WHEELOCK COLLEGE CAMPUS CENTER AND STUDENT RESIDENCE
200 THE RIVERWAY, BOSTON MA 02215

Technical Assignment II

Electrical Systems Existing Conditions

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November 4th, 2008
Advisor: Ted Dannerth

WHEELOCK COLLEGE

EXECUTIVE SUMMARY

This report details the electrical distribution system of the Campus Center and Student Residence building at Wheelock College in Boston, Massachusetts. The system utilizes an interconnected system with an entrance point from the NStar Distribution network. A primary voltage system of 480Y/277V 3Φ 4W is used throughout the majority of the building, with several step-down transformers providing 208Y/120V 3Φ 4W power to some panelboards. The emergency power servicing the building comes from a 300 kVA diesel generator.

A large portion of the loads result from kitchen equipment from the two kitchens located in the basement and the second floor of the building. Other elements of the system include elevators and mechanical equipment. Lighting loads vary from 277V and 120V, servicing the entire building. Dimming systems are used in several parts of the building, as well as photosensors which detect the amount of daylight entering a room.

The service entrance sizing methods show that all methods are comparable, but would require different equipment. Due to approximated information, even the actual loading method is not completely accurate.

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SINGLE–LINE DIAGRAM

Drawings used: E-400 (Riser Diagram), E-700, E-701, and E-702 (Panelboard Schedules)

The feeder schedule can be found in Appendix C.

The single-line drawing can be found in Appendix D.

DISTRIBUTION SYSTEM

The Wheelock College Campus Center and Student Residence utilizes an interconnected system, in which the service is brought to the building through a 13.8V, 480Y/277V transformer. The transformer provides power to the main switchboard which houses 16 circuits. The majority of the plumbing, electrical and fire protection equipment are served at 480V. Additional loads are served through 208Y/120V step-down transformers. The 1600 ampere bus in the main power center is protected by a 1600 ampere main circuit breaker. The power center further feeds a 225A elevator, an 800A chiller, two 480:208Y/120V dry-type transformers, and six distribution boards of varying amperes. The main switchboard also has four spare loads of 100A each.

UTILITY COMPANY INFORMATION

The Wheelock College Campus receives power from NSTAR.

One NSTAR Way
Westwood, MA 02090
http://www.nstaronline.com

Charges:

Customer Charge:	$18.19/month
Distribution Energy:	First 2,000 kWh = $0.01785 / kWh
	Next 150 kWh = $0.01280 / kWh
	Each Additional kWh = $0.01093 / kWh
Distribution Demand:	Greater than 10 kW = $9.43 / kW
Transition Energy:	First 2,000 kWh = $0.01288 / kWh
	Next 150 kWh = $0.01288 / kWh
	Each Additional kWh = $0.01288 / kWh
Transition Demand:	Greater than 10 kW = $5.89 / kW

SERVICE ENTRANCE

The service entrance is located on the Southeast end of the Wheelock College campus. The service entrance consists of a utility owned pad-mounted transformer connected to a main service entrance switchboard. The switchboard is a group-mounted switchboard with fixed molded case circuit breakers. The transformer is also tapped to provide a normal service to the building's fire pump. The utility metering is located in a metering section in the service entrance switchboard and in a separate meter enclosure for the fire pump. The main switchboard also contains a customer meter so that Wheelock College can monitor their consumption directly. The service enters the building through the south side into the main electrical room in the basement.

VOLTAGE SYSTEMS

The building utilized a 480Y/277V main switchboard to distribute power to most of the loads in the building. The majority of the electricity is diverted from the main switchboard to distribution panels that supply power to the panel boards connected to them. There are several step-down 208Y/120V transformers in the building.

Loads serviced by the 480Y/277V, 3Φ, 4W system are some luminaires, mechanical pumps, air handling units, exhaust fans, and chillers. Loads serviced by the 208Y/120V, 3Φ, 4W system are some luminaires, unit heaters, fan coil units, boilers, air compressors and air cooled condensers.

EMERGENCY POWER SYSTEMS

Emergency power for the building is provided by a 300 kW, 375 kVA, 480Y/277V, 3Φ 4W diesel generator. The generator is pad-mounted on ground level near the service entrance on the south east side of the Wheelock Campus. Two automatic transfer switches are used and protected by a 400A circuit breaker.

LOCATIONS OF SWITCHGEAR

The majority of the switchgear can be found in the main electrical room and emergency electrical room in the basement (room numbers 010, 010A and 009). There are also electrical closets located on each floor which house lighting and mechanical panelboards.

MAJOR EQUIPMENT LOCATION SCHEDULE

TAG	TYPE OF EQUIPMENT	DESCRIPTION	FLOOR	ROOM #	DRAWINGS
T	Transformer	750 kVA 480Y/277V 3Φ 4W	Basement	010	E-002
MSB	Switchboard	1600A 480Y/277V 3Φ 4W	Basement	010	E-600
MS2	Distribution Panelboard	800A 208Y/120V 3Φ 4W	Basement	010	E-600
MSK	Distribution Panelboard	400A 208Y/120V 3Φ 4W	Basement	010	E-600
DP4B	Distribution Panelboard	400A 480Y/277V 3Φ 4W	Basement	010	E-600
LSDP4	Distribution Panelboard	100A 480Y/277V 3Φ 4W	Basement	009	E-600
MP27A	Distribution Panelboard	600A 480Y/277V 3Φ 4W	Penthouse	n/a	E-107
OSDP4	Distribution Panelboard	300A 480Y/277V 3Φ 4W	Basement	010A	E-600
ATS "OS"	Automatic Transfer Switch	100A 480V	Basement	010A	E-600
ATS "E"	Automatic Transfer Switch	300A 480V	Basement	009	E-600

PANEL BOARD LOCATION SCHEDULE

TAG	VOLTAGE	MAIN SIZE	FLOOR	ROOM #	DRAWINGS
LS2B	208Y/120V	50 A MCB	Basement	009	E-600
OSDP2B	208Y/120V	225 A MCB	Basement	010A	E-600
RP2B	208Y/120V	100 A MLO	Basement	010	E-600
RP2K	208Y/120V	225 A MLO	Basement	010	E-600
RP21	208Y/120V	150 A MLO	First	EC-101	E-600
RP22	208Y/120V	100 A MLO	Second	EC-201	E-600
RP23	208Y/120V	150 A MLO	Third	EC-301	E-600
RP24	208Y/120V	150 A MLO	Fourth	EC-401	E-600
RP26	208Y/120V	150 A MLO	Sixth	EC-601	E-600
RP2P	208Y/120V	100 A MCB	Penthouse	n/a	E-107
OS21	208Y/120V	100 A MLO	First	EC-101	E-600
OS24	208Y/120V	100 A MLO	Fourth	EC-401	E-600
KP2	208Y/120V	225 A MCB	Second	EC-201	E-102
RP25	208Y/120V	150 A MLO	Fifth	EC-501	E-600
RP2BA	208Y/120V	100 A MCB	Basement	002	E-100
OS2BK	208Y/120V	100 A MLO	Basement	010A	E-600
KPC	208Y/120V	100 A MLO	Basement	010	E-600
LP4B	480Y/277V	150 A MCB	Basement	010	E-600
LP42	480Y/277V	150 A MCB	Second	EC-201	E-600
LS42	480Y/277V	60 A MLO	Second	EC-201	E-600
LS45	480Y/277V	60 A MLO	Fifth	EC-501	E-600

OVER–CURRENT DEVICES

The over-current devices in the building are protected from fault current by circuit breakers. The main distribution panel is protected by a 1600 ampere circuit breaker.

TRANSFORMERS

All the transformers in the Wheelock College Campus Center and Student Residence are step-down transformers from a primary voltage of 480/227V to a secondary voltage of 208/120V, with the exception of the main power center.

TRANSFORMER SCHEDULE

TAG	PRIMARY VOLTAGE	SECONDARY VOLTAGE	SIZE (kVA)	TYPE	TEMP. RISE	TAPS	MOUNTING	REMARKS
T	13,800 V 3Φ, 4W	480Y/277V 3Φ, 4W	n/a	n/a	n/a	n/a	Pad mounted on ground	
T2	480Y/277V 3Φ, 4W	208Y/120V 3Φ, 4W	15	Dry	115° C	(4) 2.5%	Pad mounted on floor	K-13 Rated
T3	480Y/277V 3Φ, 4W	208Y/120V 3Φ, 4W	30	Dry	115° C	(4) 2.5%	Pad mounted on floor	K-13 Rated
T5	480Y/277V 3Φ, 4W	208Y/120V 3Φ, 4W	75	Dry	115° C	(4) 2.5%	Pad mounted on floor	K-13 Rated
T6	480Y/277V 3Φ, 4W	208Y/120V 3Φ, 4W	112 ½	Dry	115° C	(4) 2.5%	Pad mounted on floor	K-13 Rated
T8	480Y/277V 3Φ, 4W	208Y/120V 3Φ, 4W	225	Dry	115° C	(4) 2.5%	Pad mounted on floor	K-13 Rated

SPECIAL EQUIPMENT

The building does not contain any special equipment.

LIGHTING LOADS

The typical lamping used throughout the Campus Center and Student Residence building are linear and compact fluorescent. This type of lamping was used to reduce energy usage and meet the design criteria. Study areas on the first and second floor utilize daylighting, as well as feature a mixture of pendants and downlights when there is less sun. A multi-purpose room boasts large pendants of varying size clustered around the room, with

compact fluorescent downlights for more uniform lighting. Wallwashers are common in a variety of places throughout the first and second floors. The suite and dorm rooms are relatively simple, with surface-mounted compact fluorescent luminaires for ambient light, and surface-mounted halogen downlights for task lights in the closet/dressing areas. Exterior lighting is primarily restricted to path and sign lighting. Uplights along the brick retaining walls lead students to the building.

Additional information may be found in Appendix A.

MECHANICAL LOADS

The building uses a variable air volume system, with a 232 ton air-cooled water chiller on the roof. There is one 20,700 CFM air handling unit in the basement which services the basement and first floor. A second 19,000 CFM air handling unit on the roof services the second and third floors. The dorm rooms are individually climate controlled by a fan coil unit. The unit is connected to a dual temperature water pipe so it can be used for heating and cooling. The kitchen make-up air units are located on the roof. The second floor kitchen unit runs at 4,000 CFM, while the basement kitchen unit runs at 6,000 CFM.

Additional information can be found in Appendix B.

SERVICE ENTRANCE SIZE

SERVICE ENTRANCE SIZING			
PHASE	**LOAD (kVA)**	**VOLTAGE SYSTEM**	**LOAD (AMPS)**
Schematic Design	711.31	480	1000
Design Development	1090	480	1600
Actual Conditions	2096	480	1600
Currently Designed Equipment	750	480	1600

The results of the three service sizing methods show a relatively small variety of equipment sizes. The Square Foot Method which is highly based on building size and usage requires much smaller equipment than the NEC Loading and Actual Load calculations. This difference may be due to the idea that specific loads, such as mechanical equipment and kitchen equipment, are not taken into consideration.

The Actual Loading Method sized the equipment currently specified for the system, and resulted in the same service entrance size as is specified on the project. The NEC loading method also yielded results which were the same as the actual service entrance size. Therefore both of these methods were accurate in determining the size of the service entrance.

The breakdown of the three methods can be seen below:

SERVICE ENTRANCE SIZE: SQUARE FOOT METHOD			
LEVEL	**S.F. AREA**	**VA/S.F.**	**kVA**
Residential	34,280	11	377.08
Student Union	25,710	13	334.23
		TOTAL kVA	711.31
		TOTAL AMPS @ 480V	855.57
		SERVICE ENTRANCE SIZE	1000 A

SERVICE ENTRANCE SIZE: NEC LOADING				
TYPE OF LOAD	**S.F. AREA**	**VA/S.F.**	**DEMAND FACTOR**	**kVA**
Lighting Loads[1]	3000	3	1.0 when < 3000	9
Lighting Loads[1]	31280	3	0.5 when > 3000	46.92
Lighting Loads[2]	25710	3 ½	1.0	89.985
Receptacle Loads	60000	1	10 kVA @ 1.0, 0.5	350
Mechanical	60000	7	1.0	420
Fans/Pumps	60000	2	1.0	120
Kitchen[3]	-	1	0.8	54.1
			TOTAL kVA	1090
			TOTAL AMPS @ 480 V	1311
			SERVICE ENTRANCE SIZE	1600 A

[1] Dwelling
[2] Office Building
[3] 225A and 100A Kitchen Panel @ 208V

SERVICE ENTRANCE SIZE: ACTUAL LOADS			
LOAD DESCRIPTION	**LOAD**	**DEMAND FACTORS**	**DEMAND LOAD (kVA)**
Mechanical Equipment	391.91 kW	0.8	313.53
Kitchen Equipment	106.55 kW	0.8	85.24
Panel LS2B[1]	50 A	0.8*0.8=0.64	15.36
Panel OSDP2B[1]	225 A	0.8*0.8=0.64	69.12
Panel RP2B[2]	100 A	0.8*0.8=0.64	13.3
Panel RP2K[2]	225 A	0.8*0.8=0.64	29.95
Panel RP21[2]	150 A	0.8*0.8=0.64	19.97
Panel RP22[2]	100 A	0.8*0.8=0.64	13.3
Panel RP23[2]	150 A	0.8*0.8=0.64	19.97
Panel RP24[2]	150 A	0.8*0.8=0.64	19.97
Panel RP25[2]	150 A	0.8*0.8=0.64	19.97
Panel RP26[2]	150 A	0.8*0.8=0.64	19.97
Panel RP2P[1]	100 A	0.8*0.8=0.64	30.72
Panel OS21[1]	100 A	0.8*0.8=0.64	30.72
Panel OS24[1]	100 A	0.8*0.8=0.64	30.72
Panel KP2[2]	225 A	0.8*0.8=0.64	29.95
Panel RP2BA[1]	100 A	0.8*0.8=0.64	30.72
Panel OS2BK[1]	100 A	0.8*0.8=0.64	30.72
Panel KPC[2]	100 A	0.8*0.8=0.64	13.3
Panel LP4B[1]	150 A	0.8*0.8=0.64	46.1
Panel LP42[1]	150 A	0.8*0.8=0.64	46.1
Panel LS42[1]	60 A	0.8*0.8=0.64	18.4
Panel LS45[1]	60 A	0.8*0.8=0.64	18.4
		TOTAL (kVA)	1002.3
		TOTAL AMPS @ 480V	1205.6
		SERVICE ENTRANCE SIZE	1600 A

[1] 480V
[2] 208V

ENVIRONMENTAL STEWARDSHIP DESIGN

The building incorporates intelligent lighting panels into its design. These lighting panels are connected to fluorescent luminaires in the conference room on the first floor (room number 107). These fixtures contain daylight sensors, and are programmed to dim when sufficient daylight is present within the space. The building is not LEED rated.

DESIGN ISSUES

One design issue facing the Wheelock College Campus Center and Student residence was the economic challenges associated with the project and a lack of available space for the electrical distribution equipment. The space allocation and programming required several iterations with the architectural team.

Another challenge facing the construction team was a delay in the permitting process. The building was designed under the 2005 NEC, the permit drawings were delivered in fall 2007. The electrical contractor did not secure his permit until late January in 2008. The building was required to comply with the 2008 NEC due to the State of Massachusetts adoption of the 2008 NEC on January 1, 2008.

COMMUNICATION SYSTEMS

The telecommunications system in the Wheelock College Campus Center and Student Residence consists of a wireless internet, phone systems and some audio-visual equipment. The main controls and distribution system is located in the main electric room 010 in the basement. The voice and data network extends throughout the building. There are emergency phones next to the two main building entrances on the first floor. All wireless locations are mounted above the ceiling, while other data locations are mounted on the floor, walls and ceiling. The security system is a combination of card reader access into the building, and security cameras. The card access restricts non-residents from entering the dormitory area of the building. The security cameras are located on the main circulation areas, with views of the entrances and staircases.

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Lighting|Electrical
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LUMINAIRE SCHEDULE

TAG	LAMPS	LAMP WATTAGE	No. OF LAMPS	BALLAST TYPE	OPERATING VOLTAGE	IMPUT WATTS	BALLAST FACTOR	CURRENT		POWER FACTOR	
								START	RUNNING	START	RUNNING
VFX	DTT	26W	1	Electronic	277 V	28 W	1.0	0.1 A	0.1 A	0.96	0.96
VR1	FO32T8	32 W	3	Electronic	277 V	84 W	0.88	0.31 A	0.31 A	0.99	0.99
VR2	FO32T8	32 W	3	Electronic	277 V	84 W	0.88	0.31 A	0.31 A	0.99	0.99
VS1	FO32T8	32 W	2	Electronic	277 V	64 W	0.94	0.24 A	0.24 A	0.98	0.98
VS2	FO32T8	32 W	1	Electronic	277 V	30 W	0.87	0.12 A	0.12 A	0.99	0.99
WS1	CFTR	32 W	1	Electronic	120 V	36 W	0.98	0.13 A	0.13 A	0.98	0.98
E1	LED	2.1 W	n/a	n/a	277 V	n/a	n/a	0.04 A	0.04 A	0.19	0.19
E2	LED	5.7 W	n/a	n/a	277 V	n/a	n/a	0.03 A	0.03 A	0.83	0.83
F1	E26 Halogen	100 W	1	n/a	277 V	n/a	n/a	n/a	n/a	n/a	n/a
F2	T4 Halogen	50 W	1	n/a	277 V	n/a	n/a	n/a	n/a	n/a	n/a
F2a	T4 Halogen	50 W	1	n/a	277 V	n/a	n/a	n/a	n/a	n/a	n/a
F3	CFTR	42 W	1	Electronic	120 V	45 W	1.00	0.4 A	0.4 A	0.93	0.93
F3A	CFTR	42 W	1	Electronic	120 V	45 W	1.00	0.4 A	0.4 A	0.93	0.93
F4	CFTR	42 W	1	Electronic	120 V	45 W	1.00	0.4 A	0.4 A	0.93	0.93
F4A	CFTR	26 W	1	Electronic	120 V	28 W	1.00	0.24 A	0.24 A	0.99	0.99
F5	F32T8	32 W	1	Electronic	277 V	30 W	0.87	0.12 A	0.12 A	0.99	0.99
F6	CFTR	42 W	1	Electronic	277 V	45 W	1.00	0.4 A	0.4 A	0.93	0.93
F7	MR16	50 W	1	n/a	120 V	n/a	n/a	n/a	n/a	n/a	n/a
F8	F32T8	32 W	1	Electronic	277 V	30 W	0.87	0.12 A	0.12 A	0.99	0.99
F9	F17T8	17 W	1	Electronic	120 V	18 W	0.91	0.16 A	0.16 A	0.99	0.99
F10	CFQ	26 W	2	Electronic	277 V	51 W	1.00	0.19 A	0.19 A	0.99	0.99
F11	LED	4 W	n/a	n/a	12 V	n/a	n/a	n/a	n/a	n/a	n/a
F12	CFTR	42 W	1	Electronic	277 V	45 W	1.00	0.18 A	0.18 A	0.93	0.93
F13	CFT	13 W	2	Electronic	120 V	30 W	1.00	0.26 A	0.26 A	0.98	0.98
F14	T4 Halogen	40 W	1	n/a	120 V	n/a	n/a	n/a	n/a	n/a	n/a
F15	CFQ	13 W	2	Electronic	120 V	30 W	1.00	0.26 A	0.26 A	0.98	0.98
F16	CFQ	26 W	1	Electronic	120 V	28 W	1.00	0.1 A	0.1 A	0.96	0.96
F17	F32T8	32 W	1	Electronic	120 V	30 W	0.87	0.12 A	0.12 A	0.99	0.99
F18	LED	18 W	n/a	n/a	12 V	n/a	n/a	n/a	n/a	n/a	n/a
F19	F32T8	32 W	1	Electronic	120 V	30 W	0.87	0.12 A	0.12 A	0.99	0.99

MECHANICAL EQUIPMENT SCHEDULE

TAG	DESCRIPTION	LOAD (HP/kW)	VOLTAGE	PHASE	MOTOR AMPS	POWER FACTOR[1]	EQUIVALENT LOAD (kW)
AHU 1	Air Handling Unit	25 HP 20 HP	480	3	60 A 60 A	0.95 0.95	18.6 kW 14.9 kW
AHU 2	Air Handling Unit	20 HP 15 HP	480	3	60 A 50 A	0.95 0.95	14.9 kW 11.2 kW
ERU 1	Energy Recovery Unit	7.5 HP	480	3	20 A	0.95	5.6 kW
MAU 1	Make Up Air Unit	5 HP	480	3	30 A	0.85	3.7 kW
MAU 2	Make Up Air Unit	7.5 HP	480	3	20 A	0.95	5.6 kW
CHWP 1	Chilled Water Pump	20 HP	480	3	50 A	0.95	14.9 kW
CHWP 2	Chilled Water Pump	20 HP	480	3	50 A	0.95	14.9 kW
HWP 1	Hot Water Pump	5 HP	480	3	20 A	0.85	3.7 kW
HWP 2	Hot Water Pump	5 HP	480	3	20 A	0.85	3.7 kW
DTWP 1	Dual Temp Water Pump	5 HP	480	3	20 A	0.85	3.7 kW
DTWP 2	Dual Temp Water Pump	5 HP	480	3	20 A	0.85	3.7 kW
CH 1	Air Cooled Water Chiller	227 kW	480	3	600 A	0.95	277 kW
UH 1	Unit Heater	9 W	120	1	20 A	0.85	0.009 kW
CUH 1	Cabinet Unit Heater	1/15 HP	120	1	20 A	0.85	0.05 kW
CUH 2	Cabinet Unit Heater	1/15 HP	120	1	20 A	0.85	0.05 kW
FCU 1	Fan Coil Unit	118 W	120	1	20 A	0.95	0.118 kW
FCU 2	Fan Coil Unit	142 W	120	1	20 A	0.95	0.142 kW
FCU 3	Fan Coil Unit	142 W	120	1	20 A	0.95	0.142 kW
FCU 4	Fan Coil Unit	142 W	120	1	20 A	0.95	0.142 kW
FCU 5	Fan Coil Unit	118 W	120	1	20 A	0.95	0.118 kW
KEF 1	Kitchen Exhaust Fan	15 HP	480	3	40 A	0.95	11.2 kW
KEF 2	Kitchen Exhaust Fan	5 HP	480	3	20 A	0.85	3.7 kW
KEF 3	Kitchen Exhaust Fan	¾ HP	480	3	20 A	0.85	0.56 kW
KEF 4	Kitchen Exhaust Fan	3 HP	480	3	20 A	0.85	2.2 kW
KEF 5	Kitchen Exhaust Fan	3 HP	480	3	20 A	0.85	2.2 kW
DEF 1	Dryer Exhaust Fan	1 HP	480	3	20 A	0.85	0.75 kW
EF 1	Penthouse Exhaust Fan	¼ HP	120	1	20 A	0.85	0.2 kW
B 1	Boiler	n/a	120	1	20 A	n/a	n/a
B 2	Boiler	n/a	120	1	20 A	n/a	n/a
B 3	Boiler	n/a	120	1	20 A	n/a	n/a
EWH 1	Electric Water Heater	4.5 kW	480	3	20 A	0.95	4.5 kW
BP	Water Booster	(2) 3 HP	480	3	20 A	0.85	(2) 2.2 kW
SE 1	Sewage Ejector	(2) 5 HP	480	3	20 A	0.85	(2) 3.7 kW
SP 1	Sump Pump	(2) 2HP	480	3	20 A	0.85	(2) 1.5 kW

JP 1	Jockey Pump	1.5 HP	480	3	20 A	0.85	1.1 kW
ACC 1	Air Cooled Condenser	2.6 HP	208	1	30 A	0.85	1.9 kW
ACC 2	Air Cooled Condenser	2.6 HP	208	1	30 A	0.85	1.9 kW
AC 1	Air Compressor	45 W	208	1	20 A	0.85	0.045 kW
AC 2	Air Compressor	45 W	208	1	20 A	0.85	0.045 kW
SP 2	Oil Minder Pump	¼ HP	120	1	20 A	0.85	0.2 kW
CP 1	Circulator Pump	½ HP	480	3	20 A	0.85	0.37 kW
CP 2	Circulator Pump	½ HP	480	3	20 A	0.85	0.37 kW
						TOTAL EQUIVALENT LOAD	391.91 kW

[1] The power factor is assumed to be 0.95 when the load > 5 HP and 0.85 when load < 5 HP.

BASEMENT KITCHEN EQUIPMENT SCHEDULE

TAG	QUANTITY	DESCRIPTION	LOAD (A)	VOLTAGE	PHASE	POWER FACTOR[1]	EQUIVALENT LOAD (kVA)	EQUIVALENT LOAD (kW)
2	1	Ice Maker	11 A	208 V	1	0.85	2.29 kVA	1.94 kW
9	1	Cleaning System	15 A	120 V	1	0.85	1.8 kVA	1.53 kW
10	1	Coffee Urn	29.3 A	208 V	1	0.95	6.09 kVA	5.79 kW
11	1	Refrigerated Counter	20 A	208 V	1	0.85	4.16 kVA	3.53 kW
12	1	Heated Cabinet	16 A	120 V	1	0.85	1.92 kVA	1.63 kW
13	1	Cooler/Freezer Walk In Unit	40 A	208 V	1	0.85	8.32 kVA	7.07 kW
14	1	Slicer, Food	20 A	120 V	1	0.85	2.4 kVA	2.04 kW
18	1	Food Processor	13.7 A	120 V	1	0.85	1.64 kVA	1.39 kW
19	1	Mixer, Counter	7 A	120 V	1	0.85	0.84 kVA	0.71 kW
26	1	Tilting Kettle	2 A	120 V	1	0.85	0.24 kVA	0.21 kW
28	1	Range	4.8 A	120 V	1	0.85	0.58 kVA	0.5 kW
30	1	Fryer Battery	7 A	120 V	1	0.85	0.84 kVA	0.71 kW
32	1	Steamer	4 A	120 V	1	0.85	0.48 kVA	0.41 kW
33	1	Combi Oven	20 A	120 V	1	0.85	2.4 kVA	2.04 kW
34	1	Convection Oven	6 A	120 V	1	0.85	0.72 kVA	0.61 kW
39	1	Warewasher	20 A	208 V	1	0.95	4.16 kVA	3.95 kW
						TOTAL EQUIVALENT LOAD	38.88 kVA	32.85 kW

[1] The power factor is assumed to be 0.95 when the load > 5 HP and 0.85 when load < 5 HP.

Anne-Lynn Cheney
Technical Assignment II
Lighting|Electrical
November 4th, 2008

Wheelock College
Campus Center and Student Residence
200 The Riverway, Boston, MA 02215
Advisor: Ted Dannerth

SECOND LEVEL KITCHEN EQUIPMENT SCHEDULE

TAG	QUANTITY	DESCRIPTION	LOAD (A)	VOLTAGE	PHASE	POWER FACTOR[1]	EQUIVALENT LOAD (kVA)	EQUIVALENT LOAD (kW)
46	1	Ware-washer, Rack Conveyor	29.8 A	480 V	3	0.95	14.3 kVA	13.5 kW
47	1	Disposer	8.3 A	208 V	1	0.85	1.73 kVA	1.47 kW
52	1	Heated Cabinet	9.6 A	208 V	1	0.85	1.99 kVA	1.69 kW
53	1	Freezer, Roll-In	11.5 A	120 V	1	0.85	1.38 kVA	1.17 kW
54	1	Refrigerator, Roll-In	11.4 A	120 V	1	0.85	1.37 kVA	1.16 kW
55	1	Refrigerator, Under Counter	7.2 A	120 V	1	0.85	0.87 kVA	0.73 kW
56	1	Refrigerator, Under Counter	12 A	120 V	1	0.85	1.44 kVA	1.22 kW
57	1	Fryer Battery	8.7 A	120 V	1	0.85	1.04 kVA	0.88 kW
58	1	Griddle	1.0 A	120 V	1	0.85	0.12 kVA	0.1 kW
59	1	Refrigerator, Shorty	7 A	120 V	1	0.85	0.84 kVA	0.71 kW
60	1	Hood, Make-Up Air	2.0 A	120 V	1	0.85	0.24 kVA	0.2 kW
62	1	Toaster	20.4 A	208 V	1	0.95	4.24 kVA	4.03 kW
63	1	Microwave	20 A	120 V	1	0.85	2.4 kVA	2.04 kW
64	2	Ice/Beverage Dispenser	2.5 A	120 V	1	0.85	0.3 kVA	0.26 kW
65	2	Dispenser, Juice	2.5 A	120 V	1	0.85	0.3 kVA	0.26 kW
66	1	Air-pot	8.0 A	120 V	1	0.85	0.96 kVA	0.82 kW
67	1	Dispenser, Milk	1.8 A	120 V	1	0.85	0.21 kVA	0.18 kW
69	5	Heap Lamp	2.0 A	120 V	1	0.85	0.24 kVA	0.2 kW
72	3	Heat Lamp	2.0 A	120 V	1	0.85	0.24 kVA	0.2 kW
73	1	Heated Stone Shelves	15.5 A	120 V	1	0.85	1.86 kVA	1.58 kW
75	1	Drop-in Hot Wells	8.3 A	120 V	1	0.85	0.99 kVA	0.84 kW
77	1	Refrigerator	5.5 A	120 V	1	0.85	0.66 kVA	0.56 kW
78	1	Hood, Make-up Air	2.0 A	120 V	1	0.85	0.24 kVA	0.2 kW
79	1	Drop-in Hot Wells	8.3 A	120 V	1	0.85	0.99 kVA	0.84 kW
88	3	Drop-in Hot Wells	4.2 A	120 V	1	0.85	0.5 kVA	0.42 kW
88.1	4	Heated Stone Shelves	4.2 A	120 V	1	0.85	0.5 kVA	0.42 kW
91	1	Refrigerator	12.0 A	120 V	1	0.85	1.44 kVA	1.22 kW
92	1	Deli Case, Refrigerated	6.0 A	120 V	1	0.85	0.72 kVA	0.61 kW
93	1	Refrigerator	10.0 A	120 V	1	0.85	1.2 kVA	1.02 kW
94	1	Pasta Cooker	29.0 A	208 V	1	0.95	6.03 kVA	5.12 kW
95	1	Oven, Pizza	15.0 A	120 V	1	0.85	1.8 kVA	1.53 kW

98	1	Dispenser – Ice	2.5 A	120 V	1	0.85	0.3 kVA	0.26 kW
99	1	Dispenser – Milk	1.8 A	120 V	1	0.85	0.22 kVA	0.18 kW
100	1	Dispenser – Juice	2.5 A	120 V	1	0.85	0.3 kVA	0.26 kW
101	1	Toaster	20.0 A	208 V	1	0.95	4.16 kVA	3.95 kW
102	1	Microwave	20.0 A	120 V	1	0.85	2.4 kVA	2.04 kW
103	1	Spray System	15.0 A	208 V	1	0.85	3.12 kVA	2.65 kW
						TOTAL EQUIVALENT LOADS	60.35 kVA	54.26 kW

[1] The power factor is assumed to be 0.95 when the load > 5 HP and 0.85 when load < 5 HP.

CAFE EQUIPMENT SCHEDULE

TAG	QUANTITY	DESCRIPTION	LOAD (A)	VOLTAGE	PHASE	POWER FACTOR[1]	EQUIVALENT LOAD (kVA)	EQUIVALENT LOAD (kW)
107	1	Signage Panel	3 A	120 V	1	0.85	0.36 kVA	0.31 kW
110	1	Mixer/Blender	15 A	120 V	1	0.85	1.8 kVA	1.53 kW
111	1	Ice Maker	15 A	120 V	1	0.85	1.8 kVA	1.53 kW
112	1	Espresso Maker	28 A	208 V	1	0.85	5.82 kVA	4.95 kW
114	1	Display Case	7 A	120 V	1	0.85	0.84 kVA	0.71 kW
115	1	Register	15 A	120 V	1	0.85	1.8 kVA	1.53 kW
116	1	Refrigerator	15 A	120 V	1	0.85	1.8 kVA	1.53 kW
117	1	Refrigerator	5.1 A	120 V	1	0.85	0.612 kVA	0.52 kW
118	1	Food Warmer	15 A	120 V	1	0.85	1.8 kVA	1.53 kW
119	1	Coffee Maker	30 A	208 V	1	0.85	6.24 kVA	5.3 kW
						TOTAL EQUIVALENT LOADS	22.87 kVA	19.44 kW

[1] The power factor is assumed to be 0.95 when the load > 5 HP and 0.85 when load < 5 HP.

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FEEDER SCHEDULE

TAG	FROM	TO	No. OF SETS	CONDUIT		PHASE CONDUCTORS			NEUTRAL CONDUCTORS			GROUND CONDUCTORS			OVERCURRENT PROTECTION	FRAME OR SWITCH SIZE	REMARKS
				SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE			
1		MSB	3	4”	pvc	12	#600 kcmil	cu thhn	4	#600 kcmil	cu thhn	4	#4/0 awg	cu thhn	1600 A	1600 A	
2	MSB	MP27A	2	3”	pvc	6	#350 kcmil	cu thhn	2	#350 kcmil	cu thhn	2	#1 awg	cu thhn	600 A	800 A	
3	MSB	OSDP4	1	3”	pvc	3	#350 kcmil	cu thhn	1	#250 kcmil	cu thhn	1	#4 awg	cu thhn	300 A	400 A	
4	MSB	DP4B	1	4”	pvc	3	#600 kcmil	cu thhn	1	#600 kcmil	cu thhn	1	#3 awg	cu thhn	400 A	400 A	
5	MSB	LP4B	1	2”	pvc	3	#1/0 awg	cu thhn	1	#1/0 awg	cu thhn	1	#6 awg	cu thhn	150 A	225 A	
6	MSB	CHI-1	2	3”	pvc	6	#350 kcmil	cu thhn	2	#350 kcmil	cu thhn	2	#1 awg	cu thhn	600 A	800 A	
7	MSB	Elevator	1	2”	pvc	3	#2/0 awg	cu thhn	1	#2/0 awg	cu thhn	1	#6 awg	cu thhn	225 A	125 A	
8	MSB	MSK	1	3 ½”	pvc	3	#500 kcmil	cu thhn	1	#500 kcmil	cu thhn	1	#3 awg	cu thhn	400 A	400 A	
9	MSB	LSDP4	1	1 ½”	pvc	3	#1 awg	cu thhn	1	#1 awg	cu thhn	1	#8 awg	cu thhn	100 A	100 A	
10	MSB	MS2	2	3 ½”	pvc	6	#500 kcmil	cu thhn	2	#500 kcmil	cu thhn	2	#2/0 awg	cu thhn	400 A	400 A	
11	MSB	ATS “OS”	1	3”	pvc	3	#500 kcmil	cu thhn	1	#500 kcmil	cu thhn	1	#4 awg	cu thhn	300 A	300 A	
12	MSB	ATS “E”	1	1 ½”	pvc	3	#1 awg	cu thhn	1	#1 awg	cu thhn	1	#8 awg	cu thhn	100 A	100 A	
13	MP27A	AHU-1	1	¾”	pvc	3	#6 awg	cu thhn	1	#6 awg	cu thhn	1	#10 awg	cu thhn	60 A	100 A	
14	MP27A	AHU-2	1	¾”	pvc	3	#6 awg	cu thhn	1	#6 awg	cu thhn	1	#10 awg	cu thhn	50 A	100 A	
15	MP27A	CHWP-1	1	¾”	pvc	3	#6 awg	cu thhn	1	#6 awg	cu thhn	1	#10 awg	cu thhn	50 A	100 A	
16	MP27A	CHWP-2	1	¾”	pvc	3	#6 awg	cu thhn	1	#6 awg	cu thhn	1	#10 awg	cu thhn	50 A	100 A	
17	MP27A	HWP-1	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	
18	MP27A	HWP-2	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	
19	MP27A	DTWP-1	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	
20	MP27A	ERU-1	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	
21	MP27A	MAU-1	1	¾”	pvc	3	#10 awg	cu thhn	1	#10 awg	cu thhn	1	#10 awg	cu thhn	30 A	100 A	
22	MP27A	MAU-2	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	
23	MP27A	DTWP-2	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	
24	MP27A	KEF-1	1	¾”	pvc	3	#8 awg	cu thhn	1	#8 awg	cu thhn	1	#10 awg	cu thhn	20 A	100 A	
25	MP27A	KEF-2	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	
26	MP27A	KEF-3	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	
27	MP27A	KEF-4	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	
28	MP27A	KEF-5	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	
29	MP27A	RP2P	1	1 ¼”	pvc	3	#3 awg	cu thhn	1	#3 awg	cu thhn	1	#8 awg	cu thhn	60 A	100 A	
30	MP27A	CP-1	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	
31	MP27A	CP-2	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	
32	OSDP4	OSDP2B	1	2 ½”	pvc	3	#4/0 awg	cu thhn	1	#4/0 awg	cu thhn	1	#4 awg	cu thhn	150 A	225 A	
33	OSDP4	SE-1	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	
34	OSDP4	SP-1	1	¾”	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A	

35	OSDP4	JP-1	1	¾"	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A
36	OSDP4	Elevator	1	2"	pvc	3	#2/0 awg	cu thhn	1	#2/0 awg	cu thhn	1	#6 awg	cu thhn	175 A	225 A
37	DP4B	AHU-1	1	¾"	pvc	3	#6 awg	cu thhn	1	#6 awg	cu thhn	1	#10 awg	cu thhn	60 A	100 A
38	DP4B	AHU-1	1	¾"	pvc	3	#6 awg	cu thhn	1	#6 awg	cu thhn	1	#10 awg	cu thhn	60 A	100 A
39	DP4B	BP	1	¾"	pvc	3	#12 awg	cu thhn	1	#12 awg	cu thhn	1	#12 awg	cu thhn	20 A	100 A
40	MSK	RP2K	1	2 ½"	pvc	3	#4/0 awg	cu thhn	1	#4/0 awg	cu thhn	1	#4 awg	cu thhn	225 A	225 A
41	MSK	KPC	1	1 ½"	pvc	3	#1 awg	cu thhn	1	#1 awg	cu thhn	1	#8 awg	cu thhn	100 A	100 A
42	MSK	KP2	1	2 ½"	pvc	3	#4/0 awg	cu thhn	1	#4/0 awg	cu thhn	1	#4 awg	cu thhn	225 A	225 A
43	LSDP4	LS2B	1	¾"	pvc	3	#6 awg	cu thhn	1	#6 awg	cu thhn	1	#10 awg	cu thhn	30 A	100 A
44	LSDP4	LS42	n/a	n/a	pvc	3	#8 awg	mi	1	#8 awg	mi	1	#8 awg	mi	60 A	100 A
45	LSDP4	LS45	n/a	n/a	pvc	3	#8 awg	mi	1	#8 awg	mi	1	#8 awg	mi	60 A	100 A
46	MS2	RP2B	1	1 ½"	pvc	3	#1 awg	cu thhn	1	#1 awg	cu thhn	1	#8 awg	cu thhn	100 A	100 A
47	MS2	RP21	1	2"	pvc	3	#1/0 awg	cu thhn	1	#1/0 awg	cu thhn	1	#6 awg	cu thhn	150 A	225 A
48	MS2	RP22	1	1 ½"	pvc	3	#1 awg	cu thhn	1	#1 awg	cu thhn	1	#8 awg	cu thhn	100 A	100 A
49	MS2	RP23	1	2"	pvc	3	#1/0 awg	cu thhn	1	#1/0 awg	cu thhn	1	#6 awg	cu thhn	150 A	225 A
50	MS2	RP24	1	2"	pvc	3	#1/0 awg	cu thhn	1	#1/0 awg	cu thhn	1	#6 awg	cu thhn	150 A	225 A
51	MS2	RP25	1	2"	pvc	3	#1/0 awg	cu thhn	1	#1/0 awg	cu thhn	1	#6 awg	cu thhn	150 A	225 A
52	MS2	RP26	1	2"	pvc	3	#1/0 awg	cu thhn	1	#1/0 awg	cu thhn	1	#6 awg	cu thhn	150 A	225 A
53	MS2	RP2BA	1	1 ½"	pvc	3	#1 awg	cu thhn	1	#1 awg	cu thhn	1	#8 awg	cu thhn	100 A	100 A
54	OSDP2B	OS2BK	1	1 ½"	pvc	3	#1 awg	cu thhn	1	#1 awg	cu thhn	1	#8 awg	cu thhn	100 A	100 A
55	OSDP2B	OS21	1	1"	pvc	3	#6 awg	cu thhn	1	#6 awg	cu thhn	1	#10 awg	cu thhn	60 A	60 A
56	OSDP2B	OS24	1	1"	pvc	3	#6 awg	cu thhn	1	#6 awg	cu thhn	1	#10 awg	cu thhn	60 A	60 A
57	LP4B	LP42	1	1 ½"	pvc	3	#1 awg	cu thhn	1	#1 awg	cu thhn	1	#8 awg	cu thhn	100 A	100 A

WHEELOCK COLLEGE

CAMPUS CENTER & STUDENT RESIDENCE

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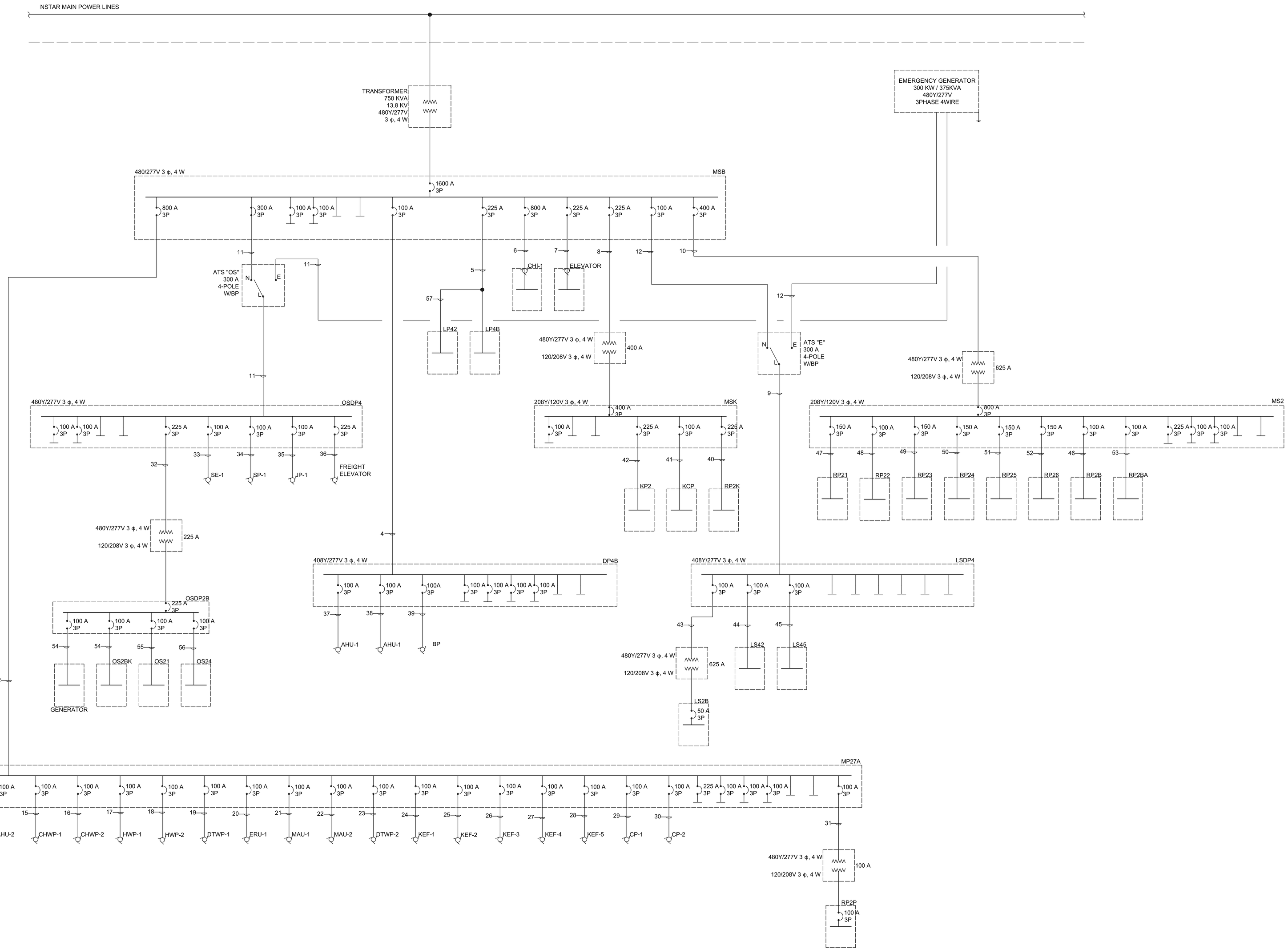

AE 481 W

AE SENIOR PROJECT I

DRAWN BY: ANNE CHENEY

DATE: OCTOBER 30, 2008

SINGLE-LINE DRAWING