cardholder data and image fields, including photo, fingerprint, and signature.

CCTV

A closed circuit television system is provided to monitor the parking facility and entrance doors. Monitors are located in the reception/security desk on the ground floor of the Office Tower. Both the CCTV System and the Access Control System are part of the main security system of the facility.

CCTV equipment include video cameras, camera outlets, camera controls, monitors, power supplies, signal-processing equipment, control stations, distribution components, videotape recorder, and accessories to generate video images, process and distribute them.

Telecommunications

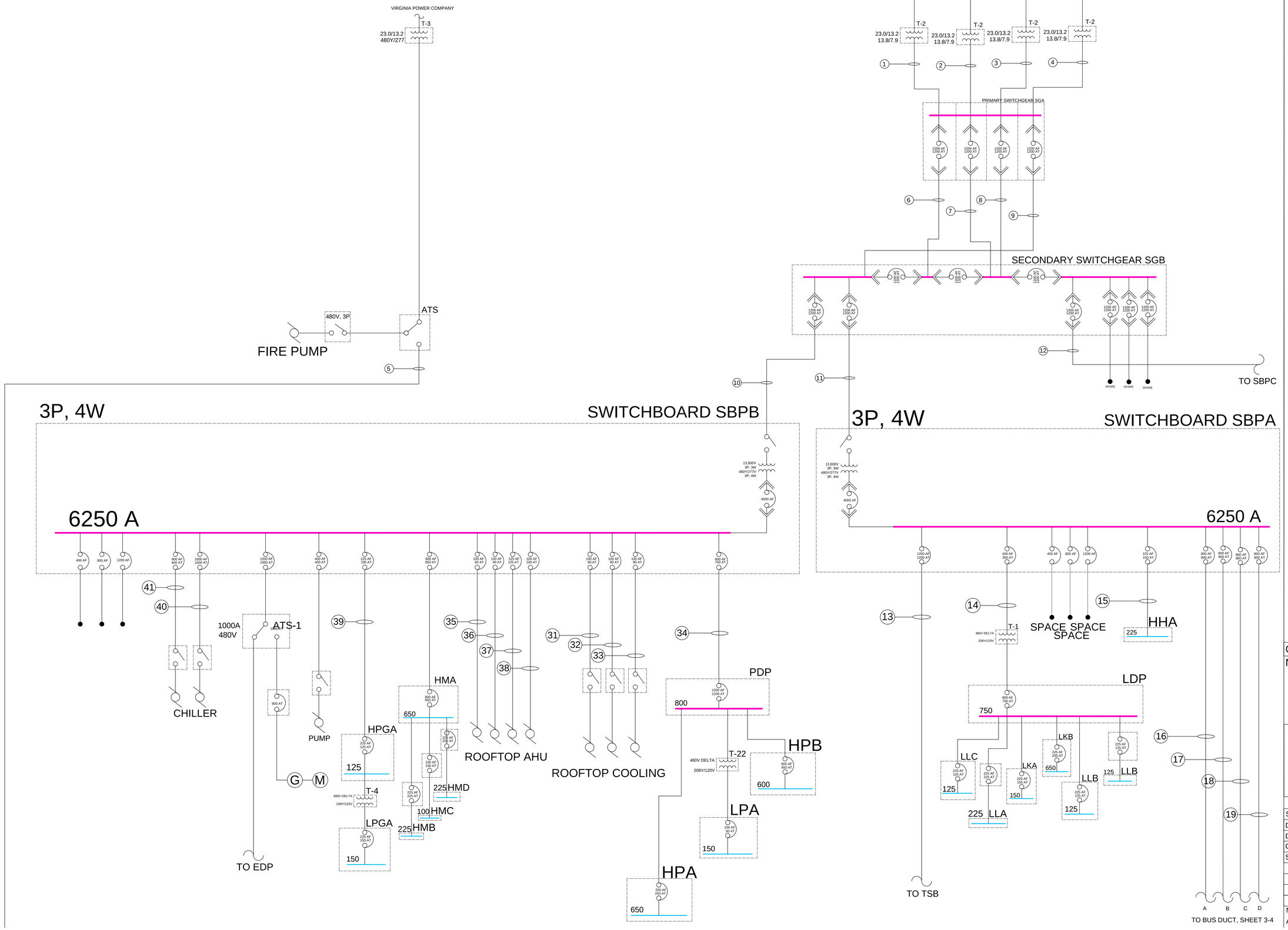
The main telecommunications room is located in the Facility Support Wing. Each floor of the Office Tower has a telecommunications room located in rooms 202 and 227 (room number corresponding with floor level). Each room has a 19" rack with modular patch panels housing multiple connections. In these rooms is a 20 amp emergency disconnect. There are also voice/data outlets designated for administrative LAN lines and separate outlets for voice. Horizontal wiring to work stations is installed in a cable tray above the lay-in ceiling tile system. Cable extends from the ceilings down the columns to connect system furniture to power.

APPENDIX A

FEEDER SCHEDULE

TAG	FROM	NO. OF SETS	CONDUIT (PER SET)		CONDUCTORS (PER SET)									SIZE OF OVER CURRENT PROTECTION	FRAME OR SWITCH SIZE	REMARKS
					PHASE CONDUCTORS			NEUTRAL CONDUCTORS			GROUND CONDUCTORS					
			SIZE	TYPE	NO.	SIZE	TYPE	NO.	SIZE	TYPE	NO.	SIZE	TYPE			
1	UTILITY XFMR	1	5"	EMT	3	250 KCMIL	UF/THWN	1	#4/0	UF/THWN						PROTECTION BY UTILITY
2	UTILITY XFMR	1	5"	EMT	3	250 KCMIL	UF/THWN	1	#4/0	UF/THWN						PROTECTION BY UTILITY
3	UTILITY XFMR	1	5"	EMT	3	250 KCMIL	UF/THWN	1	#4/0	UF/THWN						PROTECTION BY UTILITY
4	UTILITY XFMR	1	5"	EMT	3	250 KCMIL	UF/THWN	1	#4/0	UF/THWN						PROTECTION BY UTILITY
5	UTILITY XFMR	1	1-1/4"	EMT	3	4 AWG	UF/THWN				1	8 AWG	UF/THWN	1200	1200A/3P	
6	SGA	1	5"	EMT	3	250 KCMIL	UF/THWN	1	#4/0	UF/THWN				1200	1200A/3P	
7	SGA	1	5"	EMT	3	250 KCMIL	UF/THWN	1	#4/0	UF/THWN				1200	1200A/3P	
8	SGA	1	5"	EMT	3	250 KCMIL	UF/THWN	1	#4/0	UF/THWN				1200	1200A/3P	
9	SGA	1	5"	EMT	3	250 KCMIL	UF/THWN	1	#4/0	UF/THWN				1200	1200A/3P	
10	SGB	1	4"	EMT	3	250 KCMIL	UF/THWN	1	#4/0	UF/THWN				1200	1200A/3P	
11	SGB	1	4"	EMT	3	250 KCMIL	UF/THWN	1	#4/0	UF/THWN				1200	1200A/3P	
12	SGB	1	4"	EMT	3	250 KCMIL	UF/THWN	1	#4/0	UF/THWN				1200	1200A/3P	
13	SBPA	4	2-1/2"	EMT	3	350 KCMIL	UF/THWN	1	350 KCMIL	UF/THWN	1	3/0 KCMIL	UF/THWN	1200	1200A/3P	
14	SBPA	1	3"	EMT	3	500 KCMIL	UF/THWN				1	3/0 KCMIL	UF/THWN	325	400A/3P	
15	SBPA	1	1-1/2"	EMT	3	1/0 KCMIL	UF/THWN	1	1/0 KCMIL	UF/THWN	1	6 AWG	UF/THWN	150	225A/3P	
16	SBPA	2	3-1/2"	EMT	3	500 KCMIL	UF/THWN	1	500 KCMIL	UF/THWN	1	1/0 KCMIL	UF/THWN	800	800A/3P	
17	SBPA	2	3-1/2"	EMT	3	500 KCMIL	UF/THWN	1	500 KCMIL	UF/THWN	1	1/0 KCMIL	UF/THWN	800	800A/3P	
18	SBPA	2	3-1/2"	EMT	3	500 KCMIL	UF/THWN	1	500 KCMIL	UF/THWN	1	1/0 KCMIL	UF/THWN	800	800A/3P	
19	SBPA	2	3-1/2"	EMT	3	500 KCMIL	UF/THWN	1	500 KCMIL	UF/THWN	1	1/0 KCMIL	UF/THWN	800	800A/3P	
20	SBPC	2	3-1/2"	EMT	3	500 KCMIL	UF/THWN	1	500 KCMIL	UF/THWN	1	1/0 KCMIL	UF/THWN	800	800A/3P	
21	SBPC	2	3-1/2"	EMT	3	500 KCMIL	UF/THWN	1	500 KCMIL	UF/THWN	1	1/0 KCMIL	UF/THWN	800	800A/3P	
22	SBPC	2	3-1/2"	EMT	3	500 KCMIL	UF/THWN	1	500 KCMIL	UF/THWN	1	1/0 KCMIL	UF/THWN	800	800A/3P	
23	SBPC	2	3-1/2"	EMT	3	500 KCMIL	UF/THWN	1	500 KCMIL	UF/THWN	1	1/0 KCMIL	UF/THWN	800	800A/3P	
24	SBPC	1	1-1/2"	EMT	3	1/0 KCMIL	UF/THWN	1	1/0 KCMIL	UF/THWN	1	6 AWG	UF/THWN	125	225A/3P	
25	SBPC	1	1-1/2"	EMT	3	1 AWG	UF/THWN	1	1 AWG	UF/THWN	1	6 AWG	UF/THWN	125	225A/3P	
26	SBPC	1	1-1/2"	EMT	3	1 AWG	UF/THWN	1	1 AWG	UF/THWN	1	6 AWG	UF/THWN	125	225A/3P	
27	SBPC	1	1-1/4"	EMT	3	3 AWG	UF/THWN				1	6 AWG	UF/THWN	125	225A/3P	
28	SBPC	1	1-1/4"	EMT	3	3 AWG	UF/THWN				1	6 AWG	UF/THWN	125	225A/3P	
29	SBPC	1	3/4"	EMT	3	8 AWG	UF/THWN				1	10 AWG	UF/THWN	50	100A/3P	
30	SBPC	1	3/4"	EMT	3	8 AWG	UF/THWN				1	10 AWG	UF/THWN	50	100A/3P	
31	SBPB	1	3/4"	EMT	3	6 AWG	UF/THWN				1	8 AWG	UF/THWN	90	100A/3P	
32	SBPB	1	3/4"	EMT	3	6 AWG	UF/THWN				1	8 AWG	UF/THWN	90	100A/3P	
33	SBPB	1	3/4"	EMT	3	6 AWG	UF/THWN				1	8 AWG	UF/THWN	90	100A/3P	
34	SBPB	2	4"	EMT	3	500 KCMIL	UF/THWN	1	500 KCMIL	UF/THWN	1	1/0 KCMIL	UF/THWN	700	800A/3P	
35	SBPB	1	1"	EMT	3	4 AWG	UF/THWN				1	6 AWG	UF/THWN	60	100A/3P	
36	SBPB	1	1-1/4"	EMT	3	3 AWG	UF/THWN				1	6 AWG	UF/THWN	40	100A/3P	
37	SBPB	1	1/2"	EMT	3	10 AWG	UF/THWN				1	10 AWG	UF/THWN	125	225A/3P	
38	SBPB	1	3/4"	EMT	3	8 AWG	UF/THWN				1	10 AWG	UF/THWN	100	100A/3P	
39	SBPB	1	1-1/4"	EMT	3	3 AWG	UF/THWN	1	3 AWG	UF/THWN	1	8 AWG	UF/THWN	100	225A/3P	
40	SBPB	2	3"	EMT	3	500 KCMIL	UF/THWN				1	2/0 KCMIL	UF/THWN	1000	1000A/3P	
41	SBPB	2	3"	EMT	3	500 KCMIL	UF/THWN				1	2/0 KCMIL	UF/THWN	600	600A/3P	
42	SBPB	3	3"	EMT	3	400 KCMIL	UF/THWN	1	400 KCMIL	UF/THWN	1	3 AWG	UF/THWN	1000	1200A/3P	
43	EDP	3	3"	EMT	3	400 KCMIL	UF/THWN	1	400 KCMIL	UF/THWN	1	3 AWG	UF/THWN	1000	1000A/3P	
44	EDP	1	1-1/4"	EMT	3	4 AWG	UF/THWN	1	4 AWG	UF/THWN	1	8 AWG	UF/THWN	1000	1000A/3P	
45	EDP	1	2-1/2"	EMT	3	4/0 KCMIL	UF/THWN	1	4/0 KCMIL	UF/THWN	1	4 AWG	UF/THWN	1000	1000A/3P	
46	EDP	1	2-1/2"	EMT	3	4/0 KCMIL	UF/THWN	1	4/0 KCMIL	UF/THWN	1	4 AWG	UF/THWN	1000	1000A/3P	
47	EDP	1	1-1/4"	EMT	3	4 AWG	UF/THWN	1	4 AWG	UF/THWN	1	8 AWG	UF/THWN	100	100A/3P	
48	EDP	2	2-1/2"	EMT	3	4/0 KCMIL	UF/THWN	1	4/0 KCMIL	UF/THWN	1	2 AWG	UF/THWN	450	600A/3P	
49	EDP	1	1-1/2"	EMT	3	1/0 KCMIL	UF/THWN	1	1/0 KCMIL	UF/THWN	1	6 AWG	UF/THWN	450	600A/3P	
50	EDP	1	1-1/2"	EMT	3	1/0 KCMIL	UF/THWN	1	1/0 KCMIL	UF/THWN	1	6 AWG	UF/THWN	450	600A/3P	

NOTES:



GRAPHICAL SCALE:
NOT TO SCALE

THE VIRGINIA ADVANCED SHIPBUILDING CARRIER AND INTEGRATION CENTER

SCALE: NTS	
DRAWN BY: AZL	SENIOR AE THESIS
DATE: 10/20/2010	LIGHTING/ELECTRICAL
CHECKED BY:	THE PENNSYLVANIA STATE
SUPERVISOR:	UNIVERSITY

SINGLE LINE DIAGRAM

NAME:	DATE:	SHEET:
ALYSON Z. LARIMER	10/27/2010	1 OF 4

FROM ATS-1

FROM SBPA

FROM SGB

3P, 4W

SWITCHBOARD SBPC

13,800V
3P, 3W
480Y/277V
3P, 4W

6250 A

225 AF
125 AT

100 AF
50 AT

800 AF
800 AT

27 28 29 30

24 H7B2 150

25 HCA 125

26 HCB 125

23 22 21 20

EDP

1000

1000 AF
1000 AT

480Y/277, 3P, 4W

SWITCHBOARD TSB

1200 A

TO FIRE PUMP

46 47 45 44 43

EDHA 225

EDHB 100

T-5 480V DELTA 208Y/120V

EDLA 50

EH7B 100

T-6 480V DELTA 208Y/120V

EL7D 100

EHPA 250

T-4 480V DELTA 208Y/120V

ELPA 650

EH4A 70

UPS

LCA 450

48 49 50

LCD 225

LCC 225

LCB 225

T-10 480V DELTA 208Y/120V

TPA1 650

HGA 650

T-7 480V DELTA 208Y/120V

LGA 650

LGB 650

H3A 650

T-13 480V DELTA 208Y/120V

L3A1 650

L3A2 650

T-18 480V DELTA 208Y/120V

L3B1 650

L3B2 650

H5A 650

T-15 480V DELTA 208Y/120V

L5A1 650

L5A2 650

T-20 480V DELTA 208Y/120V

L5B1 650

L5B2 650

T-9 480V DELTA 208Y/120V

TPB1 650

H1A 650

T-11 480V DELTA 208Y/120V

L1A1 650

L1A2 650

T-8 480V DELTA 208Y/120V

L1B1 650

L1B2 650

H2A 650

T-12 480V DELTA 208Y/120V

L2A1 650

L2A2 650

T-17 480V DELTA 208Y/120V

L2B1 650

L2B2 650

H4A 650

T-14 480V DELTA 208Y/120V

L4A1 650

L4A2 650

T-19 480V DELTA 208Y/120V

L4B1 650

L4B2 650

H6A 650

T-16 480V DELTA 208Y/120V

L6A1 650

L6A2 650

T-21 480V DELTA 208Y/120V

L6B1 650

L6B2 650

H G F E

TO BUS DUCT , SHEET 3-4

NOTES:

GRAPHICAL SCALE:
NOT TO SCALE

THE VIRGINIA ADVANCED SHIPBUILDING CARRIER AND INTEGRATION CENTER

SCALE: NTS	SENIOR AE THESIS LIGHTING/ELECTRICAL THE PENNSYLVANIA STATE UNIVERSITY
DRAWN BY: AZL	
DATE: 10/20/2010	
CHECKED BY:	
SUPERVISOR:	

SINGLE LINE DIAGRAM

NAME:	DATE:	SHEET:
ALYSON Z. LARIMER	10/27/2010	2 OF 4

FROM SBPA

BUS DUCT D

HH1E
T-24 480V DELTA 115V DELTA
T-25 480V DELTA 208Y/120V
T-26 480V DELTA 115V DELTA
400 AF 400 AT
225 AF 200 AT
X1E
P1E
Y1E
HHBP
XBP
PBP
YPB
300 AT
175 A
110 A
70 A
200
H4C
H5D
H6D
X3C
P3C
Y3C
X5D
Y5D
P5D
X6D
Y6D
P6D

BUS DUCT C

H4C
H5C
H6C
X4C
Y4C
P4C
X5C
Y5C
P5C
X6C
Y6C
P6C

BUS DUCT B

H4B
H5B
H6B
H7B
H8B
X4B
Y4B
P4B
X5B
Y5B
P5B
X6B
Y6B
P6B
X7B
Y7B
P7B
X8B
Y8B
P8B

BUS DUCT A

H4A
H5A
H6A
H7A
H8A
X4A
Y4A
P4A
X5A
Y5A
P5A
X6A
Y6A
P6A
X7A
Y7A
P7A
X8A
Y8A
P8A

NOTES:

GRAPHICAL SCALE:
NOT TO SCALE

THE VIRGINIA ADVANCED SHIPBUILDING CARRIER AND INTEGRATION CENTER

SCALE: NTS	
DRAWN BY: AZL	SENIOR AE THESIS
DATE: 10/20/2010	LIGHTING/ELECTRICAL
CHECKED BY:	THE PENNSYLVANIA STATE
SUPERVISOR:	UNIVERSITY

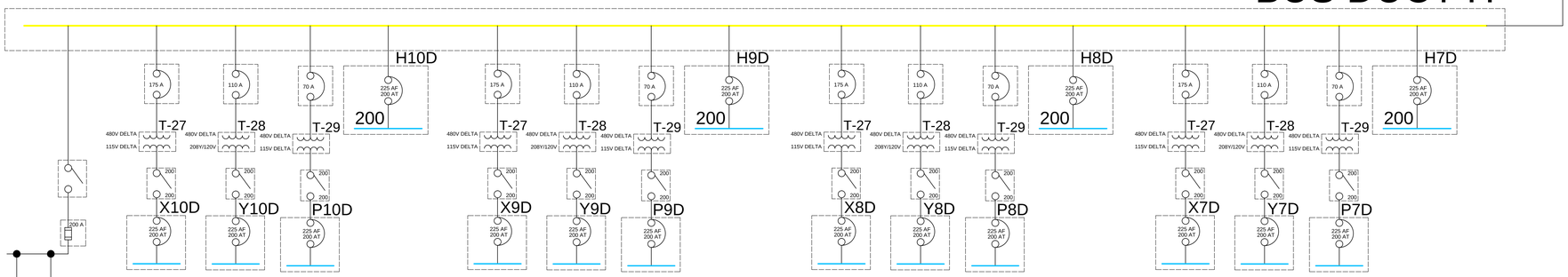
SINGLE LINE DIAGRAM

NAME:	DATE:	SHEET:	
ALYSON Z. LARIMER	10/27/2010	3	OF 4

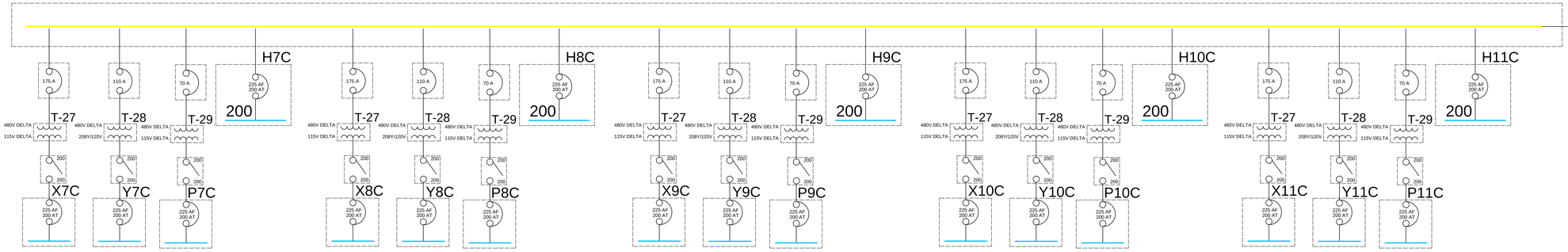
TO SBPA

H G F E FROM SBPA

BUS DUCT H



BUS DUCT G



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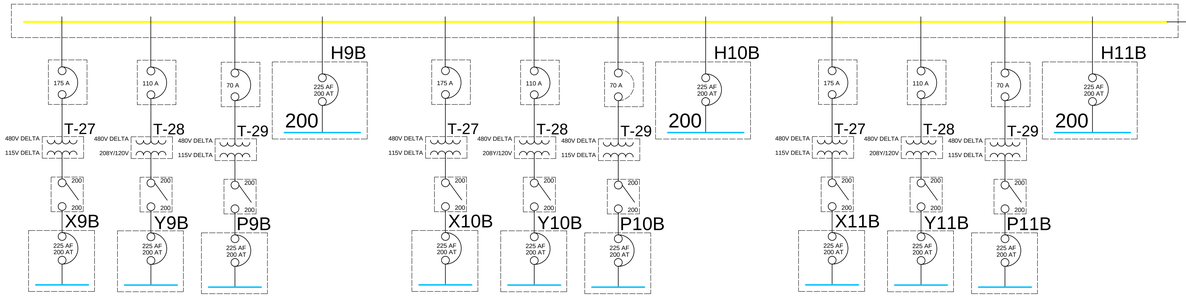
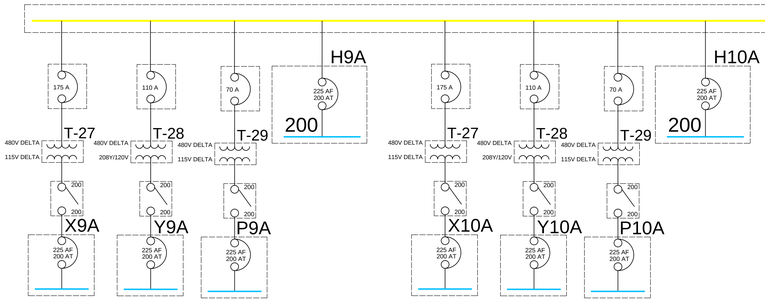


BUS DUCT E



NOTES:

GRAPHICAL SCALE:

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THE VIRGINIA ADVANCED SHIPBUILDING CARRIER AND INTEGRATION CENTER

SCALE: NTS	
DRAWN BY: AZL	SENIOR AE THESIS
DATE: 10/20/2010	LIGHTING/ELECTRICAL
CHECKED BY:	THE PENNSYLVANIA STATE UNIVERSITY
SUPERVISOR:	

SINGLE LINE DIAGRAM

NAME:	DATE:	SHEET:	
ALYSON Z. LARIMER	10/27/2010	1	OF 4

APPENDIX B

Fixture Tag: B

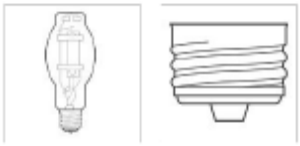
Lamp Type: 400W Metal Halide

Ballast Type: Magnetic

GE Lighting

49470 - MPR175/VBU/O

GE Protected Multi-Vapor® Quartz Metal Halide BT28



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/uvburns.html

Caution

- Lamp may shatter and cause injury if broken
  - Dispose of lamp in a closed container.
  - 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.
- Unexpected lamp rupture may cause injury, fire, or property damage
  - Do not exceed rated voltage.
  - Do not store flammable materials near/below lamp.
  - 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.
  - If used on a dimming system, see instructions.
  - Operate lamp only in specified position.
  - Turn lamp off at least once for 15 minutes per week.
  - Use only properly rated ballast.
- 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.
- Risk of Burn
  - Allow lamp to cool before handling.
  - Do not turn on lamp until fully installed.
- Risk of Fire
  - Keep combustible materials away from lamp.
  - Use in fixture rated for this product.

GRAPHS & CHARTS

Spectral Power Distribution

NOTES

- When operated on a 120 hrs. cycle (minimum), lamp life rating may be extended by up to 50% based on engineering estimates.

GENERAL CHARACTERISTICS

Lamp Type	High Intensity Discharge - Quartz Metal Halide
Bulb	BT28
Base	Mogul Screw (EX39)
Bulb Finish	Clear
Wattage	175
Rated Life	10000 hrs
Bulb Material	Hard glass
Lamp Enclosure Type (LET)	Open or enclosed fixtures
Base Temperature	210 °C
Bulb Temperature (MAX)	400 °C
LEED-EB MR Credit	333 picograms Hg per mean lumen hour
Additional Info	UV control

PHOTOMETRIC CHARACTERISTICS

Initial Lumens	15700
Mean Lumens	8400
Nominal Initial Lumens per Watt	89
Color Temperature	4000 K
Color Rendering Index (CRI)	65
Base to Arc Axis Eccentricity	3 °
Bulb to Base Eccentricity	3 °

ELECTRICAL CHARACTERISTICS

Burn Position	Vertical base up ±15°
Warm Up Time to 90% (MIN)	2 min
Warm Up Time to 90% (MAX)	5 min
Hot Restart Time to 90% (MIN)	10 min
Hot Restart Time to 90% (MAX)	15 min

DIMENSIONS

Maximum Overall Length (MOL)	8.2500 in(209.5 mm)
Light Center Length (LCL)	5.000 in(127.0 mm)

PRODUCT INFORMATION

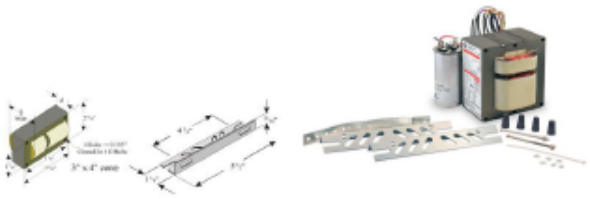
Product Code	49470
Description	MPR175/VBU/O
ANSI Code	M57
Standard Package	Case
Standard Package GTIN	10043168494707
Standard Package Quantity	6
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	6
UPC	043168494700

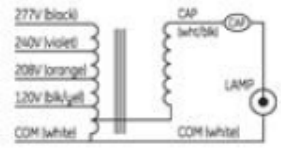
GE Lighting

86741 - GEM175MLTAC3-5

GE HID Distributor Replacement Kit Magnetic Core & Coil Ballast

- Magnetic ballast construction ideal for a wide variety of lighting applications.
- Precision-wound coils, ensuring even heat dissipation and the highest electrical integrity.
- Distributor replacement kit contains the appropriate core & coil with color coded leads, a properly rated capacitor and ignitor (if required) and all other components required for ballast replacement
- Quad ballast (120, 208, 240, 277)





GENERAL CHARACTERISTICS

Application	1- 175w MH M 57 or H 39 Quad
Category	High Intensity Discharge
Ballast Type	Magnetic - Core & Coil
Type	Replacement kit
Line Voltage Regulation (+/-)	10 %
Ballast Factor	Normal
Circuit Type	CWA
Insulation Class	180C
Enclosure Type	None
Capacitance	10 µF
Voltage	400
Capacitor Temperature Rating	100 °C(212 °F)
Diameter	1.75 in(44.4 mm)

PRODUCT INFORMATION

Product Code	86741
Description	GEM175MLTAC3-5
Standard Package	BUNDLE
Standard Package GTIN	
Standard Package Quantity	6
Sales Unit	Distributor Kit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	6
UPC	043168867412

DIMENSIONS

Case dimensions	
Length (L)	4.0 in(101.60 mm)
Width (W)	2.8 in(71.46 mm)
Mounting dimensions	
Bracket Length (BL)	5.5 in(139.70 mm)
Mount Length (M)	3.5 in(88.90 mm)
Mount Width (X or F)	2.4 in(61.93 mm)
Mount Slots (MS)	0.2 in(4.95 mm)
Weight	7 lb
Exit Type	Side
Nominal Length	3.25 in
Frame size (H x L)	2.813 x 3.939 in

ELECTRICAL CHARACTERISTICS

Supply Current Frequency	60 Hz

SAFETY & PERFORMANCE

- cUL Listed
- UL Listed

SPECIFICATIONS BY LAMP & LINE VOLTAGE

Lamp	# of Lamps	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
M57	1	120	210.0	1.8A	1	0.833	1.8A	0.96A	302V	60V	0.9	-22.0°F	5	B
M57	1	208	210.0	1.0A	1	0.833	1A	0.56A	302V	100V	0.9	-22.0°F	3	B
M57	1	240	210.0	0.9A	1	0.833	0.9A	0.48A	302V	115V	0.9	-22.0°F	3	B
M57	1	277	210.0	0.8A	1	0.833	0.8A	0.42A	302V	135V	0.9	-22.0°F	2	C
M107	1	120	210.0	1.8A	1	0.714	1.8A	0.96A	302V	60V	0.9	-22.0°F	5	B
M107	1	208	210.0	1.0A	1	0.714	1A	0.56A	302V	100V	0.9	-22.0°F	3	B
M107	1	240	210.0	0.9A	1	0.714	0.9A	0.48A	302V	115V	0.9	-22.0°F	3	B
M107	1	277	210.0	0.8A	1	0.714	0.8A	0.42A	302V	135V	0.9	-22.0°F	2	C
H39	1	120	210.0	1.8A	1	0.833	1.8A	0.96A	302V	60V	0.9	-22.0°F	5	B
H39	1	208	210.0	1.0A	1	0.833	1A	0.56A	302V	100V	0.9	-22.0°F	3	B
H39	1	240	210.0	0.9A	1	0.833	0.9A	0.48A	302V	115V	0.9	-22.0°F	3	B
H39	1	277	210.0	0.8A	1	0.833	0.8A	0.42A	302V	135V	0.9	-22.0°F	2	C

CAUTIONS & WARNINGS

Warning

- Risk of Electric Shock
  - Properly ground ballast and fixture.
  - Turn power off before servicing--see instructions.

ACCESSORIES

Oil-Filled Capacitor

Product Code	88980
Description	005-1184-MF

Oil-Filled Capacitor

Product Code	75433
Description	GECAP-10/400V-O

Fixture Tag: W

Lamp Type: 100W Metal Halide

Ballast Type: Magnetic

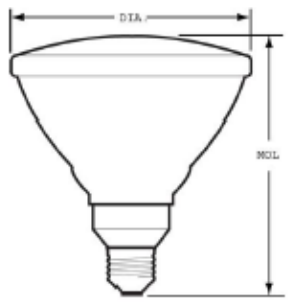
GE Lighting

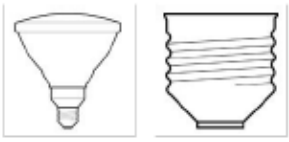
45682 - CMH100PAR38WFECO

GE ConstantColor® PulseArc® CMH® Ceramic Metal Halide PAR38

• Passes TCLP, which can lower disposal costs.

RoHs Compliant





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/uvburns.html

Caution

• Lamp may shatter and cause injury if broken
  - Do not use lamp if outer glass is scratched or broken.
• Risk of Burn
  - Allow lamp to cool before handling.
  - Do not turn on lamp until fully installed.

Warning

• Lamp emits UV radiation which may cause eye/skin irritation.
  - Turn power off if glass bulb is broken. Remove and dispose of lamp.
• Risk of Fire
  - Keep combustible materials away from lamp.
  - Use in fixture rated for this product.
• 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.
• 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 lamp if outer glass is scratched or broken.
  - Use only properly rated ballast.

NOTES

• Rated life based on 11 hours per start

GENERAL CHARACTERISTICS

Lamp Type	High Intensity Discharge - Ceramic Metal Halide
Bulb	PAR38
Base	Medium Screw (E26)
Wattage	100
Rated Life	10000 hrs
Bulb Material	Hard glass
Lamp Enclosure Type (LET)	Open or enclosed fixtures
LEED-EB MR Credit	112 picograms Hg per mean lumen hour
Additional Info	TCLP compliant/UV control

PHOTOMETRIC CHARACTERISTICS

Initial Lumens	6500
Nominal Initial Lumens per Watt	65
Beam Spread	60 °
Center Beam Candlepower (CBCP)	5500
Color Temperature	3000 K
Color Rendering Index (CRI)	81

ELECTRICAL CHARACTERISTICS

Burn Position	Universal burning position
Open Circuit Voltage (peak lead ballast)	332 V
Open Circuit Voltage (RMS lag ballast)	235 V
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)	5.3100 in(134.9 mm)
Nominal Length	5.310 in(134.9 mm)
Bulb Diameter (DIA)	4.750 in(120.6 mm)
Bulb Diameter (DIA) (MAX)	4.750 in(120.6 mm)

PRODUCT INFORMATION

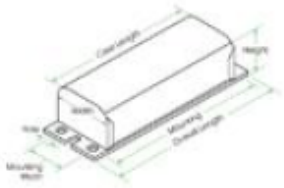
Product Code	45682
Description	CMH100PAR38WFECO
ANSI Code	M140/M90
Standard Package	Case
Standard Package GTIN	10043168456828
Standard Package Quantity	6
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	6
UPC	043168456821

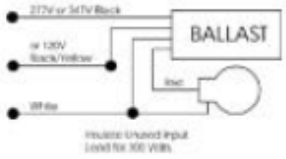
GE Lighting

86574 - 11210239CTC000I

GE HID Magnetic F-Can Ballast

- For applications requiring quieter or cooler operation than provided by standard coil & coil ballasts.
- Excellent sound-deadening and heat transfer qualities.





GENERAL CHARACTERISTICS

Application	1- 100w M90 120/277 Enclosed & Potted
Category	High Intensity Discharge
Ballast Type	Magnetic - F-Can
Type	Standard
Line Voltage Regulation (+/-)	5 %
Ballast Factor	Normal
Circuit Type	HX-HPF
Sound Rating	B (25-30 decibels)
Insulation Class	90C
Distance to Lamp	20 ft
Additional Info	Thermally protected

PRODUCT INFORMATION

Product Code	86574
Description	11210239CTC000I
Standard Package	Case
Standard Package GTIN	
Standard Package Quantity	4
Sales Unit	Standard Pack
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	4
UPC	043168865746

DIMENSIONS

Case dimensions	
Length (L)	11.8 in(298.45 mm)
Width (W)	3.2 in(80.96 mm)
Height (H)	2.6 in(66.68 mm)
Mounting dimensions	
Mount Length (M)	11.1 in(282.97 mm)
Mount Width (X or F)	2.0 in(50.80 mm)
Mount Slots (MS)	0.2 in(5.95 mm)
Weight	11 lb
Exit Type	Side
Remote Mounting Distance to Lamp	20 ft
Remote Mounting Wire Gauge	18 AWG

Lead lengths	Qty	Exit	Length (± 1 in.)
Black/Yellow	1		12 in (NaNmm)
White	1		12 in (NaNmm)
Black	1		12 in (NaNmm)
Red	1		12 in (NaNmm)

ELECTRICAL CHARACTERISTICS

Supply Current Frequency	60 Hz

SAFETY & PERFORMANCE

- cUL Listed
- UL Listed

SPECIFICATIONS BY LAMP & LINE VOLTAGE

Lamp	# of Lamps	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
M90	1	120	125.0	2.2A	1	0.8	2.2A	1.1A	250V	66V	0.9	-22.0°F	8	
M90	1	277	125.0	1.1A	1	0.8	1.1A	0.5A	250V	152V	0.9	-22.0°F	4	

CAUTIONS & WARNINGS

Warning

- Risk of Electric Shock
  - Properly ground ballast and fixture.
  - Turn power off before servicing--see instructions.

NOTES

- Anchor bracket / Tab provided for splice box (SB-4 Not Included)

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.