Chandler City Hall

Chandler, Arizona

Technical Report 2: Electrical Systems Existing Conditions and Building Load Summary Report
AE481W: Architectural Engineering Senior Thesis

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Executive Summary

The following is an overview and analysis of the electrical systems design for Chandler City Hall, located in Chandler, Arizona. The 118,000 square foot complex is a multi-use facility comprised of an office tower, the Vision Gallery, and the Council Chambers. The building is to accommodate a variety of events therefore the electrical system has provide necessary component for flexibility and control of the building systems.

An aim in the design of the project was to respect the historical past of Chandler and Arizona while leaping into the future. The lighting, electrical, communications, and security systems add to the effect acknowledging the future.

The build is designed for LEED Gold however; still currently under construction, it is striving to become a LEED Platinum facility. With this in mind, the electrical systems within the building exhibit energy efficiency, while also leaving room for a future photovoltaic design to become an additional power source for the building.

The following overview provides information about the electrical, communication, and security systems in more detail.

Table of Contents

I. Power Distribution Systems

Summary Description of Distribution System –

The electrical distribution system for Chandler City hall receives its power supply from Arizona Public Service, located in Phoenix, Arizona. Arizona Public Service owns all equipment and feeders through the service entrance up until the main switchboard. At this point the building voltage system is 480Y/277V, 3PH, 4W. Chandler City Hall's responsibility begins at the 3000A three-pole main switchboard which has an AIC rating of 65K which then serves other branch circuits of the electrical system.

The building utilizes an uninterrupted power supply, (UPS,) and an emergency diesel generator to supply electricity in the case of a power outage or other failure. Automatic transfer switches are utilized to detect a lack of electricity. From the generator, power first flows through the emergency distribution panel to distribution panels DP-LS1 and DP-OS1 and then on the life safety loads of the building.

Utility Company Information –

Arizona Public Services, located in Phoenix, Arizona is the utility company that supplies Chandler City Hall.

Arizona Public Service
400 N. 5th St.
Phoenix, AZ 85004
http://www.aps.com

For commercial buildings APS electric plan has three components

1. A monthly service charge – a basic service fee that is the same each month
2. A demand charge – based on your peak kilowatt demand for the month
3. An energy charge – based on your kilowatt-hour usage for the month

The rate schedule is as follows:

E-32 Medium	
Basic Service Charge	
Self-Contained Meters	$ 0.672 per day
Instrument-Rated Meters	$1.324 per day
Primary Voltage	$ 3.415 per day
Transmission Voltage	$26.163 per day

Energy Charge	
May – October Billing Cycles (Summer)	**November - April Billing Cycles (Winter)**
$0.10320 per kWh for the first 200 kWh, plus	$0.08619 per kWh for the first 200 kWh, plus
$0.06034 per kWh for all additional kWh	$0.04334 per kWh for all additional kWh

Demand Charge	
Secondary Service:	
$9.597 per kW for the first 100 kW, plus	$5.105 per kW for all addtional kW
Primary Service:	
$8.905 per kW for the first 100 kW, plus	$4.412 per kW for all addtional kW
Transmission Service:	
$6.942 per kW for the first 100 kW, plus	$2.450 per kW for all addtional kW

- *Note:* Chandler City Hall is currently under construction therefore Electric Utility Load Data for the previous 12 months is not available.

Service Entrance –

APS primary conductors run along Washington St. and enter the east side of the site into the utility yard. The primary voltage is not listed in the construction drawings or specifications. The primary conductors however run to the APS owned pad mounted transformer and are stepped down to a 480Y/277V, 3PH, 4W system. Still owned by APS, these secondary conductors run from the transformer into the building to the main switchboard and are metered by APS equipment.

The service entrance feeder is routed into the building into room "SES" to the main switchboard SES#1.

The following electrical components are owned by Arizona Public Service:
Primary conductors
APS Pad-mounted transformer
Secondary Conductors
APS Switching Cabinets
APS Capacitor Bank

Chandler City Hall's responsibility of electrical equipment begins at the main switchboards.

Voltage Systems–

Primary Service: N/A; owned and supplied by Arizona Public Services
Secondary Feeder: 480Y/277V, 3 PH, 4W
Main switchboard "SES#1": 480Y/277V, 3 PH, 4W
Electrical and Lighting Load Panels:
HVAC Loads: 480Y/277V, 3 PH, 4W
Lighting Loads: 480Y/277V, 3 PH, 4W
Receptacle Loads: 208Y/120V, 3PH, 4W
Council Chamber/Vision Center Dimming Panels: 208Y/120V, 3PH, 4W

Emergency Power System(s) –

In terms of emergency power systems, a 750kW, 937.5 kVA, 480Y/277V, 3PH, 4W emergency diesel generator is located in the utility yard. This is activated by an automatic transfer switch to supply the

life safety loads for the building via a distribution panel. Emergency lighting, security, fire alarm, specified receptacles, and elevator motors are serviced by the emergency panels.

Locations of Switchgear –

The main switchgear "SES#1" is located on the first floor in Area B, room B135 of electrical plan NE2.1.2. Two 1200A 480V, 3PH, 4W bus ducts are fed from this equipment; one running vertically up through the west side of the building feeding electrical rooms A212, A312, A411, and A516 and the other vertically up through the east side of the building feeding electrical rooms A220, A319, A419, and A525. The automatic transfer switches ATS-LS1 and ATS-OS1 are also located on the first floor in Area B electrical room, room B132 of electrical plan NE2.1.2.

Both Level 1 Area A and Area B of Chandler City Hall have electrical rooms where the majority of the lighting and receptacle load panels exist. Additionally on the west side, Area B of Level 1 electrical lighting room where the majority of the lighting panels reside. There are electrical rooms on each the east and west side of the upper floors as well as mechanical rooms.

Major Equipment Schedule

Tag	Type	Floor	Room #	Room Name	1/8" Scale Drawing	Enlarged Drawing
SES#1	Main Switchboard	1	B135	SES	NE2.1.2	N/A
DP-EM	Emergency Distribution Panel	1	B132	ELEC	NE2.1.2	N/A
DP-LS1	Distribution Panel	1	B132	ELEC	NE2.1.2	N/A
DP-OS1	Distribution Panel	1	B132	ELEC	NE2.1.2	N/A
T-L1WA	Transformer	1	A121	ELEC	NE2.1.1	N/A
T-L1WC	Transformer	1	A121	ELEC	NE2.1.1	N/A
T-L1EA	Transformer	1	B132	ELEC	NE2.1.2	N/A
T-L1EAV	Transformer	1	B132	ELEC	NE2.1.2	N/A
T-H1E	Transformer	1	B129	ELEC/LTG	NE2.1.2	N/A
T-L2WA	Transformer	2	A212	ELEC	NE2.2.1	N/A
T-L2EA	Transformer	2	A220	ELEC	NE2.2.1	N/A
T-L3WA	Transformer	3	A312	ELEC	NE2.3.1	N/A
T-L3EA	Transformer	3	A319	ELEC	NE2.3.1	N/A
T-L4WA	Transformer	4	A411	ELEC	NE2.4.1	N/A
T-L4EA	Transformer	4	A419	ELEC	NE2.4.1	N/A
T-L5WA	Transformer	5	A516	ELEC	NE2.5.1	N/A
T-L5EA	Transformer	5	A525	ELEC	NE2.5.1	N/A
T-LOSE1	Transformer	1	B132	ELEC	NE2.1.2	N/A
T-IDF	Transformer	1	B132	ELEC	NE2.1.2	N/A
T-LW5E	Transformer	5	A525	ELEC	NE2.5.1	N/A
Generator	Generator	1	UTILITY YARD		NE2.1.2	N/A
UPS	UPS	1	B124	DATA	NE2.1.2	N/A
ATS-LS1	Automatic Transfer Switch	1	B132	ELEC	NE2.1.2	N/A
ATS-OS1	Automatic Transfer Switch	1	B132	ELEC	NE2.1.2	N/A

PANELBOARD SCHEDULE						
Tag	Voltage System	Main Size	Floor	Room #	Room Name	1/8" Scale Drawing
H1W	480Y/277V, 3PH, 4W	400A	1	A121	ELEC	NE2.1.1
H1WA	480Y/277V, 3PH, 4W	100A	1	A121	ELEC	NE2.1.1
L1WA	208Y/120V, 3PH, 4W	225A	1	A121	ELEC	NE2.1.1
L1WC	208Y/120V, 3PH, 4W	225A	1	A104	MULTI.	NE2.1.1
VG-DP	208Y/120V, 3PH, 4W	125A	1	A102	STORAGE	NE2.1.1
CC-DP	208Y/120V, 3PH, 4W	175A	1	B129	ELEC/LTG	NE2.1.2
H1E	480Y/277V, 3PH, 4W	225A	1	B129	ELEC/LTG	NE2.1.2
H1ME	480Y/277V, 3PH, 4W	400A	1	B132	ELEC	NE2.1.2
L1EA	208Y/120V, 3PH, 4W	350A	1	B132	ELEC	NE2.1.2
L1EB	208Y/120V, 3PH, 4W	225A	1	B132	ELEC	NE2.1.2
L1EC	208Y/120V, 3PH, 4W	225A	1	B132	ELEC	NE2.1.2
L1EAV	208Y/120V, 3PH, 4W	225A	1	B132	ELEC	NE2.1.2
H1S	480Y/277V, 3PH, 4W	100A	1	B132	ELEC	NE2.1.2
LOSE1	208Y/120V, 3PH, 4W	50A	1	B132	ELEC	NE2.1.2
HOSE1	480Y/277V, 3PH, 4W	225A	1	B132	ELEC	NE2.1.2
1IDF	208Y/120V, 3PH, 4W	200A	1	B132	ELEC	NE2.1.2
HLSE1	208Y/120V, 3PH, 4W	100A	1	B132	ELEC	NE2.1.2
LMK	208Y/120V, 3PH, 4W	100A	MEZZ.	M107	STORAGE	NE2.1.3
HMW	480Y/277V, 3PH, 4W	225A	MEZZ.	M111	STORAGE	NE2.1.3
HLSW1	480Y/277V, 3PH, 4W	225A	MEZZ.	M111	STORAGE	NE2.1.3
MIDF	208Y/120V, 3PH, 4W	200A	MEZZ.	M111	STORAGE	NE2.1.3
H2E	480Y/277V, 3PH, 4W	400A	2	A220	ELEC	NE2.2.1
H2W	480Y/277V, 3PH, 4W	100A	2	A212	ELEC	NE2.2.1
L2EA	208Y/120V, 3PH, 4W	225A	2	A220	ELEC	NE2.2.1
L2WA	208Y/120V, 3PH, 4W	225A	2	A212	ELEC	NE2.2.1
H3E	480Y/277V, 3PH, 4W	400A	3	A319	ELEC	NE2.3.1
H3W	480Y/277V, 3PH, 4W	100A	3	A312	ELEC	NE2.3.1
L3EA	208Y/120V, 3PH, 4W	225A	3	A319	ELEC	NE2.3.1
L3WA	208Y/120V, 3PH, 4W	225A	3	A312	ELEC	NE2.3.1
H4E	480Y/277V, 3PH, 4W	400A	4	A419	ELEC	NE2.4.1
H4W	480Y/277V, 3PH, 4W	100A	4	A411	ELEC	NE2.4.1
L4EA	208Y/120V, 3PH, 4W	225A	4	A419	ELEC	NE2.4.1
L4WA	208Y/120V, 3PH, 4W	225A	4	A411	ELEC	NE2.4.1
4IDF	208Y/120V, 3PH, 4W	200A	4	A411	ELEC	NE2.4.1
HLSW4	480Y/277V, 3PH, 4W	225A	4	A411	ELEC	NE2.4.1
H5E	480Y/277V, 3PH, 4W	400A	5	A525	ELEC	NE2.5.1
H5W	480Y/277V, 3PH, 4W	100A	5	A516	ELEC	NE2.5.1
L5EA	208Y/120V, 3PH, 4W	225A	5	A525	ELEC	NE2.5.1

PANELBOARD SCHEDULE CONTINUED						
Tag	Voltage System	Main Size	Floor	Room #	Room Name	1/8" Scale Drawing
L5WA	208Y/120V, 3PH, 4W	225A	5	A516	ELEC	NE2.5.1
H5WA	480Y/277V, 3PH, 4W	400A	5	A516	ELEC	NE2.5.1
L5WC	208Y/120V, 3PH, 4W	100A	5	A516	ELEC	NE2.5.1
HLSE5	480Y/277V, 3PH, 4W	225A	5	A525	ELEC	NE2.5.1
LLSE5	208Y/120V, 3PH, 4W	50A	5	A525	ELEC	NE2.5.1

Over-current Devices –

From the service entrance, the main switchboard SES#1 is protected via the 3000A 3P main circuit breaker (MCB) with an AIC rating of 65K. The branch over-current devices within the switchboard range from 50A to 1200A and are all three-pole devices before serving the respective panelboards or transformers. The emergency generator has a 1400A three-pole circuit breaker. The distribution panels DP-EM, DP-LS1, and DP-OS1 are rated with a 1600A, 400A and 600A three-pole circuit breaker respectively with each of the distribution panels having an AIC rating of 42K.

Two 1200A bus ducts feed the branch circuit of the upper floors of the building. Each of these branch circuits are protected via fuses. Class RK1, current-limiting, time-delay fuses are generally utilized with Class RK5 current-limiting, time-delay fuses used where the amperage ratio between the panelboard main fuse to the largest feeder fuse is at least 2:1 and for motor starter size 3 or smaller. The fuse protection ratings within the branch circuit range from 100A to 400A, all three-pole devices..

Transformers –

Chandler City Hall's electrical distribution system utilizes 16 dry-type transformers. Each is located within an electrical room on the respective floor of the panels which it services and steps down the voltage from 480Y/277V, 3PH, 3W to 208Y/120V, 3PH, 4W.

Transformer Schedule							
TAG	Primary Voltage	Secondary Voltage	Size	Type	Temp. Rise	Taps	Mounting
T-L1WA	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	75	DRY	115°C	(4) 2.5%	Pad-Mounted
T-L1WC	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	75	DRY	115°C	(4) 2.5%	Pad-Mounted
T-L1EA	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	112.5	DRY	115°C	(4) 2.5%	Suspended
T-L1EAV	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	75	DRY	115°C	(4) 2.5%	Pad-Mounted
T-H1E	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	30	DRY	115°C	(4) 2.5%	Pad-Mounted
T-L2WA	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	75	DRY	115°C	(4) 2.5%	Pad-Mounted
T-L2EA	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	75	DRY	115°C	(4) 2.5%	Pad-Mounted
T-L3WA	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	75	DRY	115°C	(4) 2.5%	Pad-Mounted
T-L3EA	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	75	DRY	115°C	(4) 2.5%	Pad-Mounted
T-L4WA	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	75	DRY	115°C	(4) 2.5%	Pad-Mounted
T-L4EA	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	75	DRY	115°C	(4) 2.5%	Pad-Mounted

Transformer Schedule Continued							
TAG	Primary Voltage	Secondary Voltage	Size	Type	Temp. Rise	Taps	Mounting
T-L5WA	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	75	DRY	115°C	(4) 2.5%	Pad-Mounted
T-L5EA	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	75	DRY	115°C	(4) 2.5%	Pad-Mounted
T-LOSE1	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	15	DRY	115°C	(2) 2.5%	Pad-Mounted
T-IDF	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	75	DRY	115°C	(4) 2.5%	Pad-Mounted
T-LW5E	480Y/277V, 3PH, 3W	208Y/120V, 3PH, 4W	30	DRY	115°C	(4) 2.5%	Pad-Mounted

Grounding –

As shown to its extent, the grounding system in the electrical one-line diagrams E7.1-E7.3. The main neutral is bonded to the main ground bar at the service entrance to the grounding electrodes. The main ground bar is also shown connected to the building steel and cold water piping within the building.

Special Equipment –

An 80kVA uninterrupted power supply is utilized by Chandler City Hall. It is energized by automatic transfer switch ATS-OS1 and feeds distribution panel DP-OS1. The UPS is located in Data Room B134 right next to Electrical Room B132 where ATS-OS1 and DP-OS1 are located. Harmonic filtering is specified at a maximum value of 10% THD at 100% non-linear loading and the batteries are to provide 100% power for 15 minutes in this system. Other components that would fall into the category of special equipment within Chandler City Hall include the diesel generator that was previously discussed in "Emergency Power Systems."

Lighting Loads –

Keeping energy efficiency in mind, Chandler City Hall has created a lighting design solution reinforcing its architectural concepts from the outside in. A range of sources including fluorescent, metal halide, halogen, and led sources are used in the lighting design of Chandler City Hall. Typical lighting loads are serviced by a 480Y/277V system. However the lighting in the Council Chamber and Vision Gallery utilize power from the 208Y/120V system. With complex lighting and control systems both of these spaces the lower voltage is used as they are fed from dimming panels. There are programmable controls for these spaces in order to have appropriate lighting scheme for a particular event that may occur. The following luminaire schedule depicts the specified luminaires in more detail below.

Luminaire Schedule										
Tag	Light Source	Lamp Type	Individual Lamp Wattage	No. of Lamps	Ballast Type	Operating or Input Voltage	Fixture Input Watts	Ballast Factor	Current @ Start/ Operating	Power Factor@ Start/ Operating
AC	QUAR	35 W MR16	35 W	1	INTEGRAL XFMR	277 V	35 W	-	0.13	1.00
ACB	QUAR	35 W MR16	35 W	1	INTEGRAL XFMR	120 V	35 W	-	0.29	1.00

Luminaire Schedule										
Tag	Light Source	Lamp Type	Individual Lamp Watt	No. of Lamps	Ballast Type	Operating or Input Voltage	Fixture Input Watts	Ballast Factor	Current @ Start/ Operating	Power Factor@ Start/ Operating
BL	FLUOR	24 W T5HO	24 W	1	ELECTRONIC	277 V	27 W	1.02	0.10	0.98
CH	FLUOR	28 W T5	28 W	2	ELECTRONIC	277 V	58 W	0.95	0.22	0.98
CR	FLUOR	54 W T5HO	54 W	4	ELECTRONIC	277 V	234 W	1.00	0.86	0.98
CY	FLUOR	32 W TRT	32 W	1	ELECTRONIC	277 V	38 W	1.05	0.14	0.98
F1	FLUOR	32 W TRT	32 W	1	ELECTRONIC	120 V	36 W	0.98	0.31	0.98
F2	FLUOR	32 W TRT	32 W	1	ELECTRONIC	277 V	38 W	1.05	0.14	0.98
F2 EM	FLUOR	32 W TRT	32 W	1	ELECTRONIC	277 V	38 W	1.05	0.14	0.98
F3	FLUOR	32 W TRT	32 W	1	ELECTRONIC	277 V	38 W	1.05	0.14	0.98
F4	FLUOR	26 W TRT	26 W	1	ELECTRONIC	277 V	31 W	1.05	0.11	0.98
F5	FLUOR	26 W TRT	26 W	1	ELECTRONIC	277 V	31 W	1.05	0.11	0.98
F6	FLUOR	42 W TRT	42 W	1	ELECTRONIC	120 V	46 W	0.98	0.38	0.98
F7	FLUOR	54 W T5HO	54 W	1	ELECTRONIC DIMMING	120 V	13 W/63 W	0.03/1.00	0.53	0.98
F9	FLUOR	24 W T5HO	24 W	1	ELECTRONIC DIMMING	277 V	27 W	1.02	0.10	0.98
F10	FLUOR	17 W T8	17 W	1	ELECTRONIC DIMMING	120 V	7 W/24 W	0.05/1.05	0.20	0.99
F11	FLUOR	32 W TRT	32 W	1	ELECTRONIC	277 V	38 W	1.05	0.14	0.98
F11 EM	FLUOR	32 W TRT	32 W	1	ELECTRONIC	277 V	38 W	1.05	0.14	0.98
F12	FLUOR	32 W T8	32 W	1	ELECTRONIC	277 V	34 W	0.90	0.13	0.98
F13	FLUOR	54 W T5HO	54 W	1	ELECTRONIC	277 V	62 W	0.99	0.24	0.9
F14	FLUOR	55 W TBX	55 W	2	ELECTRONIC DIMMING	120 V	24 W/114 W	0.05/0.90	0.96	0.98
F15	FLUOR	54 W T5HO	54 W	1	ELECTRONIC DIMMING	120 V	13 W/63 W	0.03/1.00	0.53	0.98
		39 W T5HO	39 W				43 W	1.02	0.36	0.98
		24 W T5HO	24 W				27 W	1.02	0.23	0.98
FD	FLUOR	32 W TRT	32 W	1	ELECTRONIC	277 V	38 W	1.05	0.14	0.98
H1	MH	35 W T6	35 W	1	PULSE START	277 V	45 W	1.00	0.17	0.95
H2	MH	39 W T6	39 W	2	PULSE START	277 V	45 W	1.00	0.17	0.95
H4	MH	39 W T6	39 W	1	PULSE START	277 V	45 W	1.00	0.17	0.95
H4A	MH	39 W T6	39 W	1	PULSE START	277 V	45 W	1.00	0.17	0.95
H4AE	MH	39 W T6	39 W	1	PULSE START	277 V	45 W	1.00	0.17	0.95
H4E	MH	39 W T6	39 W	1	PULSE START	277 V	45 W	1.00	0.17	0.95
H5	MH	70 W T6	70 W	1	PULSE START	277 V	79 W	1.00	0.29	0.9

Luminaire Schedule Continued

Tag	Light Source	Lamp Type	Individual Lamp Wattage	Number of Lamps	Ballast Type	Operating or Input Voltage	Fixture Input Watts	Ballast Factor	Current @ Start/ Operating	Power Factor@ Start/ Operating
PGP	LED	INTEGRAL LED	104 W		N/A	277 V	104 W	-	0.38	1.00
PGP2	LED	INTEGRAL LED	104 W		N/A	277 V	104 W	-	0.38	1.00
RF	FLUOR	54 W T5HO	54 W	1	ELECTRONIC	277 V	62 W	0.99	0.24	0.90
RF2	FLUOR	54 W T5HO	54 W	1	ELECTRONIC	277 V	62 W	0.99	0.24	0.90
RF3	FLUOR	26 W TRT	26 W	1	ELECTRONIC	277 V	31 W	1.05	0.11	0.98
SA	FLUOR	54 W T5HO	54 W	2	ELECTRONIC	277 V	117 W	0.99	0.43	0.98
SB	FLUOR	54 W T5HO	54 W	1	ELECTRONIC	277 V	62 W	0.99	0.24	0.90
SG	FLUOR	32 W T8	32 W	2	ELECTRONIC	277 V	63 W	0.88	0.23	0.99
SG EM	FLUOR	32 W T8	32 W	2	ELECTRONIC	277 V	63 W	0.88	0.23	0.99
SH	FLUOR	32 W T8	32 W	1	ELECTRONIC	277 V	34 W	0.90	0.13	0.98
T	FLUOR	24 W T5HO	24 W	2	ELECTRONIC	277 V	52 W	1.00	0.19	0.98
T1	QUAR	90 W PAR38HIR NFL	90 W	10	N/A	120 V	900 W	-	7.50	1.00
T2	QUAR	200 W PAR38HIR WFL	200 W	1	N/A	120 V	200 W	-	1.67	1.00
T3	QUAR	100 W PAR38HIR SP10	100 W	1	N/A	120 V	100 W	-	0.83	1.00
T4	QUAR	100 W PAR38HIR SP10	100 W	1	N/A	120 V	100 W	-	0.83	1.00
T5	QUAR	100 W PAR38HIR NFL25	100 W	1	N/A	120 V	100 W	-	0.83	1.00
T6	QUAR	100 W PAR38HIR NFL25	100 W	1	N/A	120 V	100 W	-	0.83	1.00
T7	QUAR	100 W PAR38HIR NFL25	100 W	1	N/A	120 V	100 W	-	0.83	1.00
T7A	QUAR	100 W PAR38HIR NL40	100 W	1	N/A	120 V	100 W	-	0.83	1.00
TK	QUAR	35 W MR16	35 W	1	N/A	277 V	35 W	-	0.13	1.00
TR	QUAR	37 W MR16HIR CG25	37 W	3	N/A	277 V	120 W	-	0.43	1.00
TZ	FLUOR	28 W T5	28 W	2	ELECTRONIC	277 V	58 W	0.95	0.22	0.98
UC	FLUOR	32 W T8	32 W	1	ELECTRONIC	120 V	34 W	0.90	0.29	0.98
VT	FLUOR	32 W T8	32 W	2	ELECTRONIC	277 V	63 W	0.88	0.23	0.99
VT8	FLUOR	32 W T8	32 W	4	ELECTRONIC	277 V	121 W	0.88	0.45	0.99
Z1	QUAR	60 W T4	60 W	1	N/A	120 V	60 W	-	0.50	1.00

Lighting Control –

Lighting within Chandler City Hall makes use of several different control systems. In the open office spaces in the tower, a daylight harvesting system is used to control and dim the linear fluorescent lighting system. In order to meet ASHRAE/IESNA90.1 standards, two dimming control panels are used in Chandler City Hall. These serve the purpose of controlling the lighting for the Council Chamber and the Vision Gallery. These spaces have numerous luminaires with several settings that are dependent upon the event that will be occurring. There will never be an incident where all the luminaires will be on within these spaces.

Mechanical and Other Loads –

Utilizing a combination of variable air volume and constant volume systems air is circulated throughout Chandler City Hall. A total of thirteen air handling units are used between the north and south buildings of Chandler City Hall. Supplied by a chiller and cooling tower on the south building and parking garage a hydronic system supplies cool air to the building which is distributed by a variable air volume system as the main distribution with a constant air volume as the secondary distribution system for use in only a few spaces within Chandler City Hall. As only one service entrance is being evaluated, only the mechanical equipment on that service entrance is evaluated below.

*Note: Tables will be adjusted in Final report to show the headings on each page split

Mechanical Equipment Schedule

Tag	Description	Load Mag./Units		NEC Motor Amps	Voltage	Ph	Assumed Power Factor	Equivalent Load (kVA)/ (kW)	
AHU-1-1	AIR HANDLING UNIT	7.5	HP	11	480	3	0.95	9.13	8.7
AHU-A-2-1	AIR HANDLING UNIT	15	HP	21	480	3	0.95	17.44	16.6
AHU-A-2-2	AIR HANDLING UNIT	15	HP	21	480	3	0.95	17.44	16.6
AHU-A-3-1	AIR HANDLING UNIT	15	HP	21	480	3	0.95	17.44	16.6
AHU-A-3-2	AIR HANDLING UNIT	15	HP	21	480	3	0.95	17.44	16.6
AHU-A-4-1	AIR HANDLING UNIT	15	HP	21	480	3	0.95	17.44	16.6
AHU-A-4-2	AIR HANDLING UNIT	15	HP	21	480	3	0.95	17.44	16.6
AHU-A-5-1	AIR HANDLING UNIT	15	HP	21	480	3	0.95	17.44	16.6
AHU-A-5-2	AIR HANDLING UNIT	15	HP	21	480	3	0.95	17.44	16.6
AHU-A-M-1	AIR HANDLING UNIT	10	HP	14	480	3	0.95	11.63	11.0
AHU-A-R-1	AIR HANDLING UNIT	20	HP	27	480	3	0.95	22.42	21.3
HEATING COIL	HEATING COIL	105	KW	126	480	3	0.95	104.6	99.4
AHU-A-R-2	AIR HANDLING UNIT	15	HP	21	480	3	0.95	17.44	16.6
HEATING COIL	HEATING COIL	70	KW	84	480	3	0.95	69.75	66.3
AHU-A-R-3	AIR HANDLING UNIT	20	HP	27	480	3	0.95	22.42	21.3
AHU-A-LR-1	AIR HANDLING UNIT	20	HP	27	480	3	0.95	22.42	21.3
AHU-B-LR-1	AIR HANDLING UNIT	20	HP	27	480	3	0.95	22.42	21.3
								TOTAL (kW)	975.4

Mechanical Equipment Schedule Continued									
Tag	Description	Load Mag./Units		NEC Motor Amps	Voltage	Ph	Assumed Power Factor	Equivalent Load (kVA)/ (kW)	
HEATING COIL	HEATING COIL	150	KW	181	480	3	0.95	150.3	142.8
AHU-B-LR-2	AIR HANDLING UNIT	15	HP	21	480	3	0.95	17.44	16.6
AHU-B-LR-3	AIR HANDLING UNIT	15	HP	21	480	3	0.95	17.44	16.6
HEATING COIL	HEATING COIL	55	KW	66	480	3	0.95	54.81	52.1
PK-A-R-1	PACKAGED A/C UNITS	7.5	KW	36.1	208	1	0.95	7.51	7.1
PK-A-R-2	PACKAGED A/C UNITS	5.4	KW	26	208	1	0.95	5.41	5.1
CRAC-A-1-1	COMPUTER ROOM A/C UNITS	7.5	HP	11	480	3	0.95	9.13	8.7
CRAC-A-1-2	COMPUTER ROOM A/C UNITS	7.5	HP	11	480	3	0.95	9.13	8.7
TU-A	TERMINAL UNITS	2	KW	7.2	277	1	0.85	1.99	1.7
TU-B	TERMINAL UNITS	3	KW	10.8	277	1	0.85	2.99	2.5
TU-C	TERMINAL UNITS	4	KW	14.4	277	1	0.85	3.99	3.4
TU-D	TERMINAL UNITS	4.75	KW	17	277	1	0.85	4.71	4.0
TU-E	TERMINAL UNITS	6.5	KW	7.8	480	3	0.95	6.48	6.2
TU-F	TERMINAL UNITS	10	KW	12	480	3	0.95	9.96	9.5
TU-G	TERMINAL UNITS	12	KW	14.4	480	3	0.95	11.96	11.4
TU-H	TERMINAL UNITS	3	KW	11.8	277	1	0.85	3.27	2.8
TU-J	TERMINAL UNITS	4.5	KW	6.7	480	3	0.85	5.56	4.7
FCU-A-1-1	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-1-2	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-M-1	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-M-2	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-2-1	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-2-2	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-2-3	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-2-4	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-3-1	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-3-2	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-3-3	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-3-4	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-4-1	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-4-2	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-4-3	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-5-1	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2

Mechanical Equipment Schedule Continued									
Tag	Description	Load Mag./Units		NEC Motor Amps	Voltage	Ph	Assumed Power Factor	Equivalent Load (kVA)/ (kW)	
FCU-A-5-2	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-5-3	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-5-4	FAN COIL UNIT	0.07	KW	1	208	1	0.75	0.21	0.2
FCU-A-1-5	FAN COIL UNIT	0.09	KW	1	208	1	0.75	0.21	0.2
FCU-B-1-2	FAN COIL UNIT	0.12	KW	1	208	1	0.75	0.21	0.2
FCU-B-1-3	FAN COIL UNIT	0.12	KW	1	208	1	0.75	0.21	0.2
FCU-B-1-4	FAN COIL UNIT	0.12	KW	1	208	1	0.75	0.21	0.2
FCU-A-1-3	FAN COIL UNIT	0.326	KW	2	208	1	0.75	0.42	0.3
FCU-A-1-4	FAN COIL UNIT	0.695	KW	2	208	1	0.85	0.42	0.4
FCU-B-1-1	FAN COIL UNIT	1.4	KW	4	208	1	0.85	0.83	0.7
FCU-B-1-5	FAN COIL UNIT	1.7	KW	5	208	1	0.85	1.04	0.9
CU-A-R-1	OUTDOOR UNIT	15.8	KW	22	480	3	0.95	18.27	17.4
		15.4	KW	21.4	480	3	0.95	17.77	16.9
CU-A-R-2	OUTDOOR UNIT	14.2	KW	19.7	480	3	0.95	16.36	15.5
		15.1	KW	21.1	480	3	0.95	17.52	16.6
CU-A-LR-1	OUTDOOR UNIT	14.2	KW	19.7	480	3	0.95	16.36	15.5
		15.1	KW	21.1	480	3	0.95	17.52	16.6
CU-B-R-1	OUTDOOR UNIT	20.8	KW	29	480	3	0.95	24.08	22.9
		21.2	KW	26.5	480	3	0.95	22.01	20.9
6PT CONTROL	CONTROLLER	0.086	KW	1	208	1	0.75	0.21	0.2
10PT CONTROL	CONTROLLER	0.138	KW	1	208	1	0.75	0.21	0.2
EUH-A-5-1	ELECTRIC UNIT HEATER	3	KW	11	277	1	0.85	3.05	2.6
EUH-A-5-2	ELECTRIC UNIT HEATER	3	KW	11	277	1	0.85	3.05	2.6
EUH-A-5-3	ELECTRIC UNIT HEATER	3	KW	11	277	1	0.85	3.05	2.6
EUH-A-5-4	ELECTRIC UNIT HEATER	3	KW	11	277	1	0.85	3.05	2.6
EUH-A-5-5	ELECTRIC UNIT HEATER	3	KW	11	277	1	0.85	3.05	2.6
EUH-A-5-6	ELECTRIC UNIT HEATER	3	KW	11	277	1	0.85	3.05	2.6
FCU-A-5-1	CHILLED WATER FAN COIL UNIT	2	KW	10.6	208	1	0.85	2.20	1.9

Mechanical Equipment Schedule Continued									
Tag	Description	Load Mag./Units		NEC Motor Amps	Voltage	Ph	Assumed Power Factor	Equivalent Load (kVA)/ (kW)	
EHC-A-M-1	ELECTRIC HEATING COIL	80	KW	96	480	3	0.95	79.72	75.7
EF-A-1-1	EXHAUST FAN	0.078	KW	1	120	1	0.75	0.12	0.1
EF-A-LR-1	EXHAUST FAN	0.125	KW	1	120	1	0.75	0.12	0.1
EF-A-R-1	EXHAUST FAN	7.5	HP	11	460	3	0.95	8.75	8.3
EF-A-5-1	EXHAUST FAN	0.175	KW	1.4	120	1	0.75	0.17	0.1
EF-A-5-2	EXHAUST FAN	0.155	KW	1	120	1	0.75	0.12	0.1
EF-A-5-3	EXHAUST FAN	0.155	KW	9.8	120	1	0.75	1.18	0.9
EF-B-LR-1	EXHAUST FAN	0.5	HP	1.1	460	3	0.85	0.88	0.7
								TOTAL (kW)	975.4

Plumbing Equipment Schedule									
Tag	Description	Load Mag/Units		NEC Motor Amps	Voltage	Phase	Assumed Power Factor	Equivalent Load (kVA)/(kW)	
EWH-A-1-1	WATER HEATER	24	KW	30.4	480	3	0.95	25.24	24.0
EWH-A-1-2	WATER HEATER	24	KW	30.4	480	3	0.95	25.24	24.0
EWH-A-M-1	WATER HEATER	24	KW	30.4	480	3	0.95	25.24	24.0
EWH-A-2-1	WATER HEATER	24	KW	30.4	480	3	0.95	25.24	24.0
EWH-A-3-1	WATER HEATER	24	KW	30.4	480	3	0.95	25.24	24.0
EWH-A-4-1	WATER HEATER	24	KW	30.4	480	3	0.95	25.24	24.0
EWH-A-5-1	WATER HEATER	24	KW	30.4	480	3	0.95	25.24	24.0
EWH-A-1-3	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-1-4	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-1-5	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-2-2	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-2-3	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-2-4	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-3-2	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-3-3	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-3-4	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-4-2	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-4-3	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-4-4	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0

Plumbing Equipment Schedule Continued									
Tag	Description	Load Mag/Units		NEC Motor Amps	Voltage	Phase	Assumed Power Factor	Equivalent Load (kVA)/(kW)	
EWH-A-5-2	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-5-3	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-5-4	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-M-3	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-A-M-2	WATER HEATER	6.5	KW	32.9	208	1	0.95	6.84	6.5
EWH-A-5-5	WATER HEATER	6.5	KW	32.9	208	1	0.95	6.84	6.5
EWH-B-1-1	WATER HEATER	24	KW	30.4	480	3	0.95	25.24	24.0
EWH-B-1-2	WATER HEATER	18	KW	22.8	480	3	0.95	18.93	18.0
EWH-B-1-3	WATER HEATER	6.5	KW	32.9	208	1	0.95	6.84	6.5
DWP	WATER PUMP	5	HP	7.6	480	3	0.85	6.31	5.4
								TOTAL (kW)	522.5

Architectural Equipment Schedule									
Tag	Description	Load Mag/Units		NEC Motor Amps	Voltage	Phases	Assumed Power Factor	Equivalent Load (kVA)/ (kW)	
Elevator 1	ELECTRIC TRACTION ELEVATOR	25	HP	34	480	3	0.95	28.23	26.8
Elevator 2	ELECTRIC TRACTION ELEVATOR	25	HP	34	480	3	0.95	28.23	26.8
Elevator 3	ELECTRIC TRACTION ELEVATOR	30	HP	38	480	3	0.95	31.56	30.0
								TOTAL (kW)	83.6

Service Entrance Size –

The following is an analysis summary to size the service entrance. Calculations were performed for the three phases of design: Conceptual/Schematic Design, Design Development, and Working Drawings. The first method uses building areas and a demand load in VA/Sq.Ft. which is associated with the building/occupancy type of which office building was used for the analysis of Chandler City Hall. The second method used is based on NEC building load values and demand factors applied across the appropriate areas of the building. The last method, associated with the final phases of design, is based off the actual loading as indicated on the panelboards from the construction documents. The service entrance size was then computed for each of the analyses; the calculations for each method are shown below:

Conceptual/Schematic Phase: Load per Sq. Ft.			
Building Type	Area (sq.ft.)	VA/sq.ft.	VA
Office	118458	12	1421496
		Total KVA:	1421.50
		Load- Amps:	1710.58
		Service Entracne Size:	2000A

Design Development: NEC Loading				
Load Type	Area (sq.ft.)	VA/sq.ft.	Demand Factor	KVA
Lighting	118458	3.5		415
Receptacles	118458	1	1.0	10
			0.5	54
Fans and Pumps	118458	2	0.8	190
HVAC Equipment: Electric Heating	118458	15	0.8	1421
Plumbing Equipment: Electric Water Heaters (14)	60kW/heater		1.0	798
Architectural Equipment: Elevators (3)	50kW/elev		0.8	114
			Total KVA:	3002
			Load- Amps:	3612.35
			Service Entracne Size:	4000A

Working Drawings: Actual Loading			
Load Type	Connected Load (kVA)	Demand Factor	Demand Load (kVA)
Lighting	110	1	110
Receptacles	539	1	10
		0.5	264.5
Fans and Pumps	50	0.8	40
HVAC Equipment:	1190	1	1190
Plumbing Equipment:	545	1	545
Architectural Equipment:	88	0.8	70.4
		Total Demand KVA:	2229.9
		Load-Amps:	2683.39
		Service Entrance Size:	3000A

Summary Tables Table 1			
Phase	Load - kVA	Voltage System	Load - Amps
Conceptual/Schematic Design	1421	480/277V	1710.6
Design Development	3002	480/277V	3612.3
Working Drawings	2230	480/277V	2683.4
Actual Conditions	2353	480/277V	2835
Table 2			
Service Entrance	Size - Amps	Voltage System	Capacity - kVA
Actual Conditions	3000A	480/277V	2493
Summary VA/sq.ft.			21.04 VA/sq.ft.

The resulting service entrance size for the conceptual/schematic phase is likely undersized due to the actual mixed use occupancy of the building. It is meant to accommodate a variety of different events as well as the loads from a typical office space. As for the design development phase, the service entrance size is oversized. This however is likely due to the demand of the electric heating component. This is the peak demand over the cooling load, however the building is located in Chandler, Arizona, a rather warm climate where the heating actual heating loads are less than the estimated values computed in the design development phase. The working drawings phase proves to be the most accurate in computing the service entrance size as to what has been computed by the engineers on the project for the sizing of the service entrance for Chandler City Hall.

Environmental Stewardship Design –

Environmental consideration was of high importance in the design of Chandler City Hall. As the building is currently still under construction, it is striving to achieve a LEED gold rating upon completion. A photovoltaic system was considered, but not implemented into the design. Future additional open panels were supplied in the event that a photovoltaic system is implemented. Although not clearly defined, Chandler City Hall in various ways has aimed to create an electrical building system and lighting system that portrays energy efficiency with minimal building loads where appropriate.

Design Issues

Although not in the current design, Chandler City Hall's electrical distribution system has left room for the potential future design of a photovoltaic system. The photovoltaic system would be located across the street on the top floor of the parking garage and enter the site as a separate service entrance to Chandler City Hall.

II. Communication Systems

Additional systems that run into Chandler City Hall include voice/data, and cable. The building is equipped with audiovisual capabilities in many of its areas but is particularly important in the Council Chambers where a variety of different events could potentially occur. These capabilities are also fed to office conference rooms and the mayor's conference space.

III. Security Systems

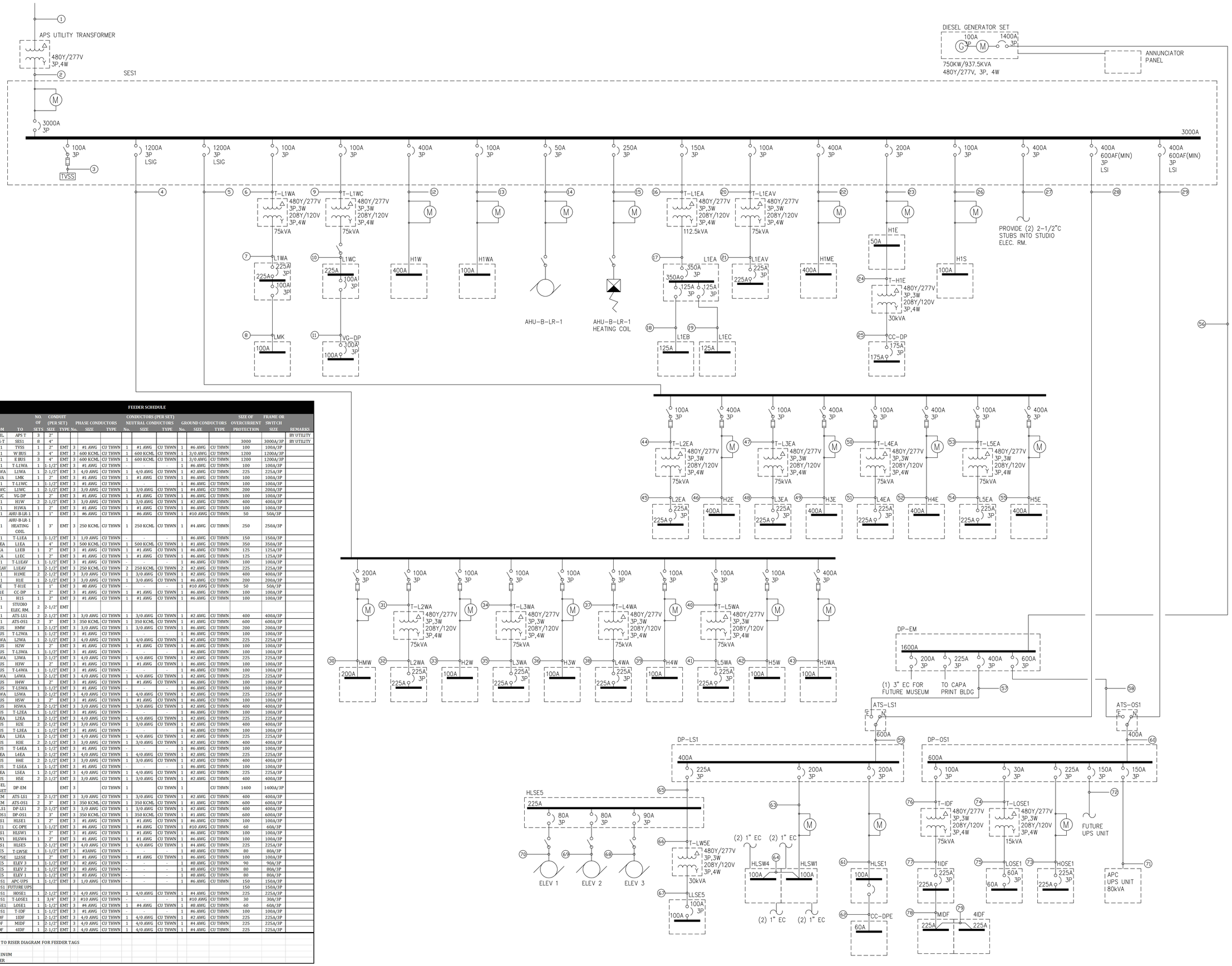
Chandler City Hall has a security system in which surveillance cameras have been installed within several of the corridor and publically accessible spaces. Additionally, for more high security areas, doors are equipped with card readers on accessible to specific personnel.

IV. Fire Protection Systems

Vital to life safety, Chandler City Hall has a fire protection plan that is laid out through the spaces of Chandler City Hall. Coordinated with all other building systems, a piping system coupled with sprinklers services all spaces within the buildings.

V. Appendix A

Please refer to inserted drawings.



FEEDER SCHEDULE

TAG	FROM	TO	NO. OF SETS	CONDUIT (PER SET) SIZE	TYPE	PHASE CONDUCTORS No.	SIZE	TYPE	NEUTRAL CONDUCTORS No.	SIZE	TYPE	GROUND CONDUCTORS No.	SIZE	TYPE	SIZE OF OVERCURRENT PROTECTION	FRAME OR SWITCH SIZE	REMARKS
1	UTIL	APS T	3	2"													BY UTILITY
2	APS-T	SES1	8	4"											3000	3000A/3P	BY UTILITY
3	SES1	TVSS	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
4	SES1	W BUS	3	4"	EMT	3	600 KCML	CU THWN	1	600 KCML	CU THWN	1	3/0 AWG	CU THWN	1200	1200A/3P	
5	SES1	E BUS	3	4"	EMT	3	600 KCML	CU THWN	1	600 KCML	CU THWN	1	3/0 AWG	CU THWN	1200	1200A/3P	
6	SES1	T-L1WA	1	1-1/2"	EMT	3	#1 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	100	100A/3P	
7	T-L1WA	L1WA	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#2 AWG	CU THWN	225	225A/3P	
8	L1WA	LMK	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
9	SES1	T-L1WC	1	1-1/2"	EMT	3	#1 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	100	100A/3P	
10	T-L1WC	L1WC	1	2-1/2"	EMT	3	3/0 AWG	CU THWN	1	3/0 AWG	CU THWN	1	#4 AWG	CU THWN	200	200A/3P	
11	L1WC	VG-DP	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
12	SES1	H1W	2	2-1/2"	EMT	3	3/0 AWG	CU THWN	1	3/0 AWG	CU THWN	1	#2 AWG	CU THWN	400	400A/3P	
13	SES1	H1WA	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
14	SES1	AHU-B-LR-1	1	1"	EMT	3	#6 AWG	CU THWN	1	#6 AWG	CU THWN	1	#10 AWG	CU THWN	50	50A/3P	
15	SES1	AHU-B-LR-1 HEATING COIL	1	3"	EMT	3	250 KCML	CU THWN	1	250 KCML	CU THWN	1	#4 AWG	CU THWN	250	250A/3P	
16	SES1	T-L1EA	1	1-1/2"	EMT	3	1/0 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	150	150A/3P	
17	T-L1EA	L1EA	1	4"	EMT	3	500 KCML	CU THWN	1	500 KCML	CU THWN	1	#1 AWG	CU THWN	350	350A/3P	
18	L1EA	L1EB	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	125	125A/3P	
19	L1EA	L1EC	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	125	125A/3P	
20	SES1	T-L1EAV	1	1-1/2"	EMT	3	#1 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	100	100A/3P	
21	T-L1EAV	L1EAV	1	2-1/2"	EMT	3	250 KCML	CU THWN	2	250 KCML	CU THWN	2	#2 AWG	CU THWN	225	225A/3P	
22	SES1	H1ME	2	2-1/2"	EMT	3	3/0 AWG	CU THWN	1	3/0 AWG	CU THWN	1	#2 AWG	CU THWN	400	400A/3P	
23	SES1	H1E	1	2-1/2"	EMT	3	3/0 AWG	CU THWN	1	3/0 AWG	CU THWN	1	#6 AWG	CU THWN	200	200A/3P	
24	H1E	T-H1E	1	1"	EMT	3	#8 AWG	CU THWN	-	-	-	1	#10 AWG	CU THWN	50	50A/3P	
25	T-H1E	CC-DP	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
26	SES1	H1S	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
27	SES1	STUDIO ELEC. RM.	2	2-1/2"	EMT												
28	SES1	ATS-LS1	2	2-1/2"	EMT	3	3/0 AWG	CU THWN	1	3/0 AWG	CU THWN	1	#2 AWG	CU THWN	400	400A/3P	
29	SES1	ATS-OS1	2	3"	EMT	3	350 KCML	CU THWN	1	350 KCML	CU THWN	1	#1 AWG	CU THWN	600	600A/3P	
30	W BUS	HMW	1	2-1/2"	EMT	3	3/0 AWG	CU THWN	1	3/0 AWG	CU THWN	1	#6 AWG	CU THWN	200	200A/3P	
31	W BUS	T-L2WA	1	1-1/2"	EMT	3	#1 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	100	100A/3P	
32	T-L2WA	L2WA	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#2 AWG	CU THWN	225	225A/3P	
33	W BUS	H2W	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
34	W BUS	T-L3WA	1	1-1/2"	EMT	3	#1 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	100	100A/3P	
35	T-L3WA	L3WA	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#2 AWG	CU THWN	225	225A/3P	
36	W BUS	H3W	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
37	W BUS	T-L4WA	1	1-1/2"	EMT	3	#1 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	100	100A/3P	
38	T-L4WA	L4WA	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#2 AWG	CU THWN	225	225A/3P	
39	W BUS	H4W	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
40	W BUS	T-L5WA	1	1-1/2"	EMT	3	#1 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	100	100A/3P	
41	T-L5WA	L5WA	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#2 AWG	CU THWN	225	225A/3P	
42	W BUS	H5W	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
43	W BUS	H5WA	2	2-1/2"	EMT	3	3/0 AWG	CU THWN	1	3/0 AWG	CU THWN	1	#2 AWG	CU THWN	400	400A/3P	
44	E BUS	T-L2EA	1	1-1/2"	EMT	3	#1 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	100	100A/3P	
45	T-L2EA	L2EA	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#2 AWG	CU THWN	225	225A/3P	
46	E BUS	H2E	2	2-1/2"	EMT	3	3/0 AWG	CU THWN	1	3/0 AWG	CU THWN	1	#2 AWG	CU THWN	400	400A/3P	
47	E BUS	T-L3EA	1	1-1/2"	EMT	3	#1 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	100	100A/3P	
48	T-L3EA	L3EA	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#2 AWG	CU THWN	225	225A/3P	
49	E BUS	H3E	2	2-1/2"	EMT	3	3/0 AWG	CU THWN	1	3/0 AWG	CU THWN	1	#2 AWG	CU THWN	400	400A/3P	
50	E BUS	T-L4EA	1	1-1/2"	EMT	3	#1 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	100	100A/3P	
51	T-L4EA	L4EA	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#2 AWG	CU THWN	225	225A/3P	
52	E BUS	H4E	2	2-1/2"	EMT	3	3/0 AWG	CU THWN	1	3/0 AWG	CU THWN	1	#2 AWG	CU THWN	400	400A/3P	
53	E BUS	T-L5EA	1	1-1/2"	EMT	3	#1 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	100	100A/3P	
54	T-L5EA	L5EA	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#2 AWG	CU THWN	225	225A/3P	
55	E BUS	H5E	2	2-1/2"	EMT	3	3/0 AWG	CU THWN	1	3/0 AWG	CU THWN	1	#2 AWG	CU THWN	400	400A/3P	
56	DIESEL GEN SET	DP-EM			EMT	3		CU THWN	1					CU THWN	1400	1400A/3P	
57	DP-EM	ATS-LS1	2	2-1/2"	EMT	3	3/0 AWG	CU THWN	1	3/0 AWG	CU THWN	1	#2 AWG	CU THWN	400	400A/3P	
58	DP-EM	ATS-OS1	2	3"	EMT	3	350 KCML	CU THWN	1	350 KCML	CU THWN	1	#1 AWG	CU THWN	600	600A/3P	
59	ATS-LS1	DP-LS1	2	2-1/2"	EMT	3	3/0 AWG	CU THWN	1	3/0 AWG	CU THWN	1	#2 AWG	CU THWN	400	400A/3P	
60	ATS-OS1	DP-OS1	2	3"	EMT	3	350 KCML	CU THWN	1	350 KCML	CU THWN	1	#1 AWG	CU THWN	600	600A/3P	
61	DP-LS1	HLSE1	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
62	HLSE1	CC-DPE	1	1-1/2"	EMT	3	#4 AWG	CU THWN	1	#4 AWG	CU THWN	1	#10 AWG	CU THWN	60	60A/3P	
63	DP-LS1	HLSW1	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
64	HLSW1	HLSW4	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
65	DP-LS1	HLSE5	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#4 AWG	CU THWN	225	225A/3P	
66	HLSE5	T-LW5E	1	1-1/2"	EMT	3	#3AWG	CU THWN	-	-	-	1	#8 AWG	CU THWN	80	80A/3P	
67	T-LW5E	LLSE	1	2"	EMT	3	#1 AWG	CU THWN	1	#1 AWG	CU THWN	1	#6 AWG	CU THWN	100	100A/3P	
68	HLSE5	ELEV 3	1	1-1/2"	EMT	3	#2 AWG	CU THWN	-	-	-	1	#8 AWG	CU THWN	90	90A/3P	
69	HLSE5	ELEV 2	1	1-1/2"	EMT	3	#3 AWG	CU THWN	-	-	-	1	#8 AWG	CU THWN	80	80A/3P	
70	HLSE5	ELEV 1	1	1-1/2"	EMT	3	#3 AWG	CU THWN	-	-	-	1	#8 AWG	CU THWN	80	80A/3P	
71	DP-OS1	APC-UPS	1	1-1/2"	EMT	3	1/0 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	150	150A/3P	
72	DP-OS1	FUTURE UPS													150	150A/3P	
73	DP-OS1	HOSE1	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#4 AWG	CU THWN	225	225A/3P	
74	DP-OS1	T-LOSE1	1	3/4"	EMT	3	#10 AWG	CU THWN	-	-	-	1	#10 AWG	CU THWN	30	30A/3P	
75	T-LOSE1	LOSE1	1	1-1/2"	EMT	3	#4 AWG	CU THWN	1	#4 AWG	CU THWN	1	#8 AWG	CU THWN	60	60A/3P	
76	DP-OS1	T-IDF	1	1-1/2"	EMT	3	#1 AWG	CU THWN	-	-	-	1	#6 AWG	CU THWN	100	100A/3P	
77	T-IDF	1IDF	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#2 AWG	CU THWN	225	225A/3P	
78	1IDF	MIDF	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#4 AWG	CU THWN	225	225A/3P	
79	MIDF	4IDF	1	2-1/2"	EMT	3	4/0 AWG	CU THWN	1	4/0 AWG	CU THWN	1	#4 AWG	CU THWN	225	225A/3P	

NOTES:
1. REFER TO RISER DIAGRAM FOR FEEDER TAGS

AL=ALUMINUM
CU-COPPER

CITY HALL

ADDRESS:
175 S. ARIZONA AVENUE
CHANDLER, AZ 85225

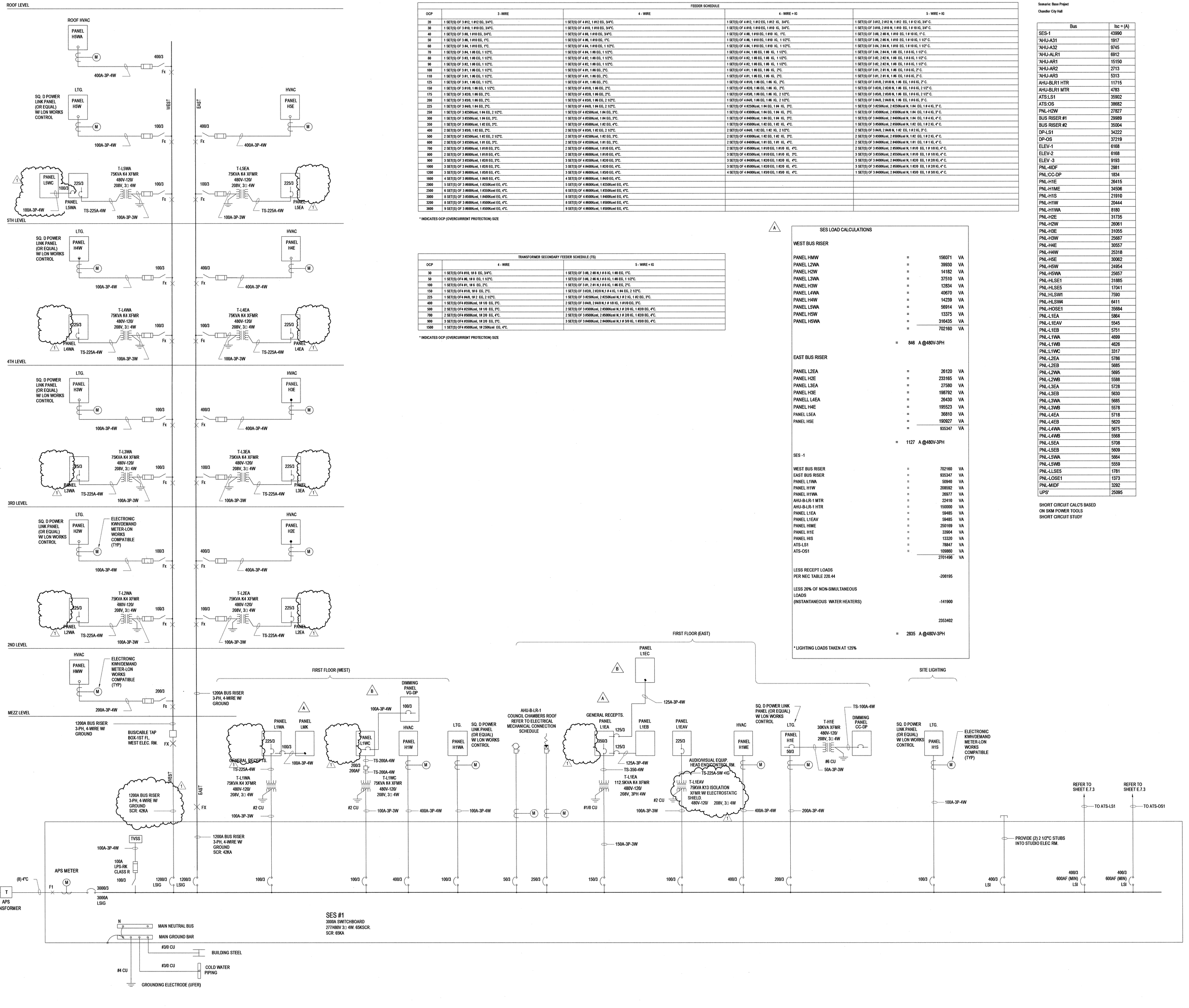
ISSUE: OCTOBER 26, 2010

DRAWN BY:
STEPHANIE ROMANIAS

AE481:
ARCHITECTURAL ENGINEERING SENIOR THESIS

SHEET TITLE:

SINGLE LINE DIAGRAM
CHANDLER CITY HALL



FEEDER SCHEDULE				
OCP	3 - WIRE	4 - WIRE	4 - WIRE + IG	5 - WIRE + IG
20	1 SET(S) OF 3 #12, 1 #12 EG, 3/4"C.	1 SET(S) OF 4 #12, 1 #12 EG, 3/4"C.	1 SET(S) OF 4 #12, 1 #12 EG, 1 #12 IG, 3/4"C.	1 SET(S) OF 3 #12, 2 #12 N, 1 #12 EG, 1 # 12 IG, 3/4" C.
30	1 SET(S) OF 3 #10, 1 #10 EG, 3/4"C.	1 SET(S) OF 4 #10, 1 #10 EG, 3/4"C.	1 SET(S) OF 4 #10, 1 #10 EG, 1 #10 IG, 3/4"C.	1 SET(S) OF 3 #10, 2 #10 N, 1 #10 EG, 1 # 10 IG, 3/4" C.
40	1 SET(S) OF 3 #8, 1 #10 EG, 3/4"C.	1 SET(S) OF 4 #8, 1 #10 EG, 3/4"C.	1 SET(S) OF 4 #8, 1 #10 EG, 1 #10 IG, 1"C.	1 SET(S) OF 3 #8, 2 #8 N, 1 #10 EG, 1 # 10 IG, 1" C.
50	1 SET(S) OF 3 #6, 1 #10 EG, 1"C.	1 SET(S) OF 4 #6, 1 #10 EG, 1"C.	1 SET(S) OF 4 #6, 1 #10 EG, 1 #10 IG, 1 1/2"C.	1 SET(S) OF 3 #6, 2 #6 N, 1 #10 EG, 1 # 10 IG, 1 1/2" C.
60	1 SET(S) OF 3 #4, 1 #10 EG, 1"C.	1 SET(S) OF 4 #4, 1 #10 EG, 1 1/2"C.	1 SET(S) OF 4 #4, 1 #10 EG, 1 #10 IG, 1 1/2"C.	1 SET(S) OF 3 #4, 2 #4 N, 1 #10 EG, 1 # 10 IG, 1 1/2" C.
70	1 SET(S) OF 3 #4, 1 #8 EG, 1 1/2"C.	1 SET(S) OF 4 #4, 1 #8 EG, 1 1/2"C.	1 SET(S) OF 4 #4, 1 #8 EG, 1 #8 IG, 1 1/2"C.	1 SET(S) OF 3 #4, 2 #4 N, 1 #8 EG, 1 # 8 IG, 1 1/2" C.
80	1 SET(S) OF 3 #3, 1 #8 EG, 1 1/2"C.	1 SET(S) OF 4 #2, 1 #8 EG, 1"C.	1 SET(S) OF 4 #2, 1 #8 EG, 1 #8 IG, 1 1/2"C.	1 SET(S) OF 3 #2, 2 #2 N, 1 #8 EG, 1 # 8 IG, 1 1/2" C.
90	1 SET(S) OF 3 #2, 1 #8 EG, 1 1/2"C.	1 SET(S) OF 4 #2, 1 #8 EG, 1 1/2"C.	1 SET(S) OF 4 #2, 1 #8 EG, 1 #8 IG, 1 1/2"C.	1 SET(S) OF 3 #2, 2 #2 N, 1 #8 EG, 1 # 8 IG, 1 1/2" C.
100	1 SET(S) OF 3 #1, 1 #6 EG, 1 1/2"C.	1 SET(S) OF 4 #1, 1 #6 EG, 2"C.	1 SET(S) OF 4 #1, 1 #6 EG, 1 #6 IG, 2"C.	1 SET(S) OF 3 #1, 2 #1 N, 1 #6 EG, 1 # 6 IG, 2" C.
110	1 SET(S) OF 3 #1, 1 #6 EG, 1 1/2"C.	1 SET(S) OF 4 #1, 1 #6 EG, 2"C.	1 SET(S) OF 4 #1, 1 #6 EG, 1 #6 IG, 2"C.	1 SET(S) OF 3 #1, 2 #1 N, 1 #6 EG, 1 # 6 IG, 2" C.
125	1 SET(S) OF 3 #1, 1 #6 EG, 1 1/2"C.	1 SET(S) OF 4 #1, 1 #6 EG, 2"C.	1 SET(S) OF 4 #1/0, 1 #6 EG, 1 #6 IG, 2"C.	1 SET(S) OF 3 #1/0, 2 #1/0 N, 1 #6 EG, 1 # 6 IG, 2"C.
150	1 SET(S) OF 3 #1/0, 1 #6 EG, 1 1/2"C.	1 SET(S) OF 4 #1/0, 1 #6 EG, 2"C.	1 SET(S) OF 4 #2/0, 1 #6 EG, 1 #6 IG, 2"C.	1 SET(S) OF 3 #2/0, 2 #2/0 N, 1 #6 EG, 1 # 6 IG, 2 1/2" C.
175	1 SET(S) OF 3 #2/0, 1 #6 EG, 2"C.	1 SET(S) OF 4 #2/0, 1 #6 EG, 2"C.	1 SET(S) OF 4 #3/0, 1 #6 EG, 1 #6 IG, 2 1/2"C.	1 SET(S) OF 3 #3/0, 2 #3/0 N, 1 #6 EG, 1 # 6 IG, 2 1/2" C.
200	1 SET(S) OF 3 #3/0, 1 #6 EG, 2 1/2"C.	1 SET(S) OF 4 #3/0, 1 #6 EG, 2 1/2"C.	1 SET(S) OF 4 #4/0, 1 #6 EG, 1 #6 IG, 2 1/2"C.	1 SET(S) OF 3 #4/0, 2 #4/0 N, 1 #6 EG, 1 # 6 IG, 3" C.
225	1 SET(S) OF 3 #4/0, 1 #4 EG, 2"C.	1 SET(S) OF 4 #4/0, 1 #4 EG, 2 1/2"C.	1 SET(S) OF 4 #250Kcmil, 1 #4 EG, 1 #4 IG, 3"C.	1 SET(S) OF 3 #250Kcmil, 2 #250Kcmil N, 1 #4 EG, 1 # 4 IG, 3" C.
250	1 SET(S) OF 3 #250Kcmil, 1 #4 EG, 2 1/2"C.	1 SET(S) OF 4 #250Kcmil, 1 #4 EG, 3"C.	1 SET(S) OF 4 #300Kcmil, 1 #4 EG, 1 #4 IG, 3"C.	1 SET(S) OF 3 #300Kcmil, 2 #300Kcmil N, 1 #4 EG, 1 # 4 IG, 3" C.
300	1 SET(S) OF 3 #350Kcmil, 1 #4 EG, 3"C.	1 SET(S) OF 4 #350Kcmil, 1 #4 EG, 3"C.	1 SET(S) OF 4 #400Kcmil, 1 #4 EG, 1 #4 IG, 3"C.	1 SET(S) OF 3 #400Kcmil, 2 #400Kcmil N, 1 #4 EG, 1 # 4 IG, 4" C.
350	1 SET(S) OF 3 #500Kcmil, 1 #2 EG, 3"C.	1 SET(S) OF 4 #500Kcmil, 1 #2 EG, 4"C.	1 SET(S) OF 4 #500Kcmil, 1 #2 EG, 1 #2 IG, 4"C.	1 SET(S) OF 3 #500Kcmil, 2 #500Kcmil N, 1 #2 EG, 1 # 2 IG, 4" C.
400	2 SET(S) OF 3 #3/0, 1 #2 EG, 2"C.	2 SET(S) OF 4 #3/0, 1 #2 EG, 2 1/2"C.	2 SET(S) OF 4 #4/0, 1 #2 EG, 1 #2 IG, 2 1/2"C.	2 SET(S) OF 3 #4/0, 2 #4/0 N, 1 #2 EG, 1 # 2 IG, 3" C.
500	2 SET(S) OF 3 #250Kcmil, 1 #2 EG, 2 1/2"C.	2 SET(S) OF 4 #250Kcmil, 1 #2 EG, 3"C.	2 SET(S) OF 4 #300Kcmil, 1 #2 EG, 1 #2 IG, 3"C.	2 SET(S) OF 3 #300Kcmil, 2 #300Kcmil N, 1 #2 EG, 1 # 2 IG, 4" C.
600	2 SET(S) OF 3 #350Kcmil, 1 #1 EG, 3"C.	2 SET(S) OF 4 #350Kcmil, 1 #1 EG, 3"C.	2 SET(S) OF 4 #400Kcmil, 1 #1 EG, 1 #1 IG, 4"C.	2 SET(S) OF 3 #400Kcmil, 2 #400Kcmil N, 1 #1 EG, 1 # 1 IG, 4" C.
700	2 SET(S) OF 3 #500Kcmil, 1 #1/0 EG, 3"C.	2 SET(S) OF 4 #500Kcmil, 1 #1/0 EG, 4"C.	2 SET(S) OF 4 #500Kcmil, 1 #1/0 EG, 1 #1/0 IG, 4"C.	2 SET(S) OF 3 #500Kcmil, 2 #500Kcmil N, 1 #1/0 EG, 1 # 1/0 IG, 4" C.
800	2 SET(S) OF 3 #600Kcmil, 1 #1/0 EG, 4"C.	2 SET(S) OF 4 #600Kcmil, 1 #1/0 EG, 4"C.	3 SET(S) OF 4 #500Kcmil, 1 #1/0 EG, 1 #1/0 IG, 3"C.	3 SET(S) OF 3 #500Kcmil, 2 #500Kcmil N, 1 #1/0 EG, 1 # 1/0 IG, 4" C.
900	3 SET(S) OF 3 #350Kcmil, 1 #2/0 EG, 3"C.	3 SET(S) OF 4 #350Kcmil, 1 #2/0 EG, 3"C.	3 SET(S) OF 4 #400Kcmil, 1 #2/0 EG, 1 #2/0 IG, 4"C.	3 SET(S) OF 3 #400Kcmil, 2 #400Kcmil N, 1 #2/0 EG, 1 # 2/0 IG, 4" C.
1000	3 SET(S) OF 3 #400Kcmil, 1 #2/0 EG, 3"C.	3 SET(S) OF 4 #400Kcmil, 1 #2/0 EG, 4"C.	3 SET(S) OF 4 #500Kcmil, 1 #2/0 EG, 1 #2/0 IG, 4"C.	3 SET(S) OF 3 #500Kcmil, 2 #500Kcmil N, 1 #2/0 EG, 1 # 2/0 IG, 4" C.
1200	3 SET(S) OF 3 #600Kcmil, 1 #3/0 EG, 4"C.	3 SET(S) OF 4 #600Kcmil, 1 #3/0 EG, 4"C.	4 SET(S) OF 4 #400Kcmil, 1 #3/0 EG, 1 #3/0 IG, 4"C.	1 SET(S) OF 3 #400Kcmil, 2 #400Kcmil N, 1 #3/0 EG, 1 # 3/0 IG, 4" C.
1600	4 SET(S) OF 3 #600Kcmil, 1 #4/0 EG, 4"C.	4 SET(S) OF 4 #600Kcmil, 1 #4/0 EG, 4"C.		
2000	5 SET(S) OF 3 #600Kcmil, 1 #250Kcmil EG, 4"C.	5 SET(S) OF 4 #600Kcmil, 1 #250Kcmil EG, 4"C.		
2500	6 SET(S) OF 3 #600Kcmil, 1 #350Kcmil EG, 4"C.	6 SET(S) OF 4 #600Kcmil, 1 #350Kcmil EG, 4"C.		
3000	8 SET(S) OF 3 #500Kcmil, 1 #400Kcmil EG, 4"C.	8 SET(S) OF 4 #500Kcmil, 1 #400Kcmil EG, 4"C.		
3200	8 SET(S) OF 3 #600Kcmil, 1 #500Kcmil EG, 4"C.	8 SET(S) OF 4 #600Kcmil, 1 #500Kcmil EG, 4"C.		
3600	9 SET(S) OF 3 #600Kcmil, 1 #500Kcmil EG, 4"C.	9 SET(S) OF 4 #600Kcmil, 1 #500Kcmil EG, 4"C.		

* INDICATES OCP (OVERCURRENT PROTECTION) SIZE

TRANSFORMER SECONDARY FEEDER SCHEDULE (TS)		
OCP	4 - WIRE	5 - WIRE + IG
30	1 SET(S) OF 4 #10, 1/0 G EG, 3/4"C.	1 SET(S) OF 3 #6, 2 #6 N, 1 #8 IG, 1 #6 EG, 1"C.
50	1 SET(S) OF 4 #6, 1/0 G EG, 1 1/2"C.	1 SET(S) OF 3 #6, 2 #6 N, 1 #8 IG, 1 #6 EG, 1 1/2"C.
100	1 SET(S) OF 4 #1, 1/0 G EG, 2"C.	1 SET(S) OF 3 #1, 2 #1 N, 1 #6 IG, 1 #6 EG, 2"C.
150	1 SET(S) OF 4 #1/0, 1/0 G EG, 2"C.	1 SET(S) OF 3 #2/0, 2 #2/0 N, 1 # 4 IG, 1 #4 EG, 2 1/2"C.
225	1 SET(S) OF 4 #4/0, 1/0 G EG, 2 1/2"C.	1 SET(S) OF 3 #250Kcmil, 2 #250Kcmil N, 1 #2 EG, 3"C.
400	1 SET(S) OF 4 #350Kcmil, 1/0 G EG, 3"C.	2 SET(S) OF 3 #400Kcmil, 2 #400Kcmil N, 1 #2 EG, 3"C.
500	2 SET(S) OF 4 #250Kcmil, 1/0 G EG, 3"C.	2 SET(S) OF 3 #300Kcmil, 2 #300Kcmil N, 1 #2 EG, 3"C.
700	2 SET(S) OF 4 #500Kcmil, 1/0 G EG, 3"C.	2 SET(S) OF 3 #500Kcmil, 2 #500Kcmil N, 1 #1/0 EG, 3"C.
1000	3 SET(S) OF 4 #400Kcmil, 1 #2/0 EG, 4"C.	3 SET(S) OF 3 #500Kcmil, 2 #500Kcmil N, 1 #2/0 EG, 4"C.
1500	1 SET(S) OF 4 #500Kcmil, 1# 250Kcmil EG, 4"C.	

* INDICATES OCP (OVERCURRENT PROTECTION) SIZE

A

SES LOAD CALCULATIONS

WEST BUS RISER

PANEL HMW	=	156071	VA
PANEL L2WA	=	39930	VA
PANEL H2W	=	14182	VA
PANEL L3WA	=	37510	VA
PANEL H3W	=	12834	VA
PANEL L4WA	=	40670	VA
PANEL H4W	=	14239	VA
PANEL L5WA	=	56914	VA
PANEL H5W	=	13375	VA
PANEL H5WA	=	316435	VA
	=	702160	VA
	=	846	A @480V-3PH

EAST BUS RISER

PANEL L2EA	=	26120	VA
PANEL H2E	=	233165	VA
PANEL L3EA	=	27580	VA
PANEL H3E	=	198792	VA
PANELL L4EA	=	26430	VA
PANEL H4E	=	195523	VA
PANEL L5EA	=	36810	VA
PANEL H5E	=	190927	VA
	=	935347	VA
	=	1127	A @480V-3PH

SES -1

WEST BUS RISER	=	702160	VA
EAST BUS RISER	=	935347	VA
PANEL L1WA	=	50940	VA
PANEL H1W	=	208592	VA
PANEL H1WA	=	26977	VA
AHU-B-LR-1 MTR	=	22410	VA
AHU-B-LR-1 HTR	=	150000	VA
PANEL L1EA	=	59485	VA
PANEL L1EAV	=	59485	VA
PANEL H1ME	=	250169	VA
PANEL H1E	=	33904	VA
PANEL H1S	=	13320	VA
ATS-LS1	=	78847	VA
ATS-OS1	=	109860	VA
		2701496	VA
LESS RECEPT LOADS PER NEC TABLE 220.44		-206195	
LESS 20% OF NON-SIMULTANEOUS LOADS (INSTANTANEOUS WATER HEATERS)		-141900	
		2353402	
	=	2835	A @480V-3PH

* LIGHTING LOADS TAKEN AT 125%

Project: Chandler City Hall 19718
Scenario: Base Project
Chandler City Hall

Bus	Isc = (A)
SES-1	43990
'AHU-A31	1917
'AHU-A32	9745
'AHU-ALR1	6912
'AHU-AR1	15150
'AHU-AR2	2713
'AHU-AR3	5313
AHU-BLR1 HTR	11715
AHU-BLR1 MTR	4783
ATS:LS1	35902
ATS:OS	39682
PNL-H2W	27827
BUS RISER #1	29989
BUS RISER #2	35004
DP-LS1	34222
DP-OS	37219
ELEV-1	6168
ELEV-2	6168
ELEV -3	9193
PNL-4IDF	2981
PNL-CC-DP	1934
PNL-H1E	26415
PNL-H1ME	34506
PNL-H1S	21910
PNL-H1W	20444
PNL-H1WA	8180
PNL-H2E	31735
PNL-H2W	26061
PNL-H3E	31055
PNL-H3W	25687
PNL-H4E	30557
PNL-H4W	25318
PNL-H5E	30062
PNL-H5W	24954
PNL-H5WA	25657
PNL-HLSE1	31885
PNL-HLSE5	17041
PNL:HLSW1	7590
PNL-HLSW4	6411
PNL-HOSE1	35684
PNL-L1EA	5864
PNL-L1EAV	5545
PNL-L1EB	5751
PNL-L1WA	4699
PNL-L1WB	4626
PNL-L1WC	3317
PNL-L2EA	5786
PNL-L2EB	5685
PNL-L2WA	5695
PNL-L2WB	5588
PNL-L3EA	5728
PNL-L3EB	5630
PNL-L3WA	5685
PNL-L3WB	5578
PNL-L4EA	5718
PNL-L4EB	5620
PNL-L4WA	5675
PNL-L4WB	5568
PNL-L5EA	5708
PNL-L5EB	5609
PNL-L5WA	5664
PNL-L5WB	5559
PNL-LLSE5	1781
PNL-LOSE1	1373
PNL-MIDF	3292
UPS*	25095

SHORT CIRCUIT CALC'S BASED ON SKM POWER TOOLS
SHORT CIRCUIT STUDY

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City Hall & Parking Garage

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www.smithgroup.com

ISSUED FOR	REV	DATE
ASI #011 Construction Set	*1*	*27AUG09*
Clarifications	*A*	*26MAY09*
Permit Set		*20APR09*
100% Design Development		*13FEB09*
60% DD Progress Print		*19DEC08*
Progress Print		*06NOV08*

SEALS AND SIGNATURES

KEYPLAN

DRAWING TITLE

ELECTRICAL ONE-LINE DIAGRAM SES #1

1/8" = 1'-0"
SCALE

19718.000
PROJECT NUMBER

E7.1
DRAWING NUMBER

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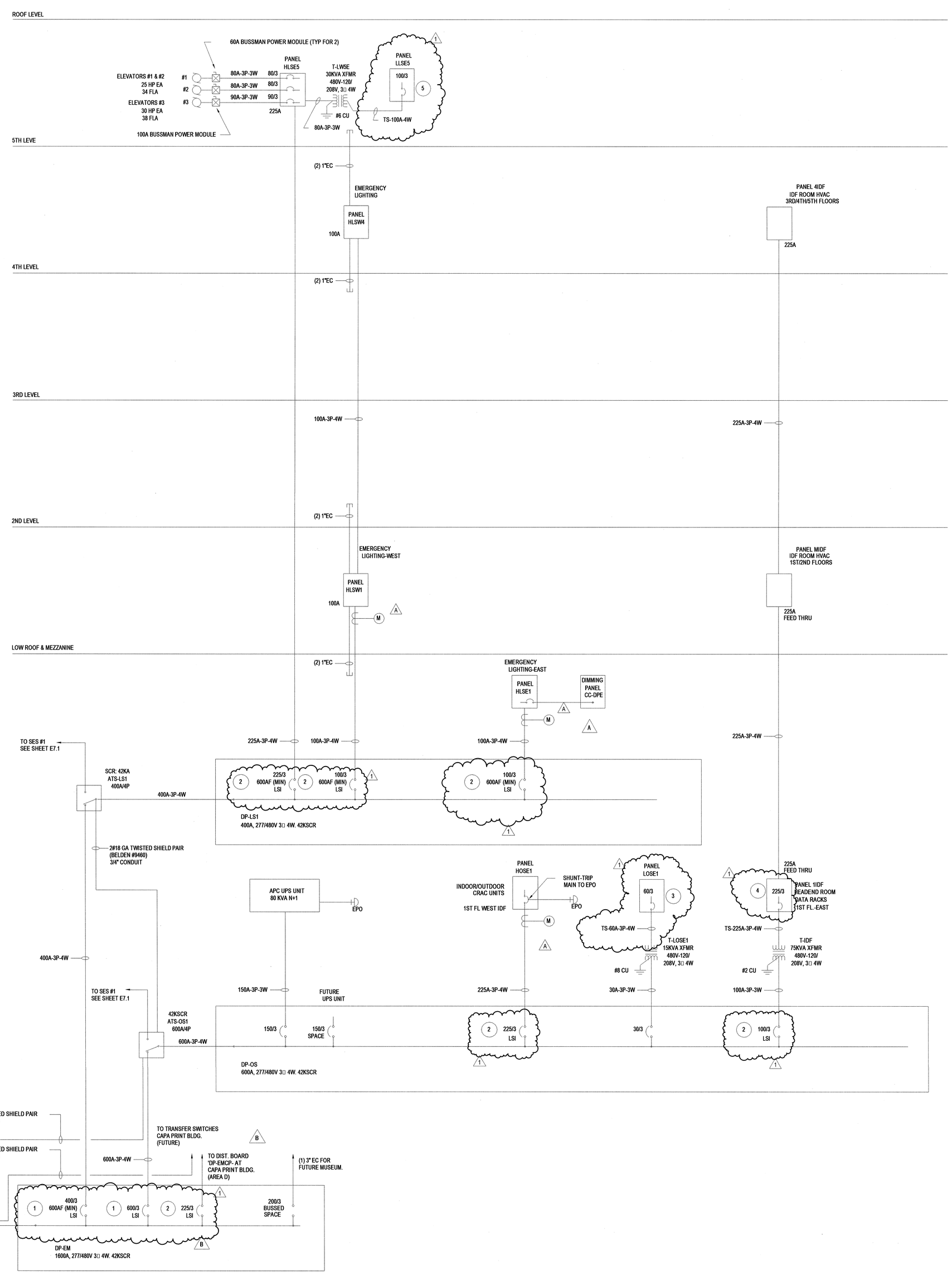
Project: Chandler City Hall 19718

Scenario: Base Project

Chandler City Hall

Bus	Isc = (A)
SES-1	43990
'AHU-A31	1917
'AHU-A32	9745
'AHU-ALR1	6912
'AHU-AR1	15150
'AHU-AR2	2713
'AHU-AR3	5313
AHU-BLR1 HTR	11715
AHU-BLR1 MTR	4783
ATS:LS1	35902
ATS:OS	38682
PNL-H2W	27827
BUS RISER #1	29989
BUS RISER #2	35004
DP-LS1	34222
DP-OS	37219
ELEV-1	6168
ELEV-2	6168
ELEV -3	9193
PNL-4IDF	2981
PNL:CC-DP	1834
PNL-H1E	26415
PNL-H1ME	34506
PNL-H1S	21910
PNL-H1W	20444
PNL-H1WA	8180
PNL-H2E	31735
PNL-H2W	26061
PNL-H3A	31055
PNL-H3W	25687
PNL-H4E	30557
PNL-H4W	25318
PNL-H5E	30062
PNL-H5W	24954
PNL-H5WA	25657
PNL-HLSE1	31885
PNL-HLSE5	17041
PNL:HLSW1	7590
PNL-HLSW4	6411
PNL-HOSE1	35684
PNL-L1EA	5864
PNL-L1EAV	5545
PNL-L1EB	5751
PNL-L1WA	4699
PNL-L1WB	4626
PNL:L1WC	3317
PNL-L2EA	5786
PNL-L2EB	5685
PNL-L2WA	5695
PNL-L2WB	5588
PNL-L3EA	5728
PNL-L3EB	5630
PNL-L3WA	5685
PNL-L3WB	5578
PNL-L4EA	5718
PNL-L4EB	5620
PNL-L4WA	5675
PNL-L4WB	5568
PNL-L5EA	5708
PNL-L5EB	5609
PNL-L5WA	5664
PNL-L5WB	5559
PNL-LLSE5	1781
PNL-LOSE1	1373
PNL-MIDF	3292
UPS'	25095

SHORT CIRCUIT CALC'S BASED
ON SKM POWER TOOLS
SHORT CIRCUIT STUDY



OVERCURRENT DEVICE COORDINATION NOTES:

1. SQ. D CIRCUIT BREAKER TYPE "RK" WITH MICRO 5.0
2. SQ. D CIRCUIT BREAKER TYPE "PK" WITH MICRO 5.0
3. SQ. D CIRCUIT BREAKER TYPE "HID" MCB.
4. SQ. D CIRCUIT BREAKER TYPE "LA-MC" MCB.
5. SQ. D CIRCUIT BREAKER TYPE "QD" MCB.

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ISSUED FOR	REV	DATE
ASI #011 Construction Set	*1*	*27AUG09*
South Permit Set	*B*	*29JUN09*
Clarifications	*A*	*26MAY09*
Permit Set		*20APR09*
100% Design Development		*13FEB09*
60% DD Progress Print		*19DEC08*
Progress Print		*06NOV08*

SEALS AND SIGNATURES

KEYPLAN

DRAWING TITLE

ELECTRICAL
ONE-LINE DIAGRAM
EMERGENCY
SYSTEMS

1/8" = 1'-0"

SCALE

19718.000

PROJECT NUMBER

E7.3

DRAWING NUMBER

VI. Appendix B

MasterColor® CDM-T T6

MasterColor CDM-T 35W/830 T6 1CT

The Elite family is at the very top of the MasterColor® CDM range, and gives a unique combination of unbeatable light quality and consistent performance over lifetime. While keeping running costs low. The Philips MasterColor® 3000KTubular Single-Ended T6 lamp is a compact, energy efficient, ceramic metal halide lamp that provides crisp, sparkling light.

Product data

- **Product Data**

Product number	223289
Full product name	MASTERColour CDM-T
Short product name	MASTERColour CDM-T
Pieces per Sku	1
eop_pck_cfg	12
Skus/Case	12
Bar code on pack	46677223281
Bar code on case	50046677223286
Logistics code(s)	928083105117
tpd_ilcos_cd	MT-35/30/1B-H-G12
eop_net_weight_pp	0.027 kg

- **General Characteristics**

Base	G12
Bulb	T6 [Diameter: 6/8 inch /19mm]
Bulb Finish	Clear
Operating Position	Universal [Any or Universal (U)]
Life to 5% failures	8000 hr
Life to 10% failures	9000 hr
Life to 20% failures	10000 hr
RatedAvgLife(See Family Notes)	12000 hr

- **Electrical Characteristics**

System Power EM	47 W
System Power EL	44 W
Watts	35 W
Lamp Wattage	38.0 W
Lamp Wattage EL	38 W
Lamp Voltage	88 V
Lamp Current EM	0.53 A
Lamp Current EL	0.47 A
Ignition Time	30 s
Run-up time 90%	3 min
Ignition Peak Voltage	3500 V
Re-ignition Time [min]	15 min
Dimmable	No

- **Environmental Characteristics**

Mercury (Hg) Content	3.1 mg

- **Light Technical Characteristics**

Color Code	830 [CCT of 3000K]
Color Rendering Index	76 (min), 81 (nom) Ra8
Color Designation	Warm White
Color Temperature	3095 K
Color Temperature technical	3095 K
Chromaticity Coordinate X	428 -
Chromaticity Coordinate Y	397 -
Initial Lumens	3300 Lm
Initial Lumens	3300 Lm
Luminous Efficacy Lamp EM	87 Lm/W
Luminous Efficacy Lamp EL	83 Lm/W
Lumen Maintenance EM 2000h	75 %
Lumen Maintenance EL 2000h	80 %
Lumen Maintenance EM 5000h	65 %
Lumen Maintenance EL 5000h	70 %

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MasterColor® CDM-T T6

MasterColor CDM-T 35W/842 T6 1CT

The Elite family is at the very top of the MasterColor® CDM range, and gives a unique combination of unbeatable light quality and consistent performance over lifetime. While keeping running costs low. The Philips MasterColor® 3000KTubular Single-Ended T6 lamp is a compact, energy efficient, ceramic metal halide lamp that provides crisp, sparkling light.

Product data

• Product Data

Product number	208868
Full product name	MasterColor CDM-T 35W/842 T6 1CT
Short product name	CDM35/T6/842 12PK
Pieces per Sku	1
eop_pck_cfg	12
Skus/Case	12
Bar code on pack	46677208868
Bar code on case	50046677208863
Logistics code(s)	928099805117
tpd_ilcos_cd	MT-35/42/1B-H-G12
eop_net_weight_pp	0.028 kg

• General Characteristics

Base	G12
Bulb	T6 [Diameter: 6/8 inch /19mm]
Bulb Finish	Clear
Operating Position	Universal [Any or Universal (U)]
Life to 5% failures	8000 hr
Life to 10% failures	9000 hr
Life to 20% failures	10000 hr
RatedAvgLife(See Family Notes)	12000 hr

• Electrical Characteristics

System Power EL	44 W
Watts	35 W
Lamp Wattage EL	38 W
Lamp Voltage	85 V
Lamp Current EL	0.46 A
Ignition Time	30 s
Run-up time 90%	3 min
Ignition Peak Voltage	3500 V
Re-Ignition Time [min]	15 min
Dimmable	No

• Environmental Characteristics

Mercury (Hg) Content	2.7 mg

• Light Technical Characteristics

Color Code	842 [CCT of 4200K]
Color Rendering Index	84 Ra8
Color Designation	Cool White
Color Temperature	4200 K
Color Temperature technical	4200 K
Chromaticity Coordinate X	365 -
Chromaticity Coordinate Y	364 -
Initial Lumens	3300 Lm
Luminous Efficacy Lamp EL	81 Lm/W
Lumen Maintenance EL 2000h	90 %
Lumen Maintenance EL 5000h	85 %
Lumen Maintenance EL 10000h	70 %

• UV-related Characteristics

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MasterColor® CDM-T T6

MasterColor CDM-T 70W/830 T6 1CT

The Elite family is at the very top of the MasterColor® CDM range, and gives a unique combination of unbeatable light quality and consistent performance over lifetime. While keeping running costs low. The Philips MasterColor® 3000KTubular Single-Ended T6 lamp is a compact, energy efficient, ceramic metal halide lamp that provides crisp, sparkling light.

Product data

• Product Data

Product number	223370
Full product name	MasterColor CDM-T 70W/830 T6 1CT
Short product name	CDM70/T6/830 12PK
Pieces per Sku	1
eop_pck_cfg	12
Skus/Case	12
Bar code on pack	46677223373
Bar code on case	50046677223378
Logistics code(s)	928082305117
tpd_ilcos_cd	MT-70/30/1B-H-G12
eop_net_weight_pp	0.029 kg

• General Characteristics

Base	G12
Bulb	T6 [Diameter: 6/8 inch /19mm]
Bulb Finish	Clear
Operating Position	Universal [Any or Universal (U)]
Life to 5% failures	9000 hr
Life to 10% failures	10000 hr
Life to 20% failures	11000 hr
RatedAvgLife(See Family Notes)	12000 hr

• Electrical Characteristics

System Power EM	88 W
System Power EL	83 W
Watts	70 W
Lamp Wattage	71.0 W
Lamp Wattage EL	73 W
Lamp Voltage	88 V
Lamp Current EM	0.98 A
Lamp Current EL	0.87 A
Ignition Time	30 s
Run-up time 90%	3 min
Ignition Peak Voltage	3500 V
Re-ignition Time [min]	15 min
Dimmable	No

• Environmental Characteristics

Mercury (Hg) Content	4.5 mg

• Light Technical Characteristics

Color Code	830 [CCT of 3000K]
Color Rendering Index	79 (min), 84 (nom) Ra8
Color Designation	Warm White
Color Temperature	3070 K
Color Temperature technical	3070 K
Chromaticity Coordinate X	428 -
Chromaticity Coordinate Y	394 -
Initial Lumens	6600 Lm
Initial Lumens	6600 Lm
Luminous Efficacy Lamp EM	93 Lm/W
Lumen Maintenance EM 2000h	85 %
Lumen Maintenance EL 2000h	85 %
Lumen Maintenance EM 5000h	75 %
Lumen Maintenance EL 5000h	80 %

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GE Lighting

31066 - CMH150CU830MED/O

GE ConstantColor® PulseArc® CMH® Ceramic Metal Halide ED17

a product of ecomagination

CAUTIONS & WARNINGS

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

Caution

- Lamp may shatter and cause injury if broken
  - Dispose of lamp in a closed container.
  - Do not use excessive force when installing lamp.
  - Do not use lamp if outer glass is scratched or broken.

Warning

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

GENERAL CHARACTERISTICS

Lamp Type	High Intensity Discharge - Ceramic Metal Halide
Bulb	ED17
Base	Medium Screw (E26)
Bulb Finish	Coated
Wattage	150
Rated Life	12000 hrs
Bulb Material	Hard glass
Lamp Enclosure Type (LET)	Open or enclosed fixtures
Bulb Temperature (MIN)	190 °C
Bulb Temperature (MAX)	400 °C
LEED-EB MR Credit	104 picograms Hg per mean lumen hour

PHOTOMETRIC CHARACTERISTICS

Initial Lumens	11900
Mean Lumens	8800
Nominal Initial Lumens per Watt	79
Color Temperature	3000 K
Color Rendering Index (CRI)	80

ELECTRICAL CHARACTERISTICS

Burn Position	Universal burning position
Warm Up Time to 90% (MIN)	2 min
Warm Up Time to 90% (MAX)	5 min
Hot Restart Time to 90%	15 min
Hot Restart Time to 90% (MAX)	15 min

DIMENSIONS

Maximum Overall Length (MOL)	5.43 cm
Nominal Length	5.43 cm
Bulb Diameter (DIA)	2.125 cm
Bulb Diameter (DIA) (MAX)	2.125 cm
Light Center Length (LCL)	3.37 cm

PRODUCT INFORMATION

Product Code	31066
Description	CMH150CU830MED/O
ANSI Code	C102/M102/M142
Standard Package	Case
Standard Package GTIN	10043168310663
Standard Package Quantity	6
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	6
UPC	043168310666

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For additional information, visit www.gelighting.com

Page 1

Revised: 6/4/2009

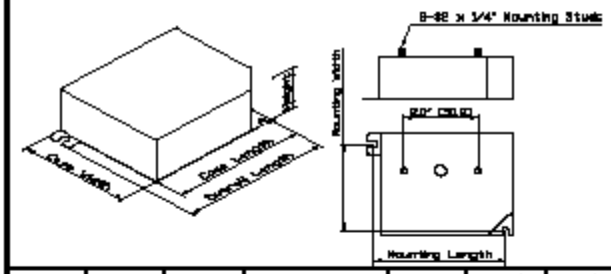
PHILIPS ADVANCE

e-Vision® Electronic Ballast for Metal Halide Lamps

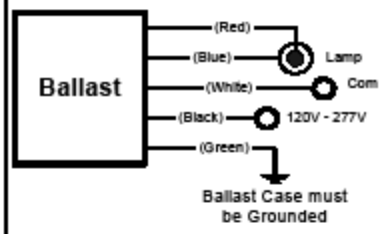
Catalog Number: IMH-P39-G
For 39W Philips Mini Master Color Lamps
ANSI C179
120-277 50/60Hz Electronic
Status: RELEASED

DIMENSIONS AND DATA

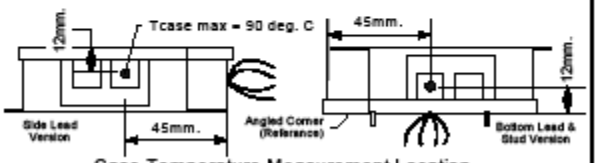
Lamp Number	Lamp Watts	Input Volts	Catalong Number*	Line Current (Amps)	Input Power (Watts)	Min Power Factor	Wiring Diag	Fig.	Weight (lb)	Max. Distance to Lamp (ft)
39W Watt Lamp, ANSI Code C179 Minimum Starting Temp -30°C/-20°F										
1	39	120	IMH-P39-G-XXX	0.39	46	0.95	3	G	0.9	5
		277		0.17	45					



Case Figure	Overall Length	Case Length	Case Width	Height	Mountin Length	Mounting Width
G	97mm [3.8"]	90mm [3.5"]	77mm [3.0"]	30mm [1.2"]	87mm [3.4"]	67mm [2.6"]



Wiring Diagram 3



Case Temperature Measurement Location

INSTALLATION & APPLICATION NOTES:

1. Maximum allowable case temperature is 90°C. See figure above for measurement location
2. Ignition pulse is 2.5 kV max
3. All leads are 9 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp

*Ordering Information

Order Suffix	Description
-LF	Ballast with side exit leads and mounting feet
-BLS	Ballast with bottom exit leads and mounting studs

Data is based on tests performed by Philips Advance in a controlled environment and is representative of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice. All specifications are nominal unless otherwise noted.

Philips Lighting Electronics N.A.
10275 West Higgins Road • Rosemont, IL 60018 • www.philips.com/advance
Tel: 800-322-2086 • Fax: 800-423-1882 • Customer Support: 800-372-3331 • OEM Support: 866-915-5886

Revised: 3/5/2009

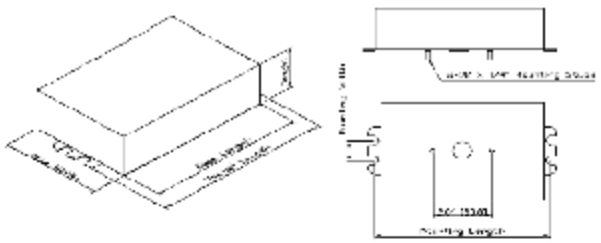
PHILIPS ADVANCE

e-Vision® Electronic Ballast for Metal Halide Lamps

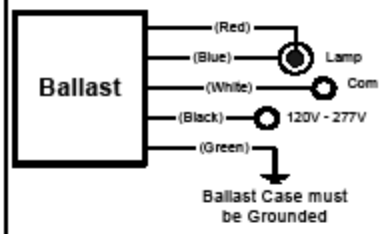
Catalog Number: IMH-70-D
For 70W Metal Halide Lamps
ANSI M98, M139 or M143
120-277 50/60Hz Electronic
Status: RELEASED

DIMENSIONS AND DATA

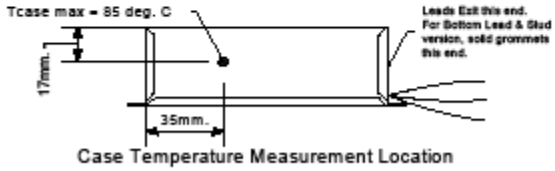
Lamp Number	Lamp Watts	Input Volts	Catalong Number*	Line Current (Amps)	Input Power (Watts)	Min Power Factor	Wiring Diag	Fig.	Weight (lb)	Max. Distance to Lamp (ft)
70W Watt Lamp, ANSI Code M98, M139 or M143 Minimum Starting Temp -30°C/-20°F										
1	70	120	IMH-70-D-XXX	0.67	80	0.9	3	D	1.6	5
		277		0.29	79					



Case Figure	Overall Length	Case Length	Case Width	Height	Mountin Length	Mounting Width
D	128mm [5.0"]	108mm [4.3"]	77mm [3.0"]	38mm [1.5"]	118mm [4.6"]	19mm [0.7"]



Wiring Diagram 3



Case Temperature Measurement Location

INSTALLATION & APPLICATION NOTES:

1. Maximum allowable case temperature is 85°C. See figure above for measurement location
2. Ignition pulse is 4 kV max
3. All leads are 12 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp

*Ordering Information

Order Suffix	Description
-LF	Ballast with side exit leads and mounting feet
-BLS	Ballast with bottom exit leads and mounting studs

Data is based on tests performed by Philips Advance in a controlled environment and is representative of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice. All specifications are nominal unless otherwise noted.

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Revised: 3/4/2009

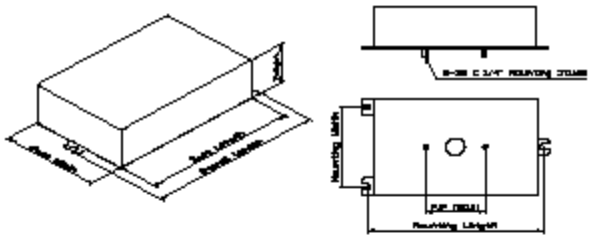
PHILIPS ADVANCE

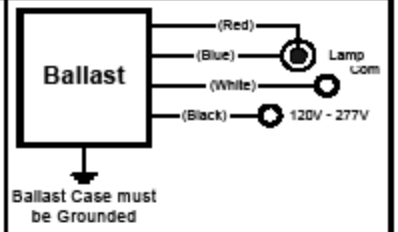
e-Vision® Electronic Ballast for Metal Halide Lamps

Catalog Number: IMH-150-H
For 150W Metal Halide Lamps
ANSI M102 or M142
120-277V 50/60Hz Electronic
Status: RELEASED

DIMENSIONS AND DATA

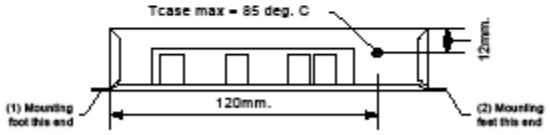
Lamp Number	Lamp Watts	Input Volts	Catalog Number*	Line Current (Amps)	Input Power (Watts)	Min Power Factor	Wiring Diag	Fig.	Weight (lb)	Max. Distance to Lamp (ft)
150 Watt Lamp, ANSI Code M102 or M142 Minimum Starting Temp -30°C/-20°F										
1	150	120	IMH-150-H-XXX	1.4	165	1	3	H	1.9	5
		277		0.6	161					





Wiring Diagram 3

Case Figure	Overall Length	Case Length	Case Width	Height	Mountin Length	Mounting Width
H	161mm [6.3"]	144mm [5.7"]	92mm [3.6"]	38mm [1.5"]	152mm [6.0"]	73mm [2.9"]



Case Temperature Measurement Location

EISA Compliant

INSTALLATION & APPLICATION NOTES:

1. Maximum allowable case temperature is 85°C. See figure above for measurement location
2. Ignition pulse is 4 kV max
3. All leads are 12 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp
6. Connect the red lead to the center terminal of the lamp when using screw base lamps

*Ordering Information

Order Suffix	Description
-LF	Ballast with side exit leads and mounting feet
-BLS	Ballast with bottom exit leads and mounting studs

Data is based on tests performed by Philips Advance in a controlled environment and is representative of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice. All specifications are nominal unless otherwise noted.

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