

JOSHUA KREUTZBERGER
LIGHTING/ELECTRICAL
TECHNICAL REPORT #2
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PROF. DANNERETH



Dorrance H. Hamilton Building Philadelphia, PA

EXECUTIVE SUMMARY

This report is a summary of the existing electrical systems, such as the power distribution systems and communications systems. Each section contains a narrative describing the general and special characteristics of every part of the electrical system analyzed. A summary of the total building electrical loads and a check of the existing main distribution equipment is included in the section titled NEC Design Loads. The appendix includes a single line and riser diagram, which represent the power distribution system of the Dorrance H. Hamilton Building.

Analysis starts at the service entrance and finishes at the end utilization based on the given information in the construction documents. The National Electric Code was used extensively throughout the calculation process to determine the correct demand loads. The evaluation of the total building load came out to be low compared to the size of the main bus duct. To explain this occurrence, the sixth floor of the building is empty. The sixth floor is not used at the moment and will be utilized at a later date.

POWER DISTRIBUTION SYSTEMS

ELECTRICAL DISTRIBUTION SYSTEM TYPE

The source of the electrical system for the Dorrance H. Hamilton Building starts with the existing 13.2 kV switchgear in the Jefferson Alumni Hall. Two 13.2 kV Philadelphia Electric Company (PECO) feeders supply six existing 13.2 kV feeders. Four of the feeders are to substations in Jefferson Alumni Hall, while the other two feeders will supply the Dorrance H. Hamilton Building. The electrical service travels through two 15 kV load interrupter switches integral for the unit substation. From the closed load interrupter switch, the 13.2 kV service is fed through a dry-type transformer rated at 480Y/277 volt, 3 phase, and 2500 kVA. After running through the 2500 kVA transformer, the service is supplied to the main bus system with TVSS located in Substation No. 1. A 4000 draw amp low voltage circuit breaker protects the main bus. The main distribution panels are located on the parking level P2 and fed up through the building into the electrical room of each floor into sub-distribution panels. From the sub-distribution panels, lighting and receptacle loads are distributed to each floor and served by 150 kVA dry-type transformers and 208Y/120V panelboards. Please see the building riser and single line diagrams to better understand the distribution system in Appendix.

The emergency power is produced with a 1000 kW, 408Y/277V diesel generator. The generator provides emergency power to the ATS Life Safety, ATS Elevator, and the Standby Distribution panels.

BUILDING SERVICE CONNECTED TO EXISTING CAMPUS SERVICE

The building service connects to the existing campus service in the Jefferson Alumni Hall 13.2 kV switchgear. Two 13.2 kV PECO feeders supply six existing 13.2 kV feeders. Four of the feeders are to substations in Jefferson Alumni Hall, while the other two feeders will supply the Dorrance H. Hamilton Building.

VARIOUS VOLTAGE SYSTEMS

Multiple service voltages are provided due to the use of multiple main distribution panels/boards. The main service to the building is 13.2 kV from the Jefferson Alumni Hall switchgear. The service provided to the building is transformed into secondary service for the various loads of the Dorrance H. Hamilton Building.

The building's main service – 13.2 kV delta-connected – feeds directly into the TJU switchgear, which is transformed to the secondary voltage of 480/277V wye-connected at Substation No. 1. From Substation No. 1, the 480/277V service is transformed into 208/120V service for the sub-distribution panels on each floor. The 480/277V service supplies the mechanical equipment, elevators, and lighting, while the 208/120V service supplies the receptacles and the remainder of the lighting load.

TRANSFORMERS

As seen below, all of the transformers except the main transformer are step-down transformers from a primary voltage of 480/277V to a secondary voltage of 208/120V. The main transformer is a step-down transformer from a primary voltage of 13200V to a secondary voltage of 480/277V.

TRANSFORMER SCHEDULE								
Tag	Primary Voltage	Secondary Voltage	Size (kVA)	Type	Temp. Rise	Taps	Mounting	Remarks
MAIN	13,200V,3PH,3W	480Y/277V,3PH,4W	2500	DRY TYPE	115°C	N/A	PAD MOUNTED TO FLOOR	N/A
TBA	480V,3PH,3W	208Y/120V,3PH,4W	45	DRY TYPE	150°C	(4) 2.5%	FLOOR, WALL, OR TRAPEZE MOUNT	N/A
T1	480V,3PH,3W	208Y/120V,3PH,4W	150	DRY TYPE	150°C	(4) 2.5%	PAD MOUNTED TO FLOOR	K-13 RATED
T2	480V,3PH,3W	208Y/120V,3PH,4W	150	DRY TYPE	150°C	(4) 2.5%	PAD MOUNTED TO FLOOR	K-13 RATED
T3	480V,3PH,3W	208Y/120V,3PH,4W	150	DRY TYPE	150°C	(4) 2.5%	PAD MOUNTED TO FLOOR	K-13 RATED
T4	480V,3PH,3W	208Y/120V,3PH,4W	150	DRY TYPE	150°C	(4) 2.5%	PAD MOUNTED TO FLOOR	K-13 RATED
T5	480V,3PH,3W	208Y/120V,3PH,4W	150	DRY TYPE	150°C	(4) 2.5%	PAD MOUNTED TO FLOOR	K-13 RATED
T6	480V,3PH,3W	208Y/120V,3PH,4W	15	DRY TYPE	150°C	(4) 2.5%	FLOOR, WALL, OR TRAPEZE MOUNT	N/A
TP	480V,3PH,3W	208Y/120V,3PH,4W	30	DRY TYPE	150°C	(4) 2.5%	FLOOR, WALL, OR TRAPEZE MOUNT	N/A
LTBA	480V,3PH,3W	208Y/120V,3PH,4W	15	DRY TYPE	150°C	(4) 2.5%	FLOOR, WALL, OR TRAPEZE MOUNT	N/A
STBA	480V,3PH,3W	208Y/120V,3PH,4W	45	DRY TYPE	150°C	(4) 2.5%	FLOOR, WALL, OR TRAPEZE MOUNT	K-13 RATED
STBB	480V,3PH,3W	208Y/120V,3PH,4W	30	DRY TYPE	150°C	(4) 2.5%	FLOOR, WALL, OR TRAPEZE MOUNT	N/A
TL1A	480V,3PH,3W	208Y/120V,3PH,4W	15	DRY TYPE	150°C	(4) 2.5%	FLOOR, WALL, OR TRAPEZE MOUNT	N/A
ST4	480V,3PH,3W	208Y/120V,3PH,4W	45	DRY TYPE	150°C	(4) 2.5%	FLOOR, WALL, OR TRAPEZE MOUNT	N/A
LPA	480V,3PH,3W	208Y/120V,3PH,4W	15	DRY TYPE	150°C	(4) 2.5%	FLOOR, WALL, OR TRAPEZE MOUNT	N/A
STPA	480V,3PH,3W	208Y/120V,3PH,4W	30	DRY TYPE	150°C	(4) 2.5%	FLOOR, WALL, OR TRAPEZE MOUNT	N/A
NOTES:								
1. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.								
2. TRANSFORMERS 45 KVA AND SMALLER MAY BE FLOOR, WALL, OR TRAPEZE MOUNT AT THE OPTION OF THE CONTRACTOR.								
KEY: A/N = AS NOTED								

Table 1: Individual Transformer Schedule

EMERGENCY POWER SYSTEM

Emergency power is generated by a 1000 kW, 408Y/277V diesel generator. This unit is located on the northwest corner of the building on level P2 of the parking garage. The generator provides emergency power to the ATS Life Safety, ATS Elevator, and the ATS Standby. In the event of an emergency, the generator sends power through three automatic transfer switches to each of the three systems, respectively. From there, it is tapped and protected by three 400 amp low voltage molded case circuit breakers. The emergency power is then fed into the three existing distribution panels; Life Safety, Elevator, and Standby. The emergency distribution panel provides power to all the mechanical equipment, elevators, and lighting of the building in the event of a power outage.

OVERCURRENT PROTECTIVE DEVICES

For overcurrent protection, the Dorrance H. Hamilton Building contains fuses, circuit breakers, load interrupter switches, and automatic transfer switches to protect and isolate the system in case of a problem. The main incoming service contains a load interrupter switch with a fuse rated at 150E. After running through a 2500 kVA, 13.2 kVA -480Y/277V transformer, the bus duct of Substation No. 1 is protected by a 4000 amp circuit breaker. From there, each line going to a distribution panel or panel boards are circuit breakers sized accordingly. In case of a failure, the substation can be isolated from the system in order to fix the problem. With Substation No. 1 down, the emergency generator will power the ATS Life Safety, ATS Elevator, and the Emergency Distribution panels.

LOCATION OF SWITCHGEAR, PANELBOARDS, AND MOTOR CONTROL CENTERS

The northwest corner of level P2 of the parking garage houses an electrical room, a fire pump room, and a generator room. Substation No. 1 is located here which includes the 13.2 kV primary switch and the 4000 amp bus. The bus duct services all of the main distribution panelboards. The main distribution panelboards provide power to the sub-distribution panel on each floor. On each floor, an electrical room is located in the northwest corner of the building footprint. Providing an electrical room in the same location on each floor reduces cost by minimizing conductor sizes and reduces voltage drop. The average electrical room of each floor contains a transformer and panelboards. The motor control centers are located on the penthouse floor (7th floor).

TYPICAL LIGHTING SYSTEMS

The lighting of the Dorrance H. Hamilton Building mostly consists of recessed fluorescent light sources powered by 277 and 120 volt services. Linear and compact fluorescent recessed fixtures are specified in most of the classrooms and corridors. The main lobby includes vast daylighting via a curved glass façade, fluorescent fixtures and HID sources. Compact fluorescent downlights are utilized in the auditorium along with some of the higher end classrooms. Accent lighting with MR16 and wallwash luminaires provides a striking design and ample illuminance. The plaza area consists of LED strip lighting, HID, and fluorescent sources of light.

ASHRAE/IESNA 90.1 SHUTOFF REQUIREMENTS

A programmable lighting control system is used in the building as a means to meet the shutoff requirements in ASHRAE/IESNA 90.1. The parking levels P1 and P2 are controlled by a system time clock. A photocell with a system time clock represents the method to control the exterior lighting of the plaza. The area lighting of the second through fifth floors will be controlled via a system time clock. During the off period, fixtures shall turn on by local occupancy sensors if presence is detected. The occupancy sensors used include dual technology occupancy sensors, PIR occupancy sensors, ultrasonic occupancy sensors, automatic wall switch sensors, and a low voltage digital time switch.

POWER FACTOR CORRECTION

At the moment, capacitors are not found in the plans or the specifications for the Dorrance H. Hamilton Building. After the building is completed in August 2007, a study may be done in order to determine if power factor correction should be utilized.

DESIGN REQUIREMENTS

Important design considerations for the building are typical of most buildings in the form of transient voltage surge suppression, voltage drop, power conservation, emergency power supply, uninterruptible power supply, and cost effectiveness.

Transient voltage surge suppression for the building can be found at the main bus duct in Substation No. 1. The manufacturers' data for the TVSS is not known at the moment. Since the building is only six stories high, voltage drop is negligible. Power conservation is of moderate concern in the space. A programmable lighting system is used throughout the building in order to save power. The large glass façade was not designed to prevent heat loss and reduce energy consumption. Fluorescent lighting was used throughout the building to reduce lighting costs and compact fluorescents are used where incandescents are typically found. The emergency power supply is provided with the diesel generator. The building is a medical education building, so the uninterruptible power supply was of a lesser necessity.

PRIMARY LAMPS TABLE

PRIMARY LAMPS									
Type	Lamp Type	Bulb Size	Base Type	Wattage	Voltage	Initial Lumens	Color Temp	Minimum CRI	Manufacturer
L1	Linear Fluorescent	T8	Medium Bi-Pin	32	277	2950	3500	0.82	GE
L2	Biaxial Fluorescent	T5	4 Pin	40	277	3150	3500	0.82	GE
L3	Double Twin Tube Compact Fluorescent	T4	4 Pin	13	277	900	3500	0.82	GE
L4	Clear Metal Halide	ED-17	Medium	175	277	14400	3600	0.65	GE
L5	Clear Incandescent	A-21	Medium	150	120	2780	N/A	1.00	GE

Table 2: Primary Lamps

NEC BUILDING DESIGN LOAD CALCULATION

The building design load calculation is found by utilizing the following tables: Lighting Loads, Mechanical Equipment I, Mechanical Equipment II, Other Mechanical Equipment, Receptacle Load, Office/Classroom Equipment, Kitchen Equipment, and Miscellaneous Equipment. The correct demand loads were found using the 2005 National Electric Code. The total loading of the Dorrance H. Hamilton Building is 1620.52 kVA. The given bus duct is rated at 4000 amps. Therefore, $(4000 \text{ amps}) * (0.480 \text{ kV}) * (\sqrt{3}) = 3326 \text{ kVA}$. The given bus duct almost doubles the NEC calculated loads because the sixth floor of the building is empty at the moment. The sixth floor will add approximately another 500 kVA to the total loading of the building at a later date.

LIGHTING LOADS			
Occupancy	Area (SF)	Unit Load (VA/SF)	Total Load kVA
SCHOOLS	129,000	3.00	387.00
NOTE: NEC 2005 – TABLE 220.12 (GENERAL LIGHTING LOADS BY OCCUPANCY)		Total Connected kVA	387.00

Table 3: Lighting Loads

MECHANICAL EQUIPMENT SCHEDULE I						
Equipment	Type	Voltage	Phase	Power	Amps	kVA
RF-1	AHU Mixed Flow Fan	480 V	3	50 HP	65 A	54.04
RF-2	AHU Mixed Flow Fan	480 V	3	50 HP	65 A	54.04
SF-3	Utility Set Stairwell Pressure Fan	480V	3	20 HP	27 A	22.45
SF-4	Utility Set Stairwell Pressure Fan	480 V	3	20 HP	27 A	22.45
EF-5	PRV Fan above Toilets	480 V	3	1 HP	2.1 A	1.75
EF-6	PRF Fan above Toilets	480 V	3	1 HP	2.1 A	1.75
EF-7	Plenum Garage Exhaust Fan	480 V	3	30 HP	40 A	33.26
EF-8	Plenum Garage Exhaust Fan	480 V	3	30 HP	40 A	33.26
EF-9	Penthouse Propeller Fan	480 V	3	2 HP	3.4 A	2.83
SF-10	Electric Room Sq. In-line Fan	480 V	3	5 HP	7.6 A	6.32
SF-11	P2 Mechanical Room In-line Fan	480 V	3	1 HP	2.1 A	1.75
SF-12	Garage Sq. In-line Fan	480 V	3	7.5 HP	11 A	9.15
EF-13	P1 Staff TLT Central Exhaust Fan	480 V	3	1 HP	2.1 A	1.75
EF-14	Fire Pump Room In-line Fan	480 V	3	7.5 HP	11 A	9.15
EF-15	Scott Building Bsm. Prop. Fan	480 V	3	1 HP	2.1 A	1.75
EF-16	Scott Building Bsm. Prop. Fan	480 V	3	2 HP	3.4 A	2.83
UH-1	Unit Heater	120 V	1	1/30 HP	3 A	0.36
EUH-1	Cabinet Electric Unit Heater	480 V	3	1/100 HP	1 A	0.83
EUH-2	Cabinet Electric Unit Heater	480 V	3	1/100 HP	1 A	0.83
EUH-2	Cabinet Electric Unit Heater	480 V	3	1/100 HP	1 A	0.83
EUH-2	Cabinet Electric Unit Heater	480 V	3	1/100 HP	1 A	0.83
CT-1	Cross Flow Cooling Tower	480 V	3	10 HP	14 A	1.16
CH-1	Chiller	480 V	3	239.6 kW	288.19 A	138.33
AHU-1	Mechanical Room AHU #1	480 V	3	75 HP	96 A	7.98
AHU-2	Mechanical Room AHU #2	480 V	3	75 HP	96 A	7.98
AHU-3	Mechanical Room AHU #3	480 V	3	75 HP	96 A	7.98

Table 4: Mechanical Equipment Schedule I

MECHANICAL EQUIPMENT SCHEDULE II						
Equipment	Type	Voltage	Phase	Power	Amps	kVA
P-1	Chiller – Horiz. Split Case Pump	480 V	3	40 HP	52 A	43.23
P-2	Spare - Horizontal Split Case Pump	480 V	3	40 HP	52 A	43.23
P-3	Cooling Tower Horizontal Pump	480 V	3	40 HP	52 A	43.23
P-4	AHU-1 In-line Pump	120 V	1	¼ HP	5.8 A	0.70
P-5	AHU-2 In-line Pump	120 V	1	¼ HP	5.8 A	0.70
P-6	AHU-3 In-line Pump	120 V	1	¼ HP	5.8 A	0.70
P-7	HHW End-Suction Pump	480 V	3	7 ½ HP	11 A	9.15
P-8	HHW End-Suction Pump	480 V	3	7 ½ HP	11 A	9.15
P-9	RHHW End-Suction Pump	480 V	3	5 HP	7.6 A	6.32
P-10	RHHW End-Suction Pump	480 V	3	5 HP	7.6 A	6.32
P-11	Radiant Floor End-Suction Pump	480 V	3	1 HP	2.1 A	1.75
P-12	Radiant Floor End-Suction Pump	480 V	3	1 HP	2.1 A	1.75
FC-1 to FC-1	Stair #1 Fan Coil	120 V	1	0.420 kW	N/A	0.42
FC-6 to FC-7	Vestibule Fan Coil	120 V	1	0.235 kW	N/A	0.24
FC-8	Mech. Level Elev. Shft. Fan Coil Unit	120 V	1	0.235 kW	N/A	0.24
AC-1	Mechanical Shop AC System	120 V	1	½ HP	9.8 A	1.18
AC-2	Mechanical Room AC System	208 V	1	½ HP	9.8 A	2.04
AC-3	MDF Room AC System	480 V	3	1 ½ HP	3 A	2.49
AC-7	Machine Room AC System	480 V	3	1 ½ HP	3 A	2.49
AC-8	3 rd Floor Data Closet AC System	208 V	1	½ HP	9.8 A	2.04
AC-9	4 th Floor Data Closet AC System	208 V	1	½ HP	9.8 A	2.04
ACC-1	PI Air Cooled Condensing Unit	208 V	1	N/A	14.5 A	3.02
ACC-2	Roof Air Cooled Condensing Unit	208 V	1	N/A	12.8 A	2.66
ACC-3	Roof Air Cooled Condensing Unit	480 V	3	N/A	11.4 A	9.48
ACC-7	Roof Air Cooled Condensing Unit	480 V	3	N/A	11.4 A	9.48
ACC-8	Roof Air Cooled Condensing Unit	208 V	1	N/A	14.5 A	2.39
ACC-9	Roof Air Cooled Condensing Unit	208 V	1	N/A	14.5 A	2.39

Table 5: Mechanical Equipment Schedule II

OTHER MECHANICAL EQUIPMENT

Panel Board	Mechanical Equipment	Voltage	Phase	Power	Amps	kVA
BHB	Irrigation Pump, P1	480 V	3	3990 W	4.80 A	2.30
BLA	AC-10	208 V	1	1880 W	9.00 A	1.87
“	AC-11	208 V	1	1880 W	9.00 A	1.87
“	Heat Trace, P1	120 V	1	500 W	4.17 A	0.50
“	Heat Trace, P2	120 V	1	500 W	4.17 A	0.50
“	RCPT Sub-Meter	120 V	1	1000 W	8.33 A	1.00
“	REM Monitor, Elev. #4	120 V	1	500 W	4.17 A	0.50
“	REM Monitor, Elev. #5	120 V	1	500 W	4.17 A	0.50
“	Relay Panel, LP-P2	120 V	1	500 W	4.17 A	0.50
“	Steam Condensing Pump	120 V	1	500 W	4.17 A	0.50
“	Water Heater	120 V	1	500 W	4.17 A	0.50
LBLA	Elev. Cab #3/4	120 V	1	1000 W	8.34 A	1.00
“	EM Call Boxes, P1/P2	120 V	1	1000 W	8.34 A	1.00
SBHA	Dom. Water Pump	480 V	3	18291 W	22.00 A	10.56
“	Jockey Pump	480 V	3	3990 W	4.80 A	2.30
“	SP-1, P201	480 V	3	7980 W	9.60 A	4.61
“	SP-1, P210	480 V	3	7980 W	9.60 A	4.61
“	UH P204	480 V	1	3000 W	6.25 A	3.00
“	UH P205	480 V	1	3000 W	6.25 A	3.00
SBLA	Fire Pump Controller	120 V	1	500 W	4.17 A	0.50
“	(3) FS Air Compressors	120 V	1	1500 W	12.50 A	1.50
1HA	VAV's	480 V	1	3648 W	7.60 A	3.65
1LA	Relay Panel LP-1	120 V	1	500 W	4.17 A	0.50
1LD	Elevator Pit	120 V	1	540 W	4.50 A	0.54
“	Sensors – Restroom	120 V	1	1000 W	8.33 A	1.00
“	FCU's	120 V	1	100 W	0.83 A	0.12
L1LA	1 st – 3 rd Floor Smoke Dampers	120 V	1	750 W	6.25 A	0.75
“	(2) FACP	120 V	1	3000 W	25.00 A	3.00
“	Fire Shutter Motor	120 V	1	1176 W	9.80 A	1.18
2HA	VAV's	480 V	1	8400 W	17.50 A	8.40
2LA	Relay Panel LP-2	120 V	1	500 W	4.17 A	0.50
2LE	Fan Coil Unit	120 V	1	480 W	4.00 A	0.48
“	Restroom Sensors	120 V	1	500 W	4.17 A	0.50
3HA	VAV's	480 V	1	7152 W	14.90 A	7.15
3LA	Relay Panel LP-3	120 V	1	500 W	4.17 A	0.50
3LE	Fan Coil Unit	120 V	1	480 W	4.00 A	0.48
“	Restroom Sensors	120 V	1	500 W	4.17 A	0.50

RECEPTACLE LOAD				
Panel Board	No. of 180VA Receptacles	180 VA Receptacles kVA	Dedicated Receptacles kVA	Total kVA
BLA	46	8.28	3.52	11.80
SBLA	21	3.78	2.73	6.51
SBLB	0	0.00	19.00	19.00
1LA	30	5.40	0.50	5.90
1LB	3	0.54	0.00	0.54
1LC	10	1.80	0.00	1.80
1LD	25	4.50	1.00	5.50
2LA	8	1.44	0.00	1.44
2LB	53	9.54	8.00	17.54
2LC	46	8.28	9.00	17.28
2LD	44	7.92	13.00	20.92
2LE	50	9.00	6.00	15.00
3LA	8	1.44	0.00	1.44
3LB	28	5.04	1.50	6.54
3LC	92	16.56	0.00	16.56
3LD	88	15.84	4.50	20.34
3LE	49	8.82	7.00	15.82
S3LA	26	4.68	12.00	16.68
4LA	8	1.44	0.00	1.44
4LB	16	2.88	3.00	5.88
4LC	69	12.42	1.00	13.42
4LD	71	12.78	6.50	19.28
4LE	30	5.40	1.00	6.40
S4LA	12	2.16	8.00	10.16
5LA	8	1.44	0.00	1.44
5LB	8	1.44	5.50	6.94
5LC	52	9.36	14.50	23.86
5LD	10	1.80	9.00	10.80
5LE	33	5.94	8.00	13.94
6LA	7	1.26	0.00	1.26
PLA	41	7.38	0.00	7.38
NOTE: A DEMAND FACTOR OF 1.0 WAS APPLIED FOR THE FIRST 10 kVA AND 0.5 FOR THE REMAINING kVA.			TOTAL CONNECTED kVA	322.81
			TOTAL DEMAND kVA	166.41

Table 7: Receptacle Load

OFFICE/CLASSROOM EQUIPMENT

Panel Board	Office/Classroom Equipment	Voltage	Phase	Power	Amps	kVA
1LB	Stair Lift, 109	120 V	1	2450 W	20.42 A	2.45
“	(52) Powered Furniture	120 V	1	78000 W	650.00 A	78.00
“	(5) AV Racks	120 V	1	7500 W	62.50 A	7.50
“	AV Raceway	120 V	1	1500 W	12.50 A	1.50
“	(5) Floor Boxes	120 V	1	7500 W	62.50 A	7.50
“	(4) Projectors	120 V	1	5500 W	45.83 A	5.50
“	(4) Motorized Screens	120 V	1	4000 W	33.33 A	4.00
1LD	AV Equipment	120 V	1	1000 W	8.33 A	1.00
“	Projector: Lobby	120 V	1	1000 W	8.33 A	1.00
“	Motorized Screen	120 V	1	500 W	4.17 A	0.50
2LB	(5) Projectors: Meeting Room	120 V	1	5000 W	41.67 A	5.00
“	(5) Screens: Meeting Room	120 V	1	3000 W	25.00 A	3.00
2LC	(5) Projectors: Meeting Room	120 V	1	5000 W	41.67 A	5.00
“	(5) Screens: Meeting Room	120 V	1	2500 W	20.83 A	2.50
2LD	(6) Projectors	120 V	1	6000 W	50.00 A	6.00
“	(6) Screens	120 V	1	3000 W	25.00 A	3.00
2LE	(3) Projectors	120 V	1	3000 W	25.00 A	3.00
“	(3) Screens	120 V	1	1500 W	12.50 A	1.50
3LB	(2) Projectors	120 V	1	2000 W	16.67 A	2.00
“	(2) Screens	120 V	1	1000 W	8.33 A	1.00
“	(2) X-Ray View Boxes	120 V	1	1000 W	8.33 A	1.00
3LC	(6) Computer: Corridor	120 V	1	6000 W	50.00 A	6.00
“	(3) Headboards	120 V	1	3000 W	25.00 A	3.00
“	(5) Racks	120 V	1	5000 W	41.67 A	5.00
“	(4) X-Ray View Boxes	120 V	1	2000 W	16.67 A	2.00
3LD	Copier	120 V	1	1000 W	8.33 A	1.00
“	Fax Machine	120 V	1	500 W	4.17 A	0.50
“	(2) Printers	120 V	1	1000 W	8.33 A	1.00
“	Projector: Classroom	120 V	1	1000 W	8.33 A	1.00
“	Screen: Classroom	120 V	1	500 W	4.17 A	0.50
3LE	(3) Projectors	120 V	1	3000 W	25.00 A	3.00
“	(3) Screens	120 V	1	1500 W	12.50 A	1.50
4LB	(2) Projectors	120 V	1	2000 W	16.67 A	2.00
“	(2) Screens	120 V	1	1000 W	8.33 A	1.00
4LC	(7) Computers: Corridor	120 V	1	10500 W	87.50 A	10.50
“	(5) Racks	120 V	1	5000 W	41.67 A	5.00
“	(4) X-Ray Viewers	120 V	1	1000 W	8.33 A	1.00
4LD	AV Equipment	120 V	1	1000 W	8.33 A	1.00
“	(2) Projectors	120 V	1	2000 W	16.67 A	2.00

“	(2) Screens	120 V	1	1000 W	8.33 A	1.00
5LB	(2) PAX/X-Ray	120 V	1	4000 W	33.33 A	4.00
“	(2) X-Ray Viewers	120 V	1	2000 W	16.67 A	2.00
“	Wall Mounted Laptop	120 V	1	1000 W	8.33 A	1.00
“	(2) Projectors	120 V	1	2000 W	16.67 A	2.00
“	(2) Screens	120 V	1	1000 W	8.33 A	1.00
5LC	AV Equipment	120 V	1	500 W	4.17 A	0.50
“	X-Ray Lab	120 V	1	500 W	4.17 A	0.50
“	Wall Mounted Laptop	120 V	1	500 W	4.17 A	0.50
“	(3) Projectors	120 V	1	3000 W	25.00 A	3.00
“	(3) Screens	120 V	1	1500 W	12.50 A	1.50
5LD	(2) Projectors	120 V	1	2000 W	16.67 A	2.00
“	(2) Screens	120 V	1	1000 W	8.33 A	1.00
5LE	Projector	120 V	1	1000 W	8.33 A	1.00
“	Screen	120 V	1	500 W	4.17 A	0.50
NOTE: NO DEMAND FACTORS WERE USED.					Total kVA	210.45

Table 8: Office/Classroom Equipment

KITCHEN EQUIPMENT						
Panel Board	Kitchen Equipment	Voltage	Phase	Power	Amps	kVA
1LA	Ice Machine	120 V	1	1000 W	8.33 A	1.00
“	Garbage Disposal	120 V	1	1000 W	8.33 A	1.00
“	Refrigerator	120 V	1	1000 W	8.33 A	1.00
“	Dishwasher, 110	120 V	1	12252 W	102.1 A	12.25
“	Coffee Maker	120 V	1	500 W	4.17 A	0.50
“	(2) Food Carts	120 V	1	3000 W	25.00 A	3.00
2LE	Ice Machine	120 V	1	1000 W	8.33 A	1.00
“	Garbage Disposal	120 V	1	1000 W	8.33 A	1.00
“	Refrigerator	120 V	1	1000 W	8.33 A	1.00
“	Microwave	120 V	1	1000 W	8.33 A	1.00
“	Coffee Maker	120 V	1	500 W	4.17 A	0.50
“	(2) Food Carts	120 V	1	3000 W	25.00 A	3.00
5LD	(14) Fry Pans	120 V	1	25200 W	210.00 A	25.20
5LE	Refrigerator	120 V	1	500 W	4.17 A	0.50
“	Range	120 V	1	2000 W	16.67 A	2.00
					Total Connected kVA	53.95
NOTE: A DEMAND FACTOR OF 0.65 WAS APPLIED TO ALL KITCHEN LOADS.					Total Demand kVA	35.07

Table 9: Kitchen Equipment

MISCELLANEOUS EQUIPMENT						
Panel Board	Miscellaneous Equipment	Voltage	Phase	Power	Amps	kVA
SBLA	Paystation, P1/P2	120 V	1	3000 W	25.00 A	3.00
“	(3) Entry/Exit Stations	120 V	1	3000 W	25.00 A	3.00
“	(3) Barrier Gates	120 V	1	2595 W	21.63 A	2.60
“	ATC Control Panel	120 V	1	500 W	4.17 A	0.50
1LA	Exterior Camera	120 V	1	200 W	1.67 A	0.20
“	Plasma Screen	120 V	1	1000 W	8.33 A	1.00
“	UH Loading Dock	120 V	1	100 W	0.83 A	0.10
1LD	(3) Plasma Screens	120 V	1	3000 W	25.00 A	3.00
“	Lutron System, 100	120 V	1	250 W	2.08 A	0.25
L1LA	EM Call Stns, Site	120 V	1	500 W	4.17 A	0.50
3LB	(9) Raceways 332/333	120 V	1	5580 W	46.50 A	5.58
3LE	Plasma Screen	120 V	1	1000 W	8.33 A	1.00
S3LA	(3) Aux. Power Supply	120 V	1	300 W	2.50 A	0.30
“	(4) CCTV's	120 V	1	400 W	3.33 A	0.40
“	Fill Station Alarm	120 V	1	250 W	2.08 A	0.25
“	(3) Security Stations	120 V	1	1500 W	12.50 A	1.50
4LB	(9) Raceways: (Sim./O.R.)	120 V	1	9000 W	75.00 A	9.00
“	(7) J-Box for Headboards	120 V	1	7000 W	58.33 A	7.00
4LC	(3) J-Box for Headboards	120 V	1	3000 W	25.00 A	3.00
S4LA	(3) CCTV's	120 V	1	300 W	2.50 A	0.30
5LB	(6) J-Box: Headboard	120 V	1	6000 W	50.00 A	6.00
“	(6) Raceways: Simulation Lab	120 V	1	6000 W	50.00 A	6.00
5LC	(3) J-Box: Headboard	120 V	1	3000 W	25.00 A	3.00
“	(3) Raceways: Simulation Lab	120 V	1	3000 W	25.00 A	3.00
5LD	(12) Raceways	120 V	1	12000 W	100.00 A	12.00
5LE	AV Rack	120 V	1	1500 W	12.50 A	1.50
“	Plasma Screen	120 V	1	1000 W	8.33 A	1.00
“	(3) Raceways	120 V	1	3000 W	25.00 A	3.00
“	Washer and Dryer	120 V	1	3000 W	25.00 A	3.00
PDPB	EM Call Box	120 V	1	500 W	4.17 A	0.50
					Total Connected kVA	81.48
NOTE: NO DEMAND FACTORS WERE USED.						

Table 10: Miscellaneous Equipment

TOTAL LOAD – DORRANCE H. HAMILTON BUILDING	
Load	Demand Load
Lighting	387.00
Mechanical Equipment	740.12
Receptacles	166.41
Office/Classroom Equipment	210.45
Kitchen Equipment	35.07
Miscellaneous Equipment	81.48
Total Load	1620.53 kVA

Table 11: Total Load

ELECTRIC UTILITY COMPANY

The electric utility company is the Philadelphia Electric Company (PECO). PECO is a unit of Exelon Energy Delivery, responsible for safe, reliable electric and natural gas distribution and customer service for residential business and institutional consumers in southeastern Pennsylvania. The pending tariff changes, current tariffs, selected rates of electric tariffs, rate for primary distribution power, rate for high tension power, transmission charges, wind energy, selected tariff provisions/rates on gas tariff, and a variety of other information is available on the PECO website. The website is <http://www.exeloncorp.com>. Please see Appendix for a full size view of the Primary Distribution Power Rate view.

COMMUNICATION SYSTEMS

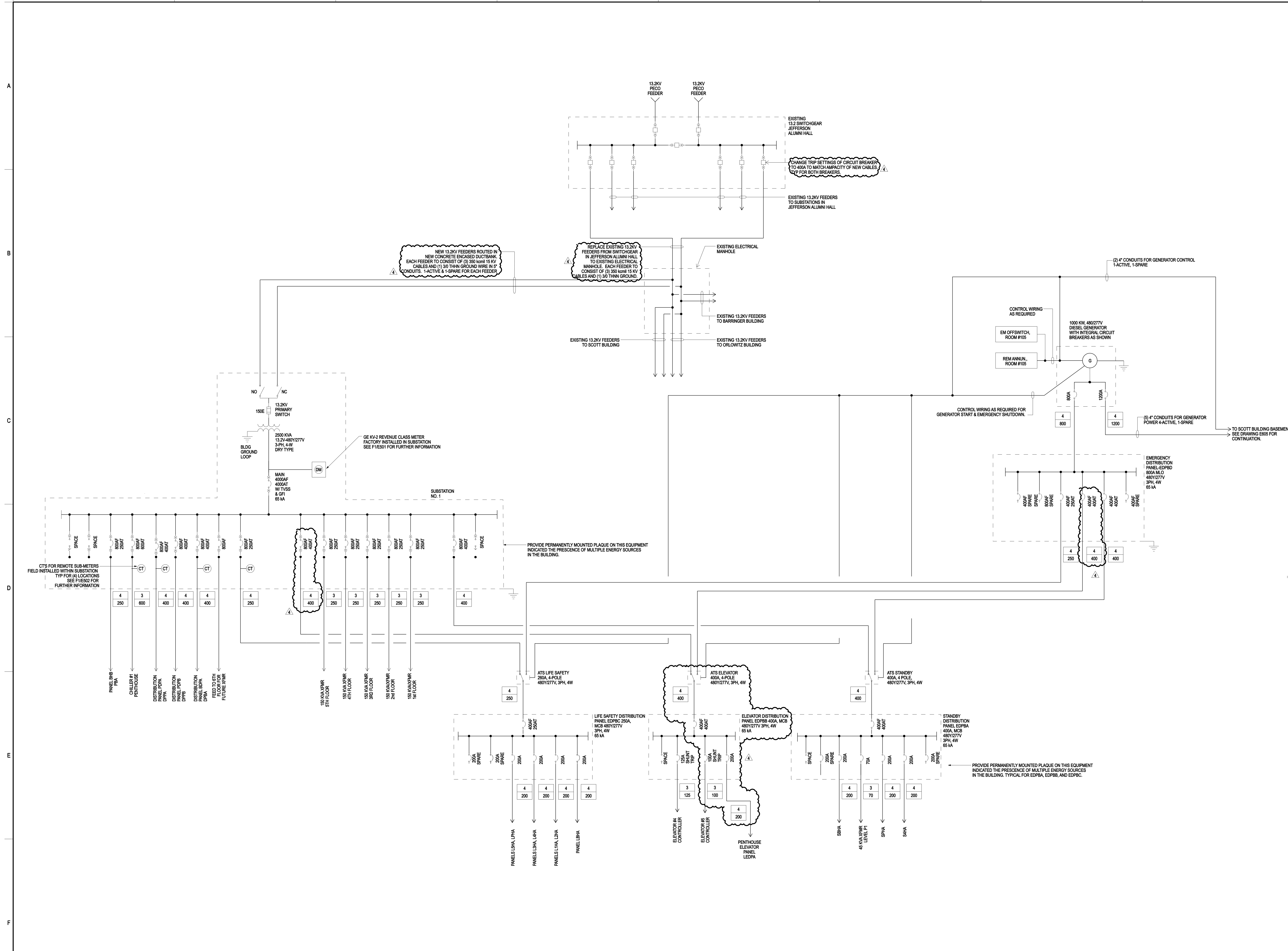
LIST OF COMMUNICATION SYSTEMS

Telecommunications

The building will have an addressable manual fire alarm station or an addressable automatic fire detecting device. Alarm signal devices will activate if system detects a fire. The system includes a automatic voice evacuation sequence, a manual voice paging sequence, a device to send a alarm to the University’s on-site central monitoring station, the activation of a sprinkler system tamper switch, smoke detectors in elevator lobbies, machine rooms, and hoist ways, addressable heat detectors, duct mounted smoke detectors, among other items. A supervised, two-way communication system between the fire command center/main fire alarm control panel and the emergency phones throughout the building is also included.

The security system of the building has surveillance television systems, security door access control, and security intrusion detection devices. The security system will provide perimeter security of the areas around the building during off peak hours.

The building has various other communications systems that are to be issued at a later date. These include the nurses call system, sound system, and a clock system.



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 Seal

CONSTRUCTION COORDINATION SET
 Seal

Dorrance H. Hamilton Building



1001 Locust St.
 Philadelphia PA, 19107

Revisions

No.	Date	By	Description
1	11-08-05	DLM	ADDENDUM 2
2	03-07-06	SCW	CONSTRUCTION COORDINATION
3	04-10-06	SCW	BULLETIN NO. 03
4	04-25-06	SCW	BULLETIN NO. 05

Date: OCTOBER 24, 2005

Drawing Name

ELECTRICAL SINGLE LINE DIAGRAM

Project Number 0492400
 TJU FDC # 05-144

Drawing Number

E-601

F3 ELECTRICAL SINGLE LINE DIAGRAM
 NTS

PECO Energy Company

Superseding Thirteenth Revised Page No. 48

RATE-PD PRIMARY-DISTRIBUTION POWER

AVAILABILITY.

Untransformed service from the primary supply lines of the Company's distribution system where the customer installs, owns, and maintains any transforming, switching and other receiving equipment required. However, standard primary service is not available in areas where the distribution voltage has been changed to either 13 kV or 33 kV unless the customer was served with standard primary service before the conversion of the area to either 13 kV or 33 kV. This rate is available only for service locations served on this rate on July 6, 1987 as long as the original primary service has not been removed. PECO Energy may refuse to increase the load supplied to a customer served under this rate when, in PECO Energy's sole judgment, any transmission or distribution capacity limitations exist. If a customer changes the billing rate of a location being served on this rate, PECO Energy may refuse to change that location back to Rate PD when, in PECO Energy's sole judgment, any transmission or distribution capacity limitations exist.

CURRENT CHARACTERISTICS.

Standard primary service.

MONTHLY RATE TABLE.

FIXED DISTRIBUTION SERVICE CHARGE: \$279.67

METERING AND BILLING CREDITS A customer receiving Advanced Meter Services from a AMSP other than the Company will receive a credit on the Fixed Distribution Service Charge equal to the Total Metering Credit set forth for this Base Rate in Appendix B to the Joint Petition for Full Settlement. A customer receiving Consolidated EGS Billing will receive a credit on the Fixed Distribution Service Charge equal to the Billing and Collection Credit set forth for this Base Rate in Appendix B to the Joint Petition for Full Settlement.

VARIABLE DISTRIBUTION SERVICE CHARGE:

\$1.82 per kW of billing demand (l)
1.62¢ per kWh of the first 150 hours' use of billing demand (l)
0.96¢ per kWh of the first next 150 hours' use of billing demand (l)
0.31¢ per kWh for additional use. (l)

COMPETITIVE TRANSITION CHARGE:

\$3.15 per kW of billing demand (l)
2.88¢ per kWh of the first 150 hours' use of billing demand (l)
1.74¢ per kWh for the next 150 hours' use of billing demand (l)
0.62¢ per kWh for additional use. (l)

ENERGY AND CAPACITY CHARGE: The following Energy and Capacity Charges will apply to the customer if the customer receives Default PLR Service. These charges are not applicable to the customer if it obtains Competitive Energy Supply.

\$4.37 per kW of billing demand (l)
5.48¢ per kWh of the first 150 hours' use of billing demand (l)
3.90¢ per kWh for the next 150 hours' use of billing demand (l)
2.35¢ per kWh for additional use. (l)

TRANSMISSION SERVICE FOR CUSTOMERS RECEIVING DEFAULT PLR SERVICE: Unless such a customer is able to obtain transmission service on its own, PECO Energy will provide transmission service, and will impose charges on such a customer for such transmission service.

STATE TAX ADJUSTMENT CLAUSE, NUCLEAR DECOMMISSIONING COST ADJUSTMENT APPLY TO THIS RATE.

DETERMINATION OF BILLING DEMAND.

The billing demand will be computed to the nearest kilowatt and will never be less than the measured demand, adjusted for power factor in accordance with the Rules and Regulations, nor less than 25 kilowatts. Additionally, during the eight months of October through May the billing demand will not be less than 40% of the maximum demand specified in the contract nor less than 80% of the highest billing demand in the preceding months of June through September (applied on an unbundled basis). There will be a one-time waiver of the application of the previous sentence as it relates to minimums associated with PLR Energy and Capacity charges the first time a customer at a service location elects to receive Competitive Energy Supply. This one-time waiver is specific to a particular service location unless a new entity has assumed operation of the service location from a customer which has ceased operations at that location as a result of dissolution provided the new entity was not created through merger, partnership, joint venture, acquisition and/or any other type of combined business structure with the former customer.

MINIMUM CHARGE.

The monthly minimum charge shall be the Fixed Distribution Service Charge, plus the charge per kW component of the Variable Distribution Service Charge, the CTC, and the Energy and Capacity Charge.

TERM OF CONTRACT.

The initial contract term shall be for at least three years.

PAYMENT TERMS.

Standard.

(l) Indicates Increase