

Lindsey Beane

Lighting/Electrical
Professor Mistrick
Harris Theater for Music and Dance
Chicago, IL

Technical Assignment #2: Existing Electrical Conditions

Executive Summary

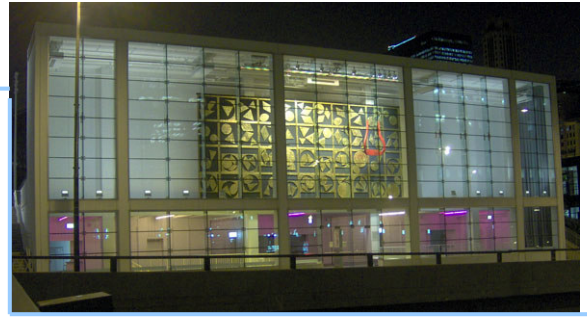
The purpose of this assignment is to exercise an understanding of the electrical system in use at the Harris Theater for Music and Dance. The components and layout of the system will be described in regards to sizing and location. Then some calculations that check the sizing of the components are listed. Information about the utility rate structure is also included and is found near the end of the report. Actual building performance records have not yet been received, so the guide for the utility rate structure is included. There are three appendices at the end of the report which are reference in the main report.



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Electrical System Components

The electrical system taps from the ComEd utility at two different voltage levels. The transformers for the main feed at the utility are not listed. Please see Appendix C to reference the one-line diagrams to this system.

System Type: 480Y/277 3 ϕ 4W
2 Main Switchboards

System Type: 208Y/120 3 ϕ 4W
1 Main Switchboard

Emergency Power: 480/277 3 ϕ 4W, 425KVA
2 Automatic transfer switches
- transfer utility to utility
- transfer utility to generator

Overcurrent Protection:

The (3) switchboards, motor control centers and most distribution panels are protected with fusible switches. Exceptions to this are (2) distribution panels dedicated to lighting which are protected with circuit breakers.

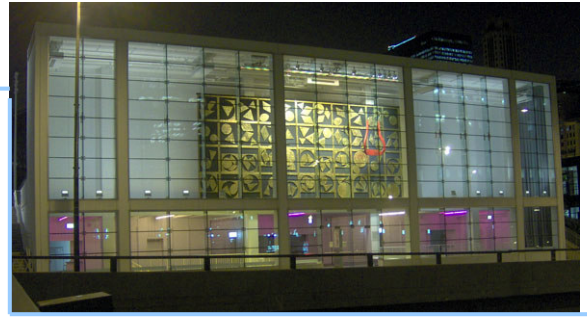
General Location:

The (3) switchboards are located in the switchgear room on the orchestra level. This room also houses the building ground point, utility meters, automatic transfer switches, and a number of other distribution panels, and panelboards. The emergency system is adjacent to the switchboards, but is in a separate room. The emergency system's room also houses the automatic transfer switches.

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Overview of Sizing Calculations

The loads listed in the following calculations are assumed to have included demand factors for lighting and receptacles. Demand factors for growth and motors were used and noted as such in the following spreadsheets. The loads were then summed using VA and then calculated to compare to the actual wires used. Due to the complexity of the system and a lack of specific panelboard information all loads were calculated using those listed on the distribution panels, motor control centers, and the one-line diagrams.

More detailed information including receptacle counts and area lighting loads were compiled but were not used for this exercise. If desired, please see Appendix A to review those calculations.

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Switchboard Feeder Sizing Calculations: 480Y/277 3φ 4W

MSB-H-OL-1		480Y/277			
Load Description	V	HP	amps	KW	kVA
C/T Section	480				
Main Disconnect	480				
ECH-5/6	480		349.00		167.52
Space	480		400.00		
Space	480		400.00		
MCC-1-H-OL-1	480		245.00		117.60
Space	480		400.00		
ECH-3	480		253.00	210	121.44
ECH-1/2	480		229.00	190	109.92
DP-1-H-OL-1	480		473.00		227.04
DP-1-H-OL-2	480		365.00		175.20
					918.72

The empty spaces on this switchboard were not included in the sizing calculation. The amps listed denotes the frame size available.

$$I = 918.72 / (1.73 * 480) * 1000$$

797.5 amps growth demand factor, 1.25

113.93 amps (7) Sets of 4#500

#500 is rated for 380A, oversized

MSB-H-OL-2		480Y/277			
Load Description	V	HP	amps	KW	kVA
C/T Section	480				
DP-1-H-OL-3	480		335.00		160.80
DP-1-H-SL-1	480		475.00		228.00
Space	480		600.00		
Emergency System	480		310.00		148.80
					537.60

The empty spaces on this switchboard were not included in the sizing calculation. The amps listed denotes the frame size available.

$$I = 537.6 / (1.73 * 480) * 1000$$

809.25 amps growth demand factor, 1.25

134.87 amps (6) Sets of 4#400

#400 is rated for 335A, oversized

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Switchboard Feeder Sizing Calculations: 208Y/120 3φ 4W

MSB-L-OL-1		208Y/120			
Load Description	V	HP	amps	KW	kVA
C/T Section	208				
Emergency System	208		714.00		148.51
Stage Lighting - Dimmer Racks	208		625.00		130.00
Main Disconnect	208		1427.00		296.82
Lobby Dimmer Panel	208		110.00		22.88
PNL: LL-UB-2	208		160.00		33.28
PNL: LL-LB-1, LL-LB-2, LL-LB-3	208		314.00		65.31
PNL: DP-L-OL-1	208		8.00		1.66
PNL: LL-ST-2, LL-ST-2A	208		160.00		33.28
PNL: LL-LR-2, LL-LR-3	208		211.00		43.89
Road Show Stage Lighting	208		400.00		
Road Show Stage Lighting	208		400.00		
PNLS: LL-LR-1, LL-ST-1	208		259.00		53.87
Sound System	208		125.00		26.00
					855.50

The empty spaces on this switchboard were not included in the sizing calculation. The amps listed denotes the frame size available.

$$I = 855.5 / (1.73 * 208) * 1000$$

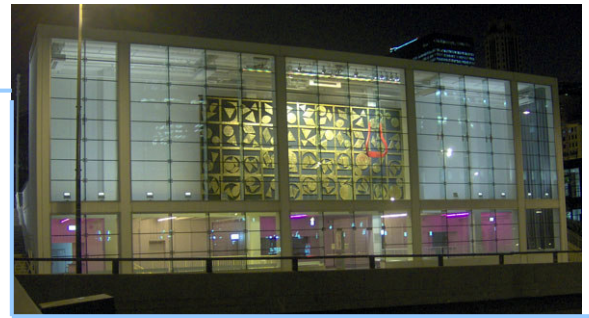
2971.82 amps growth demand factor, 1.25

371.48 amps (8) Sets of 4#500

#500 is rated for 380A, correct

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Distribution Panel Feeder Sizing

DP-1-H-UB-1		480Y/277				
Label	V	HP	amps	KW	kVA	
MCC-1-H-UB-1	480		47.00		22.56	
PNL HP-UB-1	480		24.00		11.52	
AHU-5/8	480	25.00	40.00		19.20	
E/R-5/6	480	7.50	27.00		12.96	
AHU-5/8	480	25.00	40.00		19.20	
					85.44	

$I = 85.44 / (1.73 * 480) * 1000 = 102.89$ amps

1 set of 4#3/0

#3/0 is rated for 200A, oversized

DP-1-H-OL-1		480Y/277				
Label	V	HP	amps	KW	kVA	
HUM-1, HUMIDIFIER#1	480		99.00	82.3	47.52	
HUM-2, HUMIDIFIER#2	480		50.00	41.2	24.00	
DP-1-H-UB-1	480		150.00		72.00	
S-2, E-1	480		13.00	8	6.24	
PNL HB-OL-2	480		57.00		27.36	
PNL HB-ST-2	480		20.00		9.60	
EHC-4	480		84.00		40.32	
					227.04	

$I = 227.04 / (1.73 * 480) * 1000 = 273.41$ amps

136.71 amps 2 sets of 4#350

#350 is rated for 310A, oversized

DP-LB-1		208Y/120				
Label	V	HP	amps	KW	kVA	
2-DIMMER RACKS	208		156.00	56	32.45	
2-DIMMER RACKS	208		156.00	56	32.45	
1-DIMMER RACK	208		156.00	56	32.45	
1-DIMMER RACK	208		156.00	56	32.45	
					129.79	

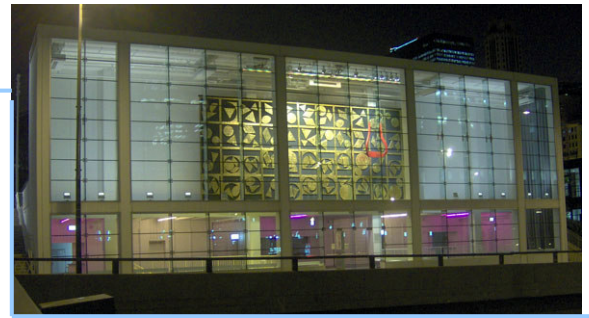
$I = 129.79 / (1.73 * 208) * 1000 = 360.69$ amps

180.35 amps 2 sets of 3#350, 2#350 N, 1#3G

#350 is rated for 310A, oversized

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Distribution Panel Feeder Sizing

DP-1-H-OL-3		480Y/277				
Label	V	HP	amps	KW	kVA	
PASSENGER ELEVATOR #1	480	60.00	77.00		36.96	
PASS ELEV #4, FRT ELEV #1	480	60, 2@50	207.00		99.36	
PASSENGER ELEVATOR #5	480	25.00	34.00		16.32	
PNL HP-ST-3	480		17.00		8.16	
Space	480		60.00			
Space	480		100.00			
					160.80	

The empty spaces on this distribution panel were not included in the sizing calculation. The amps listed denotes the frame size available.

$$I = 160.8 / (1.73 * 480) * 1000 = 193.64 \text{ amps}$$

96.82 amps, 2 sets of 4#350

#350 is rated for 310A, oversized

DP-1-H-SL-1		480Y/277				
Label	V	HP	amps	KW	kVA	
BP-1 BOOSTER PUMP	480	2@10	28.00		13.44	
EP-1 SEWAGE EJECTOR	480	2@3	10.00		4.80	
WH-1 WATER HEATER	480		217.00	180	104.16	
WH-1 WATER HEATER	480		217.00	180	104.16	
JOCKEY PUMP	480	1.5	3.00		1.44	
AC-1 DRY SYS, COMP	480	1	2.00		228.00	
Spare	480		30.00			
Spare	480		60.00			
					456.00	

The empty spaces on this distribution panel were not included in the sizing calculation. The amps listed denotes the frame size available.

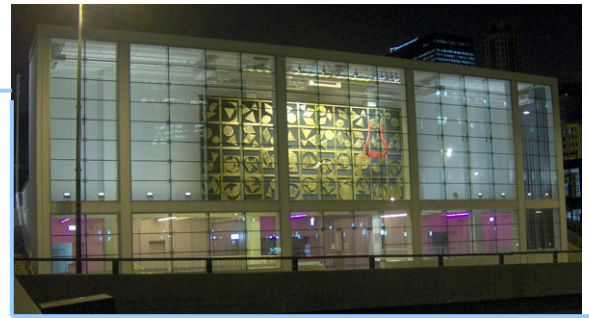
$$I = 456 / (1.73 * 480) * 1000 = 549.13 \text{ amps}$$

274.57 amps, 2 sets of 4#350

#350 is rated for 310A, oversized

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Distribution Panel Feeder Sizing

HGDP-OL-1		480Y/277			
Label	V	HP	amps	KW	kVA
ATS-2	480		319.00		153.12
GENERATOR EQUIP	480	10.00	14.00		6.72
NORM OFF LTG	480		7.00	6	3.36
FIRE PUMP	480		96.00	75	46.08
MAINTENANCE	480				0.00
					209.28

$$I = 209.28 / (1.73 * 480) * 1000 = 252.02 \text{ amps}$$

1 set of 4#500

#500 is rated for 380A, oversized

HEDP-OL-1		480Y/277			
Label	V	HP	amps	KW	kVA
PNL-EDP-OL-1	480		40.00	33.5	19.20
PASSENGER ELEV #2	480	60.00	77.00		36.96
PASSENGER ELEV #3	480	60.00	77.00		36.96
SUP PUMP SEWERAGE EJECTOR	480	6.00	10.00		4.80
E-3	480	15.00	21.00		10.08
E/4-4	480	15.00	21.00		108.00
					216.00

$$I = 216 / (1.73 * 480) * 1000 = 260.12 \text{ amps}$$

1 sets of 4#500

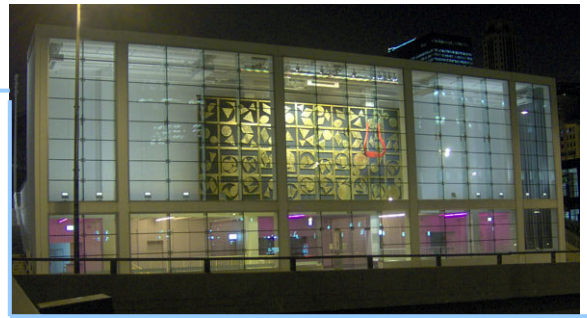
#500 is rated for 380A, oversized

EDP-OL-1		208Y/120			
Label	V	HP	amps	KW	kVA
PNL-EL-UR-1, PNL-EL-LR-1	208		28.00	8	5.82
PNL-EL-UB-1, EL-LB-1, EL-ST-1	208		32.00	9	6.66
PNL-EL-OL-1	208		8.00	2.8	1.66
LOBBY LTG. EMERG. TRANSFER DIMMER	208		18.00	6.4	3.74
PNL EL ST-2	208		28.00	8	5.82
STAGE LTG EMERG TRANSFER DIMMER	208		15.00	5.2	23.71
					47.42

This panel controls the dimmer racks for the lobby and auditorium, it is fed by DP-LB-1 and has different feeders to the (6) separate racks. 131.79 amps is the total load, and the smallest of the 9 feeders is #350 which carries 310 amps. This system is very oversized to allow flexibility on the dimmer racks.

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Distribution Panel Feeder Sizing

DP-L-OL-1		208Y/120				
Label	V	HP	amps	KW	kVA	
PNL LL-UB-1	208		133.00	48	27.66	
PNL LL-OL-2	208		83.00	30	17.26	
Spare						
MOTOR DISC	208					
Spare						
Spare						
Spare						
						44.93

The empty spaces on this distribution panel were not included in the sizing calculation. The amps listed denotes the frame size available.

$$I = 44.93 / (1.73 * 208) * 1000 = 124.86 \text{ amps}$$

62.43 amps, 2 sets of 4#350

#350 is rated for 310A, oversized

DAP-PT-1		208Y/120				
Label	V	HP	amps	KW	kVA	
PNL AP-PT-1	208		225.00			
ROAD SHOW DISCONNECT SWITCH	208		225.00			
PORTABLE AUDIO EQUIP. RECPT	208		100.00			
PORTABLE AUDIO EQUIP. RECPT	208		225.00			

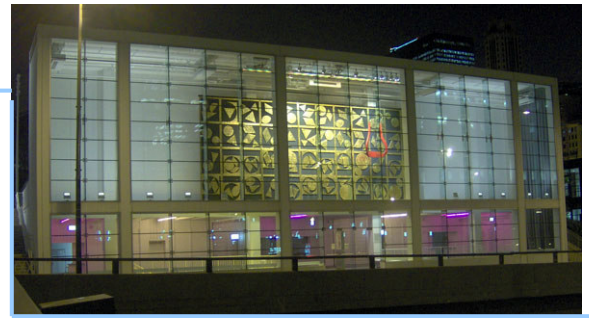
This distribution panel was not calculated because actual load information was not available.

DP-1-H-OL-2		480Y/277				
Label	V	HP	amps	KW	kVA	
PNL HP-UR-1	480	102.00	102.00		48.96	
PNL HP-LR-2	480	40.00	40.00		19.20	
PNL HP-OL-1, HP-LB-1	480	62.00	62.00		29.76	
PNL HP-PT-1, HP-LR-1, HP-ST-1	480	151.00	151.00		97.92	
Spare	480		100			
						195.84

Wire sizing information was not listed for this distribution panel.

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Distribution Panel Feeder Sizing

Motor Control Center: MCC-1-H-UB-1		480				
Label	V	HP	amps	DF	kVA	
E-	480	10.00	14.00	0.5	3.36	
E6	480	1.00	1.80		0.86	
E-	480	10.00	14.00		6.72	
E7	480	1.00	1.80		0.86	
E2	480	10.00	14.00		6.72	
E8	480	0.50	1.00		0.48	
						19.01

Wire sizing information was not listed for this motor control center.

Motor Control Center: MCC-1-H-OL-1		480				
Label	V	HP	amps	DF	kVA	
AHU - 1/2	480	25.00	34.00		16.32	
E/R-1/2	480	15.00	21.00		10.08	
AHU - 1/2	480	25.00	34.00		16.32	
S-4	480	0.50	1.00		0.48	
AHU-3	480	30.00	40.00	0.5	9.60	
E/R-1/2	480	15.00	21.00		10.08	
AHU-4	480	20.00	27.00		12.96	
P-1	480	20.00	27.00		12.96	
P-2	480	20.00	27.00		12.96	
S-3	480	2.00	3.40		1.63	
E-4	480	1.00	1.80		0.86	
E-10	480	0.50	1.00		0.48	
E-11	480	0.50	1.00		0.48	
E-9	480	0.50	1.00		0.48	
E-5	480	3.00	4.80		2.30	
Space	480		30.00			
Space	480		30.00			
Space	480					
Space	480					
Space	480					
Space	480					
						108.00

Wire sizing information was not listed for this motor control center.

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Utility Rate Structure

This rate information was found on the ComEd (of Exelon) and applies general service in Chicago. The information listed below is the basic information related to the different costs of the utility services. There is more detailed information in the complete guide which is found in Appendix B.

GENERAL SERVICE – NON-TIME OF DAY.

General Service – Non-Time of Day charges shall apply to all other customers qualifying for service under this rate.

CHARGES.

General Service – Time of Day.

Monthly Customer Charge.

The Monthly Customer Charge shall be: \$30.93

Demand Charge.

Charge per kilowatt for all kilowatts of Maximum Demand for the month:

For Summer Months \$14.24

For All Other Months \$11.13

For the purposes hereof, the Summer Months shall be the customer's first monthly billing period with an ending meter reading date on or after June 15 and the three succeeding monthly billing periods.

Energy Charge.

Charge per kilowatt-hour for kilowatt-hours supplied in the month:

For kilowatt-hours supplied

during Energy Peak Periods 5.59¢

during Energy Off-Peak Periods 2.34¢

General Service – Non-Time of Day.

Monthly Customer Charge.

The Monthly Customer Charge shall be: \$8.83

Demand Charge.

Charge per kilowatt for all kilowatts of Maximum Demand for the month:

For Summer Months \$14.24

For All Other Months \$11.13

In accordance with the Application of Demand Charge provisions of this rate, there shall be no demand charge as such for certain small customers, but in lieu thereof, such customers shall pay a charge per kilowatt-hour in addition to the energy charges of this rate.

The in-lieu of demand charge per kilowatt-hour for kilowatt-hours supplied in the month:

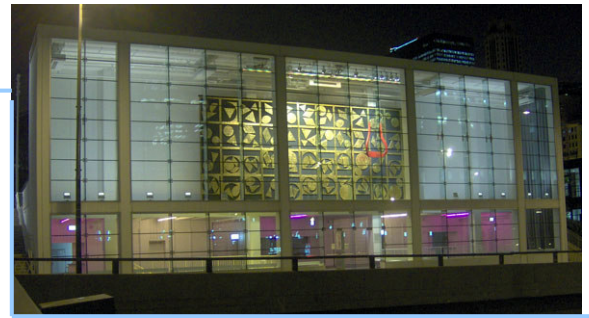
For Summer Months 6.05¢

For All Other Months 4.79¢

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Utility Rate Structure

CHARGES. (CONTINUED)

General Service – Non-Time of Day. (Continued)

Demand Charge (Continued).

For the purposes hereof, the Summer Months shall be the customer's first monthly billing period with an ending meter reading date on or after June 15 and the three succeeding monthly billing periods.

Energy Charge.

Charge per kilowatt-hour for kilowatt-hours supplied in the month:

For the first 30,000 kilowatt-hours.....	4.247¢
For the next 470,000 kilowatt-hours.....	3.167¢
For all over 500,000 kilowatt-hours.....	3.118¢

Late Payment Charge.

The late payment charge provided for in the Terms and Conditions of this Schedule of Rates shall be applicable to all charges under this rate.

Minimum Charge.

The minimum monthly charge shall be the Monthly Customer Charge.

Maximum Charge.

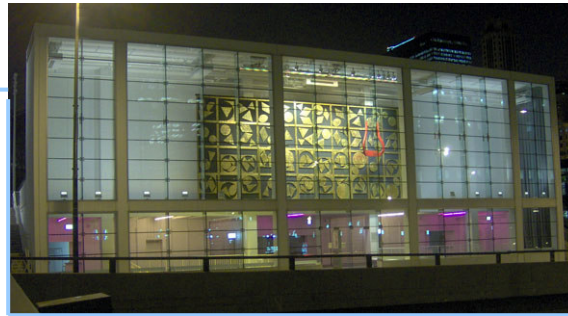
For customers with demand meters, the average cost of electricity hereunder in any month, exclusive of the Monthly Customer Charge, shall not exceed the Maximum Charge per kilowatt-hour, provided, however, that such guaranteed charge shall not operate to reduce the customer's bill to an amount less than the Minimum Charge.

The Maximum Charge per kilowatt-hour shall be: 20.502¢

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Appendix A

Area Lighting Calculations:

Space Type	Office	Seating Area	Hallways	Lobby	Restrooms/ Dressing	Mechanical/ Storage	Lounge	Multi- purpose	Loading Dock	
Area	1257	4219	4922	792	2386	6495	1024	1078	5669	
	183	4850	8269	625	2391	1608	1122			
	4811	3406	4683	3859	3275	1041				
	651		2540	3858	3765	6203				
			4816	3562	1251	1340				
			3234			1829				
Total Area	6902	12475	28464	12696	13068	18516	2146	1078	5669	
Multiplier	3.5	3.5	0.5	3.5	2	0.25	2	1	0.25	
KVA/Type	24.16	43.66	14.23	44.44	26.14	4.63	4.29	1.08	1.42	164.04 KVA Total

Receptacle Calculations:

Receptacle Counts	# receptacles	Load (VA)
Lower Level	16	2880
Intermediate level	11	1980
Stage Level	100	18000
Lower Randolph	75	13500
Lower Balcony	81	14580
Orchestra Level	49	8820
Upper Balcony Level	83	14940
Upper Randolph Level	24	4320
Grid Level + Terrace	8	1440
Total	447	80.46 KVA

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Appendix B

RATE 6 GENERAL SERVICE

APPLICABILITY.

Except as provided in Rate 6L, this rate is applicable to any commercial, industrial, or governmental customer with a Maximum Demand of less than 1,000 kilowatts who uses the Company's electric service hereunder for all requirements. Direct current requirements provided under another rate immediately prior to September 2, 1975, will, however, also be provided hereunder.

GENERAL SERVICE – TIME OF DAY.

Time of day charges shall apply to (1) any customer with a Maximum Demand of 500 kilowatts or more, but less than 1,000 kilowatts, in three of the twelve months preceding the billing month, one of which occurs during the three months preceding the billing month, (2) successors to customers served under these charges immediately prior to the date of succession whose estimated Maximum Demands meet the demand requirements in clause (1) above, (3) new customers whose estimated Maximum Demands meet the demand requirements in clause (1) above, and (4) any customer previously billed hereunder pursuant to clauses (1) or (2), except as otherwise provided below.

These charges shall not be applicable to customers or their successors with electric space heating taking service under the Heating with Light provision of Rider 25 prior to November 23, 1977, except upon written application by the customer to the Company.

If a customer at one time was served pursuant to (1) above on General Service – Time of Day and has a Maximum Demand which (A) has not exceeded 400 kilowatts in any month of the 16-month period preceding the billing month, or (B) has not equaled or exceeded 500 kilowatts in any month of the 24-month period preceding the billing month, such customer may elect, in written application to the Company, to be served on General Service – Non-Time of Day. General Service – Time of Day shall not again be applicable until such customer meets the requirements of General Service – Time of Day.

GENERAL SERVICE – NON-TIME OF DAY.

General Service – Non-Time of Day charges shall apply to all other customers qualifying for service under this rate.

CHARGES.

General Service – Time of Day.

Monthly Customer Charge.

The Monthly Customer Charge shall be: \$39.93

Demand Charge.

Charge per kilowatt for all kilowatts of Maximum Demand for the month:

For Summer Months \$14.24

For All Other Months \$11.13

For the purposes hereof, the Summer Months shall be the customer's first monthly billing period with an ending meter reading date on or after June 15 and the three succeeding monthly billing periods.

Energy Charge.

Charge per kilowatt-hour for kilowatt-hours supplied in the month:

For kilowatt-hours supplied

during Energy Peak Periods 5.599¢

during Energy Off-Peak Periods 2.341¢

General Service – Non-Time of Day.

Monthly Customer Charge.

The Monthly Customer Charge shall be: \$8.83

Demand Charge.

Charge per kilowatt for all kilowatts of Maximum Demand for the month:

For Summer Months \$14.24

For All Other Months \$11.13

In accordance with the Application of Demand Charge provisions of this rate, there shall be no demand charge as such for certain small customers, but in lieu thereof, such customers shall pay a charge per kilowatt-hour in addition to the energy charges of this rate.

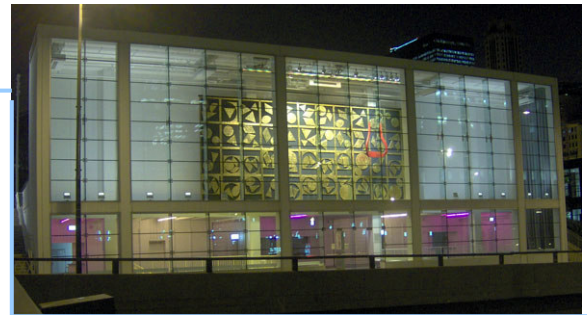
The in-lieu of demand charge per kilowatt-hour for kilowatt-hours supplied in the month:

For Summer Months 6.057¢

For All Other Months 4.798¢

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RATE 6 GENERAL SERVICE

(Continued from Sheet No. 24)

CHARGES. (CONTINUED)

General Service – Non-Time of Day. (Continued)

Demand Charge (Continued).

For the purposes hereof, the Summer Months shall be the customer's first monthly billing period with an ending meter reading date on or after June 15 and the three succeeding monthly billing periods.

Energy Charge.

Charge per kilowatt-hour for kilowatt-hours supplied in the month:

For the first 30,000 kilowatt-hours	4.247¢
For the next 470,000 kilowatt-hours	3.167¢
For all over 500,000 kilowatt-hours	3.118¢

Late Payment Charge.

The late payment charge provided for in the Terms and Conditions of this Schedule of Rates shall be applicable to all charges under this rate.

Minimum Charge.

The minimum monthly charge shall be the Monthly Customer Charge.

Maximum Charge.

For customers with demand meters, the average cost of electricity hereunder in any month, exclusive of the Monthly Customer Charge, shall not exceed the Maximum Charge per kilowatt-hour, provided, however, that such guaranteed charge shall not operate to reduce the customer's bill to an amount less than the Minimum Charge.

The Maximum Charge per kilowatt-hour shall be: 20.502¢

MAXIMUM DEMAND.

For General Service – Time of Day customers, the Maximum Demand in any month shall be the highest 30-minute demand established during the Demand Peak Periods in such month.

For General Service – Non-Time of Day customers, the Maximum Demand shall be the highest 30-minute demand established at any time during such month.

APPLICATION OF DEMAND CHARGE.

The Company shall provide a demand meter and the demand charge shall apply when a customer's monthly kilowatt-hour use exceeds 2,000 kilowatt-hours in three of the twelve months preceding the billing month; or if either Maximum Demand or monthly kilowatt-hour use is estimated to exceed 10 kilowatts or 2,000 kilowatt-hours, respectively, for at least three months of the next 12-month period. Any customer to whom the demand charge would not ordinarily apply under the preceding sentence may, at his request and upon payment of appropriate meter rentals, be provided with a demand meter and be billed the demand charge rather than the charge in lieu thereof. In such case, meter rentals shall be payable for the period during which the customer elects to retain the meter, but not less than twelve months, unless he becomes entitled to a demand meter prior to the end of the 12-month period. A customer who is entitled to a demand meter shall not be required to pay rental or other separate charges for such meter.

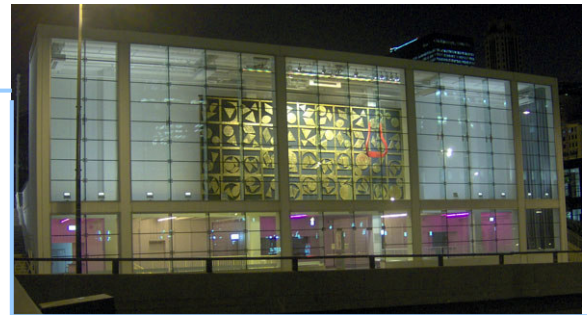
Where a demand meter is installed, the demand charge shall apply when the customer's monthly use exceeds 2,000 kilowatt-hours or his demand exceeds 10 kilowatts in three of the twelve months preceding the billing month. The demand charge shall continue to apply until the customer's monthly use has not exceeded 2,000 kilowatt-hours or his Maximum Demand has not exceeded 10 kilowatts in any month of the preceding 16-month period, at which time the charge in lieu of demand charge shall apply, except for a customer who has requested a demand meter and has elected to be billed the demand charge.

Prior to application of the demand charge, the customer being billed in lieu of demand charges will receive notification on the customer's bill each time the above 2,000 kilowatt-hours or 10 kilowatt requirement has been exceeded and the significance of it.

(Continued on Sheet No. 26)

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MEASUREMENT OF DEMAND AND KILOWATT-HOURS SUPPLIED.

Where two or more metering installations are provided on the customer's premises, the demand in any 30-minute period shall be determined by adding together the separate demands at each metering installation during such 30-minute period except that (a) in case the demand at any metering installation is registered by an indicating or cumulative demand meter, the demand at such installation in each 30-minute period of any month shall be assumed to be the same as the highest demand in any 30-minute period of such month, and (b) the demand at any installation may be assumed to be 75 percent of the connected load if such connected load is 2 kilowatts or less, and such demand is to be added to a metered demand. Where there are two or more watt-hour metering installations on the customer's premises, the kilowatt-hours supplied shall be determined by adding together the kilowatt-hours metered at each installation, provided that where the kilowatt-hours at any such installation exceed 5,500 in the billing month and are not metered in such a manner as to permit determination of the hours during which they were delivered, for purposes of applying the time of day provisions of this rate, such kilowatt-hours shall be considered to have been delivered in Energy Peak Periods. If the energy use at such installation is 5,500 kilowatt-hours or less in the billing month, the following charge per kilowatt-hour shall apply to such kilowatt-hours:

Charge per kilowatt-hour 3.68¢

The Maximum Demands and kilowatt-hours supplied for two or more premises will not be combined for billing purposes hereunder.

Upon request, the Company will provide unmetered service for connected loads not exceeding 2 kilowatts where operation of the customer's equipment is continuous or is regularly scheduled on an annual basis. For the purposes of billing in such cases, the monthly kilowatt-hours shall be determined by multiplying the rated wattage (based upon nameplate or other appropriate data) of the connected loads by one-twelfth of the annual hours of operation and dividing by 1,000. All kilowatt-hours delivered to an unmetered point of supply shall be considered to have been delivered during Energy Peak Periods.

In the case of unmetered service for qualifying cable antenna television service locations, kilowatt-hour usage for billing purposes will initially be based upon 50% of the nameplate rating of the CATV power transformers directly connected to the Company's system; the monthly kilowatt-hours may also be determined by test at the Company's option or upon request of the customer. Tests must be conducted by or on behalf of the Company within 60 days of the customer's request. Kilowatt-hour use determined by test will be used prospectively only, will apply beginning with the billing period following the test and will continue until changed by further test or other appropriate data. The customer shall pay the Company's charge for any test done at its request, unless the test discloses fewer monthly kilowatt-hours than are being used for billing. In any event, the Company shall be entitled to test kilowatt-hour usage at the customer's expense once each year at each service location. The Company's charge for a test shall not exceed \$85.00.

For unmetered service for connected loads not exceeding two kilowatts and for qualifying cable antenna television service locations, notwithstanding other provisions of this rate, the charge in lieu of demand charge shall not apply, and instead a charge equal to the weighted average of the summer and non-summer demand charges per kilowatt divided by one-twelfth of the annual hours of operation of the load shall be applied to the unmetered monthly kilowatt-hours as above determined.

ADJUSTMENT OF DEMANDS.

In case the customer, as a result of seasonal or vacation variations in load, has an abrupt decrease of at least 50% in his Maximum Demand during the months of June through September, he will be entitled to the proration of demand charges in the billing period in which such decrease occurs, and if, in the same calendar year, he has a subsequent abrupt increase of at least 100% in Maximum Demand during such months, he will be entitled to the proration of demand charges in the billing period in which such increase occurs, provided that (1) a period of reduced demand continues for at least seven consecutive days immediately following the demand reduction for which proration is sought, and for at least seven consecutive days immediately preceding the demand increase for which proration is sought, (2) demands registered by an indicating or cumulative demand meter shall not be subject to such proration, (3) such proration will be granted only upon written request by the customer stipulating the date of such decrease or increase and received by the Company in advance of such date, and (4) that proration will be granted for only one such decrease and subsequent increase in each calendar year.

SERVICE FACILITIES – TIME OF DAY.

A standard installation furnished by the Company hereunder shall be determined by the provisions of the Company's Rider 6 except that the facilities so provided as standard shall be adequate only to supply service to a load equal to the maximum 30-minute demand of the customer established during the Demand Peak Period. If larger facilities are required to serve the excess of demand established during the Demand Off-Peak Period over the demand established during the Demand Peak Period, the customer shall pay, as optional facilities in accordance with the Company's Rider 6, the cost of any facilities so required. No optional facilities charges shall apply, however, to facilities existing and in place at the time the customer qualifies for service hereunder.

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OPTIONAL GENERAL SERVICE – TIME OF DAY.

Customers with Maximum Demands of less than 500 kilowatts may elect to be billed in accordance with the provisions of General Service – Time of Day. Any customer may elect Time of Day service by written application to the Company. Election of this option will be for a minimum of 12 months. Customers electing service under this option must pay the General Service – Non-Time of Day Monthly Customer Charge and an additional monthly charge for the special metering required in excess of that metering considered standard for General Service – Non-Time of Day, in accordance with the Company's Rider 7 – Meter Lease, as revised from time to time. The energy and demand charges of General Service – Time of Day apply to this option.

OPTIONAL FIXED SUMMER PERIOD FOR GRAIN DRYING.

Customers, who have grain drying facilities used in an agricultural operation, served hereunder may, upon written request, elect to have the rates for such service which are normally applicable to the Summer Months, as defined herein, applied instead to a fixed summer period beginning May 16 and ending September 15, inclusive. Such request must be received by the Company prior to February 15 of the first year for which the fixed summer period is to be applicable. The Company will install metering equipment capable of recording the energy and demand usage during such fixed summer period. Demand charges will be prorated in billing months during which summer demand charges apply during only a portion of the month.

Customers electing service under this option must pay an additional monthly charge for the special metering required, in accordance with the Company's Rider 7 – Meter Lease, as revised from time to time. Such additional charge will begin with the first bill based on a regular ending meter reading date on or after May 16 and shall continue for a minimum of twelve regular billing periods. Once a customer has elected this option, such charges shall apply during successive 12-month periods unless the customer requests in writing by February 15 of any year that he no longer desires this option.

TERM OF CONTRACT.

For customers first receiving service hereunder, the initial term of contract shall be 24 months. Upon expiration of the initial or any renewal term of contract hereunder, the customer's contract shall be automatically renewed for a period of 12 months.

A new contract, with an initial term of 24 months, shall be required whenever the Company is called upon to provide additional or different facilities to serve a demand greater than that specified in the customer's then effective contract, and the term of such new contract shall commence at the beginning of the month next following the date when the facilities installed to serve the increased demand become available for service.

The customer shall have the right to terminate his contract and discontinue service from the Company at any time on 30 days' written notice to the Company; provided, however, that in the event of such termination all amounts due the Company shall forthwith be paid.

GENERAL.

Nothing in this rate shall be deemed to preclude a residential occupancy on the customer's property from being served as a separate customer on a residential rate.

Energy Peak Periods, for purposes hereof, shall be the hours of 9:00 a.m. to 10:00 p.m. on Monday through Friday, except on days on which the following holidays are generally observed: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas Day and, if one of the foregoing holidays occurs on a Tuesday or Thursday, the immediately preceding Monday or immediately following Friday, respectively. Energy Off-Peak Periods shall be all other hours.

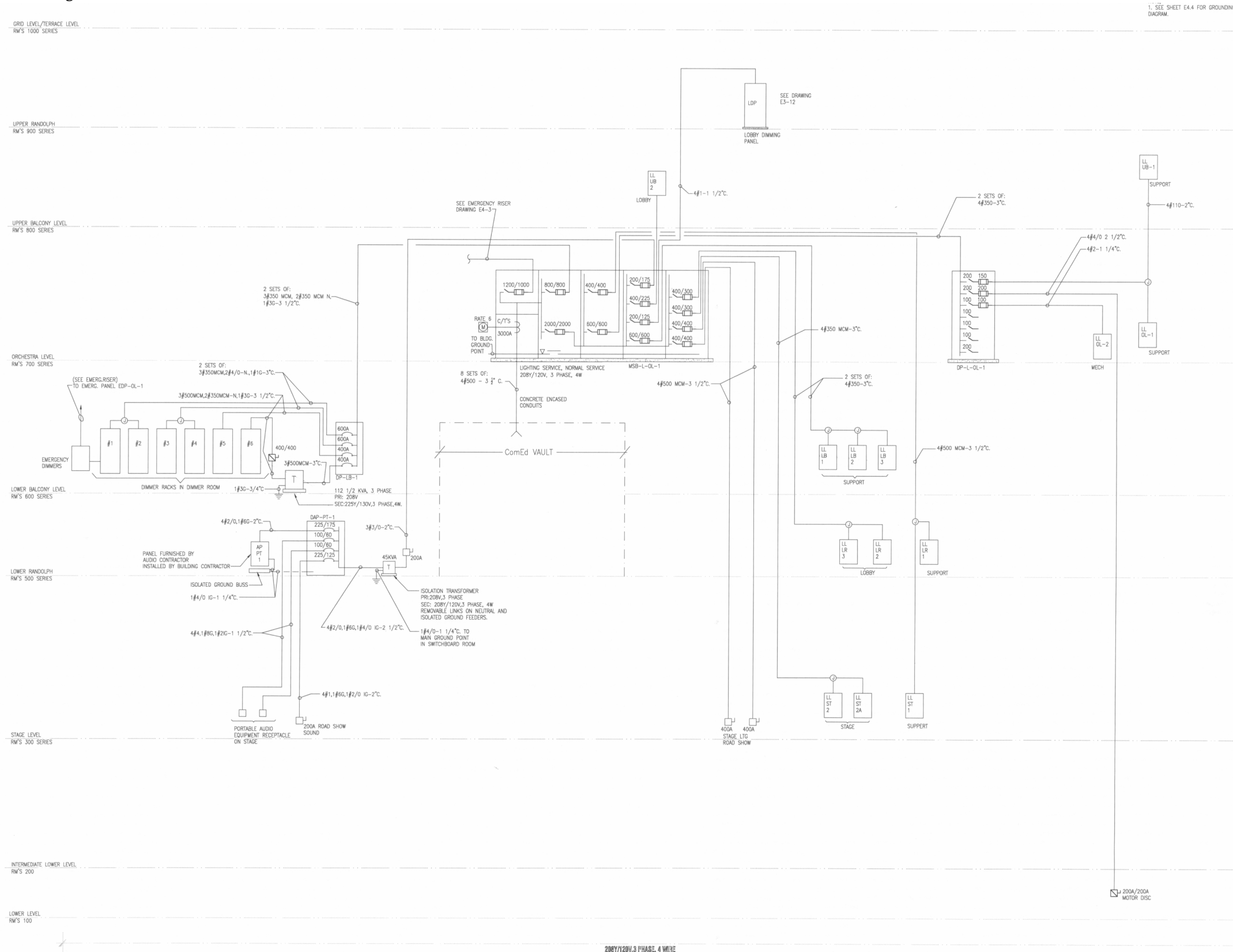
Demand Peak Periods, for purposes hereof, shall be the hours of 9:00 a.m. to 6:00 p.m. on Monday through Friday, except on the holidays designated above. Demand Off-Peak Periods shall be all other hours.

The Schedule of which this rate is a part includes certain general Terms and Conditions and Riders. Service hereunder is subject to these Terms and Conditions and the Riders applicable to this rate.

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