



Virginia Tech Basketball Practice Facility

Blacksburg, Virginia

Electrical Systems Existing Conditions and Building Load Summary Report

Technical Report 2

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Lighting/Electrical Option
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Executive Summary

This report analyzes the existing design of the new Virginia Tech Basketball Practice Facility, with specific emphasis on the electrical and communication systems implemented in the building. The building's utility information is provided, and the distribution of the power within the building is outlined and is presented in a single line diagram. All of the lighting and mechanical loads are itemized. These loads serve as the basis for the calculation of the service entrance size.

The analysis presented in this report will serve as a guide for redesigning the electrical and communication systems in the building.

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Part I – Power Distribution Systems

Summary Description of Distribution System

The power distribution system for this building is a simple radial system, with the service entrance point in the basement electrical room. The building is fed by a 750kVA transformer that steps down 12kV primary voltage to 480Y/277V secondary voltage. The main switchboard in the basement electrical room is 1200A, 480Y/277V, 3PH, 4W, and rated at 35K AIC. This switchboard distributes power to the building, to loads at 277V or 480V or to step-down transformers for loads at 120V or 208V. The emergency system in the building is powered by a 100kW diesel generator operating at 480Y/277V 3PH, 4W. Three automatic transfer switches control the power from the generator to the emergency and optional standby loads.

Utility Company Information

Virginia Tech has its own campus distribution. Their address is: 601 Country Club Drive SW, Blacksburg, VA 24061. Information about the campus service is posted at <http://www.facilities.vt.edu/utilities/>. The university buys its power from Appalachian Power Company (www.appalacianpower.com). This building is classified as “Large General Service,” according to their rate structure.

<i>Electric Service Rates</i>				
<i>Monthly Service Charge</i>	<i>Energy Charge all kWh</i>	<i>Wholesale Power Cost Adjustment per kWh</i>	<i>Demand Charge per kW</i>	<i>Reactive Demand Charge per kVAR</i>
\$18.92	\$0.048271	\$0.000000	\$12.91	\$0.75

Service Entrance

The service to the building is fed from a manhole in the South West exterior portion of the site. The utility switch, exterior transformer, and generator area all located at grade outside the building adjacent to the basement electrical room. This utility switch ties into redundant campus loops, which allows building operators to select an alternative pathway from the utility substation on campus.

The manhole conductors feed 12kV power to a pad-mounted primary switch. This switch feeds the 750KVA exterior pad-mounted primary transformer, which provides 480Y/277V, 3PH, 4W power to the switchboard in main electrical room on the basement level.

Virginia Tech has their own campus distribution system, so they provide all of the connections and equipment. This building ties directly into the campus provided medium voltage system.

Voltage Systems

The building operates at two voltage systems: 480Y/277V, 3PH and 208Y/V, 3PH. All fluorescent and metal halide luminaires operate at 277V, 1PH, while there are some luminaires with tungsten-halogen lamps that are at 120V, 1PH. Receptacle loads are 120V, 1PH. The mechanical equipment voltage varies based on the specific piece of equipment, and can either be 480V, 3PH or 208V, 3PH. All of the equipment in the basketball court area is 120V, 1PH.

Emergency Power Systems

The emergency power systems in this building are fed from a 100kW 480/277V, 3PH, 4W, diesel generator that is pad-mounted on the exterior of the South West portion of the building. The building operates with two emergency systems: emergency and optional standby. The generator provides power into the building for the two systems, with two automatic transfer switches for the emergency system and one for optional standby. Emergency lighting loads are on the emergency system, while emergency receptacles are on the optional standby system.

Locations of Switchgear

There are four areas on the site where the electrical distribution equipment is located. The utility supply equipment is pad-mounted at the South West exterior corner of the building. The main switchboard, automatic transfer switches and low voltage stepdown transformers are located in the basement electrical room. There are additional electrical rooms on the north end first and second levels.

<i>Location of Distribution Equipment</i>					
<i>Tag</i>	<i>Type of Equipment</i>	<i>Floor Level</i>	<i>Room Number</i>	<i>Room Name</i>	<i>DWG Number</i>
XMFR PAD	Exterior Transformer	Exterior - Grade	NA	NA	E003
GENSET	Generator	Exterior - Grade	NA	NA	E003
B-SWBDN-1	Main switchboard	Basement	X2	Electrical Room	E200
B-ATSE-1	Automatic Transfer Switch	Basement	X2	Electrical Room	E200
B-ATSE-2	Automatic Transfer Switch	Basement	X2	Electrical Room	E200
B-ATSE-3	Automatic Transfer Switch	Basement	X2	Electrical Room	E200
BPNL1	Distribution Panel	Basement	X2	Electrical Room	E200
BPNL2	Distribution Panel	Basement	X2	Electrical Room	E200
B-T-1	Transformer	Basement	X2	Electrical Room	E200
B-T-2	Transformer	Basement	X2	Electrical Room	E200
B-T-3	Transformer	Basement	X2	Electrical Room	E200
B-T-4	Transformer	Basement	X2	Electrical Room	E200
B-T-5	Transformer	Basement	X2	Electrical Room	E200

<i>Location of Panelboards</i>						
<i>Tag</i>	<i>Voltage</i>	<i>Main Size (AT)</i>	<i>Floor Level</i>	<i>Room Number</i>	<i>Room Name</i>	<i>DWG Number</i>
BLNH1	408V, 3PH, 4W	MLO	Basement	X2	Electrical Room	E200
BLNH2	408V, 3PH, 4W	MLO	Basement	X2	Electrical Room	E200
BPNL1	208V, 3PH, 4W	700	Basement	X2	Electrical Room	E200
BPNL2	208V, 3PH, 4W	400	Basement	X2	Electrical Room	E200
BPNL1	208V, 3PH, 4W	MLO	Basement	X2	Electrical Room	E200
BLNL1	208V, 3PH, 4W	MLO	Basement	X2	Electrical Room	E200
BLNL2	208V, 3PH, 4W	MLO	Basement	X2	Electrical Room	E200
1LNH1	408V, 3PH, 4W	MLO	Level 1	A11	Electrical Room	E201
1LNL1	208V, 3PH, 4W	MLO	Level 1	A11	Electrical Room	E201
1LNL2	208V, 3PH, 4W	MLO	Level 1	A11	Electrical Room	E201
1LNL3	208V, 3PH, 4W	MLO	Level 1	A11	Electrical Room	E201
2LNH1	408V, 3PH, 4W	MLO	Level 2	B9	Electrical Room	E203
2LNL1	208V, 3PH, 4W	MLO	Level 2	B9	Electrical Room	E203
2LNL2	208V, 3PH, 4W	MLO	Level 2	B9	Electrical Room	E203
BLEH1	408V, 3PH, 4W	100	Basement	X2	Electrical Room	E200
BLEL1	208V, 3PH, 4W	100	Basement	X2	Electrical Room	E200
1LEH1	408V, 3PH, 4W	MLO	Level 1	A11	Electrical Room	E201
1LEL1	208V, 3PH, 4W	MLO	Level 1	A11	Electrical Room	E201
BLOH1	408V, 3PH, 4W	MLO	Basement	X2	Electrical Room	E200
BLOL1	208V, 3PH, 4W	50	Basement	X2	Electrical Room	E200
1LOL1	208V, 3PH, 4W	MLO	Level 1	A11	Electrical Room	E201

Over-Current Devices

The main over-current protective device for the switchboard is one 1200AT/1200AF, 3 pole GFCI main circuit breaker. Within the switchboard, there are 17 thermal magnetic molded case circuit breakers that protect the loads fed by the switchboard.

There are two additional distribution panelboards. One features a 700A-3 Pole main circuit breaker, and the other has a 400A-3P circuit breaker. All of the other normal power panels are main lugs only panels.

All of the branch breakers in the main switchboard have minimum ratings of 35K AIC. The breakers in all of the 480/277V 3PH panels are rated at 22K AIC and all of the breakers in the 208/120V 3PH panels are rated at 10K AIC.

Transformers

There is one exterior transformer that steps down the campus medium voltage supply to low voltage. Within the building there are five transformers that take the 480/277V 3PH and step it down to 208/120V 3PH.

<i>Individual Transformer Schedule</i>								
<i>Tag</i>	<i>Primary Voltage</i>	<i>Secondary Voltage</i>	<i>Size</i>	<i>Type</i>	<i>Temp. Rise</i>	<i>Taps</i>	<i>Mounting</i>	<i>Remarks</i>
XMFR	12000V 3PH 3W	480V 3PH 3W	750kVA	N/A	N/A	N/A	Exterior Pad Mounted	
B-T-1	480V 3PH 3W	208/120V 3PH 4W	225kVA	Dry Type	115 Degree C	(6) 2.5%	Pad Mounted on Floor	
B-T-2	480V 3PH 3W	208/120V 3PH 4W	30kVA	Dry Type	115 Degree C	(6) 2.5%	Pad Mounted on Floor	
B-T-3	480V 3PH 3W	208/120V 3PH 4W	15kVA	Dry Type	115 Degree C	(6) 2.5%	Pad Mounted on Floor	
B-T-4	480V 3PH 3W	208/120V 3PH 4W	112.5kVA	Dry Type	115 Degree C	(6) 2.5%	Pad Mounted on Floor	
B-T-5	480V 3PH 3W	208/120V 3PH 4W	30kVA	Dry Type	115 Degree C	(6) 2.5%	Pad Mounted on Floor	
<p>Note:</p> <p>1. 18,100A available fault current at secondary of XFMR.</p> <p>Key:</p> <p>N/A= Not applicable.</p>								

Grounding

The normal distribution system for this building is grounded at the pad-mounted exterior transformer, and the emergency system is grounded at the diesel standby generator. There is also a copper bus 1/4" thick by 2-1/2" wide in the main electrical room for grounding the main switchboard.

Special Equipment

There is no special equipment in this building.

Lighting Loads

The majority of the spaces in this building there are linear fluorescent luminaires operating at 277W 1PH. In the gymnasium there are high bay metal halide luminaires operating at 277W 1PH. The lobby features linear fluorescent wall washing luminaires, downlights with both metal halide and tungsten halogen lamps, and adjustable tungsten halogen accent luminaires. All of the tungsten halogen luminaires operate at 120V, 1PH.

The table below summarizes the luminaires included in the lighting design for this space. The summary includes manufacturer information and operating electrical characteristics. Note that there are two luminaires that have a mixture of lamps types. A18 has two metal halide lamps and two tungsten

halogen lamps, and A22 has one linear fluorescent lamp and one tungsten halogen lamp. Each of these luminaire types is connected to 277V, 1PH and 120V, 1PH circuits.

Specification sheets for metal halide lamps and ballasts are located in Appendix 1.

Luminaire Schedule									
Tag	Light Source	Lamp Type	Individual Lamp Watts	Number of Lamps	Ballast Type	Input Watts	Ballast Factor	Current @ Start and Operating	Power Factor @ Start and Operating
A03	MH	MS750/PS/BT37	750	1	PS	818	-	3.0 / 2.8	0.9
A04	MH	MS750/PS/BT37	750	1	PS	818	-	3.0 / 2.8	0.9
A05	FLUOR	F32T8/835	32	2	IS	58	0.88	0.21	0.98
A06	FLUOR	F32T8/835	32	1	IS	29	0.91	0.26	0.99
A07	FLUOR	F17T8/835	17	1	IS	22	1.15	0.09	0.95
A15	FLUOR	CF32/FT/830	32	1	RS	36	0.98	0.13	0.98
A16	FLUOR	CF32/FT/830	32	1	RS	36	0.98	0.13	0.98
A17	FLUOR	CF32/FT/830	32	1	RS	36	0.98	0.13	0.98
A18	MH INCAN	CMH39W/PAR30L 75WPAR30L	39 75	2 2	E -	86 75	-	0.31 1.25	0.9 -
A19	FLUOR	F54T5HO/830	54	1	PS	62	0.99	0.52	0.98
A20	FLUOR	F54T5HO/830	54	1	PS	62	0.99	0.52	0.98
A21	MH	CMH39WT4/830	39	1	E	45	-	0.18	0.9
A22	INCAN FLUOR	Q20MR16/FL F32T8/830	20 32	1 1	- IS	20 29	- 0.88	1.66 0.21	- 0.9
AX02	MH	CMH20WT4/830	20	1	E	24	-	0.09	0.9
AX03	MH	CMH39WT4/830	39	1	E	45	-	0.18	0.9
AX04	FLUOR	CF32/FT/830	32	1	RS	36	0.98	0.13	0.98
A23	FLUOR	CF32/FT/830	32	1	ED	36	0.99	0.13	0.99
A24	INCAN	35WMR16	35	1	-	35	-	0.29	-
AA1	INCAN	75WMR16	75	1	-	75	-	0.625	-
AA2	INCAN	575WT6	575	1	-	575	-	4.79	-
CD1	FLUOR	CF26/FT/830	26	1	RS	27	1.0	0.1	0.99
CH1	FLUOR	CF26/FT/830	26	1	RS	27	1.0	0.1	0.99
CX1	FLUOR	CF32/FT/830	32	1	RS	36	0.98	0.13	0.98
FC1	FLUOR	F32T8/835	32	1	IS	29	0.91	0.26	0.99
FH1	FLUOR	F32T8/835	32	1	IS	29	0.91	0.26	0.99
FP1	FLUOR	F32T8/835	32	2	IS	58	0.88	0.21	0.98
FP2	FLUOR	F32T8/835	32	2	IS	58	0.88	0.21	0.98
FS1	FLUOR	F32T8/835	32	2	IS	58	0.88	0.21	0.98
FS2	FLUOR	F32T8/835	32	2	IS	58	0.88	0.21	0.98

Luminaire Schedule Continued									
Tag	Light Source	Lamp Type	Individual Lamp Watts	Number of Lamps	Ballast Type	Input Watts	Ballast Factor	Current @ Start and Operating	Power Factor @ Start and Operating
FS3	FLUOR	F32T8/835	32	2	IS	58	0.88	0.21	0.98
FS5	FLUOR	F32T8/835	32	1	IS	29	0.91	0.26	0.99
FT1	FLUOR	F32T8/835	32	2	IS	58	0.88	0.21	0.98
FT2	FLUOR	F17T8/835	17	2	IS	34	0.98	0.12	0.98
FT3	FLUOR	F17T8/835	17	2	IS	34	0.98	0.12	0.98
FT4	FLUOR	F32T8/835	32	2	IS	58	0.88	0.21	0.98
FU1	FLUOR	F32T8/835	32	1	IS	29	0.91	0.26	0.99
FV1	FLUOR	F32T8/835	32	2	IS	58	0.88	0.21	0.98
FW1	FLUOR	F25T5/835	28	1	PS	33	1.04	0.12	0.98
PP1	FLUOR	CF32/FT/830	32	4	PS	152	0.99	0.56	0.29

Lighting Control

All of the exterior lighting for the basketball facility is switched by a roof-mounted photo sensor and a time clock in the first floor electrical room. There are occupancy sensors in each of the spaces on level one and level two, excluding the gymnasium and closets. The lighting in the closet spaces is on timers. In many of the spaces there are wall-mounted switches that add an additional level of controllability, but the occupancy sensor overrides these switches.

Mechanical and Other Loads

The heating and cooling for the building is provided by two variable air volume (VAV) air handling units (AHU). One 12,000 CFM AHU serves the gymnasium area alone, and the other 8,500 CFM AHU serves the rest of the building. The building’s glycol chilled water system is fed by an air-cooled chiller mounted on the roof. There is also a rooftop heat recovery system that utilizes an energy wheel to cut down on wasted energy consumption. With regards to LEED criteria, the mechanical system for this building is designed to reduce energy cost to 28% below the recommended AHSRAE levels.

The table below summarizes the equipment loads in the building. Included in the table are mechanical, plumbing, and any other architectural equipment loads.

Equipment Table										
Load Tag	Load Description	Quantity	Load Magnitude	Load Units	Motor Amps	Voltage and Phases	Assumed PF	Equivalent Load in kVA	Equivalent Load in kW	Total Load kW
AC-1	Air Conditioner	1	1	HP	8.80	208V 1PH	0.95	1.83	1.74	1.74
ACCU-1	Air Cooled Condensing Unit	1	32.7	MCA	32.7	208V 1PH	0.95	6.80	6.46	6.46
AHU-1	Air Handling Unit (SF)	1	25	HP	34	480V 3PH	0.95	28.27	26.85	26.85
	Air Handling Unit (RF)	1	7.5	HP	11	480V 3PH	0.95	9.15	8.69	8.69

Equipment Table										
Load Tag	Load Description	Quantity	Load Magnitude	Load Units	Motor Amps	Voltage and Phases	Assumed PF	Equivalent Load in kVA	Equivalent Load in kW	Total Load kW
CH-1	Air Cooled Chiller	1	172.4	kW		480V 3PH	0.95	172.4	172.40	172.40
CP-1	Condensate Pump	2	1.5	HP	3	480V 3PH	0.85	2.49	2.12	4.24
EF-1	Exhaust Fan	1	1.5	HP	3	480V 3PH	0.85	2.49	2.12	2.12
EF-2	Exhaust Fan	1	0.5	HP	1.1	480V 3PH	0.85	0.91	0.78	0.78
ERU-1	Energy Recovery Unit (SF)	1	40	HP	52	480V 3PH	0.95	43.23	41.07	41.07
	Energy Recovery Unit (EF)	1	30	HP	40	480V 3PH	0.95	33.26	31.59	31.59
EUH-1	Electric Unit Heater	1	5	kW		480V 3PH		5.00	5.00	5.00
P-1	Pump	1	5	HP	7.6	480V 3PH	0.95	6.32	6.00	6.00
P-2	Pump	1	5	HP	7.6	480V 3PH	0.95	6.32	6.00	6.00
P-3	Pump	1	7.5	HP	11	480V 3PH	0.95	9.15	8.69	8.69
P-4	Pump	1	7.5	HP	11	480V 3PH	0.95	9.15	8.69	8.69
SF-1	Supply Fan	1	0.5	HP	1.1	480V 3PH	0.85	0.91	0.78	0.78
	Divider Curtain	1	0.75	HP	1.6	120V 1PH	0.85	0.19	0.16	0.16
	Elevator	1	20	HP	27	480V 3PH	0.95	22.45	21.33	21.33
	Clothes Dryer	2	30	kW		208V 1PH		30.0	30.0	60.0
	Clothes Washer	2	27.4	kW		208V 1PH		27.4	27.4	54.8
	HydroCollator	1	1000	W		120V 1PH		1	1	1

Service Entrance Size

Conceptual and Schematic Design Phases

Floor Area Information

Floor	Gross Square Feet
Basement	3740 SF
Level One (Locker Rms, Training)	20476 SF
Level One (Gymnasium)	16609 SF
Level Two (Offices)	9827 SF
Total Area	50652 SF

Demand Load Information

Floor	Demand Load Building Type	VA/SF	VA
Basement	Office Building	12	44880
Level One (Locker Rms, Training)	Arena	13	266188
Level One (Gymnasium)	Arena	13	215917
Level Two (Offices)	Office Building	12	117924

Total VA: 644909

Service Entrance Size

Service Entrance Voltage:	480Y/277V, 3PH, 4 W
Building Load:	644909 VA
	776 A
Conceptual Service	
Entrance Size:	800A

Design Development Phase

Lighting Loads

Floor	Type of Occupancy ¹	VA/SF	VA
Basement	Office Building	3.5	13090
Level One (Locker Rms, Training)	Assembly Halls and Auditoriums	1	20476
Level One (Gymnasium)	Assembly Halls and Auditoriums	1	16609
Level Two (Offices)	Office Building	3.5	34394.5

Total Lighting VA: 84570 VA

Receptacles

Floor	Type of Occupancy	VA/SF	VA
Basement	Office/Classroom General Use	0.5	1870
Level One (Locker Rms, Training)	Office/Classroom General Use	0.5	10238
Level One (Gymnasium)	Office/Classroom General Use	0.5	8304.5
Level Two (Offices)	Office/Classroom General Use	0.5	4913.5

Total Receptacles VA: 25326 VA

HVAC Equipment

Load Category	VA/SF	VA
Exhaust Fans	2	101304
Cooling	8	405216

Total HVAC VA: 506520 VA

¹Demand factors found in the *National Electric Code 2008*, Quincy, MA: National Fire Protection Association, Inc., 2008

Architectural Equipment

Load Category	Quantity	KW per	KW
Elevators	1	50	50
Total Architectural Equipment VA:			50 VA

Assume PF = 1

Service Entrance Size

Service Entrance Voltage:	480Y/277V, 3PH, 4 W
Total Building Load:	616466 VA
	741 A
Design Development	
Service Entrance Size: 800A	

Construction Documents Phase

Lighting and Receptacle Panelboards

Panelboard	Lighting Loads	Receptacle Loads	Motor Loads
BLEH1	5.8 kW	-	-
BLEL1	-	-	2.4 kW
BLNH1	6.2 kW	-	-
BLNH2	-	-	36.7 kW
BLNL1	-	31.9 kW	44.7 kW
BLNL2	-	14.8 kW	-
BLNL3	-	64.8 kW	-
BLOH1	-	-	12.6 kW
BLOL1	-	5.2 kW	0.5 kW
1LEL1	0.8 kW	0.2 kW	3.8 kW
1LEH1	13.8 kW	-	-
1LOL1	0.3 kW	8.8 kW	1.2 kW
1LNH1	6.8 kW	-	-
1LNL1	-	27.0 kW	13.8 kW
1LNL2	-	9.0 kW	-
1LNL3	-	20.2 kW	44.5 kW
2LNH1	34.5 kW	-	-
2LNL1	-	52.0 kW	9.2 kW
2LNL2	-	7.8 kW	6.6 kW
Total Loads:	68.2 kW	241.7 kW	176.0 kW
Total Loads:	76 KVA	269 KVA	196 KVA

Note: Panelboard schedule loads are provided in kW. Electrical engineers assumed PF = 0.9 for sizing panels.

No demand factors are applied to the lighting and the motor loads

Demand Loads

Load Type	Demand VA
Receptacles	139 KVA

Other Loads

Fed From	Equipment	Motor Load
B-SWBDN-1	Elevator	23 KVA
B-SWBDN-1	ERU-1	77 KVA
B-SWBDN-1	AHU-1	37 KVA
B-SWBDN-1	AHU-2	27 KVA
B-SWBDN-1	CH-1	172 KVA

Total Loads: 336 KVA

Service Entrance Size

Service Entrance Voltage: 480Y/277V, 3PH, 4 W

Total Building Load:	746 KVA
+ 25% for growth	933 KVA
	1122 A

Construction Documents

Service Entrance Size: 1200A

Comparison of Three Design Stage Calculations with Existing Design

Design Stage	Service Entrance Size
Conceptual	800A
Design Development	800A
Construction Documents Service Entrance Size	1200A
As Designed by Cannon Design	1200A

Environmental Stewardship Design

This building was designed with the goal of attaining the USGBC’s LEED silver rating. The lighting systems are designed to cut down significantly the energy being used. Excluding the lobby space, all of the luminaires feature either linear fluorescent or ceramic metal halide lamps.

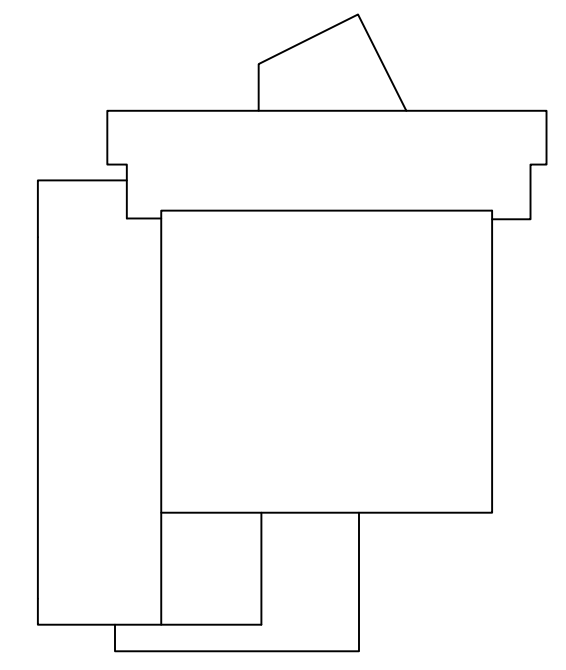
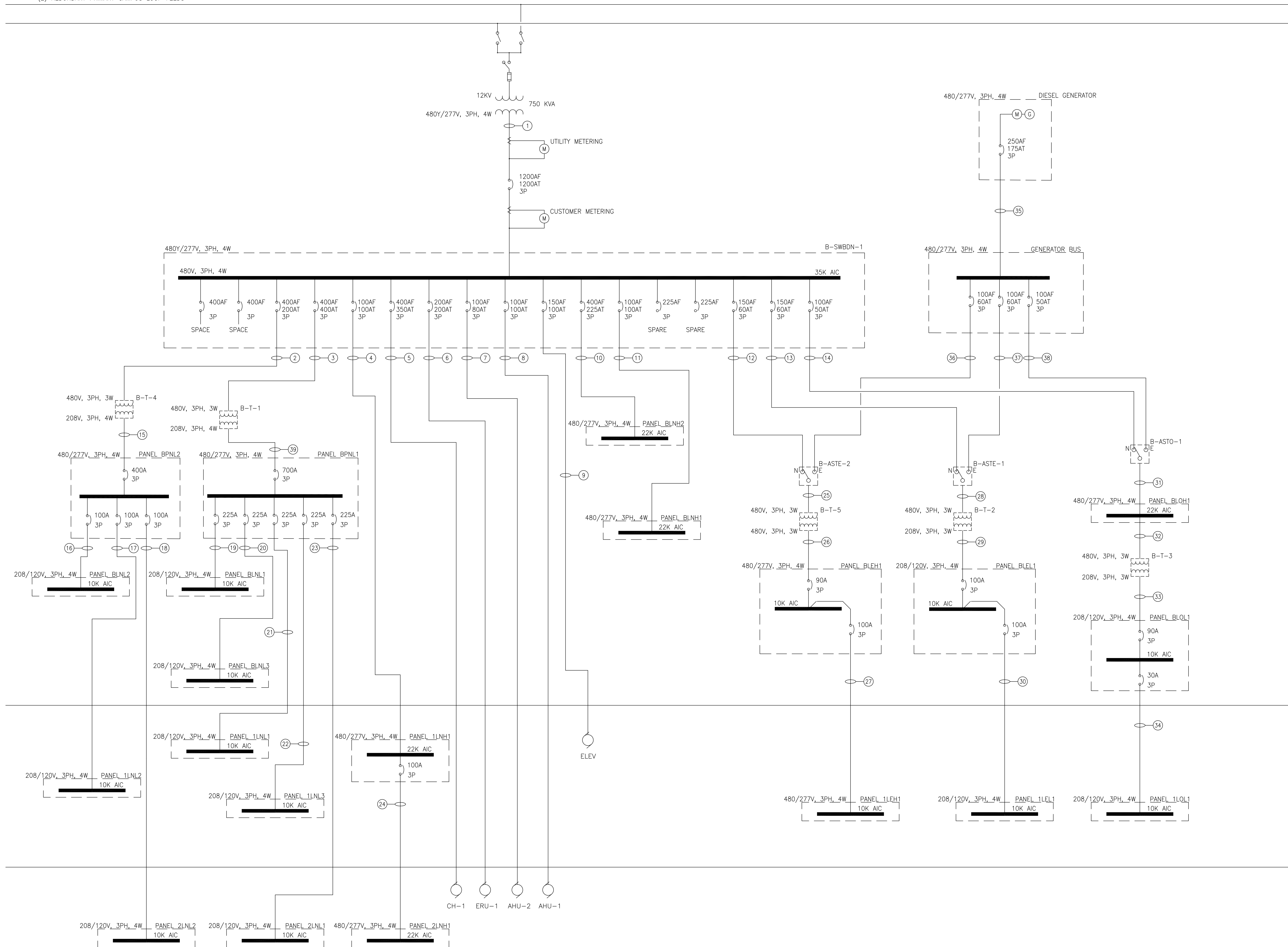
Design Issues

The utility service to the building ties into two redundant loops to ensure that if one of the two loses power the service can be manually switched.

Drawings Feeder Schedule for single line drawing:

TAG	FROM	TO	NO. OF SETS	CONDUIT (PER SET)		CONDUCTORS (PER SET)									SIZE OF OVERCURRENT PROTECTION	FRAME OR SWITCH SIZE
				SIZE	TYPE	PHASE CONDUCTORS			NEUTRAL CONDUCTORS			GROUND CONDUCTORS				
						No.	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE		
1	XFRM	B-SWBDN-1	4	4"	PVC	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	4	4/0	CU THWN	1200	1200A/3P
2	B-SWBDN-1	B-T-4	1	2"	EMT	3	3AWG	CU THWN			CU THWN	1	6AWG	CU THWN		
3	B-SWBDN-1	B-T-1	2	2"	EMT	3	3AWG	CU THWN			CU THWN	2	2AWG	CU THWN		
4	B-SWBDN-1	1LNH1	1	1-1/2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	8AWG	CU THWN	100	100A/3P
5	B-SWBDN-1	CH-1	2	2"	EMT	2	3/0AWG	CU THWN			CU THWN	2	2AWG	CU THWN	400	400/3P
6	B-SWBDN-1	ERU-1	1	1-1/2"	EMT	3	3/0AWG	CU THWN			CU THWN	1	6AWG	CU THWN	150	150/3P
7	B-SWBDN-1	AHU-2	1	1-1/4"	EMT	3	2AWG	CU THWN			CU THWN	1	8AWG	CU THWN	90	90/3P
8	B-SWBDN-1	AHU-1	1	1-1/2"	EMT	3	1/0AWG	CU THWN			CU THWN	1	6AWG	CU THWN	125	125/3P
9	B-SWBDN-1	ELEV	1	1-1/2"	EMT	3	3/0AWG	CU THWN			CU THWN	1	6AWG	CU THWN	150	150/3P
10	B-SWBDN-1	BLNH2	1	2-1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	400A/3P
11	B-SWBDN-1	BLNH1	1	1-1/2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	8AWG	CU THWN	100	100A/3P
12	B-SWBDN-1	B-ASTE-2	1	1-1/4"	EMT	3	4AWG	CU THWN	1	4AWG	CU THWN	1	10AWG	CU THWN	60	150A/3P
13	B-SWBDN-1	B-ASTE-1	1	1-1/4"	EMT	3	4AWG	CU THWN	1	4AWG	CU THWN	1	10AWG	CU THWN	60	150A/3P
14	B-SWBDN-1	B-ASTO-1	1	1-1/4"	EMT	3	6AWG	CU THWN	1	6AWG	CU THWN	1	10AWG	CU THWN	50	100A/3P
15	B-T-4	BPNL2	2	2*1/2"		3	3AWG	CU THWN	1	3AWG	CU THWN	2	2AWG	CU THWN	400	400A/30
16	BPNL2	BLNL2	1	1-1/2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	8AWG	CU THWN	100	100A/3P
17	BPNL2	1LNL2	1	1-1/2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	8AWG	CU THWN	100	100A/3P
18	BPNL2	2LNL2	1	1-1/2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	8AWG	CU THWN	100	100A/3P
19	BPNL1	BLNL1	1	2-1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225A/3P
20	BPNL1	BLNL3	1	2-1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225A/3P
21	BPNL1	1LNL1	1	2-1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225A/3P
22	BPNL1	1LNL3	1	2-1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225A/3P
23	BPNL1	2LNL1	1	2-1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225A/3P
24	1LNH1	2LNH1	1	1-1/2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	8AWG	CU THWN	100	100A/3P
25	B-ASTE-2	B-T-5	1	1-1/4"	EMT	3	4AWG	CU THWN			CU THWN	1	10AWG	CU THWN		
26	B-T-5	BLEH1	1	1-1/4"	EMT	3	2AWG	CU THWN	1	2AWG	CU THWN	1	8AWG	CU THWN	90	90/3P
27	BLEH1	1LEH1	1	1-1/4"	EMT	3	2AWG	CU THWN	1	2AWG	CU THWN	1	8AWG	CU THWN	90	90/3P
28	B-ASTE-1	B-T-2	1	1-1/4"	EMT	3	4AWG	CU THWN			CU THWN	1	10AWG	CU THWN		
29	B-T-2	BLEL1	1	1-1/2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	8AWG	CU THWN	100	100A/3P
30	BLEL1	1LEL1	1	1-1/2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	8AWG	CU THWN	100	100A/3P
31	B-ASTO-1	BLOH1	1	1-1/4"	EMT	3	6AWG	CU THWN	1	6AWG	CU THWN	1	10AWG	CU THWN	50	100A/3P
32	BLOH1	B-T-3	1	3/4"	EMT	3	10AWG	CU THWN			CU THWN	1	10AWG	CU THWN		
33	B-T-3	BLOL1	1	1-1/4"	EMT	3	6AWG	CU THWN	1	6AWG	CU THWN	1	10AWG	CU THWN	50	50A/3P
34	BLOL1	1LOL1	1	3/4"	EMT	3	10AWG	CU THWN	1	10AWG	CU THWN	1	10AWG	CU THWN	30	100A/3P
35	GEN	GEN-BUS	1	2"	EMT	3	3/0AWG	CU THWN	1	3/0AWG	CU THWN	1	6AWG	CU THWN	175	250A/3P
36	GEN-BUS	B-ASTE-2	1	1-1/4"	EMT	3	4AWG	CU THWN	1	4AWG	CU THWN	1	10AWG	CU THWN	60	150A/3P
37	GEN-BUS	B-ASTE-1	1	1-1/4"	EMT	3	4AWG	CU THWN	1	4AWG	CU THWN	1	10AWG	CU THWN	60	150A/3P
38	GEN-BUS	B-ASTO-1	1	1-1/4"	EMT	3	6AWG	CU THWN	1	6AWG	CU THWN	1	10AWG	CU THWN	50	100A/3P
39	B-T-1	BPNL1	2	4"	EMT	3	500AWG	CU THWN	1	500AWG	CU THWN	1	1/0AWG	CU THWN	700	700A/3P

NOTES:
 1. REFER TO RISER DIAGRAM FOR FEEDER TAGS
 AL=ALUMINUM
 CU=COPPER



Key Plan

AE 481 W - Senor Project
Technical Report 2

Daniel Moynagh
141 South Allen Street
Stat College, PA 16801

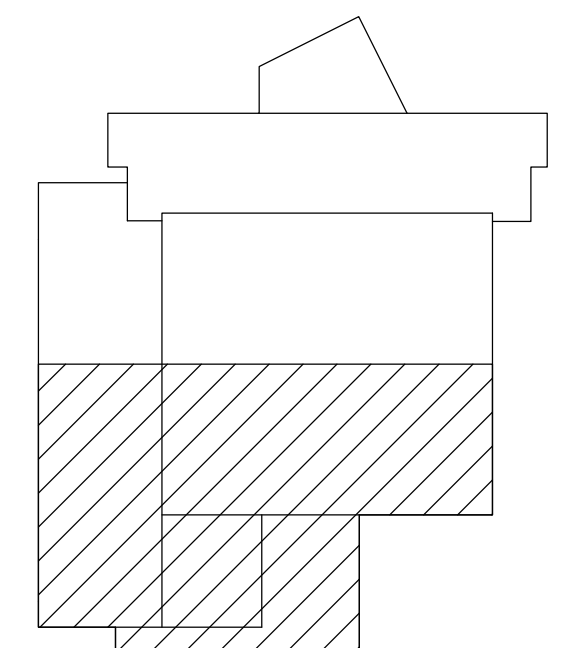
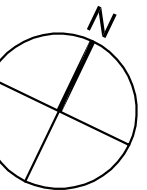
Drawing Title:
**POWER DISTRIBUTION
SINGLE-LINE DIAGRAM**

Issue Date: November 4, 2009

Drawing No.:

Scale: NTS

E1



Key Plan

3 FEEDER SCHEDULE

FEEDER ID	OCPD	PHASE WIRES (AWG)	NEUTRAL WIRES (AWG)	EQUIP. GND (AWG)	MIN. CONDUIT SIZE	FEEDER ID	OCPD	PHASE WIRES (AWG)	NEUTRAL WIRES (AWG)	EQUIP. GND (AWG)	MIN. CONDUIT SIZE
A3	30	(3)10	---	10	3/4	P3	300	(3)350KCMIL	---	4	2-1/2
A4	30	(3)10	(1)10	10	3/4	P4	300	(3)350KCMIL	(1)350KCMIL	4	3
A5	30	(3)10	(1)6	10	3/4	P5	300	(3)350KCMIL	(2)350KCMIL	4	4
B3	40	(3)8	---	10	3/4	Q3	350	(3)500KCMIL	---	2	3
B4	40	(3)8	(1)8	10	3/4	Q4	350	(3)500KCMIL	(1)500KCMIL	2	4
B5	40	(3)8	(1)2	10	1	Q5	350	(3)500KCMIL	(2)500KCMIL	2	4
C3	50	(3)6	---	10	1	R3	400	(6)3/0	---	1	(2)2
C4	50	(3)6	(1)6	10	1-1/4	R4	400	(6)3/0	(2)3/0	(2)2	(2)2
C5	50	(3)6	(1)2	10	1-1/4	R5	400	(6)3/0	(4)3/0	(2)2	(2)2-1/2
D3	60	(3)4	---	10	1	S3	500	(6)250KCMIL	---	(2)2	(2)2
D4	60	(3)4	(1)4	10	1-1/4	S4	500	(6)250KCMIL	(2)250KCMIL	(2)2	(2)2-1/2
D5	60	(3)4	(1)1/0	10	1-1/4	S5	500	(6)250KCMIL	(4)250KCMIL	(2)2	(2)3
E3	70	(3)4	---	10	1	T3	600	(6)350KCMIL	---	(2)2	(2)2
E4	70	(3)4	(1)4	8	1-1/4	T4	600	(6)350KCMIL	(2)350KCMIL	(2)1/0	(2)2-1/2
E5	70	(3)4	(1)1/0	8	1-1/4	T5	600	(6)350KCMIL	(4)350KCMIL	(2)1/0	(2)4
F3	90	(3)2	---	8	1-1/4	U3	700	(6)500KCMIL	---	(2)1/0	(2)3
F4	90	(3)2	(1)2	8	1-1/4	U4	700	(6)500KCMIL	(2)500KCMIL	(2)1/0	(2)4
F5	90	(3)2	(1)3/0	8	1-1/2	U5	700	(6)500KCMIL	(4)500KCMIL	(2)1/0	(2)4
G3	100	(3)1/0	---	8	1-1/4	V3	800	(9)300KCMIL	---	(3)1/0	(3)2-1/2
G4	100	(3)1/0	(1)1/0	8	1-1/2	V4	800	(9)300KCMIL	(3)300KCMIL	(3)1/0	(3)3
G5	100	(3)1/0	(1)3/0	8	2	V5	800	(9)300KCMIL	(6)300KCMIL	(3)1/0	(3)3
H3	125	(3)1/0	---	6	1-1/2	W3	1000	(9)400KCMIL	---	(3)2/0	(3)3
H4	125	(3)1/0	(1)1/0	6	1-1/2	W4	1000	(9)400KCMIL	(3)400KCMIL	(3)2/0	(3)4
H5	125	(3)1/0	(1)250KCMIL	6	2	W5	1000	(9)400KCMIL	(6)400KCMIL	(3)2/0	(3)4
J3	150	(3)1/0	---	6	1-1/2	X3	1200	(12)350KCMIL	---	(4)3/0	(4)2-1/2
J4	150	(3)1/0	(1)1/0	6	1-1/2	X4	1200	(12)350KCMIL	(4)350KCMIL	(4)3/0	(4)3
J5	150	(3)1/0	(2)1/0	6	2	X5	1200	(12)350KCMIL	(8)350KCMIL	(4)3/0	(4)4
K3	175	(3)2/0	---	6	1-1/2	Y3	1500	(12)500KCMIL	---	(4)4/0	(4)3
K4	175	(3)2/0	(1)2/0	6	2	Y4	1500	(12)500KCMIL	(4)500KCMIL	(4)4/0	(4)4
K5	175	(3)2/0	(2)2/0	6	2	Y5	1500	(12)500KCMIL	(8)500KCMIL	(4)4/0	(4)4
L3	200	(3)3/0	---	6	2	Z3	1600	(15)400KCMIL	---	(5)4/0	(5)3
L4	200	(3)3/0	(1)3/0	6	2	Z4	1600	(15)400KCMIL	(5)400KCMIL	(5)4/0	(5)3
L5	200	(3)3/0	(2)3/0	6	2-1/2	Z5	1600	(15)400KCMIL	(10)400KCMIL	(5)4/0	(5)4
M3	225	(3)4/0	---	4	2	AA3	2000	(18)400KCMIL	---	(6)250KCMIL	(6)3
M4	225	(3)4/0	(1)4/0	4	2-1/2	AA4	2000	(18)400KCMIL	(6)400KCMIL	(6)250KCMIL	(6)3
M5	225	(3)4/0	(2)4/0	4	2-1/2	AA5	2000	(18)400KCMIL	(12)400KCMIL	(6)250KCMIL	(6)4
N3	250	(3)250KCMIL	---	4	2						
N4	250	(3)250KCMIL	(1)250KCMIL	4	2-1/2						
N5	250	(3)250KCMIL	(2)250KCMIL	4	3						

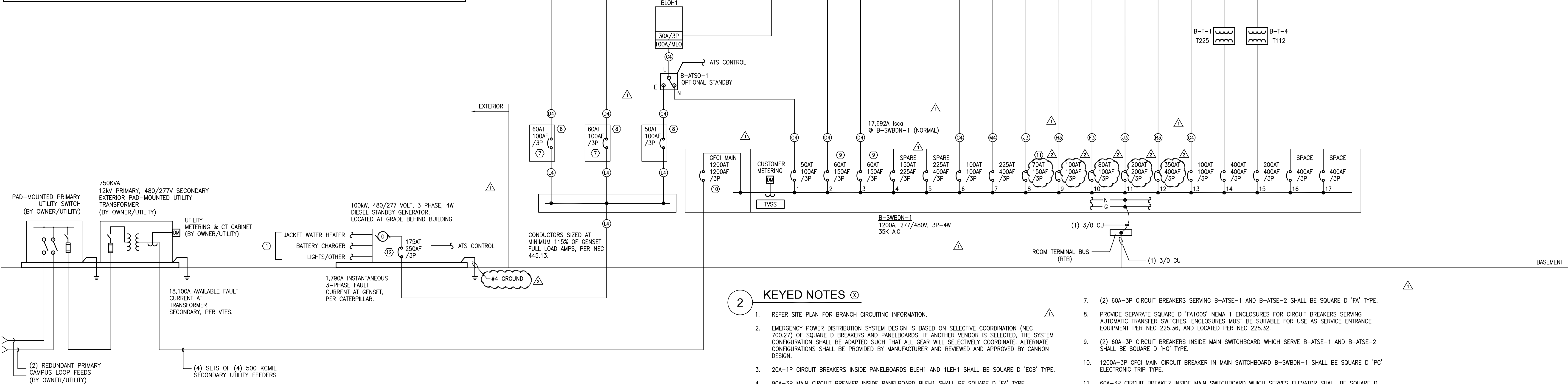
CONDUIT METRIC CONVERSION:		CONDUCTOR METRIC CONVERSION:	
INCHES	MM	AWG	SCM
1/2	16	10	5.26
3/4	21	8	8.38
	27	6	13.3
1-1/4	35	4	21
1-1/2	41	2	34
2	53	1	42
2-1/2	63	1/0	54
	78	2/0	67
	103	3/0	85
	129	4/0	107
	155	250	127
		300	152
		350	178
		400	203
		500	254

4 THREE-PHASE TRANSFORMER FEEDER SCHEDULE

DESIG.	SIZE (KVA)	PRIMARY VOLTAGE: 480V, 3-PHASE, 3-WIRE DELTA			SEC. VOLTAGE: 208/120V, 3-PHASE, 4-WIRE WYE			SECONDARY DERIVED SYSTEM GROUND ELECTRODE			
		FULL LOAD (AMPS)	OCPD (AMPS)	FEEDER CONDUCTOR (AWG) / CONDUIT (IN)	FULL LOAD (AMPS)	OCPD (AMPS)	FEEDER CONDUCTOR (AWG) / CONDUIT (IN)	CONDUCTOR (AWG)	CONDUIT (IN)		
T9	9	11	20	3#12+1#12G	3/4	30	25	30	4#10+1#10G	3/4	1/2
T15	15	18	30	3#10+1#10G	3/4	30	42	50	4#6+1#6G	1-1/4	60
T30	30	36	60	3#4+1#4G	1-1/4	100	125	150	4#2+1#2G	1-1/2	100
T45	45	54	90	3#2+1#2G	1-1/4	100	125	150	4#1/0+1#1/0G	2	200
T75	75	90	150	3#1/0+1#1/0G	1-1/2	200	208	225	4#4/0+1#4/0G	2-1/2	400
T112.5	112.5	135	200	3#3/0+1#3/0G	2	200	312	400	8#3/0+2#2G	(2)2-1/2	400
T150	150	180	300	3#350+1#4G	2-1/2	400	416	500	8#250+2#2G	(2)2-1/2	600
T225	225	271	400	6#3/0+2#2G	(2)2	400	525	700	8#200+2#1/0G	(2)2	800
T300	300	361	600	6#350+2#1G	(2)2-1/2	600	833	1000	12#400+3#2/0G	(3)4	1000
T500	500	602	1000	9#350+3#2/0G	(3)3	1000	1388	1600	20#400+5#4/0G	(5)3	1600
T750	750	903	1500	12#500+4#4/0G	(4)3	1600	2084	2500	28#500+7#350G	(7)3	3000
T1000	1000	1203	2000	18#400+6#250G	(6)3	2000	2780	3000	32#500+6#400G	(6)4	3000

NOTES FOR TRANSFORMER FEEDERS SCHEDULE

- PROVIDE PRIMARY FEEDER OF SIZE SHOWN IN SCHEDULE FROM CIRCUIT PROTECTIVE DEVICE TO TRANSFORMER PRIMARY TERMINALS UNLESS OTHERWISE NOTED.
- PROVIDE SECONDARY FEEDER OF SIZE SHOWN IN SCHEDULE, FROM TRANSFORMER SECONDARY TERMINALS TO THE LAST LOAD SHOWN ON SINGLE LINE DIAGRAM.
- IF SHOWN ON DRAWINGS PROVIDE UNFUSED DISCONNECT SWITCH OF SIZE SHOWN IN SCHEDULE.



1 POWER DISTRIBUTION ONE-LINE DIAGRAM

- ### 2 KEYED NOTES
- REFER SITE PLAN FOR BRANCH CIRCUITING INFORMATION.
 - EMERGENCY POWER DISTRIBUTION SYSTEM DESIGN IS BASED ON SELECTIVE COORDINATION (NEC 700.27) OF SQUARE D BREAKERS AND PANELBOARDS. IF ANOTHER VENDOR IS SELECTED, THE SYSTEM CONFIGURATION SHALL BE ADAPTED SUCH THAT ALL GEAR WILL SELECTIVELY COORDINATE. ALTERNATE CONFIGURATIONS SHALL BE PROVIDED BY MANUFACTURER AND REVIEWED AND APPROVED BY CANNON DESIGN.
 - 20A-1P CIRCUIT BREAKERS INSIDE PANELBOARDS BLE1 AND 1LE1 SHALL BE SQUARE D 'EGB' TYPE.
 - 90A-3P MAIN CIRCUIT BREAKER INSIDE PANELBOARD BLE1 SHALL BE SQUARE D 'FA' TYPE.
 - 20A-1P CIRCUIT BREAKERS INSIDE PANELBOARDS BLE1 AND 1LE1 SHALL BE SQUARE D 'QOB' TYPE.
 - 100A-3P MAIN CIRCUIT BREAKER INSIDE PANELBOARD BLE1 SHALL BE SQUARE D 'QB' TYPE.
 - (2) 60A-3P CIRCUIT BREAKERS SERVING B-ATSE-1 AND B-ATSE-2 SHALL BE SQUARE D 'FA' TYPE.
 - PROVIDE SEPARATE SQUARE D 'FA100S' NEMA 1 ENCLOSURES FOR CIRCUIT BREAKERS SERVING AUTOMATIC TRANSFER SWITCHES. ENCLOSURES MUST BE SUITABLE FOR USE AS SERVICE ENTRANCE EQUIPMENT PER NEC 225.36, AND LOCATED PER NEC 225.32.
 - (2) 60A-3P CIRCUIT BREAKERS INSIDE MAIN SWITCHBOARD WHICH SERVE B-ATSE-1 AND B-ATSE-2 SHALL BE SQUARE D 'HG' TYPE.
 - 1200A-3P GFCI MAIN CIRCUIT BREAKER IN MAIN SWITCHBOARD B-SWBDN-1 SHALL BE SQUARE D 'PG' ELECTRONIC TRIP TYPE.
 - 60A-3P CIRCUIT BREAKER INSIDE MAIN SWITCHBOARD WHICH SERVES ELEVATOR SHALL BE SQUARE D 'HG' TYPE.
 - 175A-3P CIRCUIT BREAKER INSIDE GENERATOR ENCLOSURE SHALL BE SQUARE D 'JG' ELECTRONIC TRIP TYPE. BREAKER SHALL BE PROVIDED WITH GROUND FAULT INDICATION ONLY.

Part II - Communication Systems

Fire Alarm System

The fire alarm control panel for this building is located in the lobby, adjacent to the main entrance. There are ceiling mounted smoke detectors throughout, with rate of rise heat detectors in the mechanical room. Manual pull stations are mounted in each of the stairwells and at the building exits.

Door Monitoring System

There is no card reading system for entrance into the building lobby, but there is a card reader for entering the corridor serving all of the other spaces on the first level, and for the entrance to the basement. There is a push plate for automatic door opening at the building entrance.

Audio and Video

All audio and video for televisions in the in the building comes from a satellite distribution system. There is satellite radio service in all of the training rooms and coaches' offices. There are connections for satellite television in the classrooms, lounges, conference rooms, and coaches' rooms. In the gymnasium there is an HD camera system for recording team practices.

Telecommunications

The telecommunication system in the building is served from existing campus equipment loop. There are voice and data outlets in all of training and office areas. There is also wireless internet in the locker room/lounge areas and coach's areas.

Fixture Tag: A03, A04

Lamp Type: Quartz Metal Halide BT37



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45560 – MVR750/C/VBU/PA
 GE Multi-Vapor® PulseArc® Quartz Metal Halide BT37



GENERAL CHARACTERISTICS

Lamp type	High Intensity Discharge - Quartz Metal Halide
Bulb	BT37
Base	Mogul Screw (E39)
Bulb Finish	Coated
Wattage	750
Rated Life	16000 hrs
Bulb Material	Hard glass
Lamp Enclosure Type (LET)	Enclosed fixtures only
Base Temperature (MAX)	250 °C (482 °F)
Bulb Temperature (MAX)	430 °C (806 °F)
LEED-EB MR Credit	137 picograms Hg per mean lumen hour



[View Larger](#)

PHOTOMETRIC CHARACTERISTICS

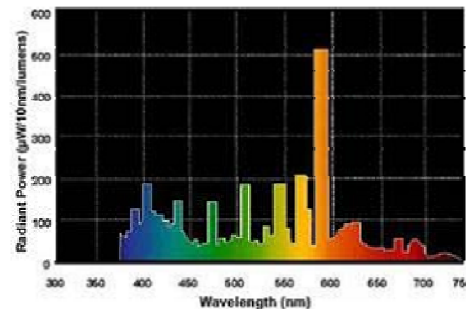
Initial Lumens	72000
Mean Lumens	54000
Nominal Initial Lumens per Watt	96
Color Temperature	3700 K
Color Rendering Index (CRI)	70

ADDITIONAL RESOURCES

- [Catalogs](#)
- [Testimonials](#)
- [MSDS \(Material Safety Data Sheets\)](#)
- [Disposal Policies & Recycling Information](#)

GRAPHS & CHARTS

Spectral Power Distribution



ELECTRICAL CHARACTERISTICS

Burn Position	Vertical base up ±15°
Open Circuit Voltage (peak lead ballast) (MIN)	466 V
Open Circuit Voltage (RMS lag ballast) (MIN)	330 V
Warm Up Time to 90% (MIN)	2 min
Warm Up Time to 90% (MAX)	5 min
1st Restart Time to 90% (MIN)	10 min
1st Restart Time to 90% (MAX)	15 min

Fixture Tag: A03, A04 (Continued)

Lamp Type: Quartz Metal Halide BT37

DIMENSIONS

Maximum Overall Length (MOL)	11 1/2
Bulb Diameter (DIA)	4 5/8
Light Center Length (LCL)	7

PRODUCT INFORMATION

Product Code	45560
Description	MVR750/C/VBU/PA
ANSI Code	M149
Standard Package	Case
Standard Package GTIN	10043168455609
Standard Package Quantity	6
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	6
UPC	043168455602

COMPATIBLE GE BALLASTS

Product Code	Description	# of Bulbs	Power Factor	Ballast Factor
46936	GEP75048TAC5-5	1	0.9	1.0
46934	GEP750MLTAC5-5	1	0.9	1.0

⚠ 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/urburns.html>

[See list of cautions & warnings.](#)


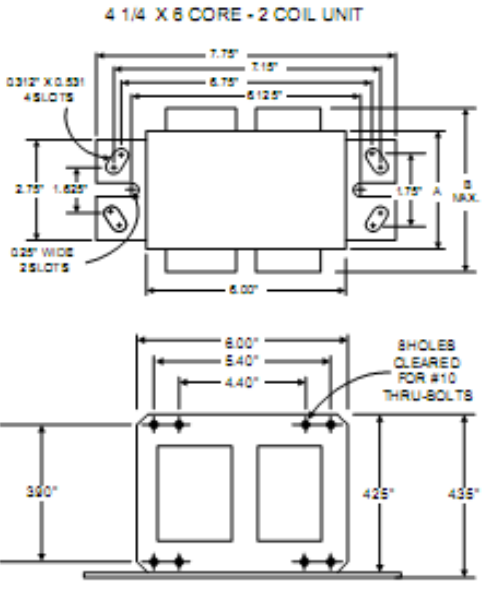

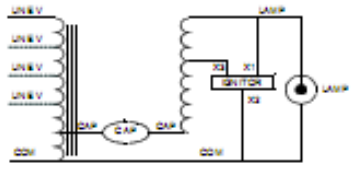
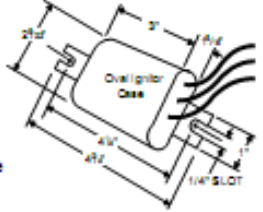
NOTES

- When operated on a 120 hrs. cycle (minimum), lamp life rating may be extended by up to 50% based on engineering estimates.

[Return To Top](#)

Fixture Tag: A03, A04

Ballast Type: Pulse Start Metal Halide Lamp Ballast

	<p>Metal Halide Lamp Ballast</p>	<p>Catalog Number 71A6452 For 750W M149 (Pulse Start) 60 Hz SUPER-CWA Status: Active</p>																																																																																																																																																																																																																							
<p>DIMENSIONS AND DATA</p>																																																																																																																																																																																																																									
<p>4 1/4 X 6 CORE - 2 COIL UNIT</p> 	<table border="1"> <thead> <tr> <th></th> <th>120</th> <th>208</th> <th>240</th> <th>277</th> <th>480</th> </tr> </thead> <tbody> <tr> <td>INPUT VOLTS</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>CIRCUIT TYPE</td> <td colspan="5">SUPER-CWA</td> </tr> <tr> <td>POWER FACTOR (min)</td> <td colspan="5">90%</td> </tr> <tr> <td>REGULATION</td> <td colspan="5"></td> </tr> <tr> <td>Line Volts</td> <td colspan="5">±10%</td> </tr> <tr> <td>Lamp Watts</td> <td colspan="5">±10%</td> </tr> <tr> <td>LINE CURRENT (Amps)</td> <td colspan="5"></td> </tr> <tr> <td>Operating</td> <td>7.00</td> <td>4.00</td> <td>3.50</td> <td>3.00</td> <td>1.80</td> </tr> <tr> <td>Open Circuit</td> <td>3.30</td> <td>2.00</td> <td>1.80</td> <td>1.70</td> <td>0.80</td> </tr> <tr> <td>Starting</td> <td>6.80</td> <td>3.80</td> <td>3.30</td> <td>2.80</td> <td>1.68</td> </tr> <tr> <td>UL TEMPERATURE RATINGS</td> <td colspan="5"></td> </tr> <tr> <td>Insulation Class</td> <td colspan="5">H(180°C)</td> </tr> <tr> <td>Coil Temperature Code</td> <td colspan="5">1029</td> </tr> <tr> <td>MIN. AMBIENT STARTING TEMP.</td> <td colspan="5">20°F or -30°C</td> </tr> <tr> <td>NOM. OPEN CIRCUIT VOLTAGE</td> <td colspan="5">365</td> </tr> <tr> <td>INPUT VOLTAGE AT LAMP DROPOUT</td> <td>80</td> <td>104</td> <td>120</td> <td>138</td> <td>240</td> </tr> <tr> <td>INPUT WATTS</td> <td colspan="5"></td> </tr> <tr> <td>RECOMMENDED FUSE (Amps)</td> <td>20</td> <td>10</td> <td>10</td> <td>8</td> <td>8</td> </tr> <tr> <td>CORE and COIL</td> <td colspan="5"></td> </tr> <tr> <td>Dimension (A)</td> <td colspan="5">2.33</td> </tr> <tr> <td>Dimension (B)</td> <td colspan="5">4.25</td> </tr> <tr> <td>Weight (lbs)</td> <td colspan="5">15</td> </tr> <tr> <td>Lead Lengths</td> <td colspan="5">12"</td> </tr> <tr> <td>CAPACITOR REQUIREMENT</td> <td colspan="5"></td> </tr> <tr> <td>Microfarads</td> <td colspan="5">28.0</td> </tr> <tr> <td>Volts (min.)</td> <td colspan="5">400</td> </tr> <tr> <td>Fault Current Withstand (amps)</td> <td colspan="5">400</td> </tr> <tr> <td>60 Hz TEST PROCEDURES (Refer to Philips Lighting Electronics N.A. TEST Procedure for HID Ballasts - Form 127)</td> <td colspan="5"></td> </tr> <tr> <td>High Potential Test (Volts)</td> <td colspan="5"></td> </tr> <tr> <td>1 minute</td> <td colspan="5">2000</td> </tr> <tr> <td>2 seconds</td> <td colspan="5">2500</td> </tr> <tr> <td>Open Circuit Voltage Test (Volts)</td> <td colspan="5">320-390</td> </tr> <tr> <td>Short-Circuit Current Test (Amps)</td> <td colspan="5"></td> </tr> <tr> <td>Secondary Current</td> <td colspan="5">500-6.00</td> </tr> <tr> <td>Input Current</td> <td>5.00-7.50</td> <td>2.90-4.30</td> <td>2.50-3.80</td> <td>2.10-3.25</td> <td>1.25-1.90</td> </tr> </tbody> </table>		120	208	240	277	480	INPUT VOLTS						CIRCUIT TYPE	SUPER-CWA					POWER FACTOR (min)	90%					REGULATION						Line Volts	±10%					Lamp Watts	±10%					LINE CURRENT (Amps)						Operating	7.00	4.00	3.50	3.00	1.80	Open Circuit	3.30	2.00	1.80	1.70	0.80	Starting	6.80	3.80	3.30	2.80	1.68	UL TEMPERATURE RATINGS						Insulation Class	H(180°C)					Coil Temperature Code	1029					MIN. AMBIENT STARTING TEMP.	20°F or -30°C					NOM. OPEN CIRCUIT VOLTAGE	365					INPUT VOLTAGE AT LAMP DROPOUT	80	104	120	138	240	INPUT WATTS						RECOMMENDED FUSE (Amps)	20	10	10	8	8	CORE and COIL						Dimension (A)	2.33					Dimension (B)	4.25					Weight (lbs)	15					Lead Lengths	12"					CAPACITOR REQUIREMENT						Microfarads	28.0					Volts (min.)	400					Fault Current Withstand (amps)	400					60 Hz TEST PROCEDURES (Refer to Philips Lighting Electronics N.A. TEST Procedure for HID Ballasts - Form 127)						High Potential Test (Volts)						1 minute	2000					2 seconds	2500					Open Circuit Voltage Test (Volts)	320-390					Short-Circuit Current Test (Amps)						Secondary Current	500-6.00					Input Current	5.00-7.50	2.90-4.30	2.50-3.80	2.10-3.25	1.25-1.90
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<p>Capacitor: 7C280S40</p>  <p>Capacitance: 28 Dia/Oval Dim: 2.00 Height: 5.12 Temp Rating: 105°C</p>	<p>Wiring Diagram:</p>  <p>UL RECOGNIZED</p>																																																																																																																																																																																																																								
<p>Ignitor: LI573-H5</p>  <p>Ballast to Lamp Distance (BTL) = 15 feet Temp Rating: 105°C</p>	<p>Typical Ordering Information (please call Philips Lighting Electronics N.A. for suffix availability)</p> <table border="1"> <thead> <tr> <th>Order Suffix</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> </tr> </tbody> </table>	Order Suffix	Description																																																																																																																																																																																																																						
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PHILIPS LIGHTING ELECTRONICS N.A.
 10275 WEST HIGGINS ROAD • ROSEMONT, IL 60018
 Tel: 800-322-2088 • Fax: 888-423-1882 • www.philips.com/advance
 Customer Support/Technical Service: 800-372-3331 • OEM Support: 888-615-5886

Revised: 06/26/06

Fixture Tag: A18

Lamp Type: Ceramic Metal Halide PAR30L



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[Products](#) > [High Intensity Discharge](#) > [Ceramic Metal Halide](#) > [PAR](#) > [PAR30L](#) > 42067

42067 – CMH39PAR30L/FL25

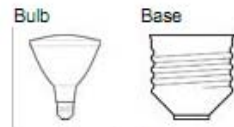
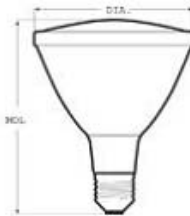
GE ConstantColor® PulseArc® CMH® Ceramic Metal Halide PAR30L



a product of
ecomagination

GENERAL CHARACTERISTICS

Lamp type	High Intensity Discharge - Ceramic Metal Halide
Bulb	PAR30L
Base	Medium Screw (E26)
Wattage	39
Rated Life	10000 hrs
Bulb Material	Hard glass
Lamp Enclosure Type (LET)	Open or enclosed fixtures
LEED-EB MR Credit	208 picograms Hg per mean Lumen hour
Additional Info	Ballast thermal protection, UV control



[View Larger](#)

PHOTOMETRIC CHARACTERISTICS

Initial Lumens	2400
Nominal Initial Lumens per Watt	61
Beam Spread	25 °
Center Beam Candlepower (CBCP)	11000
Color Temperature	3000 K
Color Rendering Index (CRI)	81

ADDITIONAL RESOURCES

- [Catalogs](#)
- [Testimonials](#)
- Sell Sheets**
 - [GE ConstantColor® CMH® Lamps](#)
- [IES/Photometric Download](#)
- [MSDS \(Material Safety Data Sheets\)](#)
- [Disposal Policies & Recycling Information](#)

ELECTRICAL CHARACTERISTICS

Burn Position	Universal burning position
Open Circuit Voltage (peak lead ballast) (MIN)	280 V
Open Circuit Voltage (RMS lag ballast) (MIN)	198 V
Warm Up Time to 90%	2 min
Warm Up Time to 90% (MAX)	2 min/3 min
Hot Restart Time to 90% (MIN)	10 min
Hot Restart Time to 90% (MAX)	15 min

Fixture Tag: A18 Continued

Lamp Type: Ceramic Metal Halide PAR30L

DIMENSIONS

Maximum Overall Length (MOL)	4 3/4
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PRODUCT INFORMATION

Product Code	42067
Description	CMH39PAR30L/FL25
ANSI Code	M130
Standard Package	Case
Standard Package GTIN	10043168420676
Standard Package Quantity	6
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	6
LPC	043168420679

COMPATIBLE GE BALLASTS

Product Code	Description	# of Bulbs	Power Factor	Ballast Factor
74116	GEMH39-MC-120	1	0.99	1.0
75378	GEMH39-MCM-120	1	0.99	1.0
87501	GEMH39-MSF-120	1	0.99	1.0

▲ 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/urburns.html>

[See list of cautions & warnings.](#)

NOTES

- Rated life based on 11 hours per start
- Use electronic ballast, peak lead ballast, or system which can shut itself off if ballast overheating occurs

Fixture Tag: A21, AX03

Lamp Type: Ceramic Metal Halide T4



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71484 – CMH39T/U930GU6.5

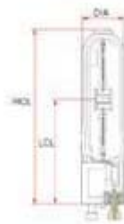
GE ConstantColor® PulseArc® CMH® Ceramic Metal Halide T4 - Retail Display



RoHS Compliant
High Color Rendering

GENERAL CHARACTERISTICS

Lamp type	High Intensity Discharge - Ceramic Metal Halide
Bulb	T4
Base	GU6.5
Bulb Finish	Clear
Wattage	39
Rated Life	10000 hrs
Lamp Enclosure Type (LET)	Enclosed fixtures only
Base Temperature (MAX)	350
Bulb Temperature (MAX)	550
LEED-EB MR Credit	187 picograms Hg per mean lumen hour
Additional Info	Ballast thermal protection, UV control
Primary Application	Retail Display



Bulb



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PHOTOMETRIC CHARACTERISTICS

Initial Lumens	3400
Mean Lumens	2300
Nominal Initial Lumens per Watt	87
Color Temperature	3000 K
Color Rendering Index (CRI)	88

ELECTRICAL CHARACTERISTICS

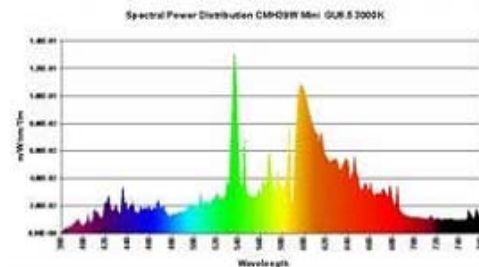
Burn Position	Universal burning position
Warm Up Time to 90%	3 min
Hbt Restart Time to 90%	5 min

ADDITIONAL RESOURCES

- [Catalogs](#)
- [Testimonials](#)
- [Sell Sheets](#)
 - [ConstantColor® CMH GU6.5 Sell Sheet](#)
 - [ConstantColor™ CMH GU6.5 OEM Data Sheet](#)
- [Disposal Policies & Recycling Information](#)

GRAPHS & CHARTS

Spectral Power Distribution



Fixture Tag: A21, AX03 Continued

Lamp Type: Ceramic Metal Halide T4

DIMENSIONS

Maximum Overall Length (MOL)	2.0500
Bulb Diameter (DIA) (MAX)	0.470
Light Center Length (LCL)	1.180

PRODUCT INFORMATION

Product Code	71484
Description	CMH39T/U930GU6.5
ANSI Code	C130/M130
Standard Package	Case
Standard Package GTIN	10043168714843
Standard Package Quantity	12
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	12
LPC	043168714846

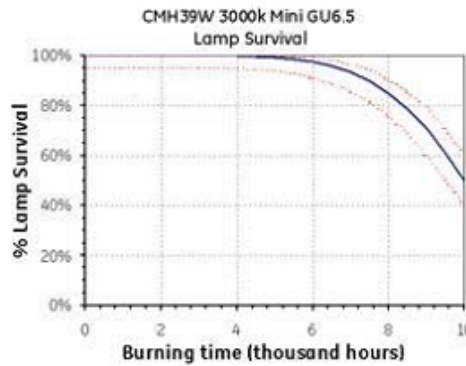
COMPATIBLE GE BALLASTS

Product Code	Description	# of Bulbs	Power Factor	Ballast Factor
74116	GEMH39-MC-120	1	0.99	1.0
75378	GEMH39-MCM-120	1	0.99	1.0
87501	GEMH39-MSF-120	1	0.99	1.0

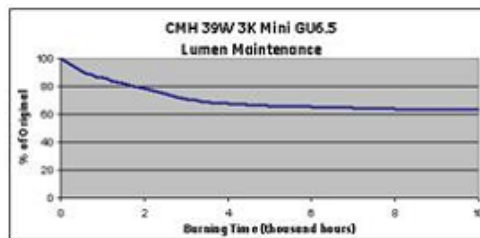
CAUTIONS & WARNINGS

[See list of cautions & warnings.](#)

Lamp Mortality



Lumen Maintenance



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Fixture Tag: A18, A21, AX03

Ballast Type: Electronic Ballast for Metal Halide Lamps

PHILIPS ADVANCE		e-Vision® Electronic Ballast for Metal Halide Lamps			Catalog Number: IMH-239-A For (2) 39W Metal Halide Lamps ANSI M130 120-277 50/60Hz Electronic Status: RELEASED											
DIMENSIONS AND DATA																
Lamp		Input Volts	Catalog Number*	Line Current (Amps)	Input Power (Watts)	Min Power Factor	Wiring Diag	Fig.	Weight (lb)	Max. Distance to Lamp (ft)						
Number	Watts															
39W Watt Lamp, ANSI Code M130 Minimum Starting Temp -30°C/-20°F																
2	39	120 277	IMH-239-A-XXX	0.74 0.31	89 86	0.9	5	A/B	1.6	6						
Case Figure	Overall Length	Case Length	Case Width	Height	Mounting Length	Mounting Width										
A/B	140mm [5.5"]	120mm [4.7"]	92mm [3.6"]	38mm [1.5"]	132mm [5.2"]	73mm [2.9"]										
<p style="text-align: center;">HOT SPOT MEASUREMENT LOCATION</p>																
<p>INSTALLATION & APPLICATION NOTES:</p> <ol style="list-style-type: none"> Maximum allowable case temperature is 85°C. See figure above for measurement location Ignition pulse is 4 kV max All leads are 12 inches long Ballast output will shutdown after 20 minutes if lamp fails to ignite Power must be cycled off – then on, after replacing lamp When one lamp fails, the other lamp remains lit Connect the red and orange leads to the center terminals of their respective lamps when using screw base lamps 							<p>*Ordering Information</p> <table border="1"> <thead> <tr> <th>Order Suffix</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>-LF</td> <td>Ballast with side exit leads and mounting feet</td> </tr> <tr> <td>-BLS</td> <td>Ballast with bottom exit leads and mounting studs</td> </tr> </tbody> </table>				Order Suffix	Description	-LF	Ballast with side exit leads and mounting feet	-BLS	Ballast with bottom exit leads and mounting studs
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Philips Lighting Electronics N.A.

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Fixture Tag: AX02

Lamp Type: Ceramic Metal Halide T4



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 [High Intensity Discharge](#) >
 [Ceramic Metal Halide](#) >
 [Single-Ended](#) >
 [T4](#) >
 85086

85086 – CMH20T/U830GU6.5

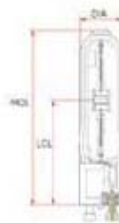
GE ConstantColor® PulseArc® CMH® Ceramic Metal Halide T4 - Retail Display



RoHS Compliant

GENERAL CHARACTERISTICS

Lamp type	High Intensity Discharge - Ceramic Metal Halide
Bulb	T4
Base	GU6.5
Bulb Finish	Clear
Wattage	20
Rated Life	12000 hrs
Lamp Enclosure Type (LET)	Enclosed fixtures only
Base Temperature (MAX)	250
Bulb Temperature (MAX)	400
LEED-EB MR Credit	198 picograms Hg per mean lumen hour
Additional Info	UV control
Primary Application	Retail Display



Bulb



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PHOTOMETRIC CHARACTERISTICS

Initial Lumens	1615
Mean Lumens	1066
Nominal Initial Lumens per Watt	80
Color Temperature	3000 K
Color Rendering Index (CRI)	81

ELECTRICAL CHARACTERISTICS

Burn Position	Universal burning position
Warm Up Time to 90%	3 min
Hot Restart Time to 90%	5 min

DIMENSIONS

Maximum Overall Length (MOL)	2.0500
Bulb Diameter (DIA) (MAX)	0.470

ADDITIONAL RESOURCES

[Catalogs](#)

[Testimonials](#)

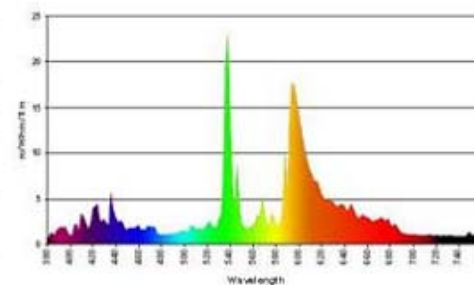
Sell Sheets

- [ConstantColor® CMH GU6.5 Sell Sheet](#)
- [ConstantColor™ CMH GU6.5 OEM Data Sheet](#)

[Disposal Policies & Recycling Information](#)

GRAPHS & CHARTS

Spectral Power Distribution



Lamp Mortality

Fixture Tag: AX02 Continued

Lamp Type: Ceramic Metal Halide T4

Light Center Length (LCL) 1.180

PRODUCT INFORMATION

Product Code 85086

Description CMH20T/U830GU6.5

ANSI Code C156/M156

Standard Package Case

Standard Package GTIN 10043168850862

Standard Package Quantity 12

Sales Unit Unit

No Of Items Per Sales Unit 1

No Of Items Per Standard Package 12

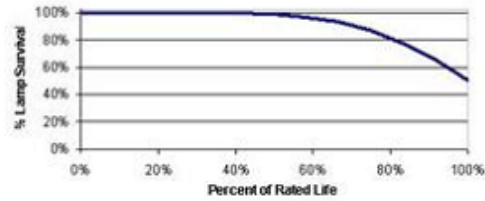
LPC 043168850865

COMPATIBLE GE BALLASTS

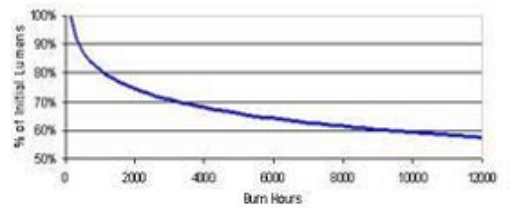
Product Code	Description	# of Bulbs	Power Factor	Ballast Factor
74115	GEMH20-MC-120	1	0.99	1.0
87490	GEMH20-MLF-120	1	0.56	1.0

CAUTIONS & WARNINGS

[See list of cautions & warnings.](#)



Lumen Maintenance



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Fixture Tag: AX02

Ballast Type: Electronic Ballast for Metal Halide Lamps

PHILIPS ADVANCE		e-Vision® Electronic Ballast for Metal Halide Lamps			Catalog Number: IMH-G20-G For 20W Metal Halide Lamps ANSI M156 120-277 50/60Hz Electronic Status: RELEASED					
DIMENSIONS AND DATA										
Lamp		Input Volts	Catalog Number*	Line Current (Amps)	Input Power (Watts)	Min Power Factor	Wiring Diag	Fig.	Weight (lb)	Max. Distance to Lamp (ft)
Number	Watts									
20W Watt Lamp, ANSI Code M156 Minimum Starting Temp -20°C/-4°F										
1	20	120 277	IMH-G20-G-XXX	0.2 0.09	24 24	0.95	3	G	0.9	5
							<p style="text-align: center;">Ballast Case must be Grounded</p>			
Wiring Diagram 3										
Case Figure	Overall Length	Case Length	Case Width	Height	Mountin Length	Mounting Width				
G	97mm [3.8"]	90mm [3.5"]	77mm [3.0"]	30mm [1.2"]	87mm [3.4"]	67mm [2.6"]				
INSTALLATION & APPLICATION NOTES: 1. Maximum allowable case temperature is 90°C. See figure above for measurement location 2. Ignition pulse is 4 kV max 3. All leads are 9 inches long 4. Ballast output will shutdown after 20 minutes if lamp fails to ignite 5. Power must be cycled off – then on, after replacing lamp 6. Connect the red lead to the center terminals of the lamp when using screw base lamps							*Ordering Information			
Order Suffix		Description								
-LF		Ballast with side exit leads and mounting feet								
-BLS		Ballast with bottom exit leads and mounting studs								
Data is based on tests performed by Philips Advance in a controlled environment and is representative of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice. All specifications are nominal unless otherwise noted.										

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