TECHNICAL REPORT TWO

LEAH MATERN
LIGHTING/ELECTRICAL
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OCTOBER 27, 2010

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Executive Summary

This report contains a detailed analysis of the electrical systems in Crystal Lake Elementary School. This school is an education facility for students between grades K-5 and provides 720 student stations. The electrical power systems were designed to power lighting loads, receptacle loads, kitchen equipment, mechanical and plumbing equipment, and other equipment.

This report contains a detailed analysis of the various loads. This will include information on the distribution system, service entrance, emergency power systems, switchgear over-current devices, transformers, lighting, mechanical and other loads and a brief description of the various communication systems throughout this building. Using the square footage of the building, NEC code requirements, and the actual loads in the building, the service entrance was sized for three different phases of the design process.

In addition, a single line diagram was created to show the distribution of power from the service entrance throughout the building. The original riser diagram is also included for comparison.

Section I: Power Distribution Systems

Summary Description of Distribution System

Crystal Lake Elementary school has one service entrance on the northeast corner of the building on ground level with utility service provided by Progress Energy. Power is received from the Utility Company's pad mounted transformer to the building's main electrical distribution panel from an underground 277/480V, 3 phases, 4 wire service lateral. The main distribution panel supplies power to all equipment in the building from the buildings distribution system.

This buildings distribution system includes both Normal Power distribution and an Emergency Power distribution sub system. The Normal Power distribution system supplies 277/480V, which distributes 3 phase power to both lighting and mechanical loads. The 480V distribution system is also stepped down by transformers at various panelboard locations around the building to a 120/208V, 3 phase, 4 wire secondary to distribute the power to receptacles and other 120V or 208V loads. The Emergency power system is similar to the normal power system (it distributes power at 277/480V, 3-phase and 120/208V, 3-phase); however, it receives its power from both the normal power system and the backup emergency power generator source. The generator is rated for 125KW or 156KVA at 80% power factor; 277/480V, 3-phase.

Utility Company Information

Crystal Lake Elementary School is served by Progress Energy, an electric utility company that provides power to the service entrance. Progress Energy's contact information is as follows:

Name: Progress Energy
Address: 1150 Greenwood Boulevard
Lake Mary, Florida 32746
Website: http://progress-energy.com

Progress Energy provides their rates based on three different factors. The total Energy Cost include an Energy Conservation Cost Recovery Factor (the cost of energy conservation programs), a Capacity Cost Recovery Factor (new nuclear costs and a portion of the cost of purchasing electricity from sources other than Progress Energy Florida), and an Environmental Cost Recovery Clause Factor (the cost of new environmental programs not in base rates). The rate breakdown for Progress Energy is in the table below.

Progress Energy Cost				
		Energy Conservation Cost Recovery Factor (¢/kWh)	**Capacity Cost Recovery Factor (¢/kWh)**	**Environmental Cost Recovery Clause (¢/kWh)**
Demand	Secondary	0.210	1.326	0.571
	Primary	0.208	1.313	0.565
	Transmission	0.206	1.299	0.560
Non-Demand	Secondary	0.223	1.488	0.583
	Primary	0.221	1473	0.577
	Transmission	0.219	1.458	0.571

The Electrical Utility Load for this building was unobtainable. However, the Electrical Consumption Data for Crystal Lake Elementary School from 2009-2010 listed in the table below.

	Electrical Consumption	
Month	**KWH**	**Monthly Cost**
July	107,861	$12,419
August	159,829	$17,365
September	143,931	$16,097
October	161,674	$17,968
November	203,469	$22,229
December	130,236	$14,839
January	181,154	$19,431
February	173,791	$18,785
March	143,256	$15,966
April	156,036	$16,840
May	175,938	$18,289
June	142,235	$15,156
Total	**1,879,410**	**$205,384**

Service Entrance

For the Normal Power for Crystal Lake Elementary School, the Utility Company provides a transformer and meter in the northeast corner of the building in the transformer yard. The owner's service and responsibility begins at this location.

The service entrance is located in the main electrical room (01-141). Power is fed from the Utility Company's primary distribution system conduit and wire and feeds the main transformer. At this point the owner takes responsibility and feeds the power to the Main Distribution Panel in the Main Electrical Room (01-141). A Building Power emergency source disconnect switch and normal power electrical service shunt trip button are located on the exterior of the building in the northeast corner.

Voltage Systems

The Service Entrance provides 277/480V, 3 phase, 4 wires voltage. Within this building, there are six transformers, four located on the first floor and two located on the second floor, that step down the voltage from 480V, 3 phase primary to 120/208V 3 phase, 4 wire secondary. The computer, receptacles, equipment, and lighting loads operate at 120/208V. AHU's, FTB's, and exterior lighting operate at 277/480V. Most of the lighting in the building operates at 277V.

Emergency Power Systems

Emergency Power is supplied from an exterior grade mounted generator external to the building. The generator contains two circuit breakers to feed the two branches of the emergency distribution system, per code requirement.

One circuit feed the Life Safety Branch, according to NEC 700. Power from the generator enters the building and feeds the emergency side/source of the 70 amp, 277/480V, 3 phase, 4 wire automatic transfer switch (ATS-LS). This transfer switch receives its normal side/source from an external 600V, 100 amp, 3 phase N-3R service rated disconnect switch with 70 amp fuses that is fed directly from the Utility Company pad mounted transformer. It feeds panel 1HE1, which serves all the life safety lighting for the building. This voltage is then stepped down to 120/208V, 3 phase, 4 wire secondary to supply panel L1E1. This panel feeds the life safety equipment, including fire alarm panels.

One circuit feed the Optional Standby System Equipment Branch, according to NEC 702.Power from the generator enters the building and feeds the emergency side/source of the 125amp, 277/480V, 3 phase, 4 wire, 4 pole automatic transfer switch (ATS-Q). This transfer switch receives its normal side/source from the normal power distribution panel (MDP). It feeds panel 1HQ1, which supplies two air handling units and feeds panel 1LQDP1 after the voltage has been stepped down to 120/208V. Panel 1LQDP1 feeds receptacles and system equipment and Panel 1LQ1. Panel 1LQ1 feeds kitchen equipment that needs continuous power, such as refrigerators and freezers.

Locations of Switchgear

The main switchboard for this building is a Main Distribution Panel (MDP) located in the Main Electrical Room (01-141) on the northeast side of the building on the first floor (grade level).

The emergency system is located in the Emergency Electrical Room (01-141A), which is next to the Main Electrical Room. This room also contains the automatic transfer switches for both branches of the emergency systems (Life safety and Optional Standby).

In addition to the main switchboard, electrical rooms also contain electrical panels and transformers. The following table lists the major equipment and their location in the building. Following the Major Equipment table is a table containing all the electrical panels and their locations within the building.

Major Equipment Table

Tag	Type Of Equipment	Floor Level	Room Number	Room Name	Drawing Number
MDP	Distribution Panel	First	01-141	Electrical	E102, E203
XFMR 1L1	Transformer	First	01-141	Electrical	E102, E203
XFMR 1LE1	Transformer	First	01-141A	Emergency Electrical	E102, E202
XFMR 1LQDP1	Transformer	First	01-141A	Emergency Electrical	E102, E202
XFMR 1LK1	Transformer	First	01-141A	Emergency Electrical	E102, E203
XFMR 1L2	Transformer	First	01-141A	Emergency Electrical	E102, E202
XFMR 2L1	Transformer	Second	01-236	Electrical	E103, E202
XFMR 2L2	Transformer	Second	01-216A	Electrical	E104, E202

Major Equipment Table					
Tag	**Type Of Equipment**	**Floor Level**	**Room Number**	**Room Name**	**Drawing Number**
GENERATOR	Generator	First-Exterior	Exterior	N/A	E203
POWER CO. XFMR	Transformer	First-Exterior	Exterior	N/A	E203
ATS-Q	Transfer Switch	First	01-141-A	Emergency Electrical	E102, E203
ATS-LS	Transfer Switch	First	01-141A	Emergency Electrical	E102, E203

Panel Boards						
Tag	**Voltage System**	**Main Size**	**Floor Level**	**Room Number**	**Room Name**	**Drawing Number**
1HM1	277/480V	400A MLO	First	01-141	Electrical	E102, E203
1HM2	277/480V	400A MLO	First	01-141	Electrical	E102, E203
1H1	277/480V	225A MLO	First	01-141	Electrical	E102, E203
1L1	120/208V	450A MCB	First	01-141	Electrical	E102, E203
1LC1	120/208V	225A MLO	First	01-141	Electrical	E102, E203
1HQ1	277/480V	125A MLO	First	01-141A	Emergency Electrical	E102, E203
1HE1	277/480V	100A MCB	First	01-141A	Emergency Electrical	E102, E203
1LE1	120/208V	90 MCB	First	01-141A	Emergency Electrical	E102, E203
1LQDP1	120/208V	225A MCB	First	01-141A	Emergency Electrical	E102, E203
1LQ1	120/208V	225 MLO	First	01-120	Kitchen	E102, E201
1LK1	120/208V	450A MCB	First	01-120	Kitchen	E102, E201
1LK2	120/208V	225 MLO	First	01-120	Kitchen	E102, E201
1HM3	277/480V	400 MLO	First	01-134A	Electrical	E102, E202
1H2	277/480V	125 MLO	First	01-134A	Electrical	E102, E202
1LC2	120/208v	225 MLO	First	01-134A	Electrical	E102, E202
1L2	120/208V	450 MCB	First	01-134A	Electrical	E102, E202
2HM1	277/480V	600 MLO	Second	01-236	Electrical	E103, E202
2H1	277/480V	125 MLO	Second	01-236	Electrical	E103, E202
2LC1	120/208V	125 MLO	Second	01-236	Electrical	E103, E202
2L1	120/208V	350 MCB	Second	01-236	Electrical	E103, E202
2HM2	277/480V	400 MLO	Second	01-213	Electrical	E104, E202
2L2	120/208V	225 MCB	Second	01-213	Electrical	E104, E202
2LC2	120/208V	125 MLO	Second	01-213	Electrical	E104, E202
2H2	277/480V	100 MLO	Second	01-213	Electrical	E104, E202

Over-current Devices

Within Crystal Lake Elementary School, some panels are protected by main circuit breakers and others contain main lugs only. Main circuit breakers are required per NEC for panels that are fed from a transformer, otherwise main lugs only is used. The Main Distribution Panel supplies power to 26 different feeders. Feeders are protected by either a circuit breaker or fuse.

At Utility Service Entrance there is a 600V, 100A, 3P, S/N, N-3R service rated disconnect switch with 70amp fuses for the emergency service. The Main Distribution Panel is protected by a circuit breaker, since it is a service and contains over six overcurrent protective devices, NEC requires a main breaker. The feeders from the emergency generator are protected by two circuit breakers: one 70amp, 3 pole for life safety branch and one 125 amp, 3 pole for equipment branch.

Transformers

Within Crystal Lake Elementary School, there are seven transformers located in electrical rooms. Each transformer steps down 480V, 3 phase, 4 wire power to 120/208V 3 phase, 4 wire. The higher voltage transformer outside the building is not included in this information since it is owned and supplied by Progress Energy.

Individual Transformer Schedule

Tag	Primary Voltage	Secondary Voltage	Size	Type	Temp. Rise	Taps	Mounting	Remarks
XFMR 1L1	480V, 3PH, 4W	120/208V, 3PH, 4W	200	Dry	115 Degree C	(2) 5%	Pad Mounted	NEMA ST 20
XFMR 1LE1	480V, 3PH, 4W	120/208V, 3PH, 4W	40	Dry	115 Degree C	(2) 5%	Pad Mounted	NEMA ST 20
XFMR 1LQDP1	480V, 3PH, 4W	120/208V, 3PH, 4W	100	Dry	115 Degree C	(2) 5%	Pad Mounted	NEMA ST 20
XFMR 1LK1	480V, 3PH, 4W	120/208V, 3PH, 4W	200	Dry	115 Degree C	(2) 5%	Pad Mounted	NEMA ST 20
XFMR 1L2	480V, 3PH, 4W	120/208V, 3PH, 4W	200	Dry	115 Degree C	(2) 5%	Pad Mounted	NEMA ST 20
XFMR 2L1	480V, 3PH, 4W	120/208V, 3PH, 4W	150	Dry	115 Degree C	(2) 5%	Pad Mounted	NEMA ST 20
XFMR 2L2	480V, 3PH, 4W	120/208V, 3PH, 4W	100	Dry	115 Degree C	(2) 5%	Pad Mounted	NEMA ST 20

Grounding

Grounding for the power systems is shown on sheet E501 on the power riser diagram.

Special Equipment

Crystal Lake Elementary School is equipped with a number of surge protection devices. There is a 75KA surge suppressor located on the emergency service disconnect switch at the service entrance. On the Main Distribution there is a 75KA surge suppressor and a lightning arrestor. Also, there are eight other panels in the building that have surge suppressors. These surge protection devices are installed on various panels to protect equipment that is fed from the electrical distribution panels from high voltage surges. They protect emergency equipment, computer panes, and other electronic equipment. The surge protection devices are connected to a 30 amp breaker on the respective panel.

There is a lightning arrestor on the Main Distribution panel for lightning protection. This building does not require lightning protecting; however, lightning protection was installed in compliance with NFPA 780 since the location of this building results in a risk factor of over 7 or severe.

Lighting Loads

The majority of the indoor lighting for Crystal Lake Elementary School consists of linear fluorescent luminaires with a correlated color temperature of 4100K and a color rendering index of 80. In the lobby and covered entrance there are recessed downlights of both metal halide and fluorescent lamps that help accentuate the ceiling height of both of these spaces by illuminating the ceiling. Both of these lamps have a correlated color temperature of 4100K and a color rendering index of either 75 or 80.

In the Luminaire Schedule provided in the table below is a list of each type of luminaire with its appropriate tag, the lamp source, the lamp type, the lamp wattage, the number of lamps, the ballast type for fluorescent and metal halide lamps, the operating or input voltage, the input watts, the ballast factor, the operating current, and the power factor.

The manufacturer cut sheets for all HID lamp/ballast combinations are included in Appendix B at the end of this report.

Luminaire Schedule

Type	Light Source	Lamp Type	Individual Lamp Wattage	Number of Lamps	Ballast Type	Operating or Input Voltage	Input Watts	Ballast Factor	Current @ Start and Operating	Power Factor @ Start and Operating
A2	FLUOR	F32T8	32	2	Electronic	120/277	56	0.89	0.22	0.99
A3	FLUOR	F32T8	32	3	Electronic	120/277	88	0.97	0.32	0.98
A3G	FLUOR	F32T8	32	3	Electronic	120/277	88	0.97	0.32	0.98
A4	FLUOR	F32T8	32	4	Electronic	120/277	106	0.87	0.39	0.98
A44	FLUOR	F32T8	32	4	Electronic	120/277	106	0.87	0.39	0.98
C2	FLUOR	F32T8	32	2	Electronic	120/277	56	0.89	0.22	0.99
DI1A	INCAN	100W A19	100	1	N/A	120	100	-	0.83	1

Luminaire Schedule										
Type	**Light Source**	**Lamp Type**	**Individual Lamp Wattage**	**Number of Lamps**	**Ballast Type**	**Operating or Input Voltage**	**Input Watts**	**Ballast Factor**	**Current @ Start and Operating**	**Power Factor @ Start and Operating**
DI2A	INCAN	150W A23	150	1	N/A	120	150	-	1.25	1
DF2F	FLUOR	F26PL	26	2	Electronic Dimming	120/277	55	1.02	0.20	0.98
DF2G	FLUOR	F42PL	42	2	Electronic Dimming	120/277	90	0.98	0.32	0.98
DH1D	MH	250W MH	250	1	Electronic	120/277	269	0.929	1.06	0.99
DH1DQ	MH	250W MH	250	1	Electronic	120/277	269	0.929	1.06	0.99
		150W QTZ MH	150	1	Electronic	120/277	164	1	0.62	0.915
E2	INCAN	150W A19	150	1	N/A	120	150	-	1.25	1
G2	FLUOR	F32T8	32	2	Electronic	120/277	56	0.89	0.22	0.99
H1	FLUOR	F32T8	32	1	Electronic	120/277	36	1.05	0.13	0.99
HDL4	MH	175W MH	175	1	Electronic	277	191	1	0.7	1
		100W QTZ	100	1	Electronic	277	107	0.935	0.41	0.98
HWB1	MH	175W MH	175	1	Electronic	277	191	1	0.7	1
HWB1Q	MH	175W MH	175	1	Electronic	277	191	1	0.7	1
		150W QTZ	150	1	Electronic	277	164	1	0.62	0.915
HWB2	MH	175W MH	175	1	Electronic	277	191	1	0.7	1
HWB2Q	MH	175W MH	175	1	Electronic	277	191	1	0.7	1
		100W QTZ	100	1	Electronic	277	107	0.935	0.41	0.98
LLB	MH	175W MH	175	1	Electronic	277	191	1	0.7	1
MSL2	FLUOR	F55T5	55	1	Electronic Dimming	120/277	24 Min/ 114Max	0.03 Min/ 1.00 Max	0.0	0.98

Luminaire Schedule										
Type	**Light Source**	**Lamp Type**	**Individual Lamp Wattage**	**Number of Lamps**	**Ballast Type**	**Operating or Input Voltage**	**Input Watts**	**Ballast Factor**	**Current @ Start and Operating**	**Power Factor @ Start and Operating**
MSL4	FLUOR	F55T5	55	2	Electronic Dimming	120/277	24 Min/ 114Max	0.03 Min/ 1.00 Max	0.0	0.98
P2	FLUOR	F32T8	32	2	Electronic	120/277	56	0.89	0.22	0.99
PFA8	FLUOR	F32T8	32	6	(2)Electronic	120/277	88	0.97	0.32	0.98
PFA12	FLUOR	F32T8	32	9	(3)Electronic	120/277	88	0.97	0.32	0.98
PFA16	FLUOR	F32T8	32	12	(4)Electronic	120/277	88	0.97	0.32	0.98
PFA20	FLUOR	F32T8	32	15	(5)Electronic	120/277	88	0.97	0.32	0.98
PFA24	FLUOR	F32T8	32	18	(6)Electronic	120/277	88	0.97	0.32	0.98
PFA36	FLUOR	F32T8	32	27	(9)Electronic	120/277	88	0.97	0.32	0.98
PLD1	FLUOR	CFQ18W PL	18	2	Electronic	277	20	1.05	0.17	0.97
SL	MH	150W CERAMIC MH	150	1	Electronic	120	167	0.898	1.44	0.99
SLA	MH	175W MH	175	1	Electronic	277	191	1	0.7	1
SLB	MH	175W MH	175	1	Electronic	277	191	1	0.7	1
SLC	MH	175W MH	175	1	Electronic	277	191	1	0.7	1
T12	INCAN	100W PAR38 FLOOD	100	6	N/A	120	100	-	0.83	1
WW2	INCAN	100W PAR SPOT	100	1	N/A	120	100	-	0.83	1
W2	FLUOR	F17T8	17	2	Electronic	120	41	1.18	0.49	0.98
WL	FLUOR	39W FLUOR	39	2	Integrated Electronic	120/277	88	1.00	0.32	0.98
WP	FLUOR	26WPL	26	1	Electronic	120/277	-	-	-	-
WP2C	MH	175W MH	175	1	Electronic	277	191	1	0.7	1

Lighting Control

Crystal Lake Elementary School meets ASHRAE/IESNA Standard 90.1 for automatic lighting shutoff by the use of occupancy sensors. Occupancy sensors are located in all classrooms, offices, conference rooms, restrooms, and storage closets. The occupancy sensors are programmed to turn lighting off within 30 minutes of an occupant leaving the space. However, the lighting may also be manually controlled by snap switches that are quiet tumbler operation types are meet NEMA performance standards. The switches are either toggle switches or key-operated. Incandescent lamps are on semiconductor dimmers.

Mechanical and Other Loads

The mechanical systems in this building typically run off of either 480V or 208V, with the exception of some fans running on 120V or 277V.

The following table lists all the equipment that is found in this educational facility that requires power. The mechanical equipment includes air handling units, fans, and pumps. The plumbing equipment includes hot water pumps, and water heaters. The kitchen equipment schedule includes all the necessary equipment for the full service kitchen within this school. The architectural equipment schedule includes the one passenger elevator in this building.

Mechanical Equipment Schedule										
Equipment Tag	Load Description	Qty.	Load	Load Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load (KVA)	Load (KW)
AHU 1-1	DUEL PATH PACKAGED AIR HANDLING UNIT	1	25	HP	34	480	3	0.95	28.25	26.84
AHU 1-1 (PRE-HEAT)	DUEL PATH PACKAGED AIR HANDLING UNIT	1	42	KW	-	480	3	1.00	-	42
AHU 1-4	DUEL PATH PACKAGED AIR HANDLING UNIT	1	25	HP	34	480	3	0.95	28.25	26.84
AHU 1-4 (PRE-HEAT)	DUEL PATH PACKAGED AIR HANDLING UNIT	1	44	KW	-	480	3	1.00	-	44
AHU 2-1	DUEL PATH PACKAGED AIR HANDLING UNIT	1	25	HP	34	480	3	0.95	28.25	26.84
AHU 2-1 (PRE-HEAT)	DUEL PATH PACKAGED AIR HANDLING UNIT	1	43	KW	-	480	3	1.00	-	43
AHU 2-2	DUEL PATH PACKAGED AIR HANDLING UNIT	1	20	HP	27	480	3	0.95	22.44	21.32
AHU 2-2 (PRE-HEAT)	DUEL PATH PACKAGED AIR HANDLING UNIT	1	44	KW	-	480	3	1.00	-	44

Mechanical Equipment Schedule										
Equipment Tag	Load Description	Qty.	Load	Load Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load (KVA)	Load (KW)
AHU 1-2	PACKAGED AIR HANDLING UNIT	1	7.5	HP	11	480	3	0.95	9.14	8.68
AHU 1-2 (PRE-HEAT)	DUEL PATH PACKAGED AIR HANDLING UNIT	1	40	KW	-	480	3	1.00	-	40
AHI 1-2 (RE-HEAT)	DUEL PATH PACKAGED AIR HANDLING UNIT	1	53	KW	-	480	3	1.00	-	53
AHU 1-3	PACKAGED AIR HANDLING UNIT	1	5	HP	7.6	480	3	0.95	6.32	6.00
AHI 1-2 (PRE-HEAT)	DUEL PATH PACKAGED AIR HANDLING UNIT	1	36	KW	-	480	3	1.00	-	36
CH-1	AIR COOLED LIQUID CHILLER SCHEDULE	9	2	HP	2.8	480	3	0.85	2.33	1.98
CH-2	AIR COOLED LIQUID CHILLER SCHEDULE	9	2	HP	2.8	480	3	0.85	2.33	1.98
FC-1	DX FAN COIL	1	0.5	HP	5.4	208	1	0.85	0.65	0.55
CU-1	SPLIT SYSTEM AIR COOLED	1	0.25	HP	3.2	208	1	0.75	0.38	0.29
EF-1	EXHAUST FAN	1	0.17	HP	4.4	120	1	0.75	0.53	0.40
EF-2	EXHAUST FAN	1	0.25	HP	5.8	120	1	0.75	0.70	0.52
EF-3	EXHAUST FAN	1	0.05	HP	4.4	120	1	0.75	0.53	0.40
EF-4	EXHAUST FAN	1	1.5	HP	6.6	208	3	0.85	2.38	2.02
EF-5	EXHAUST FAN	1	0.04	HP	1	120	1	0.75	0.12	0.09
EF-6	EXHAUST FAN	1	2	HP	7.5	208	3	0.85	2.70	2.30
EF-7	EXHAUST FAN	1	2	HP	7.5	208	3	0.85	2.70	2.30
EF-8	EXHAUST FAN	1	0.5	HP	9.8	120	1	0.85	1.18	1.00
EF-9	EXHAUST FAN	1	0.75	HP	13.8	120	1	0.85	1.66	1.41
EF-10	EXHAUST FAN	1	0.17	HP	4.4	120	1	0.75	0.53	0.40
EF-11	EXHAUST FAN	1	0.17	HP	4.4	120	1	0.75	0.53	0.40
EF-12	EXHAUST FAN	1	0.04	HP	1	120	1	0.75	0.12	0.09
EF-13	EXHAUST FAN	1	0.17	HP	4.4	120	1	0.75	0.53	0.40
FTB 1-1	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-2	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54

Mechanical Equipment Schedule										
Equipment Tag	Load Description	Qty.	Load	Load Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load (KVA)	Load (KW)
FTB 1-3	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-4	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-5	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-6	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-7	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.25	HP	2.4	277	1	0.75	0.66	0.50
FTB 1-8	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-9	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-10	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-11	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-12	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68

Mechanical Equipment Schedule										
Equipment Tag	Load Description	Qty.	Load	Load Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load (KVA)	Load (KW)
FTB 1-13	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-14	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-15	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-16	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-17	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-18	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-19	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	2	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-20	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-21	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.25	HP	1.9	480	3	0.85	1.58	1.34
FTB 1-22	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.25	HP	1.9	480	3	0.85	1.58	1.34

Mechanical Equipment Schedule										
Equipment Tag	Load Description	Qty.	Load	Load Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load (KVA)	Load (KW)
FTB 1-23	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.25	HP	2.4	277	1	0.85	0.66	0.57
FTB 1-24	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-25	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-26	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.17	HP	1.8	277	1	0.75	0.50	0.37
FTB 1-27	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-28	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-29	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.25	HP	1.9	480	3	0.75	1.58	1.18
FTB 1-30	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.25	HP	1.9	480	3	0.75	1.58	1.18
FTB 1-31	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-32	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54

Mechanical Equipment Schedule										
Equipment Tag	Load Description	Qty.	Load	Load Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load (KVA)	Load (KW)
FTB 1-33	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-34	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-35	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-36	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.25	HP	2.4	277	1	0.75	0.66	0.50
FTB 1-37	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.25	HP	1.9	480	3	0.75	1.58	1.18
FTB 1-38	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-39	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.25	HP	2.4	277	1	0.75	0.66	0.50
FTB 1-40	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 1-41	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-42	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54

Mechanical Equipment Schedule										
Equipment Tag	Load Description	Qty.	Load	Load Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load (KVA)	Load (KW)
FTB 1-43	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 1-44	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.25	HP	1.9	480	3	0.75	1.58	1.18
FTB 1-45	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.08	HP	2.4	277	1	0.75	0.66	0.50
FTB 2-1	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-2	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 2-3	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-4	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-5	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 2-6	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-7	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54

Mechanical Equipment Schedule										
Equipment Tag	Load Description	Qty.	Load	Load Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load (KVA)	Load (KW)
FTB 2-8	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-9	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-10	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-11	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-12	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	2	0.50	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-14	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.25	HP	3.8	480	3	0.75	3.16	2.37
FTB 2-15	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	2.4	277	1	0.85	0.66	0.57
FTB 2-16	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 2-17	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.8	480	3	0.85	3.16	2.68
FTB 2-18	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54

Mechanical Equipment Schedule										
Equipment Tag	Load Description	Qty.	Load	Load Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load (KVA)	Load (KW)
FTB 2-19	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-20	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-21	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-22	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-23	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-24	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-25	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-26	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 2-27	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.25	HP	2.4	480	3	0.75	1.99	1.50
FTB 2-28	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54

Mechanical Equipment Schedule										
Equipment Tag	Load Description	Qty.	Load	Load Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load (KVA)	Load (KW)
FTB 2-29	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.25	HP	2.4	480	3	0.75	1.99	1.50
FTB 2-30	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-31	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-32	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-33	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-34	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-35	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-36	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
FTB 2-37	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54
FTB 2-38	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.5	HP	3.6	480	3	0.85	2.99	2.54

Mechanical Equipment Schedule										
Equipment Tag	Load Description	Qty.	Load	Load Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load (KVA)	Load (KW)
FTB 2-39	FAN POWERED TERMINAL BOX WITH ELECTRIC HEATING COIL	1	0.75	HP	3.8	480	3	0.85	3.16	2.68
PCHP-1	PUMP	1	7.5	HP	11	480	3	0.95	9.14	8.68
PCHP-2	PUMP	1	7.5	HP	11	480	3	0.95	9.14	8.68
SCHP-1	PUMP	1	20	HP	27	480	3	0.95	22.44	21.32
SCHP-2	PUMP	1	20	HP	27	480	3	0.95	22.44	21.32
KEF-1	KITCHEN EXHAUST FAN	1	2	HP	7.5	208	3	0.85	2.70	2.30
KSF-1	KITCHEN HOOD SUPPLY FAN	1	1.5	HP	6.6	208	3	0.85	2.38	2.02
WAC-1	PACKAGED TERMINAL AIR CONDITIONER	1				120	1			

Plumbing Equipment Schedule										
Equipment Tag	Load Description	Qty.	Load	Load Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load (KVA)	Load (KW)
HWCP-1	HOT WATER CIRCULATION PUMP	1	0.25	HP	5.8	120	1	0.75	0.70	0.52
HWCP-2	HOT WATER CIRCULATION PUMP	1	0.25	HP	5.8	120	1	0.75	0.70	0.52
EWH-1	WATER HEATER	1	4.5	KW	16.2	277	1	0.95	4.49	4.50
EWH-2	WATER HEATER	1	4.5	KW	16.2	277	1	0.95	4.49	4.50
EWH-3	WATER HEATER	1	6	KW	12.5	480	1	0.95	3.46	6.00
EWH-4	WATER HEATER	1	9	KW	32.5	277	1	0.95	9.00	9.00
EWH-5	WATER HEATER	1	9	KW	32.5	277	1	0.95	9.00	9.00
EWH-6	WATER HEATER	1	4.5	KW	16.2	277	1	0.95	4.49	4.50
EWH-7	WATER HEATER	1	18	KW	21.7	480	3	0.95	18.03	18.00
EWH-8	WATER HEATER	1	4.2	KW	15	277	1	0.95	4.16	4.20

Kitchen Equipment Schedule										
Equipment Tag	Load Description	Qty.	Load	Load Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load (KVA)	Load (KW)
K-3	WALK-IN COOLER	1	13	A	13	120	1	0.95	1.56	1.48
K-4	WALK-IN FREEZER	1	13	A	13	120	1	0.95	1.56	1.48
K-5	COOLER COMPRESSOR	1	9	A	9	208	3	0.95	3.24	3.08
K-6	FREEZER COMPRESSOR	1	21	A	21	208	3	0.95	7.56	7.18
K-13	COMM. MICROWAVE	1	24	A	24	208	1	0.95	2.88	2.74
K-12	ICE MACHINE	1	17	A	17	120	1	0.95	2.04	1.94
K-18	DISPOSER	1	14	A	14	120	1	0.95	1.68	1.60
K-20	VERTICAL MIXER	1	10	A	10	208	1	0.95	1.20	1.14
K-27	SLICER	1	0.5	HP	10	120	1	0.85	1.20	1.02
K-34	CONVECTION OVEN	1	31	A	31	208	3	0.95	11.16	10.60
K-35A	INDUCTION RANGE	1	15	A	15	208	1	0.95	1.80	1.71
K-37	STEAM KETTLE	1	41	A	41	208	3	0.95	14.76	14.02
K-50	DISPOSER	1	17	A	17	120	1	0.95	2.04	1.94
K-56	ROLL-THRU REFRIGERATOR	1	10	A	10	208	3	0.95	3.60	3.42
K-57	ROLL-THRU HEAT CA	1	14	A	14	208	3	0.95	5.04	4.79
K-67	CASH REGISTER	1	3	A	3	120	1	0.95	0.36	0.34
K-77	FREEZER COIL	1	25	A	25	208	3	0.95	9.00	8.55
K-81	MILK COOLER	1	4	A	4	120	1	0.95	0.48	0.46
K-84	AIR CURTAIN	1	4	A	4	120	1	0.95	0.48	0.46
K-85	WASHER/DRYER	1	25	A	25	208	3	0.95	9.00	8.55
K-86	COOLER COIL	1	3	A	3	120	1	0.95	0.36	0.34
K-97-1	HOT FOOD SVG. CTR.	1	30	A	30	208	3	0.95	10.80	10.26
K-91-2	COLD FOOD SVG. CTR.	1	7	A	7	120	1	0.95	0.84	0.80
K-91-3	DIRECTIONAL COUNTER	1	15	A	15	120	1	0.95	1.80	1.71
K-91-4	DIRECTIONAL COUNTER	1	15	A	15	120	1	0.95	1.80	1.71
K-91-5	BEVERAGE COUNTER	1	15	A	15	120	1	0.95	1.80	1.71
K-97-1A	HOT FOOD SVG. CTR.	1	30	A	30	208	3	0.95	10.80	10.26
K-97-2A	DIRECTIONAL COUNTER	1	15	A	15	120	1	0.95	1.80	1.71
K-97-3A	BEVERAGE COUNTER	1	10	A	10	120	1	0.95	1.20	1.14
K-97-4A	COLD FOOD SVG. CTR.	1	6	A	6	120	1	0.95	0.72	0.68
K-97-5A	DIRECTIONAL COUNTER	1	15	A	15	120	1	0.95	1.80	1.71

Architectural Equipment Schedule										
Equipment Tag	**Load Description**	**Qty.**	**Load**	**Load Units**	**Motor Amps**	**Voltage**	**Phase**	**Assumed Power Factor**	**Load (KVA)**	**Load (KW)**
ELEV.	ELEVATOR	1	25	HP	34	480	3	0.95	28.25	26.84

Service Entrance Size

The following tables show three different ways to size the service entrance. The first method is for the is for the conceptual and schematic phase, where the total VA per square foot for this building type is multiplied by the total square footage of the building to get the total kVA. The second method is for the design development phase, where the various building load values from NEC are used, along with the demand factor for lighting and receptacles and power factors for plumbing and architectural equipment, to find the total kVA. The third method is for the construction document phase where the actual lighting loads from the panelboards with all loads are used along with the demand factors to determine the actual load on the building. These methods are shown in the tables below.

Service Entrance Calculations-Conceptual and Schematic Phases		
Building Square Footage	**VA/ft^2**	**VA**
108,101	11	1,189,110
	Total kVA	**1189.11 kVA**
	Total Current at 480V	**1430.28 A**

Service Entrance Calculations-Design Development					
Load Category	**Square footage**	**VA/ft²**	**Demand Factor**	**Power Factor**	**Load (kVA)**
Lighting	108,101	3[1]	100%[2]	-	324.30
Receptacles	108,101	1	First 10Kva=100%, remainder=50%[3]	-	59.05
HVAC heating	108,101	15	100%	-	1,621.52
HVAC Exhaust Fans	108,101	2	100%	-	216.20
Kitchen-Full service	2,031	20	65%[4]	-	26.40
Load Category	**Quantity**	**KW/unit**	**-**	**-**	**Load (kVA)**
Plumbing Electric Water Heaters	8	60KW	100%	0.95	505.26
Architectural Equipment Elevators	1	50KW	100%	0.95	52.63
				Total kVA	**2805.36 kVA**
				Total Current at 480V	**3374.32 A**

[1]Value from NEC Table 220.12 "General Lighting Loads by Occupancy"
[2]Value from NEC Table 220.42 "Lighting Load Demand Factors"
[3]Value from NEC Table 220.44 "Demand Factors for Non-Dwelling Receptacle Loads"
[4]Value from NEC Table 220.56 "Kitchen Equipment Demand Factors-Commercial"

Service Entrance Calculation - Working Drawings			
Load Category	**Connected Load (VA)**	**Demand Factor**	**Demand Load (VA)**
Lighting	181256	100%[1]	181256
Receptacles	111851	First 10Kva=100%, remainder=50%[2]	60925.5
HVAC heating	1289397	100%[3]	1289397
Pumps	63156	80%	50524
Fans	14520	100%	14520
Kitchen-Full Service	89760	65%[4]	58344
Electric Water Heaters	38503	100%	38503
Elevators	28254	100%	28254
Equipment	121104	65%	78717.6
Computer	168120	100%	168120
		Total kVA	**1968.56 kVA**
		Total Current at 480V	**2367.81 A**

[1]Value from NEC Table 220.12 "General Lighting Loads by Occupancy"
[2]Value from NEC Table 220.42 "Lighting Load Demand Factors"
[3]Value from NEC Table 220.51 "Fixed Electric Space Heating"
[4]Value from NEC Table 220.56 "Kitchen Equipment Demand Factors-Commercial"

Service Entrance Size – Table 1			
Phase	**Load-kVA**	**Voltage System**	**Load-Amps**
Conceptual/Schematic Design	1189.11	277/480V,3P,4W	1430.28
Design Development	2805.36	277/480V,3P,4W	3374.32
Working Drawings	1968.56	277/480V,3P,4W	2367.81
Actual Service	1801.60	277/480V,3P,4W	2167

Service Entrance Size – Table 2			
Service Entrance	**Size - Amps**	**Voltage System**	**Capacity - KVA**
Actual Conditions – Service Entrance 1	2167	277/480V,3P,4W	1801.60
Summary – VA/ft^2 (108,101 ft^2)	16.67		

When comparing all three methods of calculating a service entrance the conceptual/schematic design has the smallest load. Therefore, the VA per square foot load for an Elementary school of 11 VA/ft^2 is too low for the loads present in this building. The design development method gives the highest estimate. This is likely due to the electric water heaters being estimated at 60kW per unit, when this building does not have an electric water heater greater than 18kW, and the elevator being estimated at 50kW per unit, when this buildings elevator is 26.84kW. The working drawing method is slightly higher than the actual load. The discrepancy is likely from the electrical engineers use of NEC 220.86 optional method for schools. The actual service entrance was sized for 3000A.

Environmental Stewardship Design

Crystal Lake Elementary School is not LEED certified. However, design features were implemented to lower the building energy usage to lower its impact on the environment. This was done through the use of energy efficient lighting with low power density.

Design Issues

There were no design issues during the design or construction of Crystal Lake Elementary School.

Single Line Diagram

The single-line diagram for this building is located in Appendix A.

Section II: Communications Systems

Fire Alarm System

The fire alarm system provides notification to all persons within the building at the time of a fire emergency. The fire alarm system consists of visual strobe lights that must flash in synchronization as required by NFPA and also an audible (horn) system. There are various manual pull stations located through the building for occupants to use in case of an emergency. There is a fire alarm shut down relay to the AHUs, fans, and fire dampers are connected to this system in order to prevent the spreading of smoke throughout the building in case of an emergency. The fire alarm system is U.L. listed.

Premise Distribution Systems

The premise distribution system provides a structured cabling system throughout the building for voice (telephone), Data, Intercom and other Ethernet based systems. There are televisions equipment located in each classroom that is attached to this system for video announcements.

The premise distribution system provides the means for the public address with bell signaling system. The public address with bell signaling system is used for making public announcements, emergency addresses, and tone signaling to classrooms and public areas.

Security System

The security system for this school consists of intrusion detection system. There are sensors are all perimeter doors and windows so detect if there is an intruder and this sends a signal to the local police station.

Public Address with Bell Signaling system

This system is used for making public announcements, emergency addresses, and tone signaling to classrooms and public areas via the telephone system equipment and Premise Distribution System.

Appendix A- Single-Line Diagram

Drawings used: E501-Power Riser Diagram

Engineer: Matern Professional Engineering, inc.

File: D:\04099_E501.DWG, Layout: Layout1, By: ltm5014, Plotted: Tue Oct 26, 2010 at 5:22pm, XREFs Used: XBOR_04099 [XBOR_04099.dwg]

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VOLTS L/N: 277
VOLTS PH.: 480
PHASE : 3
MOUNTING : SURF
TYPE : QED2
MFR : SQ D

SWITCHBOARD : 1MDP

<------AIC RATING------>
SERIES RATED : 65 KA(*)
FULLY RATED : ____KA
(*)NOTE: MAY REQUIRE FULL RATING TO ACHIEVE.

COPPER BUS : NO
NEMA 3R : NO
FRONT ACCESSIBLE : YES
REAR ACCESSIBLE : NO

GENERAL NOTES:
(1) ALL C.B.'S FEEDING HVAC EQUIPMENT TO BE HACR TYPE.
(2) ALL C.B.'S FEEDING ELEV. EQUIP. TO BE SHUNT-TRIP TYPE.
(3) ALL C.B.'S FEEDING ELEV. EQUIP. TO BE SIZED AS REQUIRED BY MFR.
(4) ALL C.B.'S FEEDING HID LTG TO BE HID RATED.
(5) MODIFY DISTRIBUTION CKT. BRKRS. IN SECTION(S) AS REQUIRED TO FIT PER MFR. RECOMENDATIONS.
(6) FOR 3000 DISTRIBUTION BUS PANELS, SWAP CKT BRKRS SHOWN BELOW FROM LEFT TO RIGHT SIDE AND VISA VERSA.
(7) FRONT OF BOARD TO BE ALIGNED FOR FULL LENGTH OF BOARD.
(8) SHIP IN MULTIPLE SECTIONS TO FIT THRU DOORS, ETC.

YES NOTE: MAIN CKT BRKR TO BE ELECTRONIC SYSTEMS TYPE (SOLID STATE TYPE) WITH FULL ADJUSTABILITY.
____ NOTE: NON-LINEAR PNL, 200% NEUTRAL
____ NOTE: ISOLATED GROUND BUS
$ NOTE: SHUNT TRIP C.B.
____ NOTE: GFI C.B.
____ NOTE: RED LOCKING CB
NOTE: SIZE CB PER MANUFACTURERS RECOMMENDATION
____ NOTE:
____ NOTE:

MAIN SERVICE CALC. : YES

2831 : TOTAL AMPS A PHASE	ACTUAL CONN. LOAD :	2354	2831 AMPS
2831 : TOTAL AMPS B PHASE	NEC LOAD/DEMAND :	2236	2689 AMPS
2831 : TOTAL AMPS C PHASE	NEC DIVERSITY	1802	2167 AMPS
NONE : ERROR CODE	XFMR KVA : 0		

SECTION I (MAINS) WIDTH : 42 DEPTH : 36

MAINS:
--MAIN LUGS ONLY : 3000 AMPS
--MAIN CIRCUIT BREAKER : ______ AMPS

YES : SHUNT TRIP
YES : GROUND FAULT PROTECTION
YES : SYSTEMS TYPE MAIN CB
YES : FULL RATED THRU BUS

_____ : DRAW-OUT MOUNTED MAIN
YES : INDIVIDUALLY MOUNTED MAIN
_____ : METERS(SEE SPECS)

SWITCHBOARD : 1MDP WIDTH(IN.) : 36
DISTRIBUTION SECTION : II DEPTH(IN.) : 36

DESCRIPTION	LOAD CONN	TYPE	AMPS	AMPS	AMPS	C.B. AMPS	C.B. POLE	CKT. NO.	CKT. NO.	C.B. POLE	C.B. AMPS	AMPS	AMPS	AMPS	DESCRIPTION	LOAD CONN	TYPE
AHU1-2	64	11	64			80	3	1	2	3	90	34			AHU1-1	34	10
(RE-HEAT)	64	11		64		------	-----			-----	-----		34		-----	34	10
-----	64	11			64	------	-----			-----	-----			34	-----	34	10
SPACE	0	14	0				3	3	4	3	70	51			AHU1-1	51	11
-----	0	14		0		------	-----			-----	-----		51		(PRE-HEAT)	51	11
-----	0	14			0	------	-----			-----	-----			51	-----	51	11
SPACE	0	14	0				3	5	6	3	90	34			AHU1-4	34	10
-----	0	14		0		------	-----			-----	-----		34		-----	34	10
-----	0	14			0	------	-----			-----	-----			34	-----	34	10
PANEL 1HM1	199	14	199			250	3	7	8	3	70	53			AHU1-4	53	11
-----	199	14		199		------	-----			-----	-----		53		(PRE-HEAT)	53	11
-----	199	14			199	------	-----			-----	-----			53	-----	53	11
PANEL 1HM2	202	14	202			250	3	9	$# 10	3	90	34			ELEVATOR	34	15
-----	202	14		202		------	-----			-----	-----		34		-----	34	15
-----	202	14			202	------	-----			-----	-----			34	-----	34	15
PANEL 1HM3	264	14	264			350	3	11	12	3	200	119			PANEL 1L1	134	14
-----	264	14		264		------	-----			-----	-----		119		-----	134	14
-----	264	14			264	------	-----			-----	-----			119	-----	134	14
									14	3	200	119			PANEL 1L2	135	14
										-----	-----		119		-----	135	14
										-----	-----			119	-----	135	14
									16	3	70	27			SCHP-1	27	8
										-----	-----		27		-----	27	8
										-----	-----			27	-----	27	8
PANEL 2L1	88	14	79			150	3	13	18	3	70	27			SCHP-2	27	8
-----	88	14		79		------	-----			-----	-----		27		-----	27	8
-----	88	14			79	------	-----			-----	-----			27	-----	27	8
PANEL 2L2	85	14	74			100	3	15	20	3	30	11			PCHP-1	11	8
-----	85	14		74		------	-----			-----	-----		11		-----	11	8
-----	85	14			74	------	-----			-----	-----			11	-----	11	8
SPACE	0	14	0				3	17	22	3	30	11			PCHP-2	11	8
-----	0	14		0		------	-----			-----	-----		11		-----	11	8
-----	0	14			0	------	-----			-----	-----			0	-----	0	14
SPACE	0	14	0				3	19	24	3		0			SPACE	0	14
-----	0	14		0		------	-----			-----	-----		0		-----	0	14
-----	0	14			0	------	-----			-----	-----			0	-----	0	14
			0									0					
				0									0				
					0									0			
			0									0					
				0									0				
					0									0			

SWITCHBOARD : 1MDPIII WIDTH(IN.) : 36
DISTRIBUTION SECTION : III DEPTH(IN.) : 24

DESCRIPTION	LOAD CONN	TYPE	AMPS	AMPS	AMPS	C.B. AMPS	C.B. POLE	CKT. NO.	CKT. NO.	C.B. POLE	C.B. AMPS	AMPS	AMPS	AMPS	DESCRIPTION	LOAD CONN	TYPE
PANEL 2HM1	375	14	375			500	3	1	2	3	225	163			PANEL 1H1	163	14
-----	375	14		375		------	-----			-----	-----		163		-----	163	14
-----	375	14			375	------	-----			-----	-----			163	-----	163	14
PANEL 2HM2	311	14	311			400	3	3	4	3	125	96			PANEL 1H2	96	14
-----	311	14		311		------	-----			-----	-----		96		-----	96	14
-----	311	14			311	------	-----			-----	-----			96	-----	96	14
SPACE	0	14	0				3	5	6	3	125	98			PANEL 2H1	98	14
-----	0	14		0		------	-----			-----	-----		98		-----	98	14
-----	0	14			0	------	-----			-----	-----			98	-----	98	14
PANEL 1LK1	171	14	117			200	3	7	8	3	100	73			PANEL 2H2	73	14
-----	171	14		117		------	-----			-----	-----		73		-----	73	14
-----	171	14			117	------	-----			-----	-----			73	-----	73	14
SPACE	0	14	0				3	9	10	3	110	83			PANEL 1HQ1	96	14
-----	0	14		0		------	-----			-----	-----		83		-----	96	14
-----	0	14			0	------	-----			-----	-----			83	-----	96	14
SPACE	0	14	0				3	11	12	3		0			SPACE	0	14
-----	0	14		0		------	-----			-----	-----		0		-----	0	14
-----	0	14			0	------	-----			-----	-----			0	-----	0	14
									14	3		0			SPACE	0	14
										-----	-----		0		-----	0	14
										-----	-----			0	-----	0	14
									16	3		0			SPACE	0	14
										-----	-----		0		-----	0	14
										-----	-----			0	-----	0	14
SPACE	0	14	0				3	13	18	3		0			SPACE	0	14
-----	0	14		0		------	-----			-----	-----		0		-----	0	14
-----	0	14			0	------	-----			-----	-----			0	-----	0	14
SPACE	0	14	0				3	15	20	3		0			SPACE	0	14
-----	0	14		0		------	-----			-----	-----		0		-----	0	14
-----	0	14			0	------	-----			-----	-----			0	-----	0	14
SPACE	0	14	0				3	17	22	3		0			SPACE	0	14
-----	0	14		0		------	-----			-----	-----		0		-----	0	14
-----	0	14			0	------	-----			-----	-----			0	-----	0	14
SPACE	0	14	0				3	19	24	3		0			SPACE	0	14
-----	0	14		0		------	-----			-----	-----		0		-----	0	14
-----	0	14			0	------	-----			-----	-----			0	-----	0	14
			0						26	3		0			SPACE	0	14
				0						-----	-----		0		-----	0	14
					0					-----	-----			0	-----	0	14
			0						# 28	3	30	0			SURGE SUPP		
				0						-----	-----		0		-----		
					0					-----	-----			0	-----		

FEEDERS FOR : 2007-007 SCPS - NEW MIDWAY ELEMENTARY Apr 19, 2005 REVISED MPE, INC COPYWRITE 3/23/90 10/20/04 SCA

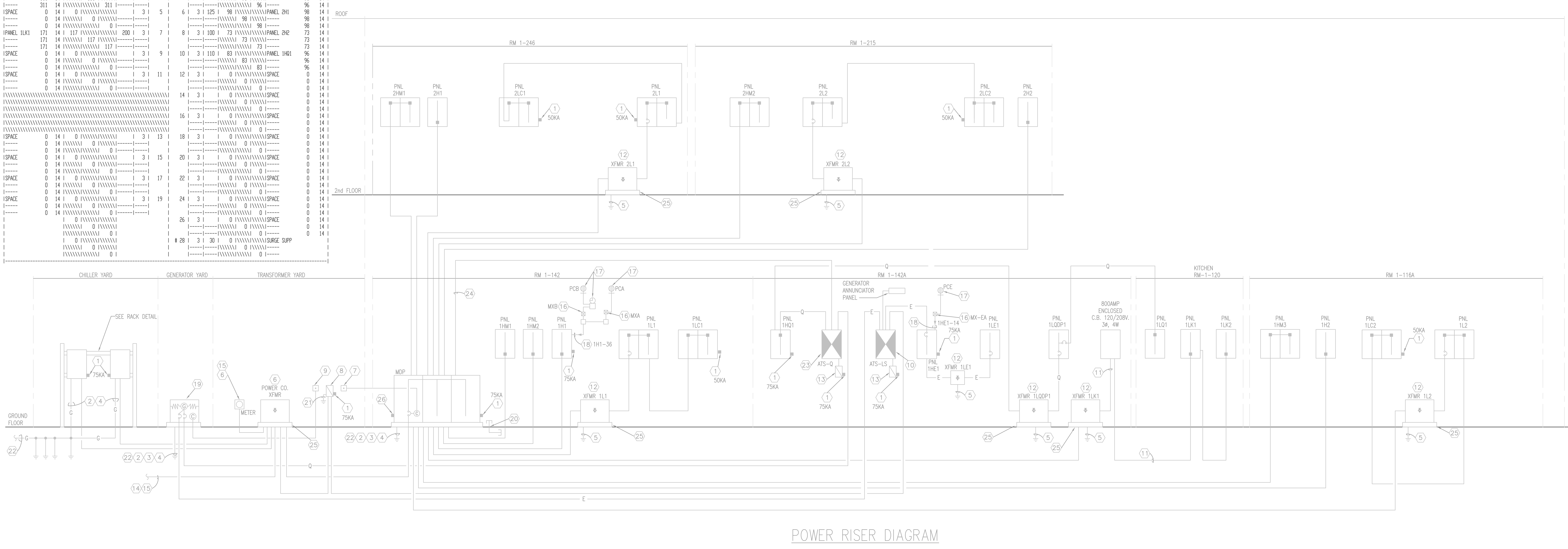
FEEDER FEEDING	CKT BRKR/FUSE AMP SIZE	VOLTS	FEEDER AMPS	FEEDER VOLT DROP %	WIRE/ PHASE	NEUT WIRE	GROUND WIRE(CU)	ISO GND OR XTRA NEUT	FEEDER MATERIAL	PARALLEL RUNS	CONDUIT SIZE(IN.)	SHORT CKT AMPS @ PANEL
1MDP	3000	480	3040	0.30	#500 MCM	#500 MCM	#3/0	-----	COPPER	8	3.50	45,228
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
1HM1	250	480	255	0.48	#250 MCM	#250 MCM	#4	-----	COPPER	1	2.50	33,284
1HM2	250	480	255	0.48	#250 MCM	#250 MCM	#4	-----	COPPER	1	2.50	33,284
1H1	225	480	232	0.46	#250 MCM	#250 MCM	#4	-----	COPPER	1	2.50	33,284
1L1	450	208	460	0.69	#4/0	#4/0	#1/0	-----	COPPER	2	2.50	5,622
XFMR PRI	200	480	200	0.55	#3/0	-----	#6	-----	COPPER	1	2.00	27,967
1LC1	175	208	180	0.81	#3/0	#4/0	#6	#4/0	COPPER	1	2.50	5,516
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
1LK1	450	208	460	2.07	#4/0	#4/0	#1/0	-----	COPPER	2	2.50	5,178
XFMR PRI	200	480	200	0.58	#3/0	-----	#6	-----	COPPER	1	2.00	26,694
1LK2	150	208	150	3.25	#1/0	#1/0	#6	-----	COPPER	1	2.00	4,330
1HM3	350	480	380	1.72	#500 MCM	#500 MCM	#3	-----	COPPER	1	3.50	14,890
1H2	125	480	136	1.63	#1/0	#1/0	#6	-----	COPPER	1	2.00	7,130
1L2	450	208	460	1.97	#4/0	#4/0	#1/0	-----	COPPER	2	2.50	4,787
XFMR PRI	200	480	200	1.84	#3/0	-----	#6	-----	COPPER	1	2.00	9,311
1LC2	175	208	180	2.10	#3/0	#4/0	#6	#4/0	COPPER	1	2.50	4,710
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
2HM1	500	480	510	1.20	#250 MCM	#250 MCM	#2	-----	COPPER	2	2.50	23,840
2H1	125	480	136	1.10	#1/0	#1/0	#6	-----	COPPER	1	2.00	10,753
2L1	350	208	360	1.39	#3/0	#3/0	#2	-----	COPPER	2	2.00	4,584
XFMR PRI	150	480	150	1.26	#1/0	-----	#6	-----	COPPER	1	1.50	10,753
2LC1	125	208	136	1.51	#1/0	#1/0	#6	#1/0	COPPER	1	2.00	4,487
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
2HM2	400	480	400	2.45	#3/0	#3/0	#3	-----	COPPER	2	2.00	12,223
2H2	100	480	110	2.19	#1	#1	#8	-----	COPPER	1	1.50	4,314
2L2	225	208	232	2.31	#250 MCM	#250 MCM	#2	#250 MCM	COPPER	1	3.00	2,620
XFMR PRI	100	480	110	2.19	#1	-----	#8	-----	COPPER	1	1.25	4,314
2LC2	125	208	136	2.44	#1/0	#1/0	#6	#1/0	COPPER	1	2.00	2,588
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A

NOTES:
1) CONDUIT SIZE IS BASED ON 2002 N.E.C. FOR EMT, IMC, RMC, FLEXIBLE METAL, AND SCHED 40 PVC. AND IF ANY OTHER TYPE OF CONDUIT/TUBING IS USED CONTRACTOR SHALL RESIZE CONDUIT/SIZE AS REQUIRED TO COMPLY WITH THE N.E.C..
2) USE CABLE REDUCERS AT TERMINATIONS AS REQUIRED TO COORDINATE OVERSIZED PHASE OR NEUTRAL CONDUCTORS WITH TERMINATION LUG SIZE OR PROVIDE TERMINATION/LUGS SIZED FOR FEEDERS.
3) CONTRACTOR IS TO MEGGER TEST ALL FEEDERS PER SPECIFICATIONS.

FEEDERS FOR : 2004-007 SCPS - NEW MIDWAY ELEMENTARY Apr 12, 2005 REVISED MPE, INC COPYWRITE 3/23/90 10/20/04 SCA

FEEDER FEEDING	CKT BRKR/FUSE AMP SIZE	VOLTS	FEEDER AMPS	FEEDER VOLT DROP %	WIRE/ PHASE	NEUT WIRE	GROUND WIRE(CU)	ISO GND OR XTRA NEUT	FEEDER MATERIAL	PARALLEL RUNS	CONDUIT SIZE(IN.)	SHORT CKT AMPS @ PANEL
EMERG DISC	60	480	70	0.35	#4	#4	#10	-----	COPPER	1	1.25	11,782
ATS-LS(NORM)	60	480	70	0.35	#4	#4	#10	-----	COPPER	1	1.25	11,628
ATS-LS(EMERG)	60	480	70	0.12	#4	#4	#10	-----	COPPER	1	1.25	8,244
1EH1	60	480	70	0.06	#4	#4	#10	-----	COPPER	1	1.25	30,526
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
1LE1	90	208	95	0.13	#2	#2	#8	-----	COPPER	1	1.25	1,430
XFMR PRI	40	480	40	0.18	#8	-----	#10	-----	COPPER	1	0.75	13,807
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
ATS-Q(NORM)	110	480	115	0.32	#2	#2	#6	-----	COPPER	1	1.50	18,318
ATS-Q(GEN)	110	480	115	0.43	#2	#2	#6	-----	COPPER	1	1.50	6,978
1HQ1	110	480	115	0.07	#2	#2	#6	-----	COPPER	1	1.50	34,097
1LQDP1	225	208	230	0.07	#4/0	#4/0	#2	-----	COPPER	1	2.50	3,437
XFMR PRI	100	480	110	0.03	#1	-----	#8	-----	COPPER	1	1.25	39,832
1LQ1	150	208	150	1.91	#1/0	#1/0	#6	-----	COPPER	1	2.00	2,838
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A
-----	-----	-----	-----	-----	-----	-----	-----	-----	COPPER	-----	-----	N/A

NOTES:
1) CONDUIT SIZE IS BASED ON 2002 N.E.C. FOR EMT, IMC, RMC, FLEXIBLE METAL, AND SCHED 40 PVC. AND IF ANY OTHER TYPE OF CONDUIT/TUBING IS USED CONTRACTOR SHALL RESIZE CONDUIT/SIZE AS REQUIRED TO COMPLY WITH THE N.E.C..
2) USE CABLE REDUCERS AT TERMINATIONS AS REQUIRED TO COORDINATE OVERSIZED PHASE OR NEUTRAL CONDUCTORS WITH TERMINATION LUG SIZE OR PROVIDE TERMINATION/LUGS SIZED FOR FEEDERS.
3) CONTRACTOR IS TO MEGGER TEST ALL FEEDERS PER SPECIFICATIONS.



POWER RISER DIAGRAM

N.T.S.

GENERAL NOTES
1) REFER TO GENERAL NOTES ON SHEET 'E0.01'.
2) REFER TO SPECIFICATIONS.

HEX NOTES
1. SURGE SUPPRESSION PER SPECIFICATION.
2. #3/0 CU GROUND WIRE TO (3) 5/8" X 30'-0" MIN. GROUND RODS.
3. #3/0 CU GROUND WIRE TO BUILDING STEEL.
4. #3/0 CU GROUND WIRE TO METAL COLD WATER PIPING.
5. COPPER GROUND WIRE TO BUILDING STEEL OR METAL COLD WATER PIPING PER N.E.C..
6. COORDINATE EXACT METER REQUIREMENTS WITH UTILITY COMPANY AND INCLUDE ALL ELECTRICAL AS REQUIRED IN BID.
7. SHUNT TRIP PUSHBUTTON FOR MDP. LABEL "NORMAL POWER DISCONNECT SWITCH".
8. 600V, 100AMP, 3P, S/N, N-3R SERVICE RATED DISCONNECT SWITCH WITH 70AMP FUSES. LABEL "EMERGENCY SERVICE DISCONNECT SWITCH". SWITCH SHALL BE PAINTED RED.
9. SHUNT TRIP PUSHBUTTON FOR GENERATOR SHUT-DOWN. LABEL "GENERATOR SHUT OFF SWITCH".
10. AUTOMATIC TRANSFER SWITCH, 70 AMP, 277/480V., 3 PHASE, 4 WIRE, 4 POLE.
11. (2) RUNS OF 4 # 4/0, 1 # 2 GND., 2 1/2"C.
12. STEP-DOWN TRANSFORMER, 480VOLT, 3 PHASE PRIMARY, 120/208V., 3 PHASE, 4 WIRE SECONDARY. KVA AS CALLED FOR ON RESPECTIVE PANEL SCHEDULE.
13. 600V, 30AMP, 3P, S/N, N-1 DISCONNECT SWITCH WITH 30AMP FUSES. CONNECT SURGE SUPPRESSION VIA DISCONNECT TO EMERGENCY POWER TERMINALS OF TRANSFER SWITCH.
14. PRIMARY CONDUIT AND WIRE FURNISHED BY LOCAL UTILITY COMPANY. CONTRACTOR SHALL PROVIDE TRENCH AND INSTALLATIONS OF 4" CONDUITS(S). UTILITY COMPANY TO INSTALL WIRE.
15. COORDINATE ALL WORK WITH LOCAL UTILITY COMPANY PRIOR TO BID AND PROVIDE ALL ELECTRICAL AS REQUIRED.
16. LIGHTING CONTACTOR, QUANTITY AND POLES AS REQUIRED FOR NUMBER OF CIRCUITS BEING CONTROLLED. REFER TO DETAILS.
17. PHOTOCELL, MOUNT AS HIGH AS POSSIBLE FACING NORTH. REFER TO DETAILS.
18. 277V. CONTROL CIRCUIT CONNECT TO ALL PC'S, MX'S, TC'S, ETC.
19. 277/280V. GENERATOR RATED 125KW/156KVA FOR STANDBY OPERATION. GENERATOR SHALL HAVE (2) CIRCUIT BREAKERS. 70AMP, 3 POLE FOR LIFE SAFETY BRANCH AND 125AMP, 3POLE FOR EQUIPMENT BRANCH.
20. STUB-OUT OF BUILDING FOR FUTURE PORTABLES (6) 2"C., CAP AND MARK.
21. #2 CU GROUND WIRE TO SERVICE GROUND.
22. #3/0 CU GROUND TO #4/0 TINNED COPPER GROUND RING AROUND BUILDING.
23. AUTOMATIC TRANSFER SWITCH, 125AMP, 277/480VOLT, 3 PHASE, 4 WIRE, 4 POLE.
24. THIS FEEDER MUST INCLUDE A MINIMUM OF 50 LINEAR FEET OF EMT CONDUIT TO LIMIT THE AVAILABLE FAULT CURRENT AT THE TRANSFER SWITCH.
25. PROVIDE CONCRETE PAD.
26. LIGHTNING ARRESTOR.

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ENG. BUS. No. EB-0005096
CERT. OF AUTH. No. 5096
130 Candace Drive
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PHONE (407) 740-5020
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MPE JOB #: 2004-099

ADRIAN BAUS
P.E.# 52580

Elementary School "L"

Seminole County School Board
Seminole County, Florida

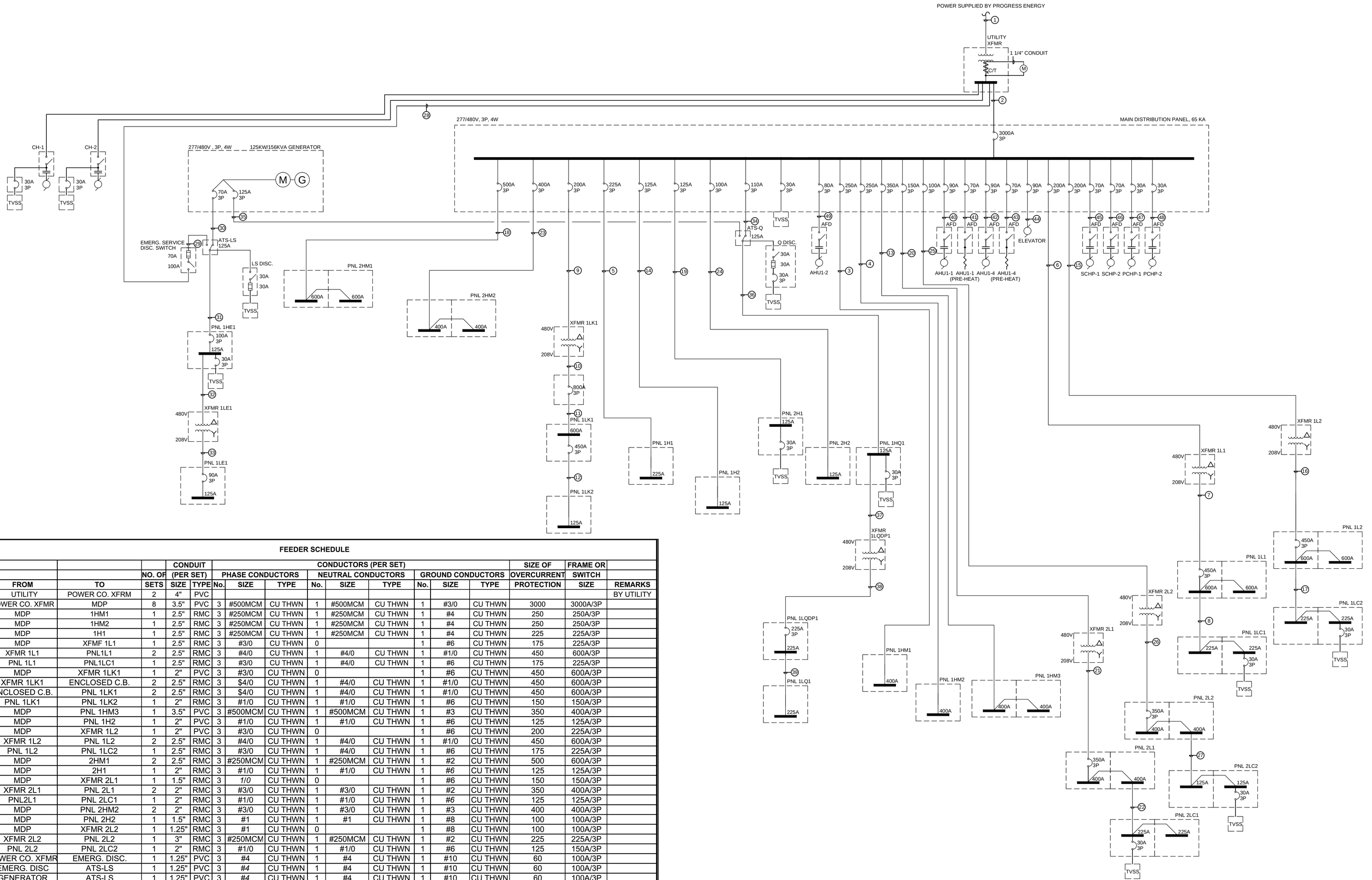
revisions:

drawn: JSE/MAT
checked: AWB
date: 04/19/05
comm. no.: 0420170

POWER RISER DIAGRAM - FEED SCHEDULES

E501

100% CD Submittal



FEEDER SCHEDULE																	
				CONDUIT		CONDUCTORS (PER SET)									SIZE OF	FRAME OR	
			NO. OF	(PER SET)		PHASE CONDUCTORS			NEUTRAL CONDUCTORS			GROUND CONDUCTORS			OVERCURRENT	SWITCH	
TAG	FROM	TO	SETS	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	PROTECTION	SIZE	REMARKS
1	UTILITY	POWER CO. XFRM	2	4"	PVC												BY UTILITY
2	POWER CO. XFMR	MDP	8	3.5"	PVC	3	#500MCM	CU THWN	1	#500MCM	CU THWN	1	#3/0	CU THWN	3000	3000A/3P	
3	MDP	1HM1	1	2.5"	RMC	3	#250MCM	CU THWN	1	#250MCM	CU THWN	1	#4	CU THWN	250	250A/3P	
4	MDP	1HM2	1	2.5"	RMC	3	#250MCM	CU THWN	1	#250MCM	CU THWN	1	#4	CU THWN	250	250A/3P	
5	MDP	1H1	1	2.5"	RMC	3	#250MCM	CU THWN	1	#250MCM	CU THWN	1	#4	CU THWN	225	225A/3P	
6	MDP	XFMF 1L1	1	2.5"	RMC	3	#3/0	CU THWN	0			1	#6	CU THWN	175	225A/3P	
7	XFMR 1L1	PNL1L1	2	2.5"	RMC	3	#4/0	CU THWN	1	#4/0	CU THWN	1	#1/0	CU THWN	450	600A/3P	
8	PNL 1L1	PNL1LC1	1	2.5"	RMC	3	#3/0	CU THWN	1	#4/0	CU THWN	1	#6	CU THWN	175	225A/3P	
9	MDP	XFMR 1LK1	1	2"	PVC	3	#3/0	CU THWN	0			1	#6	CU THWN	450	600A/3P	
10	XFMR 1LK1	ENCLOSED C.B.	2	2.5"	RMC	3	$4/0	CU THWN	1	#4/0	CU THWN	1	#1/0	CU THWN	450	600A/3P	
11	ENCLOSED C.B.	PNL 1LK1	2	2.5"	RMC	3	$4/0	CU THWN	1	#4/0	CU THWN	1	#1/0	CU THWN	450	600A/3P	
12	PNL 1LK1	PNL 1LK2	1	2"	RMC	3	#1/0	CU THWN	1	#1/0	CU THWN	1	#6	CU THWN	150	150A/3P	
13	MDP	PNL 1HM3	1	3.5"	PVC	3	#500MCM	CU THWN	1	#500MCM	CU THWN	1	#3	CU THWN	350	400A/3P	
14	MDP	PNL 1H2	1	2"	PVC	3	#1/0	CU THWN	1	#1/0	CU THWN	1	#6	CU THWN	125	125A/3P	
15	MDP	XFMR 1L2	1	2"	PVC	3	#3/0	CU THWN	0			1	#6	CU THWN	200	225A/3P	
16	XFMR 1L2	PNL 1L2	2	2.5"	RMC	3	#4/0	CU THWN	1	#4/0	CU THWN	1	#1/0	CU THWN	450	600A/3P	
17	PNL 1L2	PNL 1LC2	1	2.5"	RMC	3	#3/0	CU THWN	1	#4/0	CU THWN	1	#6	CU THWN	175	225A/3P	
18	MDP	2HM1	2	2.5"	RMC	3	#250MCM	CU THWN	1	#250MCM	CU THWN	1	#2	CU THWN	500	600A/3P	
19	MDP	2H1	1	2"	RMC	3	#1/0	CU THWN	1	#1/0	CU THWN	1	#6	CU THWN	125	125A/3P	
20	MDP	XFMR 2L1	1	1.5"	RMC	3	*1/0*	CU THWN	0			1	#6	CU THWN	150	150A/3P	
21	XFMR 2L1	PNL 2L1	2	2"	RMC	3	#3/0	CU THWN	1	#3/0	CU THWN	1	#2	CU THWN	350	400A/3P	
22	PNL2L1	PNL 2LC1	1	2"	RMC	3	#1/0	CU THWN	1	#1/0	CU THWN	1	#6	CU THWN	125	125A/3P	
23	MDP	PNL 2HM2	2	2"	RMC	3	#3/0	CU THWN	1	#3/0	CU THWN	1	#3	CU THWN	400	400A/3P	
24	MDP	PNL 2H2	1	1.5"	RMC	3	#1	CU THWN	1	#1	CU THWN	1	#8	CU THWN	100	100A/3P	
25	MDP	XFMR 2L2	1	1.25"	RMC	3	#1	CU THWN	0			1	#8	CU THWN	100	100A/3P	
26	XFMR 2L2	PNL 2L2	1	3"	RMC	3	#250MCM	CU THWN	1	#250MCM	CU THWN	1	#2	CU THWN	225	225A/3P	
27	PNL 2L2	PNL 2LC2	1	2"	RMC	3	#1/0	CU THWN	1	#1/0	CU THWN	1	#6	CU THWN	125	150A/3P	
28	POWER CO. XFMR	EMERG. DISC.	1	1.25"	PVC	3	#4	CU THWN	1	#4	CU THWN	1	#10	CU THWN	60	100A/3P	
29	EMERG. DISC	ATS-LS	1	1.25"	PVC	3	*#4*	CU THWN	1	#4	CU THWN	1	#10	CU THWN	60	100A/3P	
30	GENERATOR	ATS-LS	1	1.25"	PVC	3	*#4*	CU THWN	1	#4	CU THWN	1	#10	CU THWN	60	100A/3P	
31	ATS-LS	PNL 1HE1	1	1.25"	RMC	3	*#4*	CU THWN	1	#4	CU THWN	1	#10	CU THWN	60	100A/3P	
32	PNL 1HE1	XFMR 1LE1	1	0.75"	RMC	3	*#8*	CU THWN	0			1	#10	CU THWN	40	100A/3P	
33	XFMR 1LE1	PNL 1LE1	1	1.25"	RMC	3	#2	CU THWN	1	#2	CU THWN	1	#8	CU THWN	90	100A/3P	
34	MDP	ATS-Q	1	1.5"	RMC	3	#2	CU THWN	1	#2	CU THWN	1	#6	CU THWN	110	125A/3P	
35	GENERATOR	ATS-Q	1	1.5"	PVC	3	#2	CU THWN	1	#2	CU THWN	1	#6	CU THWN	110	125A/3P	
36	ATS-Q	PNL 1HQ1	1	1.5"	RMC	3	#2	CU THWN	1	#2	CU THWN	1	#6	CU THWN	110	125A/3P	
37	PNL 1HQ1	XFMR 1LQDP1	1	1.25"	RMC	3	#1	CU THWN	0			1	#8	CU THWN	100	100A/3P	
38	XFMR 1LQDP1	PNL 1LQDP1	1	2.5"	RMC	3	#4/0	CU THWN	1	#4/0	CU THWN	1	#2	CU THWN	225	225A/3P	
39	PNL 1LQDP1	PNL 1LQ1	1	2.5"	RMC	3	#1/0	CU THWN	1	#1/0	CU THWN	1	#6	CU THWN	150	150A/3P	
40	MDP	AHU 1-1	1	0.75"	PVC	3	#6	CU THWN	0			1	#8	CU THWN	90	100A/3P	
41	MDP	AHU 1-1 (PRE-HEAT)	1	1"	PVC	3	#4	CU THWN	0			1	#8	CU THWN	70	100A/3P	
42	MDP	AHU 1-4	1	0.75"	PVC	3	#6	CU THWN	0			1	#8	CU THWN	90	100A/3P	
43	MDP	AHU 1-4 (PRE-HEAT)	1	1"	PVC	3	#4	CU THWN	0			1	#8	CU THWN	70	100A/3P	
44	MDP	ELEVATOR	1	1"	PVC	3	#4	CU THWN	0			1	#8	CU THWN	70	100A/3P	
45	MDP	SCHP-1	1	0.75"	PVC	3	#8	CU THWN	0			1	#8	CU THWN	70	100A/3P	
46	MDP	SCHP-2	1	0.75"	PVC	3	#8	CU THWN	0			1	#8	CU THWN	70	100A/3P	
47	MDP	PCHP-1	1	0.75"	PVC	3	#12	CU THWN	0			1	#12	CU THWN	30	100A/3P	
48	MDP	PCHP-2	1	0.75"	PVC	3	#12	CU THWN	0			1	#12	CU THWN	30	100A/3P	
49	MDP	AHU 1-2	1	0.75"	PVC	3	#12	CU THWN	0			1	*#12*	CU THWN	30	100A/3P	

NOTES:
1. REFER TO RISER DIAGRAM FOR FEEDER TAGS
2. ADD OTHER PROJECT NOTES HERE

AL=ALUMINUM
CU=COPPER

CRYSTAL LAKE ELEMENTARY SCHOOL

SEMINOLE COUNTY SCHOOL BOARD
LAKE MARY, FL

DATE: 10/20/2010

DRAWN BY:

LEAH MATERN

AE 481-SENIOR THESIS

Single Line Diagram

E502

Appendix B- High Intensity Discharge Lamp/Ballast Combination

Luminaire Tag: **DH1D, DH1DQ**
Lamp: **250W Metal Halide**
Ballast: **Electronic**

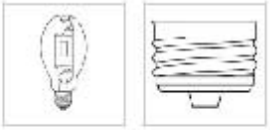
GE Lighting

48432 - CMH250/C/V/PA/O

GE Protected ConstantColor® PulseArc® CMH® Ceramic Metal Halide ED28

a product of ecomagination

High Color Rendering



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.

GRAPHS & CHARTS

Spectral Power Distribution

GENERAL CHARACTERISTICS

Lamp Type	High Intensity Discharge - Ceramic Metal Halide
Bulb	ED28
Base	Mogul Screw (EX39)
Bulb Finish	Coated
Wattage	250
Rated Life	20000 hrs
Bulb Material	Hard glass
Lamp Enclosure Type (LET)	Open or enclosed fixtures
Base Temperature	210 °C
Bulb Temperature	
LEED-EB MR Credit	56 picograms Hg per mean lumen hour

PHOTOMETRIC CHARACTERISTICS

Initial Lumens	22000
Mean Lumens	17600
Nominal Initial Lumens per Watt	88
Color Temperature	4100 K
Color Rendering Index (CRI)	90
Effective Arc Length	0.63 in

ELECTRICAL CHARACTERISTICS

Burn Position	Vertical base up +/- 15° or vertical base down +/- 15°
Warm Up Time to 90%	3 min
Warm Up Time to 90% (MAX)	3 min
Hot Restart Time to 90%	20 min
Hot Restart Time to 90% (MAX)	20 min

DIMENSIONS

Maximum Overall Length (MOL)	8.3100 in(211.1 mm)
Nominal Length	8.070 in(205.0 mm)
Bulb Diameter (DIA)	3.500 in(88.9 mm)
Bulb Diameter (DIA) (MAX)	3.500 in(88.9 mm)
Light Center Length (LCL)	5.000 in(127.0 mm)

PRODUCT INFORMATION

Product Code	48432
Description	CMH250/C/V/PA/O
ANSI Code	No CMH250 ANSI code
Standard Package	Case
Standard Package GTIN	10043168484326
Standard Package Quantity	12
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	12
UPC	043168484329

For additional information, visit www.gelighting.com

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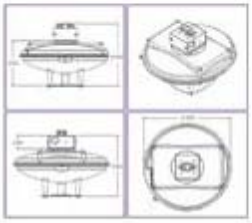
Luminaire Tag: **DH1D, DH1DQ**
Lamp: **250W Metal Halide**
Ballast: **Electronic**

GE Lighting

29377 - GE-MH-250-400-MA

GE HID UltraMax™ eHID Electronic Low Frequency Ballast

- High efficiency electronic ballast provides 45% less ballast losses compared to electromagnetic CWA ballasts
- Improves lumen maintenance by 10 points on pulse start lamps.
- Multi-Voltage Technology handles voltage from 208 to 277V
- Multi-Wattage operates 250W, 300W, 320W, 350W and 400W pulse start and ceramic metal halide lamps.
- Superior low frequency square wave frequency design maximizes performance and life of ceramic metal halide lamps.



GENERAL CHARACTERISTICS

Application	1- 250 to 400w UltraMax HID Electronic 208-277 50-60Hz
Category	High Intensity Discharge
Ballast Type	Electronic - Low Frequency
Line Voltage Regulation (+/-)	10 %
Ambient Temperature (MAX)	130 °F(54 °C)
Ballast Factor	Normal
Power Factor Correction	Active
Circuit Type	Electronic
Sound Rating	D (37-42 decibels)
Enclosure Type	Metal
Additional Info	Thermally protected

PRODUCT INFORMATION

Product Code	29377
Description	GE-MH-250-400-MA
Standard Package	Case
Standard Package GTIN	10043168293775
Standard Package Quantity	1
Sales Unit	Standard Pack
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	1
UPC	043168293778

DIMENSIONS

Case dimensions	
Length (L)	14.9 In(378.66 mm)
Width (W)	14.9 In(378.66 mm)
Height (H)	9.4 In(237.79 mm)
Mounting dimensions	
Bracket Length (BL)	6.5 In(165.10 mm)
Weight	10.2 lb
Exit Type	Bottom

Lead lengths	Qty	Exit	Length (± 1 In.)
Yellow	2	Bottom	9.0 (229mm)
White	1	Bottom	9.0 (229mm)
Red	1	Bottom	10.0 (254mm)
Green	1	Bottom	9.0 (229mm)
Brown	1	Bottom	10.0 (254mm)
Black	1	Bottom	9.0 (229mm)
Black	1	Bottom	9.0 (229mm)
Brown	1	Bottom	10.0 (254mm)
Green	1	Bottom	9.0 (229mm)
Red	1	Bottom	10.0 (254mm)
White	1	Bottom	9.0 (229mm)
Yellow	2	Bottom	9.0 (229mm)

ELECTRICAL CHARACTERISTICS

Lamp Operating Frequency	75 Hz
Supply Current Frequency	50 Hz/60 Hz

SAFETY & PERFORMANCE

- cUL Listed
- FCC - CLASS A Non-Consumer
- UL Class P
- UL Listed
- UL Type 1 Outdoor
- UL Type HL

SPECIFICATIONS BY LAMP & LINE VOLTAGE

Lamp	# of Lamps	Specifications by Line Voltage	System Wattage	Nominal Current	Ballast Factor	Ballast Efficiency	Max.Input Current	Starting Current	Open Circuit Voltage	Drop Out Voltage	Power factor	Min.starting temperature	Fuse rating	UL bench top rise
No CMH4(ANSI code	1	208	431.0	2.23A		0.928					0.99	-20.0°F		
No CMH4(ANSI code	1	240	431.0	1.92A		0.928					0.99	-20.0°F		
No CMH4(ANSI code	1	277	428.0	1.65A		0.935					0.99	-20.0°F		

For additional information, visit www.gelighting.com

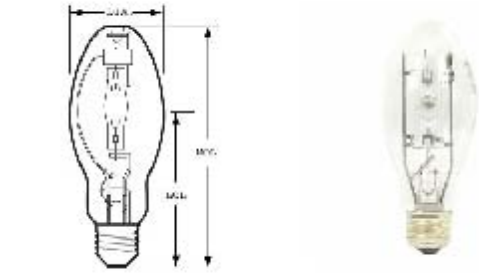
Page 1

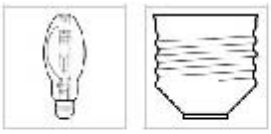
Luminaire Tag: **DH1DQ, HWB1Q**
Lamp: **150W QTZ Metal Halide**
Ballast: **Electronic**

GE Lighting

12598 - MVR150/U/MED

GE Multi-Vapor® PulseArc® Quartz Metal Halide BD17





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/urburna.html

Caution

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

Warning

- Risk of Fire
  - Keep combustible materials away from lamp.
  - Use in fixture rated for this product.
- Risk of Burn
  - Allow lamp to cool before handling.
  - Do not turn on lamp until fully installed.
- Unexpected lamp rupture may cause injury, fire, or property damage
  - Do not exceed rated voltage.
  - Do not turn on lamp until fully installed.
  - Do not use 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.
  - Turn lamp off at least once for 15 minutes per week.
  - Use in enclosed fixture rated for this product.
  - Use only properly rated ballast.
- A damaged lamp emits UV radiation which may cause eye/skin injury
  - Turn power off if glass bulb is broken. Remove and dispose of lamp.
- Risk of Electric Shock
  - Do not use where directly exposed to water or outdoors without an enclosed fixture.
  - Turn power off before inspection, installation or removal.

GRAPHS & CHARTS

Spectral Power Distribution

GENERAL CHARACTERISTICS

Lamp Type	High Intensity Discharge - Quartz Metal Halide
Bulb	BD17
Base	Medium Screw (E26)
Bulb Finish	Clear
Wattage	150
Rated Life	15000 hrs
Bulb Material	Hard glass
Lamp Enclosure Type (LET)	Enclosed fixtures only
Base Temperature	210 °C
Bulb Temperature (MAX)	400 °C
LEED-EB MR Credit	69 picograms Hg per mean lumen hour

PHOTOMETRIC CHARACTERISTICS

Initial Lumens	14000
Mean Lumens	10500
Nominal Initial Lumens per Watt	93
Color Temperature	4300 K
Color Rendering Index (CRI)	65

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% (MIN)	10 min
Hot Restart Time to 90% (MAX)	15 min

DIMENSIONS

Maximum Overall Length (MOL)	5.4300 in(137.9 mm)
Bulb Diameter (DIA)	2.125 in(54.0 mm)
Bulb Diameter (DIA) (MAX)	2.125 in(54.0 mm)
Light Center Length (LCL)	3.430 in(87.1 mm)

PRODUCT INFORMATION

Product Code	12598
Description	MVR150/U/MED
ANSI Code	M102
Standard Package	Case
Standard Package GTIN	10043168125984
Standard Package Quantity	6
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	6
UPC	043168125967

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For additional information, visit www.gelighting.com

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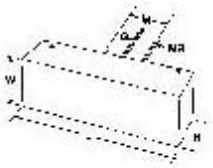
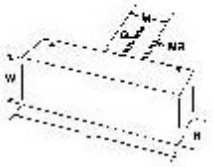
Luminaire Tag: **DH1DQ, HWB1Q**
Lamp: **150W QTZ Metal Halide**
Ballast: **Electronic**

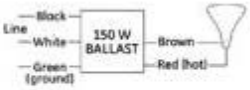
GE Lighting

87576 - GEMH150-SLJ-MV

GE HID UltraMax™ eHID Electronic Low Frequency Ballast







GENERAL CHARACTERISTICS

Category	High Intensity Discharge
Ballast Type	Electronic - Low Frequency
Line Voltage Regulation (+/-)	10 %
Ambient Temperature (MAX)	55 °C(13 °C)
Case Temperature	85 °C(185 °F)
Ballast Factor	Normal
Sound Rating	A (20-24 decibels)
Enclosure Type	Metal
Distance to Lamp	8 ft
Additional Info	End of Life Protection (EOL)/ Thermally protected

PRODUCT INFORMATION

Product Code	87576
Description	GEMH150-SLJ-MV
Standard Package	Case
Standard Package GTIN	10043168875766
Standard Package Quantity	10
Sales Unit	Case
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	10
UPC	043168875769

DIMENSIONS

Case dimensions	
Length (L)	7.3 In(184.91 mm)
Width (W)	2.6 In(65.53 mm)
Height (H)	2.2 In(55.88 mm)
Mounting dimensions	
Mount Length (M)	0.4 In(10.92 mm)
Weight	0.38 lb
Exit Type	Bottom Leads with Studs
Remote Mounting Distance to Lamp	8 ft
Remote Mounting Wire Gauge	18 AWG

Lead lengths	Qty	Exit	Length (± 1 In.)
Black	1	Left	10.0 (254mm)
Brown	1	Right	10.0 (254mm)
Red	1	Right	10.0 (254mm)
White	1	Left	10.0 (254mm)

ELECTRICAL CHARACTERISTICS

Lamp Operating Frequency	130 Hz

SAFETY & PERFORMANCE

- ANSI - C62.41
- cUL Listed
- FCC - CLASS A Non-Consumer
- UL Type 1 Outdoor
- RoHs Compliant
- UL 1029 Listed
- Suitable for recessed use

SPECIFICATIONS BY LAMP & LINE VOLTAGE

Lamp	# of Lamps	Specifications by Line Voltage	System Wattage	Nominal Current	Ballast Factor	Ballast Efficiency	Max.Input Current	Starting Current	Open Circuit Voltage	Drop Out Voltage	Power factor	Min.starting temperature	Fuse rating	UL bench top rise
M142	1	120	167.0	1.44A	1	0.898				96V	0.99	0.0°F	3	
M142	1	277	164.0	0.62A	1	0.915				96V	0.99	0.0°F	3	
M102	1	120	167.0	1.44A	1	0.898				96V	0.99	0.0°F	3	
M102	1	277	164.0	0.62A	1	0.915				96V	0.99	0.0°F	3	
C142	1	120	167.0	1.44A	1					96V	0.99	0.0°F	3	
C142	1	277	164.0	0.62A	1					96V	0.99	0.0°F	3	

NOTES

- 200C rated lead wires
- Do not connect brown or red wires to ground

WARRANTY INFORMATION

GE Lighting warrants to the purchaser that each ballast will be free from defects in material or workmanship for period as defined in the attached documents from the date of manufacture when properly installed and under normal conditions of use.

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For additional information, visit www.gelighting.com

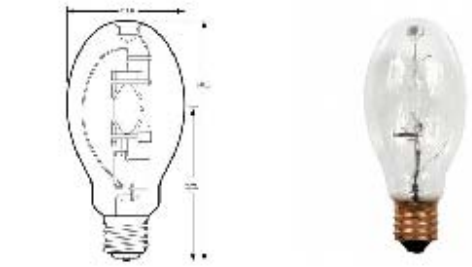
Page 1

Luminaire Tag: **HDL4, HWB1, HWB1Q, HWB2, BWB21, LLB, SLA, SLB, SLC, WP2C**
Lamp: **175W Metal Halide**
Ballast: **Electronic**

GE Lighting

26434 - MVR250/U/CP

GE Multi-Vapor® Quartz Metal Halide ED28 - Street Lighting



CAUTIONS & WARNINGS

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

Caution

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

Warning

- Risk of 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.
- Unexpected lamp rupture may cause injury, fire, or property damage
  - Do not exceed rated voltage.
  - Do not turn on lamp until fully installed.
  - Do not use beyond rated life.
  - Do not use lamp if outer glass is scratched or broken.
  - Do not use where directly exposed to water or outdoors without an enclosed fixture.
  - If used on a dimming system, see instructions.
  - Operate lamp only in specified position.
  - Turn lamp off at least once for 15 minutes per week.
  - Use in enclosed fixture rated for this product.
  - Use only properly rated ballast.
- A damaged lamp emits UV radiation which may cause eye/skin injury
  - Turn power off if glass bulb is broken. Remove and dispose of lamp.
- Risk of Fire
  - Keep combustible materials away from lamp.
  - Use in fixture rated for this product.

GRAPHS & CHARTS

Spectral Power Distribution

GENERAL CHARACTERISTICS

Lamp Type	High Intensity Discharge - Quartz Metal Halide
Bulb	ED28
Base	Mogul Screw (E39)
Bulb Finish	Clear
Wattage	175
Rated Life	6000 hrs
Bulb Material	Hard glass
Lamp Enclosure Type (LET)	Enclosed fixtures only
Primary Application	Street Lighting

PHOTOMETRIC CHARACTERISTICS

Initial Lumens	19100 /20600
Mean Lumens	12400 /13500
Nominal Initial Lumens per Watt	109
Color Temperature	4200 K
Color Rendering Index (CRI)	65
Effective Arc Length	1.4 in

ELECTRICAL CHARACTERISTICS

Burn Position	Universal burning position
Open Circuit Voltage (peak lead ballast)	540 V
Open Circuit Voltage (RMS lag ballast)	382 V
Warm Up Time to 90% (MIN)	2 min
Warm Up Time to 90% (MAX)	5 min
Hot Restart Time to 90% (MIN)	10 min
Hot Restart Time to 90% (MAX)	15 min

DIMENSIONS

Maximum Overall Length (MOL)	8.2500 In(209.5 mm)
Nominal Length	8.250 In(209.5 mm)
Bulb Diameter (DIA)	3.500 In(88.9 mm)
Bulb Diameter (DIA) (MAX)	3.500 In(88.9 mm)
Light Center Length (LCL)	5.000 In(127.0 mm)

PRODUCT INFORMATION

Product Code	26434
Description	MVR250/U/CP
ANSI Code	M58
Standard Package	Case
Standard Package GTIN	30043168264342
Standard Package Quantity	4
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	4
UPC	043168264341

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For additional information, visit www.gelighting.com

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Luminaire Tag: **HDL4, HWB1, HWB1Q, HWB2, BWB21, LLB, SLA, SLB, SLC, WP2C**
Lamp: **175W Metal Halide**
Ballast: **Electronic**

Revised: 4/8/2009

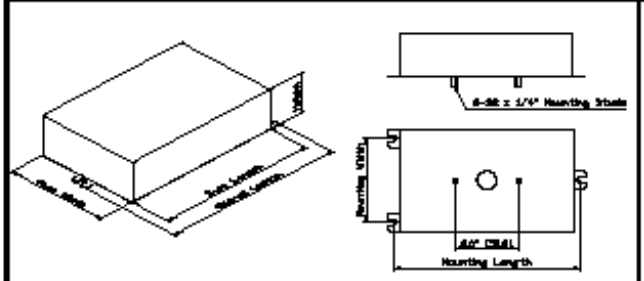
PHILIPS ADVANCE

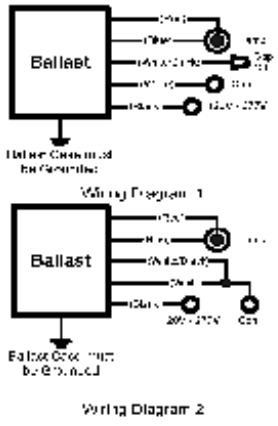
e-Vision® Electronic Ballast for Metal Halide Lamps

Catalog Number: IMH-175-C
For 150W or 175W Metal Halide Lamps
ANSI M102, M142, S56, M137 or M152
120-277V 50/60Hz Electronic
Status: RELEASED

DIMENSIONS AND DATA

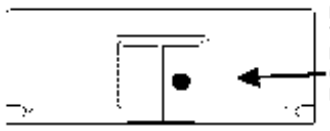
Lamp Number	Lamp Watts	Input Volts	Catalog Number*	Line Current (Amps)	Input Power (Watts)	Min Power Factor	Wiring Diag	Fig.	Weight (lb)	Max. Distance to Lamp (ft)
150 Watt Lamp, MH ANSI Code M102 or M142 and HPS ANSI Code S56 Minimum Starting Temp -30°C/-20°F										
1	150	120	IMH-175-C-XXX	1.4	169	1	1	C	2.5	5
		277		0.6	166					
175 Watt Lamp, ANSI Code M137 or M152 Minimum Starting Temp -30°C/-20°F										
1	175	120	IMH-175-C-XXX	1.7	194	1	2	C	2.5	5
		277		0.7	191					





Wiring Diagram 2

Case Figure	Overall Length	Case Length	Case Width	Height	Mountin Length	Mounting Width
C	204mm [8.0"]	184mm [7.2"]	92mm [3.6"]	38mm [1.5"]	195mm [7.7"]	73mm [2.9"]



MEASURE CASE TEMPERATURE ON RIGHT HEAT SINK CLIP AT BALAST END

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

*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.

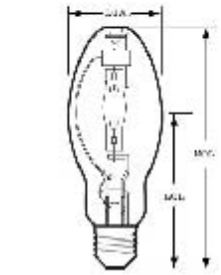
Philips Lighting Electronics N.A.
10275 West Higgins Road • Rosemont, IL 60018 • www.philips.com/advance
Tel: 800-322-2086 • Fax: 800-423-1882 • Customer Support: 800-372-3331 • OEM Support: 866-915-5886

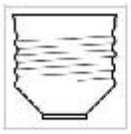
Luminaire Tag: **HDL4, HWB2Q**
Lamp: **100W QTZ Metal Halide**
Ballast: **Electronic**

GE Lighting

12652 - MVR100/U/MED

GE Multi-Vapor® PulseArc® Quartz Metal Halide BD17





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/uribums.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.
- Unexpected lamp rupture may cause injury, fire, or property damage
  - Do not exceed rated voltage.
  - Do not turn on lamp until fully installed.
  - Do not use 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.
  - Turn lamp off at least once for 15 minutes per week.
  - Use in enclosed fixture rated for this product.
  - Use only properly rated ballast.
- Risk of Fire
  - Keep combustible materials away from lamp.
  - Use in fixture rated for this product.

GRAPHS & CHARTS

Spectral Power Distribution

GENERAL CHARACTERISTICS

Lamp Type	High Intensity Discharge - Quartz Metal Halide
Bulb	BD17
Base	Medium Screw (E26)
Bulb Finish	Clear
Wattage	100
Voltage	100
Rated Life	15000 hrs
Bulb Material	Hard glass
Lamp Enclosure Type (LET)	Enclosed fixtures only
LEED-EB MR Credit	98 picograms Hg per mean lumen hour

PHOTOMETRIC CHARACTERISTICS

Initial Lumens	8100
Mean Lumens	5800
Nominal Initial Lumens per Watt	81
Color Temperature	4000 K
Color Rendering Index (CRI)	70
Effective Arc Length	0.49 cm

ELECTRICAL CHARACTERISTICS

Burn Position	Universal burning position
Open Circuit Voltage (peak lead ballast)	332 V
Open Circuit Voltage (RMS lag ballast)	235 V
Warm Up Time to 90% (MIN)	2 min
Warm Up Time to 90% (MAX)	5 min
Hot Restart Time to 90% (MIN)	10 min
Hot Restart Time to 90% (MAX)	15 min

DIMENSIONS

Maximum Overall Length (MOL)	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)	3.43 cm

PRODUCT INFORMATION

Product Code	12652
Description	MVR100/U/MED
ANSI Code	M90
Standard Package	Case
Standard Package GTIN	10043168126523
Standard Package Quantity	6
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	6
UPC	043168126526

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For additional information, visit www.gelighting.com

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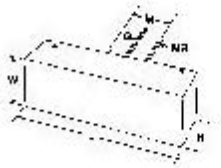
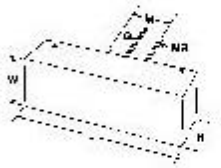
Luminaire Tag: **HDL4, HWB2Q**
Lamp: **100W QTZ Metal Halide**
Ballast: **Electronic**

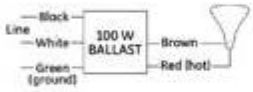
GE Lighting

87561 - GEMH100-SLJ-MV

GE HID UltraMax™ eHID Electronic Low Frequency Ballast







GENERAL CHARACTERISTICS

Category	High Intensity Discharge
Ballast Type	Electronic - Low Frequency
Line Voltage Regulation (+/-)	10 %
Ambient Temperature (MAX)	55 °C(13 °C)
Case Temperature	90 °C(194 °F)
Ballast Factor	Normal
Sound Rating	A (20-24 decibels)
Enclosure Type	Metal
Distance to Lamp	8 ft
Additional Info	End of Life Protection (EOL)/ Thermally protected

PRODUCT INFORMATION

Product Code	87561
Description	GEMH100-SLJ-MV
Standard Package	Case
Standard Package GTIN	10043168875612
Standard Package Quantity	10
Sales Unit	Case
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	10
UPC	043168875615

DIMENSIONS

Case dimensions	
Length (L)	7.3 In(184.91 mm)
Width (W)	2.6 In(65.53 mm)
Height (H)	2.2 In(55.88 mm)
Mounting dimensions	
Mount Length (M)	0.4 In(10.92 mm)
Weight	0.38 lb
Exit Type	Bottom Leads with Studs
Remote Mounting Distance to Lamp	8 ft
Remote Mounting Wire Gauge	18 AWG

Lead lengths	Qty	Exit	Length (± 1 In.)
Black	1	Left	10.0 (254mm)
Red	1	Right	10.0 (254mm)
White	1	Left	10.0 (254mm)
Brown	1	Right	10.0 (254mm)

ELECTRICAL CHARACTERISTICS

Lamp Operating Frequency	130 Hz

SAFETY & PERFORMANCE

- ANSI - C62.41
- cUL Listed
- UL Type 1 Outdoor
- RoHs Compliant
- UL 1029 Listed
- Suitable for recessed use

SPECIFICATIONS BY LAMP & LINE VOLTAGE

Lamp	# of Lamps	Specifications by Line Voltage	System Wattage	Nominal Current	Ballast Factor	Ballast Efficiency	Max.Input Current	Starting Current	Open Circuit Voltage	Drop Out Voltage	Power factor	Min.starting temperature	Fuse rating	UL bench top rise
M90	1	277	107.0	0.41A	1	0.935				96V	0.98	0.0°F	3	
M90	1	120	110.0	0.93A	1	0.909				96V	0.99	0.0°F	3	
M140	1	277	107.0	0.41A	1	0.935				96V	0.98	0.0°F	3	
M140	1	120	110.0	0.93A	1	0.909				96V	0.99	0.0°F	3	
C140	1	120	110.0	0.93A	1					96V	0.99	0.0°F	3	
C140	1	277	107.0	0.41A	1					96V	0.98	0.0°F	3	

NOTES

- 200C rated lead wires
- Do not connect brown or red wires to ground

WARRANTY INFORMATION

GE Lighting warrants to the purchaser that each ballast will be free from defects in material or workmanship for period as defined in the attached documents from the date of manufacture when properly installed and under normal conditions of use.

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For additional information, visit www.gelighting.com

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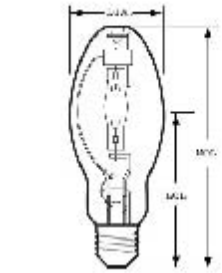
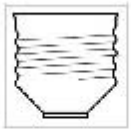
Luminaire Tag: **SL**
Lamp: **150W Ceramic MH**
Ballast: **Electronic**

GE Lighting

12598 - MVR150/U/MED

GE Multi-Vapor® PulseArc® Quartz Metal Halide BD17





CAUTIONS & WARNINGS

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

Caution

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

Warning

- Risk of Fire
  - Keep combustible materials away from lamp.
  - Use in fixture rated for this product.
- Risk of Burn
  - Allow lamp to cool before handling.
  - Do not turn on lamp until fully installed.
- Unexpected lamp rupture may cause injury, fire, or property damage
  - Do not exceed rated voltage.
  - Do not turn on lamp until fully installed.
  - Do not use 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.
  - Turn lamp off at least once for 15 minutes per week.
  - Use in enclosed fixture rated for this product.
  - Use only properly rated ballast.
- A damaged lamp emits UV radiation which may cause eye/skin injury
  - Turn power off if glass bulb is broken. Remove and dispose of lamp.
- Risk of Electric Shock
  - Do not use where directly exposed to water or outdoors without an enclosed fixture.
  - Turn power off before inspection, installation or removal.

GRAPHS & CHARTS

Spectral Power Distribution

GENERAL CHARACTERISTICS

Lamp Type	High Intensity Discharge - Quartz Metal Halide
Bulb	BD17
Base	Medium Screw (E26)
Bulb Finish	Clear
Wattage	150
Rated Life	15000 hrs
Bulb Material	Hard glass
Lamp Enclosure Type (LET)	Enclosed fixtures only
Base Temperature	210 °C
Bulb Temperature (MAX)	400 °C
LEED-EB MR Credit	69 picograms Hg per mean lumen hour

PHOTOMETRIC CHARACTERISTICS

Initial Lumens	14000
Mean Lumens	10500
Nominal Initial Lumens per Watt	93
Color Temperature	4300 K
Color Rendering Index (CRI)	65

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% (MIN)	10 min
Hot Restart Time to 90% (MAX)	15 min

DIMENSIONS

Maximum Overall Length (MOL)	5.4300 in(137.9 mm)
Bulb Diameter (DIA)	2.125 in(54.0 mm)
Bulb Diameter (DIA) (MAX)	2.125 in(54.0 mm)
Light Center Length (LCL)	3.430 in(87.1 mm)

PRODUCT INFORMATION

Product Code	12598
Description	MVR150/U/MED
ANSI Code	M102
Standard Package	Case
Standard Package GTIN	10043168125984
Standard Package Quantity	6
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	6
UPC	043168125967

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For additional information, visit www.gelighting.com

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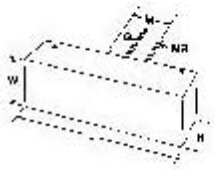
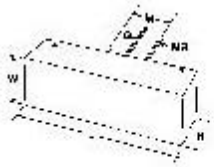
Luminaire Tag: **SL**
Lamp: **150W Ceramic MH**
Ballast: **Electronic**

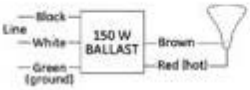
GE Lighting

87576 - GEMH150-SLJ-MV

GE HID UltraMax™ eHID Electronic Low Frequency Ballast







GENERAL CHARACTERISTICS

Category	High Intensity Discharge
Ballast Type	Electronic - Low Frequency
Line Voltage Regulation (+/-)	10 %
Ambient Temperature (MAX)	55 °C(13 °C)
Case Temperature	85 °C(185 °F)
Ballast Factor	Normal
Sound Rating	A (20-24 decibels)
Enclosure Type	Metal
Distance to Lamp	8 ft
Additional Info	End of Life Protection (EOL)/ Thermally protected

PRODUCT INFORMATION

Product Code	87576
Description	GEMH150-SLJ-MV
Standard Package	Case
Standard Package GTIN	10043168875766
Standard Package Quantity	10
Sales Unit	Case
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	10
UPC	043168875769

DIMENSIONS

Case dimensions	
Length (L)	7.3 In(184.91 mm)
Width (W)	2.6 In(65.53 mm)
Height (H)	2.2 In(55.88 mm)
Mounting dimensions	
Mount Length (M)	0.4 In(10.92 mm)
Weight	0.38 lb
Exit Type	Bottom Leads with Studs
Remote Mounting Distance to Lamp	8 ft
Remote Mounting Wire Gauge	18 AWG

Lead lengths	Qty	Exit	Length (± 1 In.)
Black	1	Left	10.0 (254mm)
Brown	1	Right	10.0 (254mm)
Red	1	Right	10.0 (254mm)
White	1	Left	10.0 (254mm)

ELECTRICAL CHARACTERISTICS

Lamp Operating Frequency	130 Hz

SAFETY & PERFORMANCE

- ANSI - C82.41
- cUL Listed
- FCC - CLASS A Non-Consumer
- UL Type 1 Outdoor
- RoHs Compliant
- UL 1029 Listed
- Suitable for recessed use

SPECIFICATIONS BY LAMP & LINE VOLTAGE

Lamp	# of Lamps	Specifications by Line Voltage	System Wattage	Nominal Current	Ballast Factor	Ballast Efficiency	Max.Input Current	Starting Current	Open Circuit Voltage	Drop Out Voltage	Power factor	Min.starting temperature	Fuse rating	UL bench top rise
M142	1	120	167.0	1.44A	1	0.898				96V	0.99	0.0°F	3	
M142	1	277	164.0	0.62A	1	0.915				96V	0.99	0.0°F	3	
M102	1	120	167.0	1.44A	1	0.898				96V	0.99	0.0°F	3	
M102	1	277	164.0	0.62A	1	0.915				96V	0.99	0.0°F	3	
C142	1	120	167.0	1.44A	1					96V	0.99	0.0°F	3	
C142	1	277	164.0	0.62A	1					96V	0.99	0.0°F	3	

NOTES

- 200C rated lead wires
- Do not connect brown or red wires to ground

WARRANTY INFORMATION

GE Lighting warrants to the purchaser that each ballast will be free from defects in material or workmanship for period as defined in the attached documents from the date of manufacture when properly installed and under normal conditions of use.

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