

Towson Arena Addition

Lighting Electrical

Towson, Maryland



Joseph Becker Thesis Final Report

May 25, 2012

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Executive Summary:

The proposed thesis shall include information about the Towson Arena Addition. I will present areas of analysis of the Towson University Arena Addition. Finally I will discuss three different breadth options that I will cover for this project.

I have identified problems and solutions for several parts of the building. I will do a lighting redesign of certain spaces. I have chosen to analyze the court area, the press room, a reception area and the northwest exterior entrance. Each lighting redesign will go into my selections for luminaires and controls and will demonstrate my ideas through images and calculations.

Once the four lighting spaces were redesigned I went through the architect provided drawings in search of all the affected panelboards. For each panelboard I removed the existing lighting circuits that were removed and resized new circuits for my new lighting system. From there I then resized the panelboard and feeders.

Once the panelboard redesign was finished I performed a short circuit rating analysis on a single run of the electrical distribution system. I went through and found the time current curves for a comparison, and I went through the calculations to find the short circuit rating for each breaker.

Next I concentrated on two electrical depths of my choosing. I decided to do a cost analysis of the existing emergency generator system and build an SKM model of the existing system. I used RS Means 2010 for the cost comparison of using two generators instead of the existing three. The SKM model was built for ease of demand load and voltage drop calculations. The SKM software can also perform many other calculations once a model is built.

Then I went into my first breadth topic outside of my Lighting/Electrical concentration. I studied the court's acoustic properties for several different uses. I used reverberation time calculations to determine the fit of the space per use. Then recommendations were made for the space to better suit the acoustical needs.

My final breadth topic was a glazing analysis of the court space. A clerestory surrounds the top of the court. I built a model in Trace and chose five different glazing options to study the effects on the cooling load for the year. Depending on the glazing option, different rates of heat loss and gain were calculated with a major contributing factor being the sun.

This sums up the body of my report and I hope you enjoy. I have gained endless knowledge on each of the topics that I studied for countless hours. If there are any questions or comments, please do not hesitate to contact me.

Background:



General Building Data:

Building Name: Towson Center Arena Addition

Location & Site: Towson, Maryland

Building Occupant Name: Towson University

Occupancy: Basketball Arena

Size: 116,586 square feet

Number of stories: 3

Primary Project Team:

Owner: Towson University	http://www.towson.edu/
General Contractor: Gilbane Construction	http://www.gilbaneco.com/
Architect: Hord Coplan Macht	http://www.hcm2.com/
Associated Architects: Sasaki	http://www.sasaki.com/
Civil: Site Resources, Inc.	www.siteresourcesinc.com/
Structural: Faisant Associates, Inc.	http://mysite.verizon.net/faisant/
MEP: James Posey Associates, Inc.	http://www.jamesposey.com/
Landscape: Mahan Rykiel Associates	http://www.mahanrykiel.com/
Code Consultants: Koffel Associates	http://www.koffel.com/
Lighting: Bruce Dunlop Lighting Design LLC	http://www.dunloplighting.com/
IT Consultants: Unlimited Systems Support, Inc.	http://www.ussinet.com/
Foodservice Consultants: Culinary Advisors	http://www.culinaryadvisors.com/

Dates of Construction: May 2011 – March 1, 2013

Cost: 33.5 million (overall project)

Project Delivery Method: Design – Bid – Build

Architecture:

Towson University will build a new state of the art arena for basketball, gymnastics and volleyball. Tiger arena will seat over 5,000 people and also accommodates luxury suites. A zinc, steel and glass façade gives a modern feel to the main entrance of the arena. Vertical windows help stretch the building so as to make it seem taller and more profound. A large overhang covers a glass and steel façade and helps to anchor the building. Floating over the entrance, the overhang gives a sense of strength to the building and exaggerates the grand scale.

Major National Model Codes:

NSPC 2006 – National Standard Plumbing Code/2007 Supplement

IBC 2009 – International Building Code with modifications

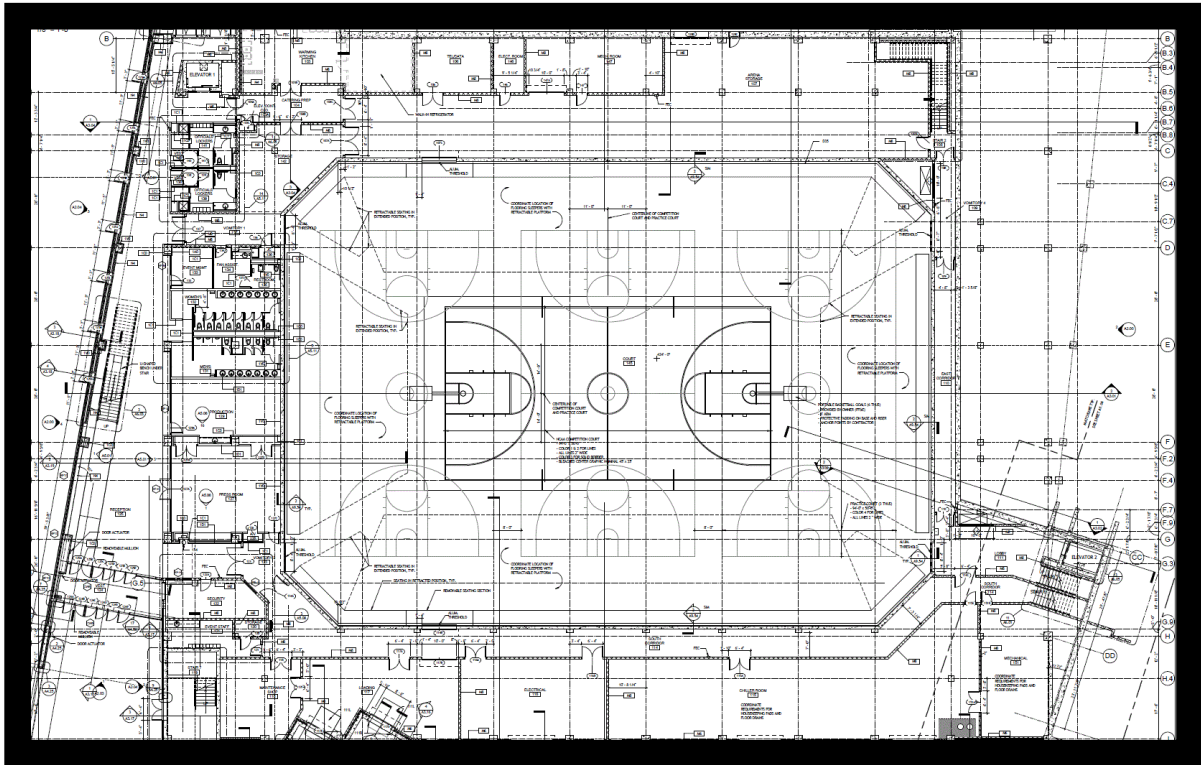
NFPA 101 – National Fire Protection Association



Zoning:

The first and second floors are zoned as A-4. The third floor and mezzanine level are zoned as A-3. There are also areas zoned as B and S. High rise provisions are not applicable because the highest floor is less than 75 feet above the lowest level of fire department access. The building will have a maximum building area of 60,448 square feet. The building will be sprinkled. Based on the A-3/A-4 Use Groups of 1B Construction the allowable area is unlimited. The allowable height is 160 feet and the allowable stories are eleven. To see more Baltimore County Zoning regulations please visit:

[Baltimore County Citizen's Guide to Zoning](#)



Statement of the Problem:

The Towson Arena Addition project has four spaces that I have scrutinized where I plan to redesign the lighting. The electrical system's emergency power capabilities will be assessed. Also, the four lighting solutions will need an electrical redesign.

The four spaces for a lighting redesign will be the court, the reception area on the first floor, the press room and the exterior northeast entrance. The court will need a lighting solution to accommodate games, physical education classes and sudden darkness for introductions at basketball games. I will design the reception to have a welcoming and guiding experience for the user. The press room design will have a psychological impression to go along with its design solution. The exterior will easily bring the spectators into the building through the use of an effective lighting design.

The electrical system shall be redesigned as well. The emergency power system will be examined, and I will decide if a better solution exists. The spaces that I plan to redesign with new lighting solutions will need to have their electrical design assessed for safety and code compliance. The branch circuits will need to be examined for the arena's electrical system serving these spaces. I would also like to perform a short circuit analysis of the building's electrical system.

Proposed Solution(s):

Lighting:

The court will be addressed by having a system to meet the NCAA basketball requirements for illuminance. The luminaires will need to be designed in zones to allow for the illuminance values needed for graduation ceremonies while saving energy. Finally, shutters will need to be installed on the luminaires so that the court can be blacked out during introductions of the opposing teams.

The reception area's lighting design will have several objectives. The users of the space will need to be directed through the space. The lighting solution will help direct the viewers. The reception area also should be welcoming so as to foster social interaction among the users. The lighting solution will need to give the users the most comfort in meeting and staying in the space. This will allow users to enjoy the space during pregame, halftime or other recesses when the arena is being used.

The press room will have the psychological impression of being public to help the speakers feel comfortable presenting in front of numerous reporters. This will be achieved by

providing enough vertical illumination to allow the speakers to see the audience. The space should be conducive to social interaction among the occupants.

The northeast entrance of the arena will be designed to have ample vertical illumination to allow for facial recognition of the users. There will also be a prominently illuminated entrance of the building that will let the users know exactly where to go. Luminaires will be positioned to create a line of light to the entrance as well. The line of light will be made up of posts.

Electrical:

The existing emergency power system consists of three generators. The needs of the building versus the existing system's capabilities will be checked. Then I will determine if there is a better solution that is more cost-effective. The spaces that will receive a lighting redesign will be examined for protection devices and wire sizing. The branch circuits and panelboard sizing will be examined and redesigned if necessary. I will also perform a short circuit analysis of the Towson Arena's electrical system. Finally an SKM analysis will be performed on the system.

Solution Methods:

In order to find cogent solutions to the design of the four spaces I will need to first research the illuminance values, power densities, codes and any other design concerns that apply to the spaces. The criteria will guide my choices of how to meet the design goals. Then equipment can be looked at in order to decide how I want to place the luminaires to fulfill my design concept. Finally I will create renderings and illuminance calculations with software. Power density calculations will also need to be done to comply with ASHRAE. My design will then be fine-tuned until I find an acceptable solution.

For the emergency power system I will go through the existing building and determine the capacity requirements. Once I determine the existing equipment size, I can assess whether the current system is adequate for the existing building or possible expansion. I would then like to research other emergency power setups to attempt to find a better and more cost-effective solution.

In the spaces that are redesigned, the lighting solutions will need to be examined for safety and code compliance. I will first find the needs of my new proposed lighting system. I will also check the current performance of the existing system. Where upgrades are needed I will make adjustments and redesign the wiring, panelboards or overcurrent protection devices. After I have a new electrical system for the new lighting design I will run a short circuit analysis.

The SKM Analysis will be difficult and a steep learning curve will ensue. A user's manual will need to be obtained to gain a basic understanding of the software. Consultants with experience with the software will be able to give advice. The SKM analysis will cover the buildings entire electrical system.

Tasks and Tools:

Lighting Solution

Task 1: Lighting Research for Design Criteria

- a) Find the illuminance values for each space
- b) Find the power densities from ASHRAE per space
- c) Make note of other design considerations from the 10th edition IESNA handbook

Task 2: Schematic Design

- a) Brainstorm design goals that will be achieved in each space
- b) Consider focal points or other areas of emphasis in each space
- c) Define specific design objectives for each space

Task 3: Choosing Equipment

- a) Make choices for lamp types needed per space
- b) Research equipment with photometric data that will meet design criteria

Task 4: Calculate with software

- a) Use AGi32 to test for compliance with IES guidelines
- b) Calculate power density for each space
- c) Capture renderings to better explain findings

Emergency Power Solution

Task 1: Determine needs for existing Towson Arena

- a) Find the size of the current electrical Towson Arena system
- b) Find the classification of the building for the NEC

Task 2: Determine acceptability of current system

- a) Compare the current system to code for compliance
- b) Determine if current emergency power system has any inadequacies

Task 3: Research better and more cost-effective emergency power system

- a) Research more depth on current emergency power system
- b) Research available emergency power systems
- c) Come up with rough cost estimates for each emergency system for a comparison

Lighting Solution Electrical Redesign

Task1: Finish lighting solution

- a) Finalize lighting solution for each space
- b) Define electrical needs for new systems' designs

Task 2: Determine Spaces' electrical needs

- a) Run calculations to determine the size of each new lighting system
- b) Find the limits of the current system through calculations
- c) Consult code for existing systems' compliance
- d) Make adjustments and redesigns where necessary
- e) Run short circuit analysis of new electrical system for each space
- f) Consider lighting controls for each space and electrical consumption

Task 3: Present Findings

- a) Gather data for existing and new electrical systems
- b) Show comparison of existing versus new electrical system per space

SKM Analysis

Task 1: Achieve basic understanding of software

- a) Acquire a user's manual
- b) Gain basic proficiency of software program
- c) Ask for help from professional contacts

Task 2: Use SKM skills to build a model of the electrical system

- a) Scrutinize the existing Towson Arena electrical system
- b) Make note of all panels and their loads

- c) Build computer model in SKM

Task 3: Use SKM skills to run an analysis of the electrical system

- a) Run analysis and interpret the results
- b) Interpret various reports
- c) Present findings

Additional Issues:

The biggest issues that I will encounter will be software, finding adequate ies files, researching emergency power systems and finding LED cost information. There are always issues with file saving and renderings. Elumit is a great site, but I will have to sift through many ies files in order to find suitable replacements for LED fixtures. Also, LEDs don't have the best record of even having ies files. I am quite inept with emergency power systems, so there will be a steep learning curve at first for this portion of my thesis. The LED cost information will be tedious to find. Perhaps I can contact certain reps to help me find correct data.

Breadth Topics:

I would like to do a further study into two aspects of the Towson Arena Addition in addition to those already discussed. I would like to investigate how glazing affects the heating and cooling loads of the building and the different acoustical needs of the court.

The Towson Arena has lots of glazing and even a clerestory letting light into the court area. I want to determine the effectiveness of the current design. I would like to analyze the change in energy requirements for heating and cooling loads due to changes in the glazing. Certain glass can affect how much solar heat is gained during the course of the day. I would then like to research mechanical systems that would better meet the needs of the different glazing characteristics.

The court space in the Towson Arena will serve many purposes including a basketball court, volleyball court, physical education facility, concert arena and graduation ceremony stage. The acoustics in the court space will be very important for these different uses. Concerts, graduation ceremonies and sporting events all require different acoustic levels. I want to explore the adequacy of the current acoustic system. I'd like to assess the different reverberation times with the existing system and for the multiple uses. There will be different orientations for a concert versus a basketball game and I would like to analyze how sound will

activities. The glass is low-e-coated, clear insulating with an overall thickness of 1 inch. The interspace content is air, the visible light transmittance is 74 percent minimum, the U-Value is .35 maximum and the SHGC is .4 maximum. It is room 145 on drawing A1.03 of the first floor. The space is 188' x 136', and it extends three floors. The first floor has retractable bleachers. Concourses on the second floor open to the court area, and the third floor has arena seating and suites. The truss level has a series of catwalks above the court. The floor is a hardened rubber material beneath grade 2 maple that complies with floorscore standards. The ceiling is a structural truss system with a clerestory, and there are two tiers of seating along the edge of the space.

Existing Lighting Systems

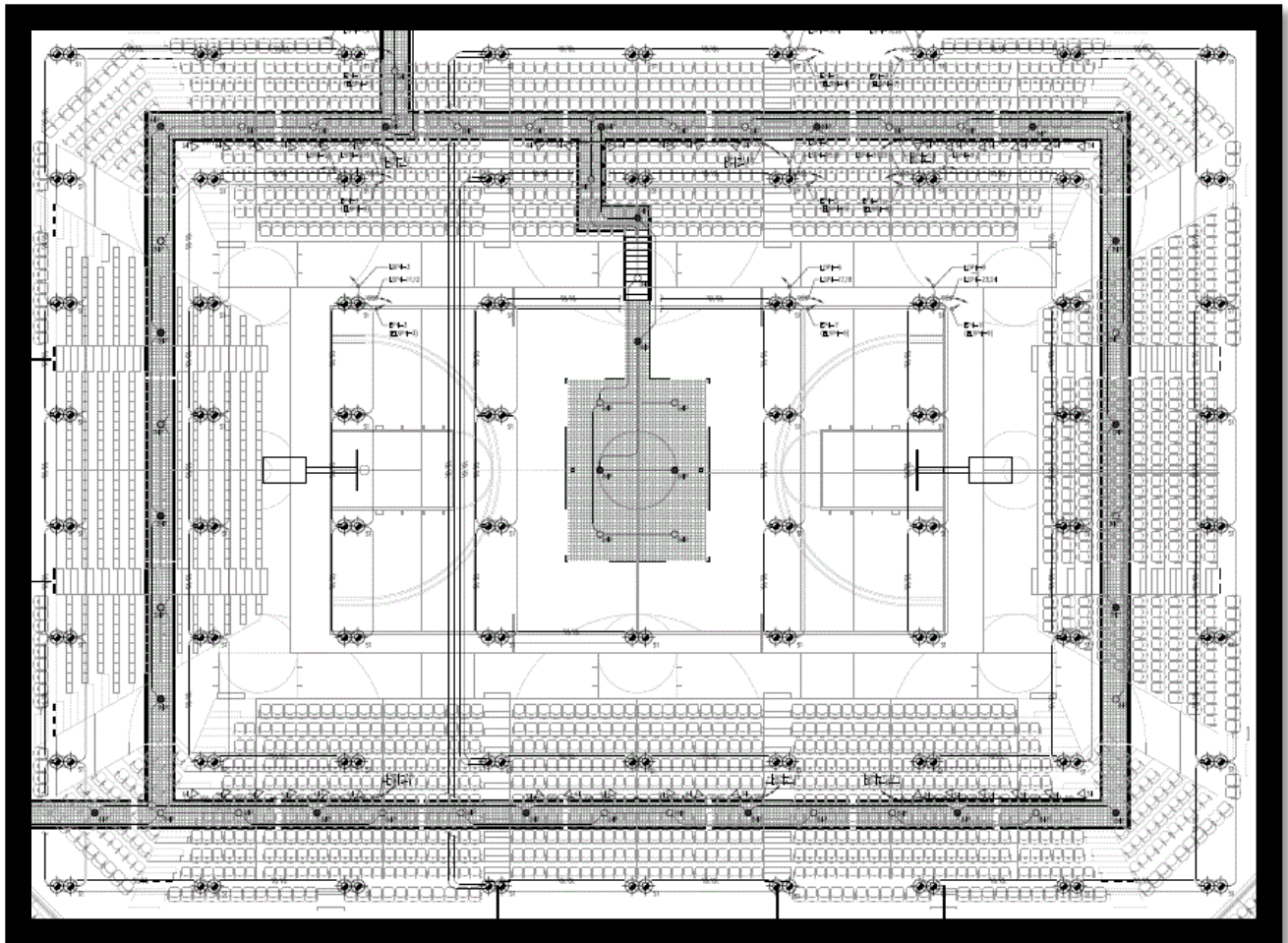


Figure 2.2

The space is illuminated by luminaire types H3, S1, S4. See Figure 2.2 above. Fixture H3 is a four foot gasketed fluorescent fiberglass, high impact acrylic, rated for wet location, and they are located behind the first floor bleachers. There are two 28 Watt T5 lamps with 80 CRI and 4100 Kelvin. Fixture S1 is a four circuit CFL high-bay with three 2-lamp switching ballasts and one 2-lamp 1% dimming ballast, twin-fixture cluster mounting bracket. There are six 42 Watt CFLs at 80 CRI and 4100 Kelvin. Also, there are two 42 Watt CFLs at 80 CRI and 3000 Kelvin. Fixture S4 is a broadcast sports lighting system with motorized shutters, catwalk mounting brackets and safety cables. The lamp is a 1000 Watt metal halide.

Space Lighting Design Theme

Going along with the central theme of social interaction and communication, the court should have an environment so the players and viewers can communicate easily. High light levels are needed for the court, 75 fc. This will spill into the arena seating. Also, lights are needed to light seating areas for egress of aisles. Vertical light levels are important so that the face of someone can be seen. This will aid in the communication of the space if the viewers can see each other easily. The light needed for the court and seating areas will create an environment conducive to conversation.

Space Lighting Design Criteria

The Court area will be used primarily for basketball, and it will be designed for such. Basketball can be categorized as a multi-directional aerial sport due to the fact that games are played in both directions and the ball is in the air for part of the game. Volleyball is also a multi-directional sport, and in fact falls under the same design criteria.

“Higher illuminance values allow the use of high speed shutters and small apertures that increase image sharpness and depth of field”(DiLaura 35,3). Stop action, slow motion and special effects are aided by more light applied to the area. HDTV can be particularly affected by the lamp’s stroboscopic effect in low frequency ballasts in HID lighting systems. “This can be minimized by ensuring the illumination is provided by multiples of three luminaires, with overlapping beams which are balanced across three electrical phases”(Dilaura 35.3).

The arena will have a maximum capacity of 5000 seats. For a college facility, the class of play is II due to the fact that the spectators will never be greater than 5000.

Basketball: Class II	Observers age 25-65	Eh @ 3'	
Eh: 750 lux	Ev: 200 lux	CVmax: .21	Max:Min: 2.5:1

Stairs: Typical	Observers age 25-65	Eh @ Floor	Ev @ 5'AFF
Eh: 50 lux	Ev: 30 lux	Avg:Min: 2:1	

Horizontal illuminance is calculated 3' above the competition surface while vertical illuminance matters over the entire height of the playing area. I made four vertical calculation grids at 3', 8', 13' and 18'. The 3' grid is angled west, the 8' grid is angled south, the 13' grid is angled east and the 18' grid is angled north. This should cover the range of heights the basketball will be located during a game.

Color temperature is an issue for the space due to windows, clerestories and television cameras. A color temperature range of 3000 K to 6000 K can be balanced for television. Lamps with a color temperature closer to that of daylight will minimize issues. The desired CRI is at least 65.

Power Allowances

By Table 9.5.1, using the building area method to calculate lighting power densities allows 0.78 W/ft² for a sports arena.

By Table 9.6.1, using the space-by-space method allows for 0.43 W/ft² for audience seating and 1.92 W/ft² for Class 2 sports. The facility is a class 2 because it is a college facility with a capacity of 5000 seats.

Existing Lighting System Critique

One of the flaws of this system is in the S4 fixture. It is almost impossible to find photometric information for a 1000W metal halide, sports accent light. This makes it very hard to comprehend the amount of light hitting the surfaces of the arena seating areas.

Space reflectances are assumed to be standard 0.8, 0.5, and 0.2 for ceiling, walls, and floor respectively. Light loss factor of 0.7 is calculated with a 0.9 Ballast Factor, a 0.9 LLD and 0.9 LDD.

The recommended illuminance values are:

Basketball: Class II	Observers age 25-65	Eh @ 3'	
Eh: 750 lux	Ev: 200 lux	Max:Min: 2.5:1	CVmax: .21

The calculated illuminance values are:

Calculated	(lux)				
	Avg	Max	Min	Max/Min	CV
Horz 3'	1499	2069	893	2.31	0.17
Vert 3'	593.1	718.7	267.9	2.7	0.19
Vert 8'	591.5	810.2	277.7	2.9	0.17
Vert13'	629.2	1053.1	302.7	3.5	0.23
Vert 18'	608.3	938.7	278.8	3.4	0.22

The horizontal illuminance values from the model more than compensate for the average illuminance needed for the court. It is acceptable to exceed the recommended as higher illuminance values benefit television cameras. The ratio of Max/Min, 2.31:1 was within the recommended value of 2.5:1. The hot spots are distributed evenly throughout the space to meet the coefficient of variance. The calculated value of 0.17 is below the recommended value of 0.21 for CV.

There is also ample vertical illumination at the different heights on the court. The guideline is 200 lux and each height exceeds this requirement. This will give the light needed for slow motion, stop action and other special effects used for television. See Figure 2.3 below for a distribution of hotspots from the simulated, computer model.

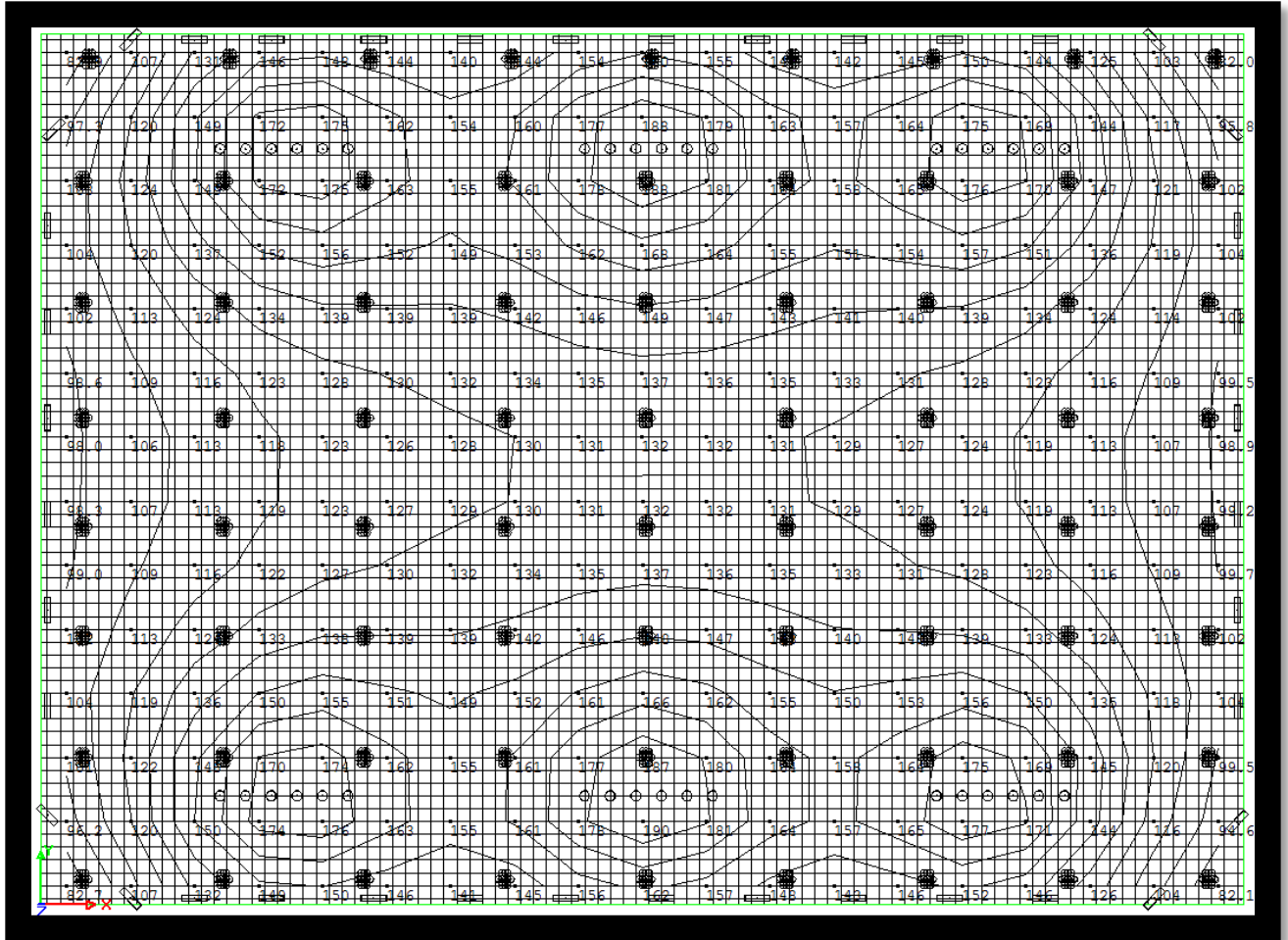


Figure 2.3

The lamp CCTs range from 3000 to 4100. Some of the CFLs are 3000 Kelvin for a warmer feel, however the 4100 Kelvin CFLs will be used with games with the linear fluorescent and metal halide lamps.

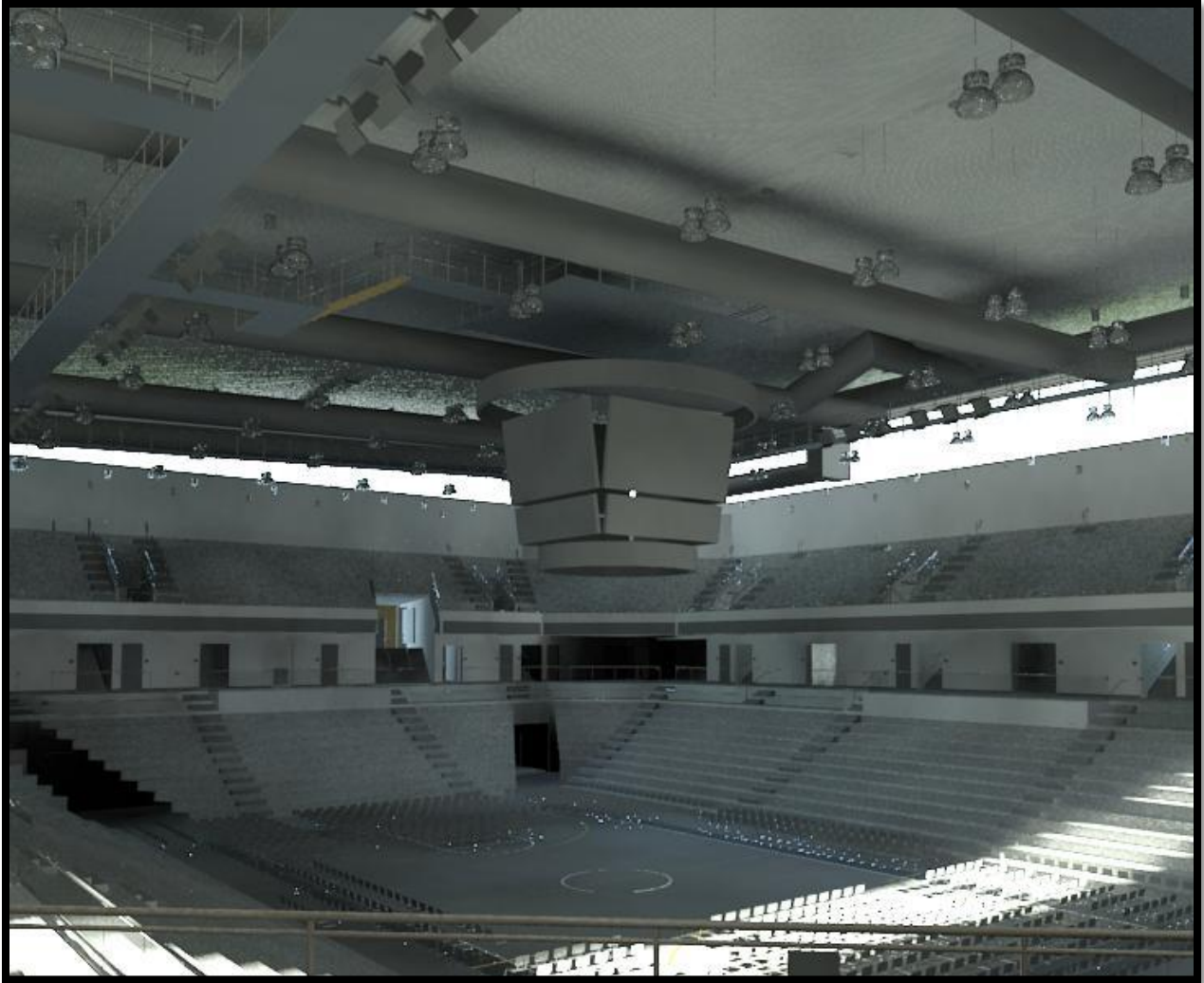


Figure: Daytime Rendering of the original system

New Lighting System

For the Court I designed the space with Philips WideLite's AE2 fixture. It is a 1000W MH sports lighting fixture. I chose the fixture for its high light output and blackout shutters. The lighting fixture mounts directly onto a surface so I used the existing catwalk just above the truss level to mount the fixtures. You can see the attached cutsheet for this fixture in the appendix. The luminaire has a Reflector Type A beam pattern which I have chosen for the design. There is an optional dimming ballast option for the luminaire, and the ballast is in the fixture itself. It uses a BT37 1000W MH lamp, and puts out 110,000 lumens of light at 3700K, 65CRI.

It was very difficult to design the space due to the stringent energy codes. I was able to just meet the court horizontal and vertical illuminance levels as well as stay within energy code. I used a total of 20 luminaires to light the space. Fourteen of the luminaires were above the

court area and 6 were above the audience space. The following tables indicate the design. Also, the following layout will give you an idea of my fixture spacing on the catwalk and around the scoreboard at the center of the court.

I spaced the 6 luminaires for the audience at the four corners and one in the middle of the two shorter sides. The court area is 72' x 120'. The luminaires over the court area are positioned in an "I" formation. Horizontally they are spaced 15' apart on the top and bottom of the "I". In the middle of the "I" the luminaires are spaced 20' apart horizontally and vertically. The system will have two zones so as to be able to use less light if the use calls for it. There will be two switches near to entrances on the first floor. One switch will control one zone and then the other switch will control the second zone of lights.

Horizontal Plane Calc Grids (footcandles)								
	2 nd Tier Audience		1 st Tier Audience		Ceremony		Court	
	Design	Criteria	Design	Criteria	Design	Criteria	Design	Criteria
Eh	25.06	5	32.65	5	47.19	30	75.92	75
Ev	25.06	3	22.92	3	24.33	20	next	20
Avg:Min	20.88	2:1	6.66	2:1		3:1	-	-
Max:Min	-	-	-	-	-	-	2.35	2.5:1
CVmax	-	-	-	-	-	-	0.21	0.21

Calculated (lux) Designing all to 20 footcandles					
Court	Avg	Max	Min	Max/Min	CV
Vert 3'	24.33	38.3	24.33	4.3	0.34
Vert 8'	22.92	22.92	36.9	4.19	0.34
Vert13'	25.04	25.04	40.5	5.00	0.36
Vert 18'	22.87	22.87	41.3	5.29	0.40

Improvements that I could have made to the design include a incorporating a daylight friendly system. There is a large clerestory around the top of the court that provides ample daylight for solar sensors and dimming systems to be installed. What left me from designing to this was the need for blackout shutters on the light fixture. I had a lot of trouble looking for a high wattage metal halide fixture with blackout shutters and a photometric file. The fixture does have an optional dimming ballast, but it is meant to have a high and low setting for the blackout shutters. However, for practical cost and time purposes I chose to sacrifice for this system.

Another improvement I could have made on the system was concentrating on having a more uniform design for the audience seating. The Avg:Min ratios are nowhere near where they should be. The light from the court leaks heavily onto the audience seating. It gives enough footcandles for exiting and that is the main goal.

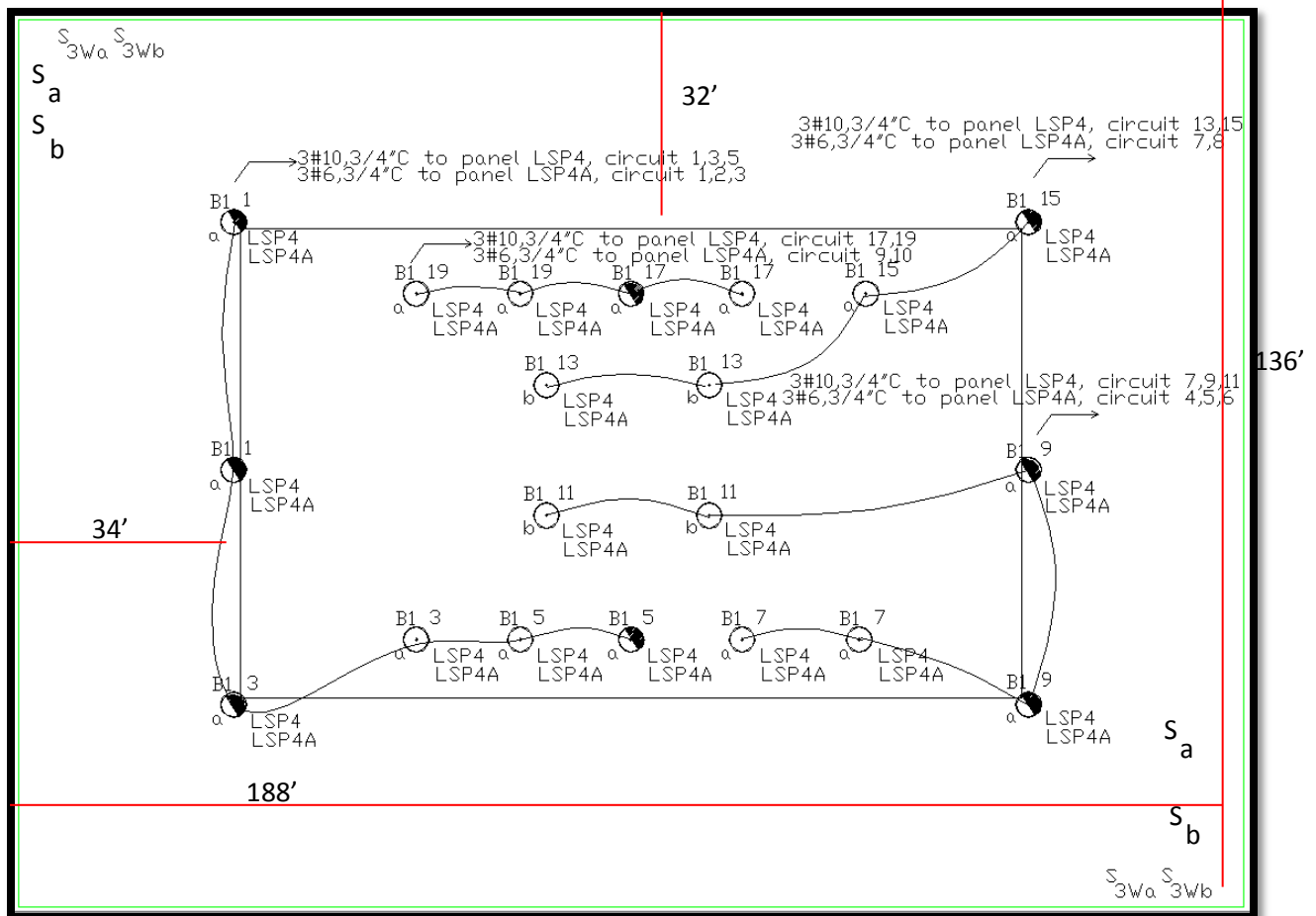


Figure: New design luminaire layout

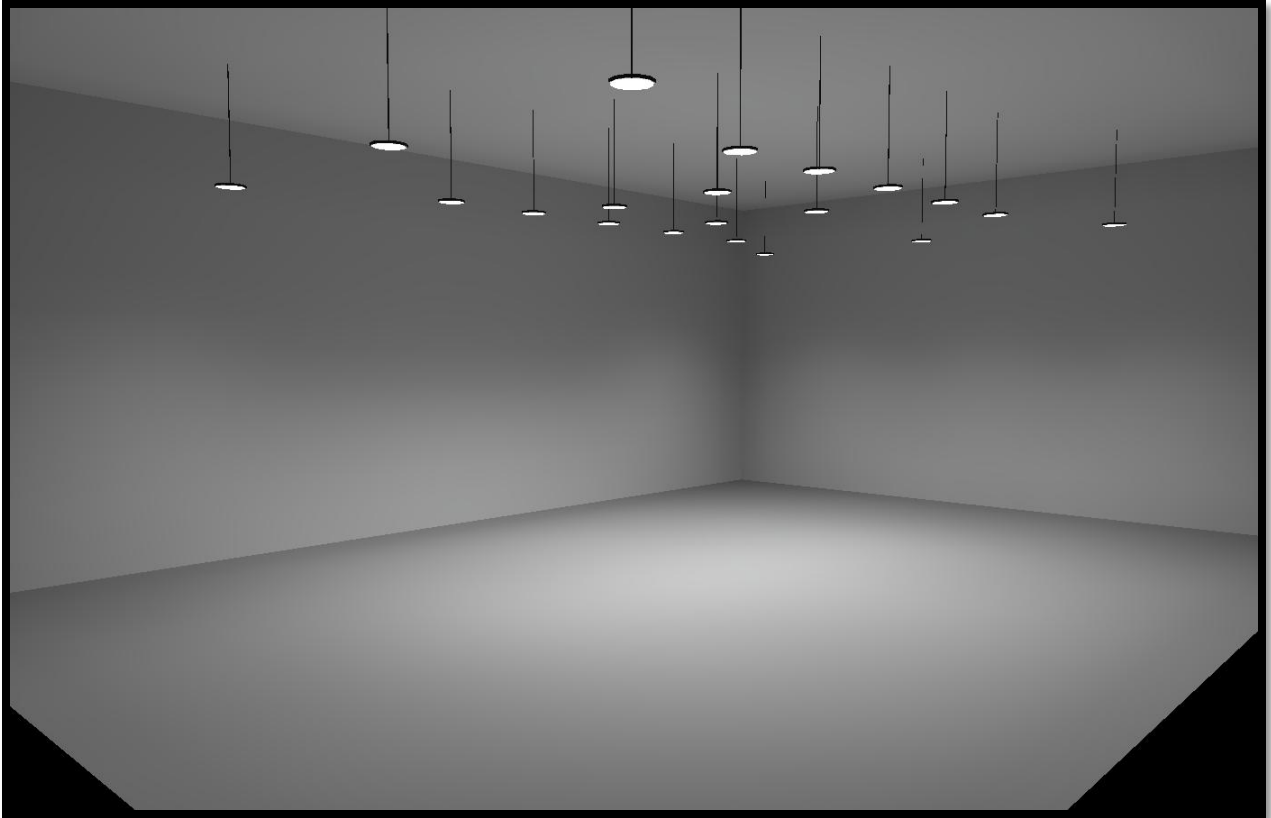


Figure: Simple model showing light in Court area.

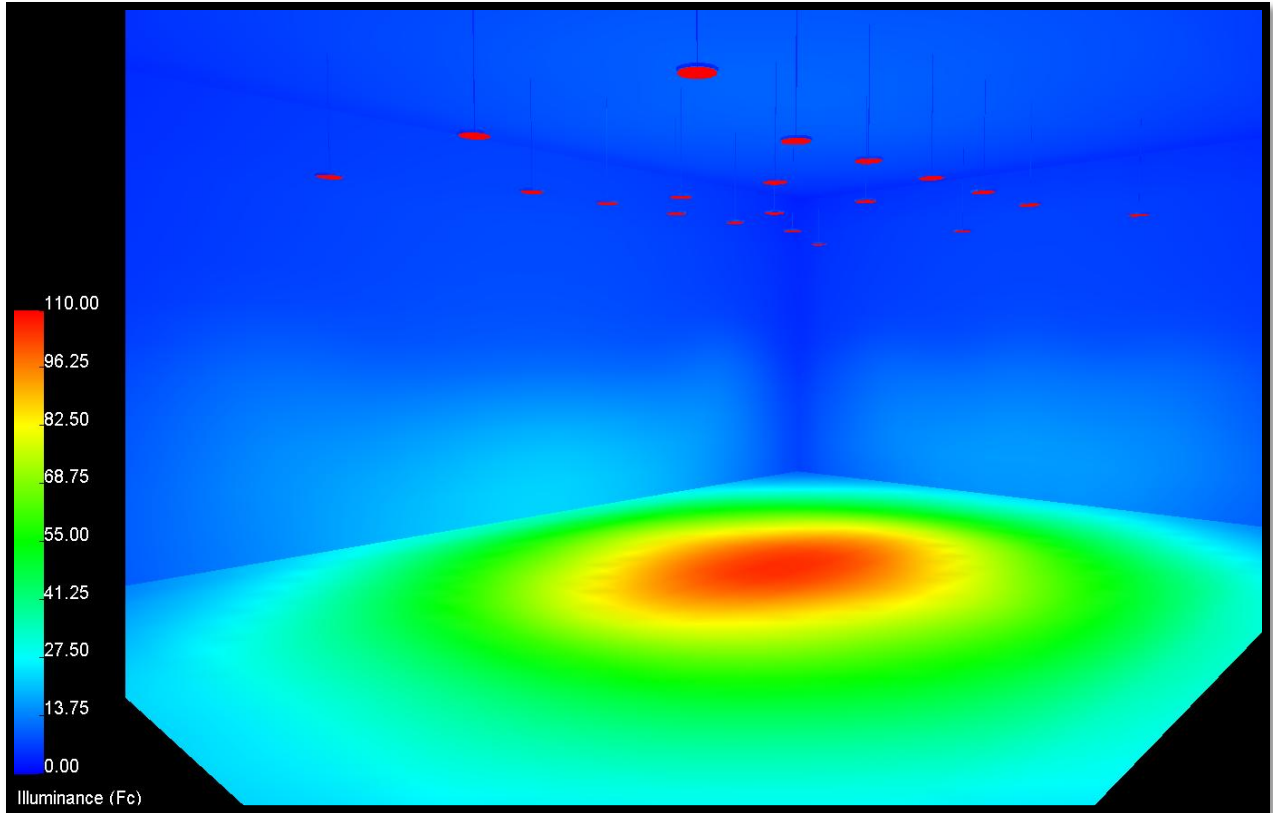


Figure: Pseudo Color of distribution of Light

Reception:

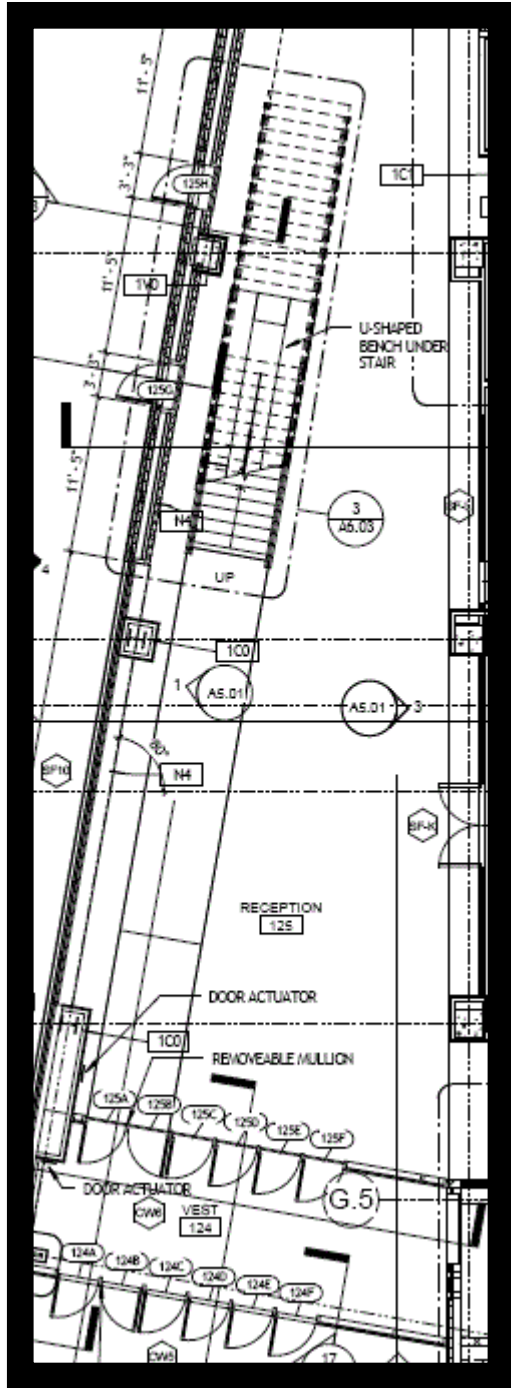


Figure 3.1

The circulation space will be on the first floor reception area. This is an entrance to the building and is a two story atrium with a stairwell that leads to the second floor concourse area. This welcomes VIP players and viewers to the arena. It is a place for people to meet and a transition point into the busier areas. The tasks in this space will primarily be social, so people will need to be able to view each other. There may also be sports memorabilia around the walls and periphery. There are many windows and doors that allow access to this space on the first floor. This will allow daylight to be a factor in the lighting design of the space. The glass is low-e-coated, clear insulating with an overall thickness of 1 inch. The interspace content is air, the visible light transmittance is 74 percent minimum, the U-Value is .35 maximum and the SHGC is .4 maximum. The reception is room 125 on drawing A1.03. The dimensions are 80' x about 16', and the space extends upward two floors. A stairwell hugs a fully glazed wall along the western side of the building. Underneath of the stairwell there is a twelve foot long U-shaped bench. The space is in the shape of a triangle and the widest point is about 30'. The floor is porcelain floor tile of a nickel color, the walls are gypsum wallboard painted silver satin and graphite and the ceiling is acoustical ceiling tile. This space will have three different design solutions.

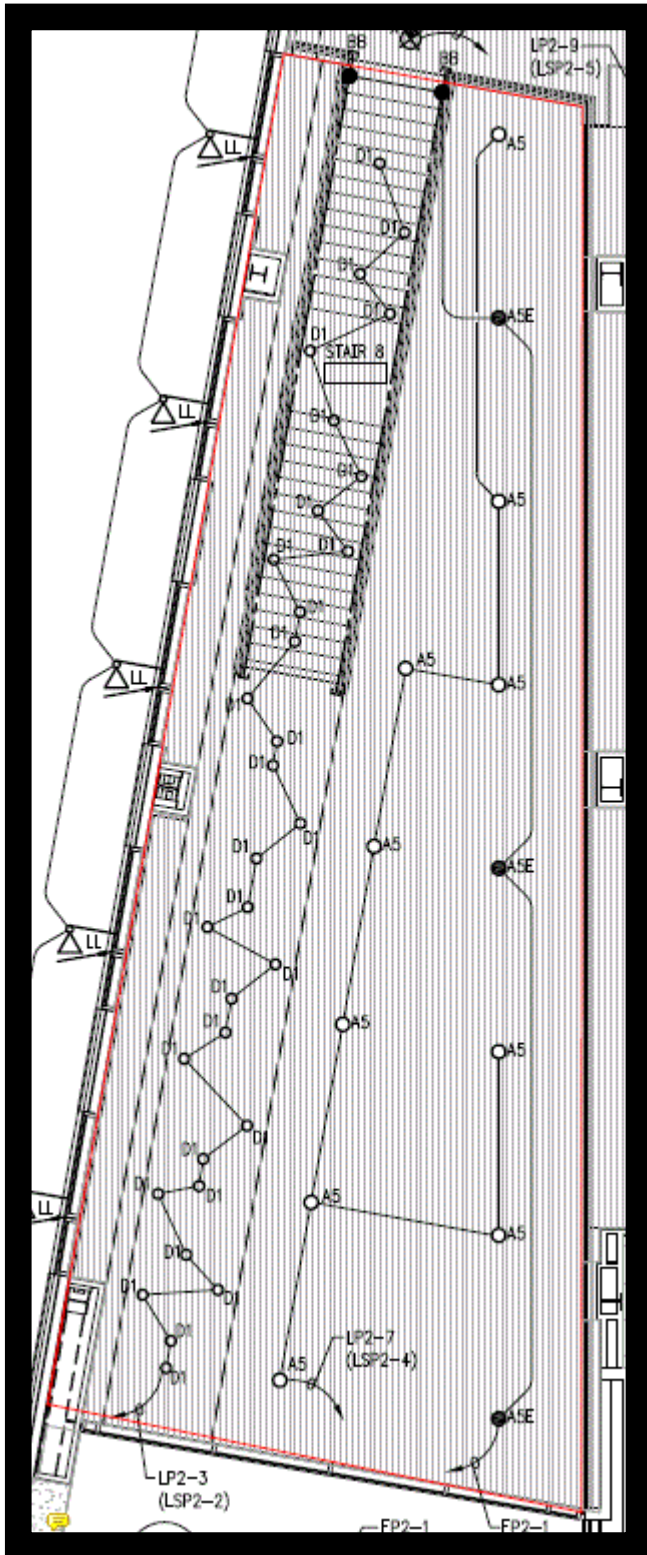


Figure 3.2

Existing Lighting Systems

The space is illuminated by luminaire types A5, D1 and BB. Fixture A5 is a 7" recessed downlight with medium base par lamp, open specular clear alzac cone and steel housing. The lamp is a ceramic metal halide 70 Watt par30 flood. Fixture D1 is a 4-3/4" diameter by various heights LED architectural pendant with remote drivers, processor, manual controls and timeclock. The LEDs are RGB color-changing. Fixture BB is an LED handrail with LEDs at 4100 Kelvin.

Space Lighting Design Theme

The reception area will be conducive to social interaction and communication. It is a meeting and transition space. Vertical illuminance will allow the users to see other people and engage in conversation. It is a two story atrium with full glazing on one side and a staircase in the middle of the glazed wall. The space will feel dynamic and as if everyone will be or will need to be moving. Accent lighting on artwork around the periphery will help take the focus off of the people using the space. This way the users may freely interact with each other and not feel as if they are the center of attention.

Space Lighting Design Criteria

The primary considerations for building entries, from IES, include the following:

- Degree to which entries are covered from the elements
- Proximity of vehicular traffic to pedestrian traffic
- Anticipated nighttime activity levels
- Nighttime outdoor lighting zone for the project under consideration
- Security

Building Entries: Vestibules – Medium Activity					Avg:Min
Day	Eh @ floor	Ev @ 5' AFF	Eh: 100 lux	Ev: 50 lux	2:1
Night	Eh @ floor	Ev @ 5' AFF	Eh: 50 lux	Ev: 30	2:1

Lobbies that are in close proximity to building entry should assist with transition from exterior to interior and vice versa.

Transition Spaces: Lobbies – At building Entries					Avg:Min
Day	Eh @floor	Ev @5' AFF	Eh: 100 lux	Ev: 30 lux	4:1
Night	Eh @floor	Ev @5' AFF	Eh: 50 lux	Ev: 20 lux	4:1

Transition Spaces: Stairs					Avg:Min
Typical	Eh @floor	Ev @5' AFF	Eh: 50 lux	Ev: 30 lux	2:1

Medium activity is moderate pedestrian traffic with occasional occurrences of swells of activity. Lamp type and color qualities should also be consistent with adjacent spaces to transition space.

The main point of interest in the first floor reception is the stairwell to the second floor. A freestanding column along the curtain wall of glass pulls the viewers' eyes to the left as they enter the space. Their attention will follow the line of the stairs to the second floor.

Power Allowances

By Table 9.5.1, using the building area method to calculate lighting power densities allows 0.78 W/ft² for a sports arena.

By Table 9.6.1, using the space-by-space method designates an allowance of 0.90 W/ft². An atrium allows for 0.03 W/ft² per foot of height for the first 40 feet of height.

Existing Lighting System Critique

It can be difficult to critically analyze the lighting design of a space without a correct computer model. This difficulty is compounded by the uncertainty of lumen output by LED sources. However, assessments and educated inferences may still be made.

The CMH 70w par30 gives off 4700 lumens initially. There are 13 A5 fixtures, so that is roughly 61,100 lumens before LLF. After LLF are applied the lumen output total for all 13 fixtures is roughly 44,500 lumens. The total area is around 524 square meters so the lux in the space is about 85 lux. This value does not include the LED downlights as the lumen output is not precisely known. During the day the required horizontal illuminance may not be met. On a sunny day, there should be enough daylight entering the space in the morning and until about noon. In the afternoon, the space will be in shadow, so there may not be enough horizontal illuminance. Cloudy days may not provide the amount of light needed for the recommended 100 lux during the day. However, on a clear or cloudy night, the 85 lux horizontal value will more than cover the guideline of 50 lux. It is very difficult to predict or calculate the vertical illuminance or Avg:Min ratio.

The space is a two story atrium and a majority of the users will make their way through the space and ascend the stairwell. The existing lighting design has a cluster of LED downlights that follow the path of the entrance to the stairwell. This cluster of brighter light will draw the user to the stairwell. The rest of the space has CMH par30 fixtures that are evenly spaced as to not draw much attention. A LED handrail runs along each side of the stairwell to draw the users' attentions. The illuminated handrail also helps to connect the second and first floor atrium.

Space reflectances are assumed to be standard 0.8, 0.5, and 0.2 for ceiling, walls, and floor respectively. Light loss factor of 0.7 is calculated with a 0.9 Ballast Factor, a 0.9 LLD and 0.9 LDD.

New Lighting System

Transition Spaces: Lobbies – At building Entries					Avg:Min
Day	Eh @floor	Ev @5' AFF	Eh: 100 lux	Ev: 30 lux	4:1
Results (fc)			193.18	174.94	2.99
Night	Eh @floor	Ev @5' AFF	Eh: 50 lux	Ev: 20 lux	4:1
Results (fc)			22.49 fc	6.58 fc	2.78

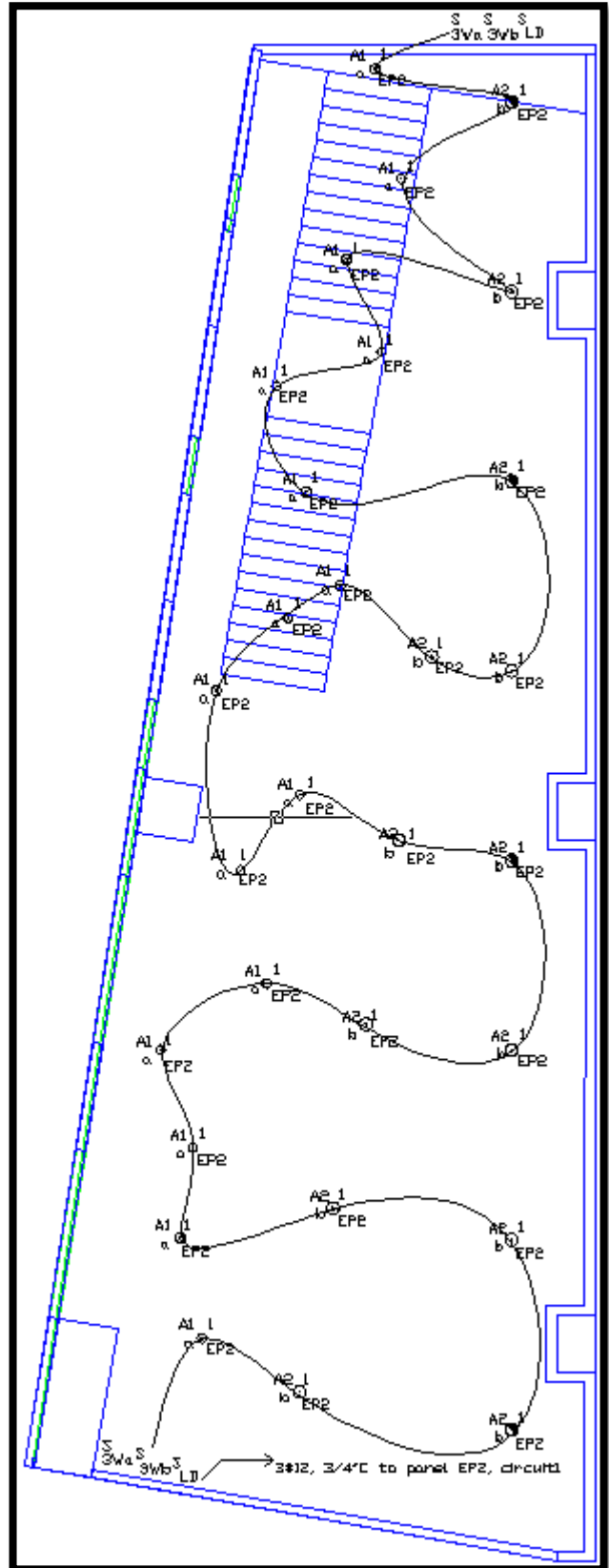
Transition Spaces: Stairs					Avg:Min
Typical	Eh @floor	Ev @5' AFF	Eh: 50 lux	Ev: 30 lux	2:1
Results (fc)			43.34 fc	6.31 fc	1.54

In my design I used 3500K LED downlight fixtures from Philips. Please see the appendix for the attached cutsheets. I chose a suspended pendant fixture to give a sense of depth to the space. The pendants hover approximately 15' above the floor and stair respectively. Recessed LED downlights also illuminate the space from 28' high ceilings. They are used to supplement the rest of the space with the lighting guidelines.

I have incorporated a wattstopper solar daylight harvesting sensor into the LED dimming system. Depending on the amount of daylight that enters the space, the lights will be dimmed to meet the minimum illumination requirements. The LED driver has dimming capabilities that make the daylightin system possible. There will be two light zones with two switches for each zone as well.

The power densities for the space meet energy code. Using the building wide method for a sports arena the maximum power density is 0.78 W/ft^2 , and for the space by space method, the maximum is 0.9 W/ft^2 . In the reception area of 1730 ft^2 the total wattage was 1329 Watts so that makes the lighting power density 0.768 W/ft^2 which is within the guidelines.

Figure: Fixture Layout



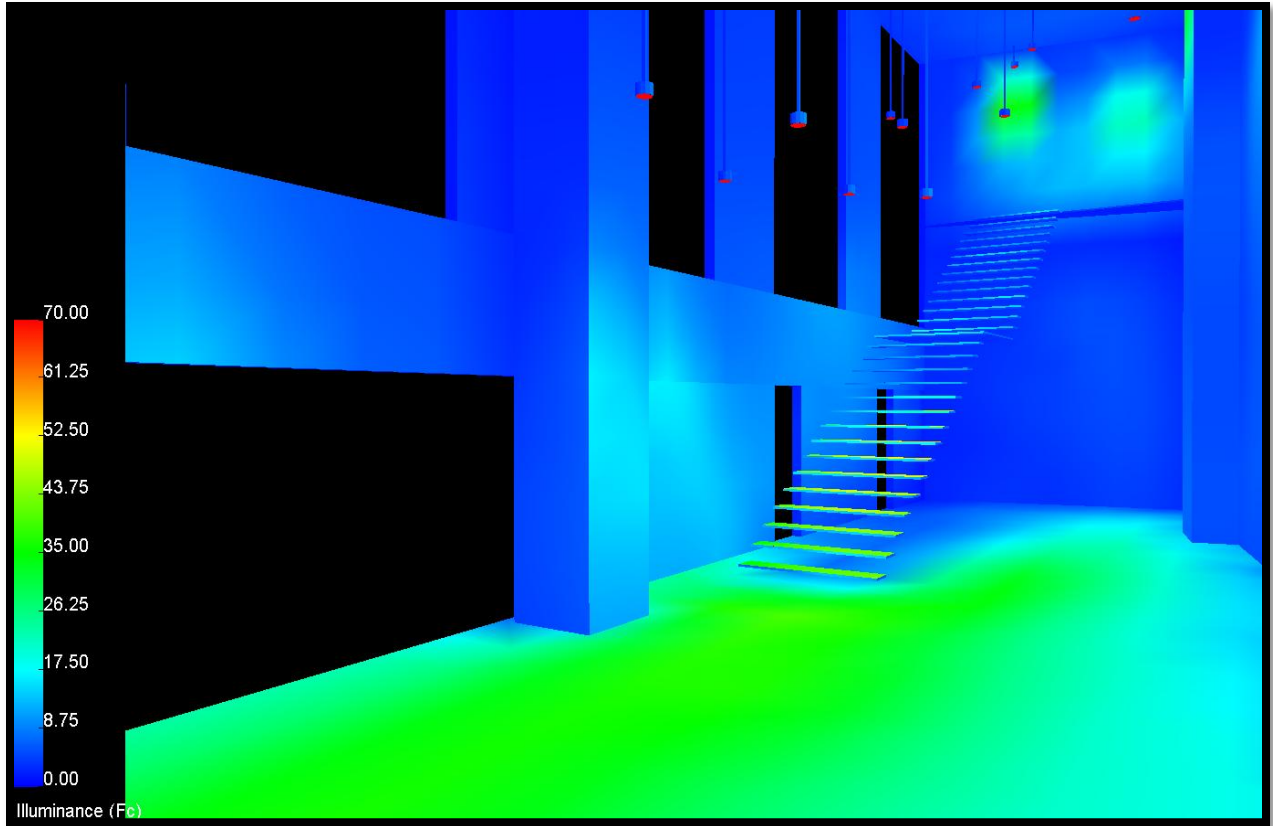


Figure: Reception Pseudo Color



Figure: Rendering Reception Artificial Light



Figure: Rendering of Reception with Artificial and Daylight

Outdoor Space: Northeast Entrance

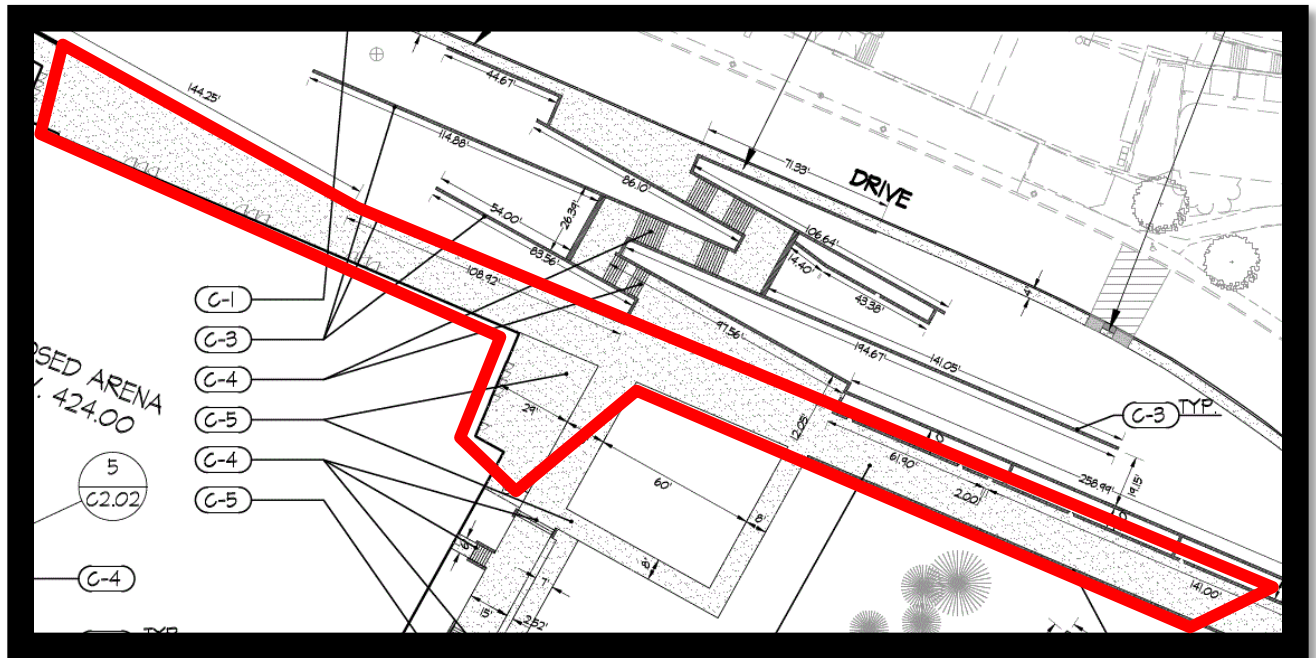


Figure 4.1

The outdoor space will be the northeast entrance to the tiger arena. Most of the attendees will enter and pass through this space. There is a large glass façade and overhang at the corner and all along the northern side of the building. A grassy lawn and system of stairs and ramps is also in this space. People may use this space to meet or just as a transition space into the building. After events many people will need to exit the building at once and enough light needs to allow people to see as they exit the grounds. This space can be viewed on drawing C2.01. The dimensions are approximately 18' x 520' for with walkway, and 40' x 120' for the entrance area. The walkways and plaza are concrete. No exterior seating or benches exist, only walkways. The façade is metal paneling and glazing. This space will be a social space and a way to egress away from the building. The walkways need to be visible and other people need to be visible for the users of the space.

Existing Lighting Systems

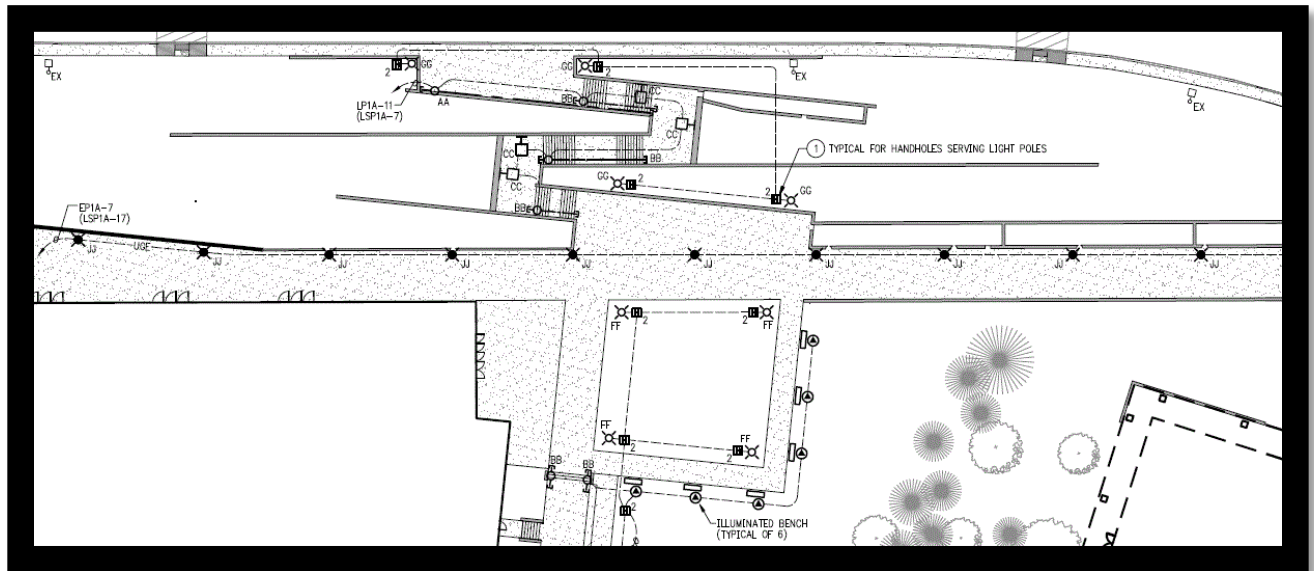


Figure 4.2

The space is illuminated by luminaire types JJ, BB, GG, FF, AA and CC. Fixture JJ is a 13' promenade post light with indirect light source behind tempered glass and specular reflector, type V distribution, included tapered pole with handhole. The lamp is a 150 Watt pulse start metal halide. Fixture BB is an LED handrail with LEDs at 4100 Kelvin. Fixture FF is a post top metal halide site fixture with a vertical lamp and type V distribution on a 12' pole. Fixture AA is a linear LED wall grazer with a wet location listing, and the LEDs are 4000K. Fixture GG is a post top metal halide site fixture, vertical lamp, Type V distribution on an 18' pole. The lamp is a 150 Watt metal halide at 277V.

Space Lighting Design Theme

During the day the exterior of the building will be well illuminated so as to foster social interaction and communication. At night, the space will be much different. While exterior lighting is required for egress purposes, this does not always accommodate communication. Vertical illuminance is essential for people to feel safe. Seeing someone's face registers a feeling of safety, and if that face is familiar then it is easier to communicate as well. Power density for the exterior of the building will be monitored stringently, but pole mounted lights can help spread light and illuminate users. The exterior space should be a place for people to discuss the preceding events and enjoy the plaza and building. Light levels that allow communication will encourage people to use the space.

Space Lighting Design Criteria

The main point of interest at the northeast entrance is the glass façade that encases the building underneath an L-shaped overhang. The users will need to see this part of the building and be able to decide that this is the entrance into the arena. The exterior walkway, plaza and stairs are transition spaces to and from the arena. The busiest time of use will be immediately following a sporting event in the arena. This is when all of the spectators will be leaving. Before the event there will be a steady stream of pedestrians, but a swell will occur at the end.

Other points of particular interest include the plaza area. The plaza will need a certain level of light for egress, and it is a gathering point outside the arena. The plaza will give the viewer an encompassing view of the northeast entrance.

Other considerations include foliage in the vicinity of the luminaires. If not properly cared for, light may be shielded from walkway surfaces. BUG rating is also important when trying to control light spill from luminaires.

The following are design guidelines from the IESNA handbook:

Table 22.2 Common Applications Illuminance Recommendations

Building Entries: Canopied Entries – High Activity				Max:Avg	Avg:Min
LZ3	Eh @grade	Ev @5' AFG	Eh: 30 lux	Ev: 15 lux	Eh 2:1 Ev 4:1

The walkway underneath the overhang will have periods when pedestrian traffic will swell, and the users will be adapted to LZ3, moderately high ambient light levels, from the arena. The primary considerations for building entries, from IES, include the following:

- Degree to which entries are covered from the elements
- Proximity of vehicular traffic to pedestrian traffic
- Anticipated nighttime activity levels
- Nighttime outdoor lighting zone for the project under consideration
- Security

Suggested guidelines for exterior lighting include:

- Establish and confirm the need for light

- Carefully define areas of application and the application itself
- Establish the lowest illuminance criteria appropriate to the need
- Independently address unique areas of interest
- Design lighting layouts to address only those areas of interest
- Select equipment with distribution and optical control to address criteria
- Use controls to energize, dim and extinguish lighting to address activity levels

Table 34.2 Retail Illuminance Recommendations

Centers, Outdoor: Plazas – High Activity					Max:Avg	Avg:Min
LZ3	Eh @pavement	Ev @5' AFG 2-dir	Eh: 6 lux	Ev: 2 lux	4:1	5:1

The vertical illuminance is measured in two directions and should be coordinated with security cameras.

Power Allowances

From ASHRAE 90.1, Table 9.4.3A Exterior Lighting Zones, the lighting zone for the northeast entrance will be categorized as Lighting Zone 3. The base site allowance for Zone 3 is 750 W. Tradable surfaces include building grounds, building entrances and exits, and canopies and overhangs.

Table 9.4.3B Individual Lighting Power Allowances for Building Exteriors

Building Grounds	
Walkways 10 ft wide or greater/Plaza areas	0.16 W/ft ²¹
Building entrances and exits	
Main entries	30 W/linear foot of door width
Other doors	20 W/linear foot of door width
Entry canopies	0.4 W/ft ²

Nontradable Surfaces include building facades and are in addition to the tradable surfaces already addressed in the previous table. The allowance for building facades is 0.15 W/ft² for each illuminated wall or surface or 3.75 W/linear foot for each illuminated wall or surface length, for Zone 3.

By Table 9.5.1, using the building area method to calculate lighting power densities allows 0.78 W/ft² for a sports arena.

Existing Lighting System Critique

It is difficult to understand the horizontal and vertical illuminance values for an exterior space without a computer model. Within the confines of walls, it is easy to estimate the horizontal illuminance, but with a wide open area it is hard to determine where the light will reach.

A “Z” shaped step system is illuminated by LED handrails, recessed CFLs and 18’ metal halide pole lights. The illuminated handrails pull the users through the space by giving their eyes a path to follow as they traverse the space. From the parking roadway an LED wall grazer invites the user to the main site stair.

The main walkway has a colonnade of 13’ pole metal halide lights. They line the walkway and lead right to the entrance of the arena. They lights pull the users through the space. There are also 12’ metal halide pole lights that illuminate a green plaza area. This aids as a transition area from the exterior of the building into the main entrance of the arena. The brightly illuminated façade will also draw the users through the space once they get a glimpse of the arena.

Space reflectances are assumed to be standard 0.8, 0.5, and 0.2 for ceiling, walls, and floor respectively. Light loss factor of 0.7 is calculated with a 0.9 Ballast Factor, a 0.9 LLD and 0.9 LDD.

New Lighting System:

The new lighting system design for the exterior uses LED pole luminaires and LED downlights to illuminate the northeast walkway and entry plaza. Energy code and lighting design criteria were achieved for the spaces under consideration.

Philips Lumec Leonis pole mounted LED fixture was used along the walkway and up to the entry. Philips Omega recessed LED downlight was used for the canopied entry. The Leonis fixture is 47 Watts with 3829 lumen output, 70 CRI, 4000K, minimum 100 lumens per Watt, 70,000 hours for which 50% still have over 70% original lumen output, a 16’ pole with 26” arm, and a Type II light distribution. The Omega downlight uses 53 Watts with a lumen output of 3254 lumens, 8” recessed LED cylinder, CCT 4000K, 80 CRI 50,000 hour lifetime at 70% lumen maintenance.

The Leonis LED pole fixtures were spaced at 33’ between fixtures along the length of the 520’ pathway. The recessed Led downlights are spaced at 5’, but vary over the main entry. The lighting design criteria was met for all spaces, and energy code was complied with. The walkway lighting will be on an automatic timeclock set by the owner while the arena façade

lighting will be switched just inside the arena entrances. The following figures show the luminaire layout, and the tables give the calculated values versus the design guidelines.

Table 22.2 Common Applications Illuminance Recommendations

Building Entries: Canopied Entries – High Activity					Max:Avg	Avg:Min
LZ3	Eh @grade	Ev @5' AFG	Eh: 30 lux	Ev: 15 lux	4:1	Eh 2:1 Ev 4:1
Calculated			Eh: 8.2 fc	Ev:9.23 fc	Eh: 1.52	Eh:2.00 Ev: 2.71

Table 34.2 Retail Illuminance Recommendations

Centers, Outdoor: Plazas – High Activity					Max:Avg	Avg:Min
LZ3	Eh @pavement	Ev @5' AFG 2-dir	Eh: 6 lux	Ev: 2 lux	4:1	5:1
			Eh: 3.26 fc	Ev: 2.5 fc	Eh: 3.22	Eh: 1.72

Table 9.4.3B Individual Lighting Power Allowances for Building Exteriors

Building Grounds	
Walkways 10 ft wide or greater/Plaza areas	0.16 W/ft ²
Calculated	0.086 W/ft ²
Building entrances and exits	
Main entries	30 W/linear foot of door width
Calculated	20 W/linear foot
Other doors	20 W/linear foot of door width
Calculated	3.53 W/linear foot
Entry canopies	0.4 W/ft ²
Calculated	0.385 W/ft ²

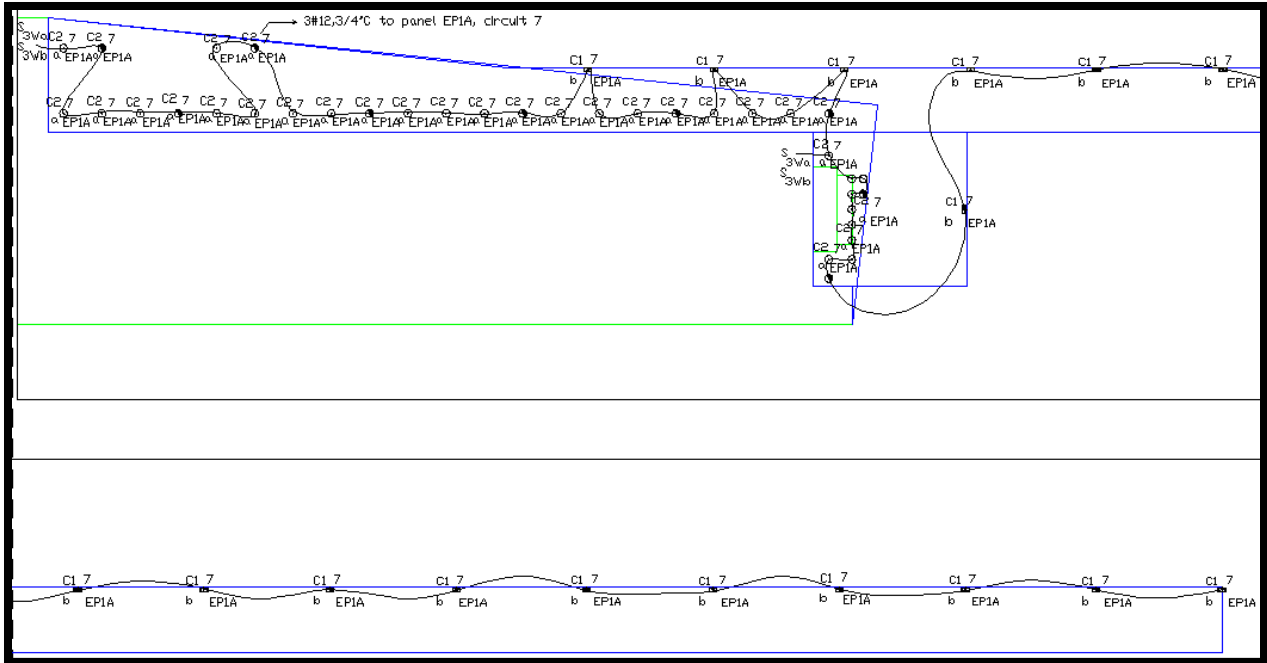


Figure: Fixture Layout for main entrance: Fixture A is Leonis and Fixture B is the recessed LED downlight.

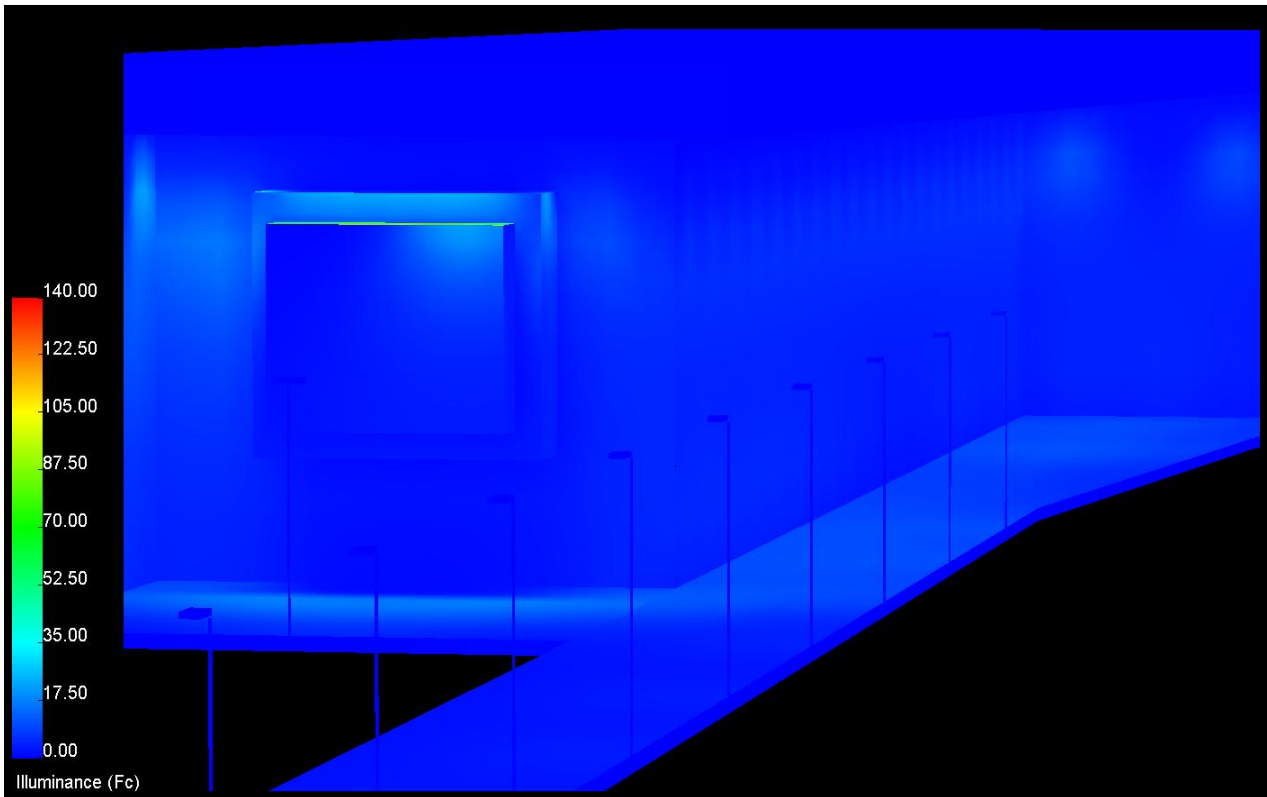


Figure: Pseudo color or Northeast Entrance



Figure: Exterior Rendering at Night

Large Work Space: Press Room

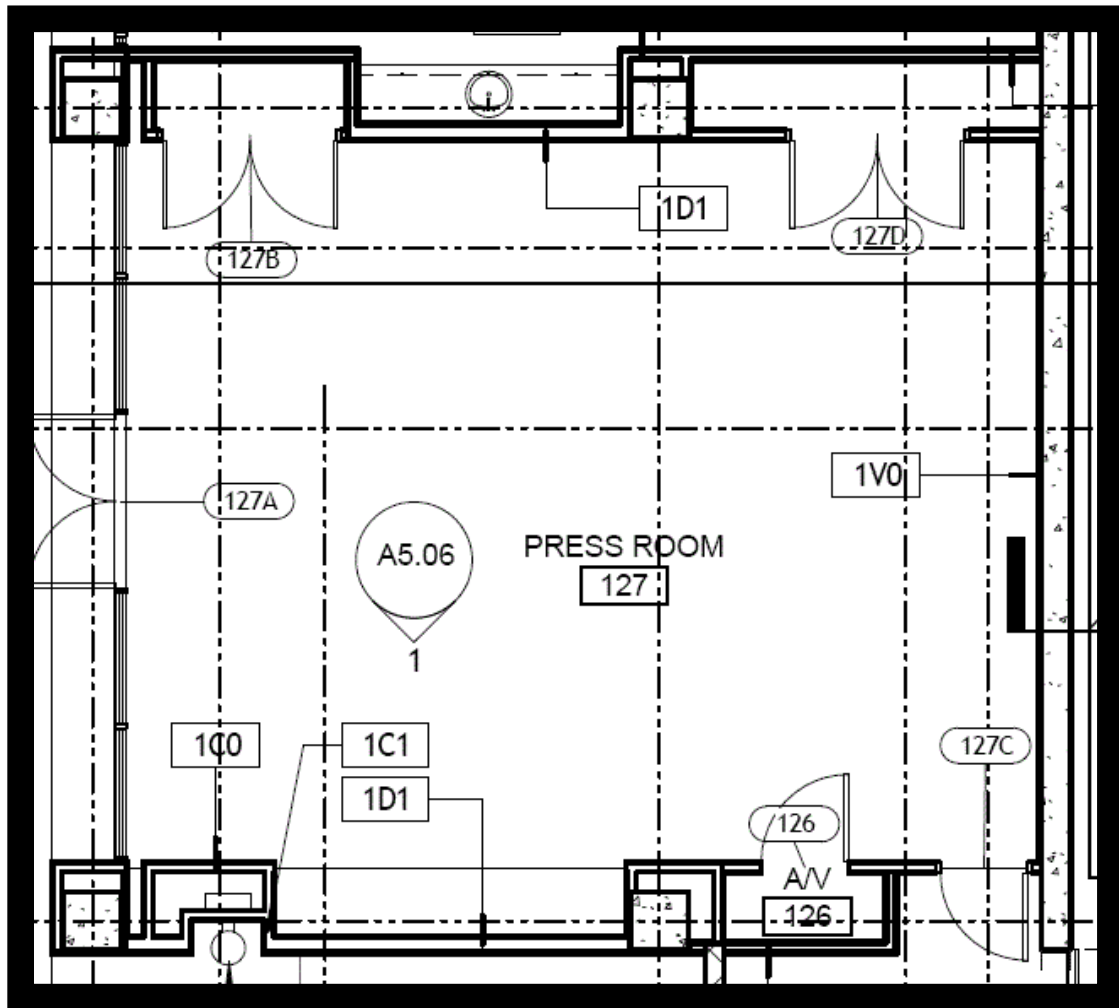


Figure 1.1

The large workspace will be the press room. Please see Figure 1.1 above. This will be designed to feel public. The press room is located on the first floor, adjacent to the court. It will be used to hold conferences after a game so that the media can receive feedback on the previous event from the players and coaching staff. It is room 127 on A1.03. The dimensions are 25' x 32' so the room is in a rectangular shape. The ceiling is a 10 feet high acoustical tile system, the walls are gypsum wall board painted satin silver and the floor will be painted a sunshine color. A podium or table will be placed at one end of the room. Chairs will be placed in rows for reporters to see. Artwork will be placed on the walls of the space. The space will be used for

the press to take notes via electronic devices or paper. There needs to be enough light to record what is said, and there must be enough light on the speaker for television to broadcast the event. There is no daylight contribution in the press room.

Existing Lighting Systems

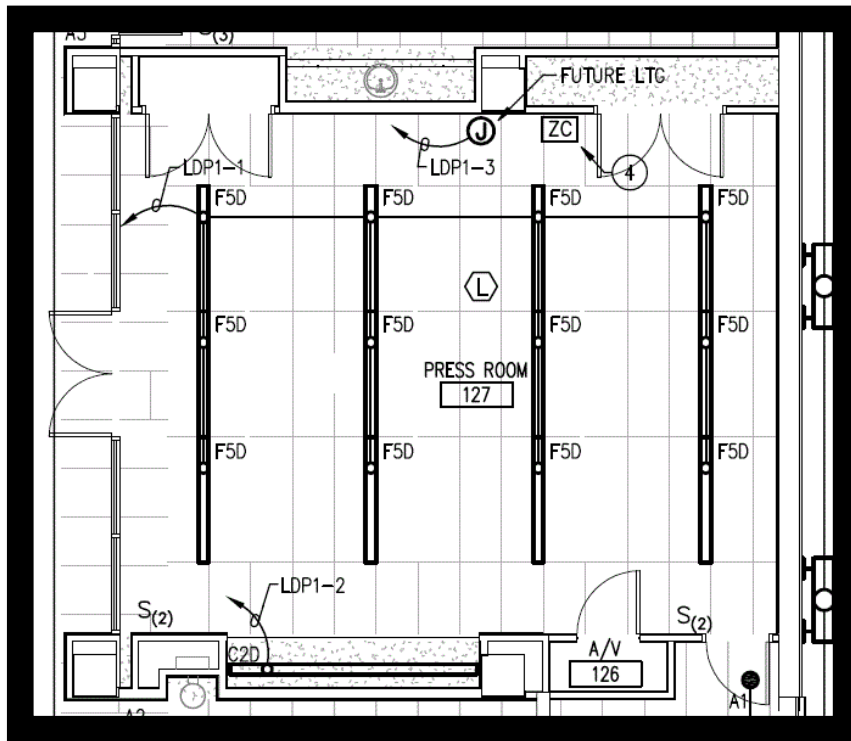


Figure 1.2

The space is illuminated by luminaire types F5D and C2D. Please see Figure 1.2 above. Fixture F5D is a 6 foot linear, surface mounted fluorescent with a 1% dimming ballast. There are two 21 Watt T5 lamps of 80 CRI and 4100 Kelvin. Fixture C2D is a linear LED cove accent lighting with adjustable mounting bracket and a dimmable driver. The LEDs are 2700 Kelvin.

Space Lighting Design Theme

The theme of the lighting design is to have spaces conducive to social interaction and communication. In the press room one or a few people will be speaking to a room full of reporters and television crews. The goal of the space is to make the speakers feel comfortable answering questions. A public ambiance will help the speakers easily communicate to the reporters.

Psychological Impression Space

Going along with the theme of encouraging social interaction and communication, the press room will have a public feel. By making a space, where millions of viewers may be watching at one time, feel private, the speaker will be more willing to share their thoughts and reflections.

Press rooms need high levels of light on the speaker for the television cameras. This will make the speaker feel like they are the center of attention. Fortunately this has become institutionalized and it is expected and understood. Ample light will be needed for reporters to record notes on laptops, ipads or notepads. Veiling reflections are a big design concern. Also, high vertical illuminance values will be needed on the speaker.

Space Lighting Design Criteria

Default illuminance ratio recommendations are as follows:

The space may be classified as a conference space. The guidelines are as follows:

Meeting: Discourse			Avg: Min
Eh @ 2'-6"	Eh = 300 lux	Task Area	2:1
Ev @ 4' AFF	Ev = 75 lux	Task Area	

Presenter: Fixed Position			Avg:Min
Face: Ev @ 5' AFF	Avg ≥ 1 times but ≤ 3 times audience task Eh		3:1
Task Surface: Eh @ 3'-6" AFF	Avg ≥ 1 times but ≤ 3 times audience task Eh		2:1

Handwritten Work: white or canary paper			
Pencil, Graphite:	Eh @ 2'-6" AFF Eh: 300 lux	Ev @ 4' AFF Ev: 75 lux	Medium veiling reflection
Ballpoint Pen:	Eh @ 2'-6" AFF Eh: 300 lux	Ev @ 4' AFF Ev: 75 lux	Small veiling reflection

Reading & Writing: VDT Screen & Keyboard		
CSA/ISO Types I & II	Matte or Semi-specular Finish	Positive polarity
Eh @ 2'-6" AFF Eh: 300 lux	Ev @ 3'-6" AFF Ev: 150 lux	Small veiling reflection
CSA/ISO Type III	Specular Finish	Positive polarity
Eh @ 2'-6" AFF Eh: 150 lux	Ev @ 3'-6" AFF Ev: 50 lux	Medium veiling reflection

The main points of interest in the Press Room are the speaking area and the reporter area. The reporter area will consist of chairs with possible retractable desks, and the speaking area will consist of a podium or desk with adjacent seats.

Power Allowances

By Table 9.5.1, using the building area method to calculate lighting power densities allows 0.78 W/ft² for a sports arena.

By Table 9.6.1, using the space-by-space method allows 1.23 W/ft² for Conference/Meeting/Multipurpose.

Existing Lighting System Critique

The space is 25' x 32' so it is 800 ft²(73.5 m²). The two fixtures are a linear fluorescent source and an LED source. Type F5D uses two 21 Watt T5 lamps, and the LEDs are a strip of LEDs. The T5 linear fluorescent has initial lumens of 2100. Light loss factor of 0.7 is calculated with a 0.9 Ballast Factor, a 0.9 LLD and 0.9 LDD. Space reflectances are assumed to be standard 0.8, 0.5, and 0.2 for ceiling, walls, and floor respectively.

The calculated values are as follows:

Illuminance (lux)	Avg	Max	Min	Avg/Min	CV
Horz	297.0	493.3	71.9	4.1	4.4
Vert 4	128.3	229.8	39.2	3.3	4.6
Vert 5	133.0	252.6	37.0	3.6	5.0

The design values are as follows:

Illuminance (lux)	Avg	Max	Min	Avg/Min	CV
Horz	300			1.5:1	
Vert 4	75			1.5:1	
Vert 5	300 ≤ Avg ≤ 900			3:1	

The calculated average from the model is slightly less than what is recommended for horizontal illuminance. This could be a result of not adding in the LED accent light along the southern wall. With the addition of the LED accent light, more of the room would have higher lux values, but

the avg/min ratio will be altered as well. Adding more light will increase the max and average, but the calculated ratio of 4.1 is already the recommended value of 1.5:1. The average vertical illuminance calculated in the model is acceptable for 4' AFF, but the 5' vertical illuminance for presenters is well under. Again, having a photometric file for the LED accent luminaire would help with analyzing a more accurate calculation. Each ratio of Avg/Min exceeds the recommended values. This means there are areas of excessive darkness that keeps the room from being uniformly illuminated. Please see Figure 1.3 below for identification of hotspot areas.

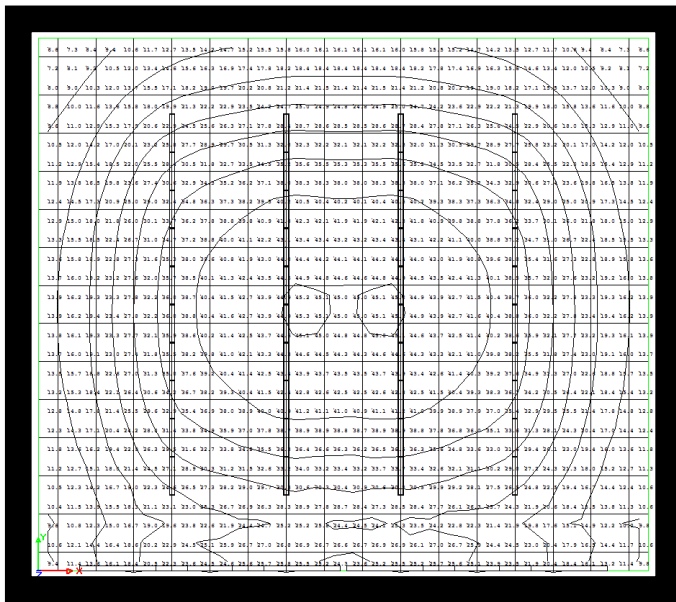


Figure 1.3

The space will need adequate accent on the speakers during conferences. Video conferencing may require up to 400 lux on vertical surfaces. Without having specification data on the LED fixture it is difficult to scrutinize the system. The space will be used by speakers and reporters/camera crews. The average illuminance is adequate, but more accent lighting may be needed on the speakers, especially for television. Also, the space is a simple rectangle, so a

uniform layout is an easy solution to the space.

New Lighting System

The new lighting system will be designed for 30 fc on the work plane at 2'-6" and the vertical illuminance guideline is 7.5 fc for the general press room area. There will be a position that the speaker presents and that will have a vertical illuminance equal to but not exceeding 3 times the task area horizontal illuminance, 30 fc. There are also guidelines for handwritten design criteria and vdt use for reporters to take notes.

I used two Omega Philips LED fixtures for this design. Both fixtures put out about 3000 lumens, but one fixture is a downlight while the other is a wallwasher. I chose 3500K, 80 CRI LEDs to give a warmer feel to the space. There are four wallwashers at the front of the room with two extras that provide extra light on the presenter. The design criteria called for the vertical illuminance on the presenter to be at least that of the audience task horizontal illuminance. However I could not get this to work out because the more wall washers I added,

the higher the audience horizontal illuminance became. In the end I designed for the Ev of the presenter to be above 30fc which is the design value for the audience Eh. The space is controlled with a single lighting zone. The space will only be used for presentations to the press, so there is no need for multiple zone switching.

Please see the following tables for my calculated values and images for renderings and luminaire layout.

Meeting: Discourse			Avg: Min
Eh @ 2'-6"	Eh = 300 lux	Task Area	2:1
Ev @ 4' AFF	Ev = 75 lux	Task Area	
Calculated	Eh: 50.46	Ev: 22.94	1.63

Presenter: Fixed Position		Avg:Min
Face: Ev @ 5' AFF	Avg ≥ 1 times but ≤ 3 times audience task Eh	3:1
Task Surface: Eh @ 3'-6" AFF	Avg ≥ 1 times but ≤ 3 times audience task Eh	2:1
Calculated	Eh: 69.75	

Handwritten Work: white or canary paper			
Pencil, Graphite:	Eh @ 2'-6" AFF	Ev @ 4' AFF	Medium veiling reflection
	Eh: 300 lux	Ev: 75 lux	
Ballpoint Pen:	Eh @ 2'-6" AFF	Ev @ 4' AFF	Small veiling reflection
	Eh: 300 lux	Ev: 75 lux	

Reading & Writing: VDT Screen & Keyboard		
CSA/ISO Types I & II	Matte or Semi-specular Finish	Positive polarity
Eh @ 2'-6" AFF	Ev @ 3'-6" AFF	Small veiling reflection
Eh: 300 lux	Ev: 150 lux	
CSA/ISO Type III	Specular Finish	Positive polarity
Eh @ 2'-6" AFF	Ev @ 3'-6" AFF	Medium veiling reflection
Eh: 150 lux	Ev: 50 lux	

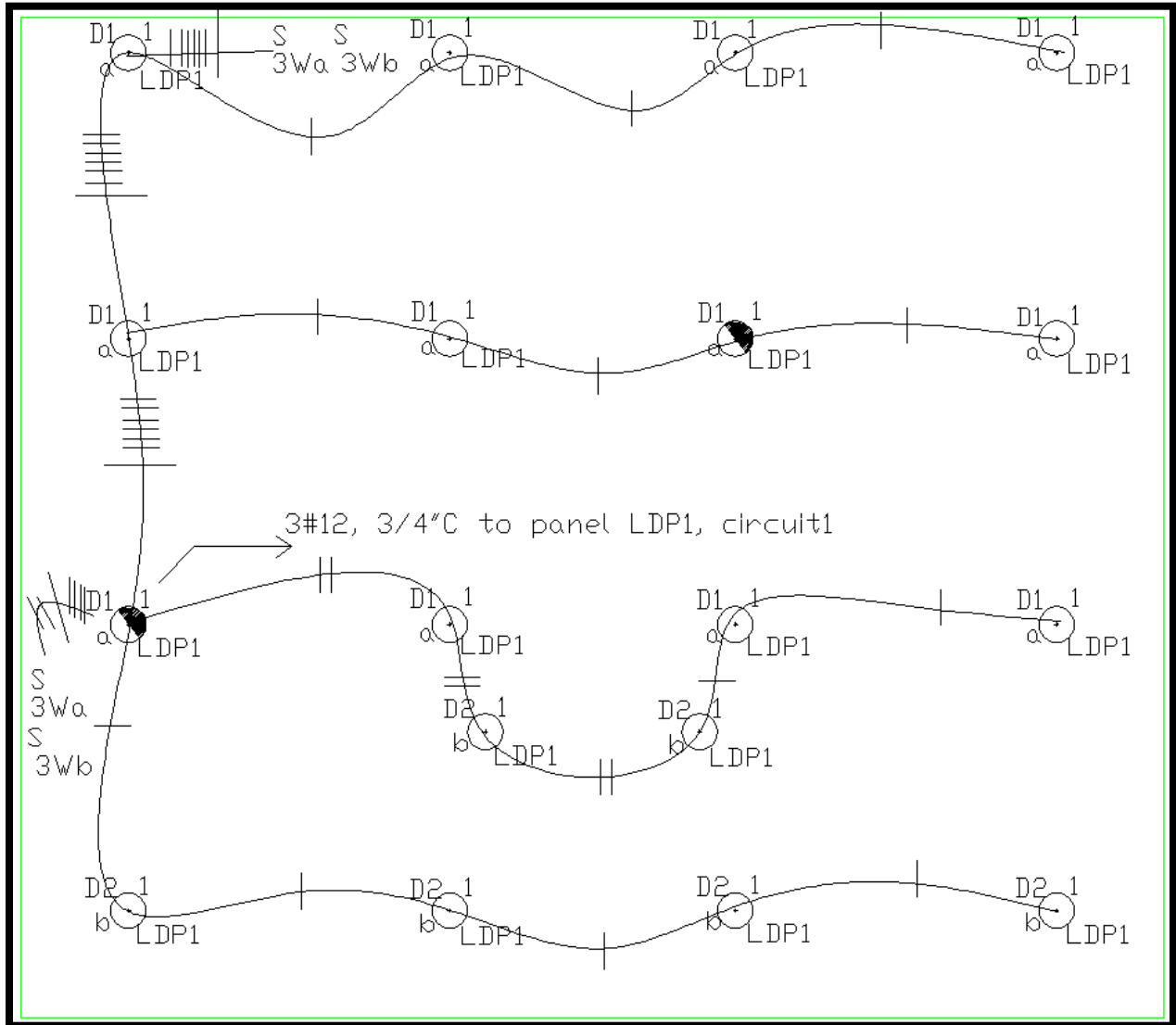


Figure: Luminaire Layout showing wallwashers as B and downlights as A with switching locations

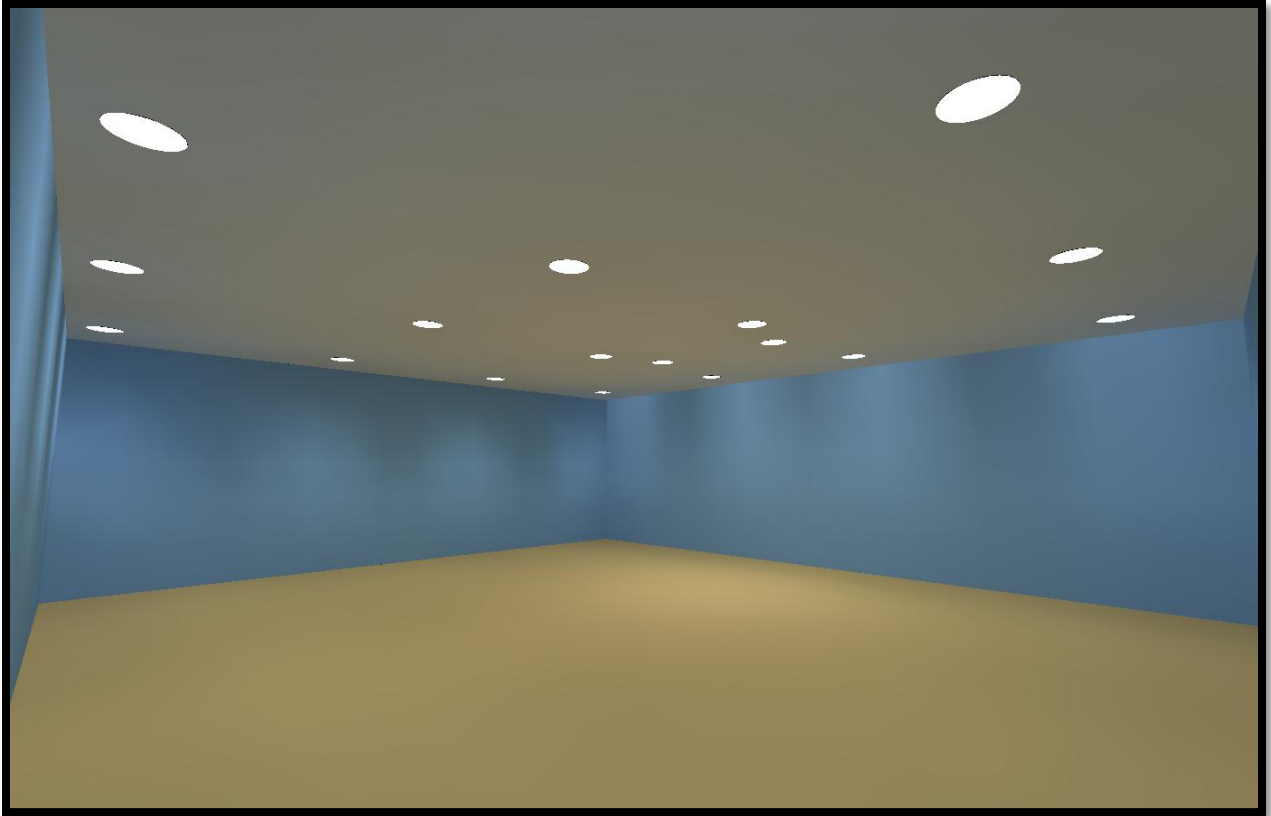


Figure: Press Room Rendering

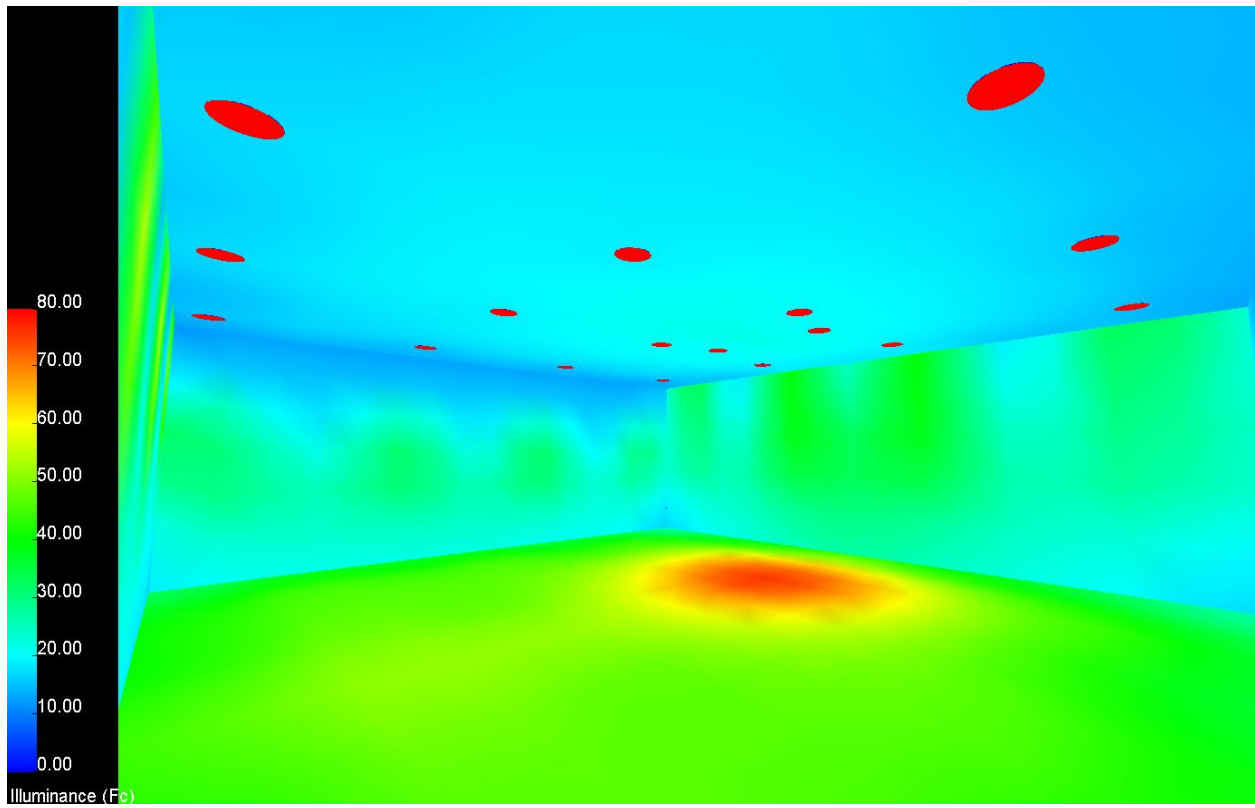


Figure: Press Room Pseudo Color showing the distribution of light

Electrical Design:

The new lighting designs for my four spaces need to have their electrical panels redesigned. Lighting circuits will need to be added to the existing panelboards. I will also do a short circuit study for one line of the Towson Arena distribution system. Then I will go into detail on an emergency generator system cost analysis and the abilities of SKM software to simulate a system.

Branch Circuit Redesign:

Introduction:

After redesigning all of the lighting spaces the panelboards that feed the lighting circuits will need to be updated. The existing circuits that the lights were on initially can be left with the lights that were not altered in the panelboard. Otherwise, the panelboards will have spare breakers for the empty circuits. My new lights might be able to fit on those existing circuits or on the spare breakers.

The court is a large space, 187'x137'x74' and will be used for sporting events, concerts, and ceremonies. The Reception is a lobby on the ground floor that greets the spectators as they come into the arena. It is two stories with an open stairwell. The northeast entrance brings the occupants into the space and allows for them to exit the space safely. There is a long pathway that leads to the parking lot as well as a canopied entrance that wraps around the building. The Press Room is a small room only 25' x 32'. It is where conferences for coaches and players will take place before or after sporting events. There is space for reporters as well as speakers.

The court has been redesigned with 20 1000W Metal Halide fixtures that have a shutter system available for blackouts during sporting events. The Reception has been redesigned with 39W LED suspended downlights and recessed 53W LED downlights that are both on a daylight dimming system. The exterior pathway has been redesigned with 40W LED pole mounted exterior fixtures and recessed 53W LED downlights over the entry. The press Room has been redesigned with recessed with 53W LED downlights and 53W LED wallwashers.

For the electrical redesign I will plan to use the minimum wire size required by the NEC to keep costs on the project low. The existing panelboards will be utilized for the new circuits. The emergency lighting will fixtures will be shown as normal/emergency fixtures. The conduit will be THWN EMT conduit. The wiring diagrams and layouts will follow.

Existing Panelboard Modifications:

Panelboards						
Panel Tag	Voltage	System	Court	Reception	Exterior	Press Room
LSP4	480/277,3P,4W	N	X			
LSP4A	120/277 (DUAL VOLTAGE)	N	X			
LDP4			X			
EP4			X			
EP2	480/277,3P,4W	N		X		
LP2				X		
EP1A	480/277,3P,4W	N			X	
LP1A					X	
LDP2					X	
ELDP2					X	
LDP1	277,3P,4W	N				X

Controls:

The reception will be controlled by two switches as shown for two zones as shown by line voltage switching. There will also be a low voltage dimming control for the two zones as shown. The dimming capabilities will require low voltage wiring. There will be Emergency/Normal fixtures. Please see the attached fixture layout sheet in the appendix.

The court will have line voltage switching in two locations near the northwest entrance to the court and the southeast entrance toward the Towson Center. There will be Emergency/Normal fixtures, and two zones will allow for different uses of the space. The light fixtures will have a 480/277V and a 208/120V feed because the shutter motor taps off of the ballast at 120V. So the 277V feed will come from LSP4 and the 120V feed will come from LSP4A. These two dimmer panels have a 20A relay capacity. I did not show the circuits going to the switches for simplicity of the drawing and ease of reading. Please see the attached fixture layout in the appendix.

The exterior is powered by one panel, EP1A. The fixture layout is long so it is broken into two views with no overlapping luminaires. There are to line to voltage switches for two zones. One zone illuminates the canopied entrance while the other zone is the extending pathway. Please see the attached fixture layout sheet in the appendix.

The Press Room will have two lighting zones with line voltage three way switching. One zone illuminates the speaker with wallwashers. The other zone illuminates the rest of the room

for reporters during press conferences. The fixtures are fed from lighting dimming panel LDP1. Please see the attached fixture layout sheet in the appendix.

Existing Panelboard Schedules:

SCHEDULE OF LIGHTING SWITCHING PANEL LSP4							
277 / 480 VOLTS		3 PHASE 4 WIRE	100A MCB		SURFACE MOUNTED		
RELAY NUMBER	CIRCUIT NUMBER	LOCATION	NORMAL/ EMERG.	RELAY & CIRCUIT BREAKER CAPACITY (AMPS)	CIRCUIT LOAD (WATTS)	WIRE / CONDUIT	NOTES
1	1	SPORTS FLOODLIGHTING	N	20	3300	#12-3/4"C	-
2	3	SPORTS FLOODLIGHTING	N	20	3300	#12-3/4"C	-
3	5	SPORTS FLOODLIGHTING	N	20	3300	#12-3/4"C	-
4	7	SPORTS FLOODLIGHTING	N	20	3300	#12-3/4"C	-
5	9	SPORTS FLOODLIGHTING	N	20	3300	#12-3/4"C	-
6	11	SPORTS FLOODLIGHTING	N	20	3300	#12-3/4"C	-
7	13	SPORTS FLOODLIGHTING	N	20	3300	#12-3/4"C	-
8	15	SPORTS FLOODLIGHTING	N	20	3300	#12-3/4"C	-
9	17	SPORTS FLOODLIGHTING	N	20	3300	#12-3/4"C	-
10	19	SPORTS FLOODLIGHTING	N	20	3300	#12-3/4"C	-
11	21	SPORTS FLOODLIGHTING	N	20	3300	#12-3/4"C	-
12	23	SPORTS FLOODLIGHTING	N	20	3300	#12-3/4"C	-
13	25	SPARE	N	20	-	-	-
14	27	SPARE	N	20	-	-	-
15	2	CATWALK	N	20	1584	#12-3/4"C	-
16	4	NORTH MECHANICAL AREA	N	20	484	#12-3/4"C	-
17	6	NORTH VIDEO AREA	N	20	284	#12-3/4"C	-
18	8	UPPER DECK SEATING	N	20	2430	#12-3/4"C	-
19	10	UPPER DECK SEATING	N	20	720	#12-3/4"C	-
20	12	LED INDIRECT FLOODS	N	20	1750	#12-3/4"C	-
21	14	LED INDIRECT FLOODS	N	20	1750	#12-3/4"C	-
22	16	3RD FLOOR LOBBY	N	20	878	#12-3/4"C	-
23	18	CLEANING LIGHTS BELOW UPPER DECK SEATING	N	20	1024	#12-3/4"C	-
24	20	SPARE	N	20	-	-	-
25	22	SPARE	N	20	-	-	-
26	24	SPARE	N	20	-	-	-
27	26	SPARE	N	20	-	-	-
28	28	SPARE	N	20	-	-	-

GENERAL NOTES:	CONNECTED LOAD =	50,50	KVA
A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.	DEMAND LOAD =	50,50	KVA
B. TIMELOCK SCHEDULING SHALL BE COORDINATED WITH FACILITIES AND PROGRAMMED ACCORDINGLY.	MIN AIC RATING =	10,000	AMPS SYM
	LOCATION	_____	

SCHEDULE OF LIGHTING SWITCHING PANEL LSP4A							
120 / 277 VOLTS (DUAL VOLTAGE)			FEED-THRU		SURFACE MOUNTED		
RELAY NUMBER	CIRCUIT NUMBER	LOCATION	NORMAL/ EMERG.	RELAY CAPACITY (AMPS)	CIRCUIT LOAD (WATTS)	WIRE / CONDUIT	NOTES
1	LP4-1	SPORTS FLOODLIGHTING SHUTTER CONTROL	N	20	150	#12-3/4" C	--
2	LP4-1	SPORTS FLOODLIGHTING SHUTTER CONTROL	N	20	150	#12-3/4" C	--
3	LP4-1	SPORTS FLOODLIGHTING SHUTTER CONTROL	N	20	150	#12-3/4" C	--
4	LP4-1	SPORTS FLOODLIGHTING SHUTTER CONTROL	N	20	150	#12-3/4" C	--
5	LP4-1	SPORTS FLOODLIGHTING SHUTTER CONTROL	N	20	150	#12-3/4" C	--
6	LP4-1	SPORTS FLOODLIGHTING SHUTTER CONTROL	N	20	150	#12-3/4" C	--
7	LP4-3	H-BAY LIGHTING (4100K LAMPS) LEFT COURT	N	20	2232	#12-3/4" C	--
8	LP4-5	H-BAY LIGHTING (4100K LAMPS) LEFT COURT	N	20	2232	#12-3/4" C	--
9	LP4-7	H-BAY LIGHTING (4100K LAMPS) LEFT COURT	N	20	1488	#12-3/4" C	--
10	LP4-7	H-BAY LIGHTING (4100K LAMPS) LEFT COURT	N	20	1488	#12-3/4" C	--
11	LP4-9	H-BAY LIGHTING (4100K LAMPS) LEFT COURT	N	20	744	#12-3/4" C	--
12	LP4-9	H-BAY LIGHTING (4100K LAMPS) LEFT COURT	N	20	744	#12-3/4" C	--
13	LP4-11	H-BAY LIGHTING (4100K LAMPS) CENTER COURT	N	20	1116	#12-3/4" C	--
14	LP4-11	H-BAY LIGHTING (4100K LAMPS) CENTER COURT	N	20	1116	#12-3/4" C	--
15	LP4-13	H-BAY LIGHTING (4100K LAMPS) CENTER COURT	N	20	1116	#12-3/4" C	--
16	LP4-13	H-BAY LIGHTING (4100K LAMPS) CENTER COURT	N	20	1116	#12-3/4" C	--
17	LP4-15	H-BAY LIGHTING (4100K LAMPS) CENTER COURT	N	20	1674	#12-3/4" C	--
18	LP4-15	H-BAY LIGHTING (4100K LAMPS) CENTER COURT	N	20	1674	#12-3/4" C	--
19	LP4-17	H-BAY LIGHTING (4100K LAMPS) RIGHT COURT	N	20	2232	#12-3/4" C	--
20	LP4-19	H-BAY LIGHTING (4100K LAMPS) RIGHT COURT	N	20	2232	#12-3/4" C	--
21	LP4-21	H-BAY LIGHTING (4100K LAMPS) RIGHT COURT	N	20	1488	#12-3/4" C	--
22	LP4-21	H-BAY LIGHTING (4100K LAMPS) RIGHT COURT	N	20	1488	#12-3/4" C	--
23	LP4-23	H-BAY LIGHTING (4100K LAMPS) RIGHT COURT	N	20	744	#12-3/4" C	--
24	LP4-23	H-BAY LIGHTING (4100K LAMPS) RIGHT COURT	N	20	744	#12-3/4" C	--
25	LP4-25	MECHANICAL ROOM 325	N	20	832	#12-3/4" C	--
26	LP4-25	LED BARS @ EAST WINDOWS	N	20	500	#12-3/4" C	--
27	--	SPARE	N	20	--	--	--
28	--	SPARE	N	20	--	--	--
29	--	SPARE	N	20	--	--	--
30	--	SPARE	N	20	--	--	--
31	--	SPARE	N	20	--	--	--
32	--	SPARE	N	20	--	--	--

GENERAL NOTES:	CONNECTED LOAD =	27.90	KVA
A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.	DEMAND LOAD =	27.90	KVA
	MIN AIC RATING =	10,000	AMPS SYM
	LOCATION	ELEC 132	

SCHEDULE OF EMERGENCY LIGHTING SWITCHING PANEL ELSP4							
120 / 277 VOLTS (DUAL VOLTAGE)			FEED-THRU		SURFACE MOUNTED		
RELAY NUMBER	CIRCUIT NUMBER	LOCATION	NORMAL/ EMERG.	RELAY CAPACITY (AMPS)	CIRCUIT LOAD (WATTS)	WIRE / CONDUIT	NOTES
1	EP4-1	HI-BAY LIGHTING (4100K LAMPS) LEFT COURT	N	20	2232	#12-3/4"C	--
2	EP4-3	HI-BAY LIGHTING (4100K LAMPS) LEFT COURT	N	20	1488	#12-3/4"C	--
3	EP4-3	HI-BAY LIGHTING (4100K LAMPS) LEFT COURT	N	20	744	#12-3/4"C	--
4	EP4-5	HI-BAY LIGHTING (4100K LAMPS) CENTER COURT	N	20	1116	#12-3/4"C	--
5	EP4-5	HI-BAY LIGHTING (4100K LAMPS) CENTER COURT	N	20	1116	#12-3/4"C	--
6	EP4-7	HI-BAY LIGHTING (4100K LAMPS) CENTER COURT	N	20	1674	#12-3/4"C	--
7	EP4-9	HI-BAY LIGHTING (4100K LAMPS) RIGHT COURT	N	20	2232	#12-3/4"C	--
8	EP4-11	HI-BAY LIGHTING (4100K LAMPS) RIGHT COURT	N	20	1488	#12-3/4"C	--
9	EP4-11	HI-BAY LIGHTING (4100K LAMPS) RIGHT COURT	N	20	744	#12-3/4"C	--
10	EP4-13	UPPER DECK SEATING	N	20	1440	#10-3/4"C	--
11	EP4-13	UPPER DECK SEATING	N	20	810	#10-3/4"C	--
12	EP4-15	CATWALK	N	20	968	#10-3/4"C	--
13	EP4-15	NORTH VIDEO AREA	N	20	132	#12-3/4"C	--
14	EP4-17	3RD FLOOR LOBBY	N	20	450	#12-3/4"C	--
15	EP4-19	STAIR 7	N	20	384	#12-3/4"C	--
16	EP4-19	STAIR 7	N	20	384	#12-3/4"C	--
17	EP4-21	ROOF LTG	N	20	680	#12-3/4"C	--
18	EP4-17	MECHANICAL ROOM 325	N	20	256	#12-3/4"C	--
19	--	SPARE	N	20	--	--	--
20	--	SPARE	N	20	--	--	--
21	--	SPARE	N	20	--	--	--
22	--	SPARE	N	20	--	--	--
23	--	SPARE	N	20	--	--	--
24	--	SPARE	N	20	--	--	--

GENERAL NOTES:	CONNECTED LOAD =	18.34	KVA
A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.	DEMAND LOAD =	18.34	KVA
	MIN AIC RATING =	10,000	AMPS SYM
	LOCATION	ELEC 132	

SCHEDULE OF DIMMER PANEL LDP4								
277 VOLTS		3 PHASE 4 WIRE			100A MLO		SURFACE MOUNTED	
DIMMER CIRCUIT NO.	LOCATION	DESCRIPTION	CONTROL ZONE	DIM/SWITCH	LOAD TYPE	DIMMER CAPACITY (WATTS)	CIRCUIT LOAD (WATTS)	NOTES
1	ARENA	HIBAY LIGHTING (2700K LAMPS)	1	DIM	CFL	4500	2232	--
2	ARENA	HIBAY LIGHTING (2700K LAMPS)	2	DIM	CFL	4500	1468	--
3	ARENA	HIBAY LIGHTING (2700K LAMPS)	3	DIM	CFL	4500	744	--
4	ARENA	HIBAY LIGHTING (2700K LAMPS)	4	DIM	CFL	4500	1116	--
5	ARENA	HIBAY LIGHTING (2700K LAMPS)	5	DIM	CFL	4500	1116	--
6	ARENA	HIBAY LIGHTING (2700K LAMPS)	6	DIM	CFL	4500	1674	--
7	ARENA	HIBAY LIGHTING (2700K LAMPS)	7	DIM	CFL	4500	2232	--
8	ARENA	HIBAY LIGHTING (2700K LAMPS)	8	DIM	CFL	4500	1468	--
9	ARENA	HIBAY LIGHTING (2700K LAMPS)	9	DIM	CFL	4500	744	--
10	ARENA	CENTER COURT LED SPOTS	10	DIM	LED	4500	100	--
11	ARENA	CENTER COURT LED SPOTS	11	DIM	LED	4500	100	--
12	ARENA	CENTER COURT LED SPOTS	12	DIM	LED	4500	100	--
13	ARENA	CENTER COURT LED SPOTS	13	DIM	LED	4500	100	--
14	ARENA	CENTER COURT LED SPOTS	14	DIM	LED	4500	100	--
15	ARENA	CENTER COURT LED SPOTS	15	DIM	LED	4500	100	--
16	ARENA	CENTER COURT LED SPOTS	16	DIM	LED	4500	100	--
17	ARENA	CENTER COURT LED SPOTS	17	DIM	LED	4500	100	--
18	SUITE 311	DOWNLIGHTS - MAIN	18	DIM	CFL	4500	116	--
19	SUITE 311	DOWNLIGHTS - FRONT	19	DIM	CFL	4500	58	--
20	SUITE 311	COVE	20	DIM	LED	4500	182	--
21	SUITE 312	DOWNLIGHTS - MAIN	21	DIM	CFL	4500	290	--
22	SUITE 312	DOWNLIGHTS - FRONT	22	DIM	CFL	4500	145	--
23	SUITE 312	COVE	23	DIM	LED	4500	238	--
24	SUITE 313	DOWNLIGHTS - MAIN	24	DIM	CFL	4500	290	--
25	SUITE 313	DOWNLIGHTS - FRONT	25	DIM	CFL	4500	145	--
26	SUITE 313	COVE	26	DIM	LED	4500	238	--
27	SUITE 314	DOWNLIGHTS - MAIN	27	DIM	CFL	4500	116	--
28	SUITE 314	DOWNLIGHTS - FRONT	28	DIM	CFL	4500	58	--
29	SUITE 314	COVE	29	DIM	LED	4500	182	--
30	SUITE 316	DOWNLIGHTS - REAR	30	DIM	CFL	4500	261	--
31	SUITE 316	DOWNLIGHTS - FRONT	31	DIM	CFL	4500	319	--
32	SUITE 316	DOWNLIGHTS - WINDOW	32	DIM	CFL	4500	116	--
33	SUITE 316	REFRESHMENTS	33	DIM	CFL	4500	58	--
34	SUITE 316	LINEAR SLOTS	34	DIM	FLUORESCENT	4500	320	--
35	SUITE 316	COVE	35	DIM	LED	4500	136	--
36	SUITE 317	DOWNLIGHTS	36	DIM	CFL	4500	116	--
37	VIDEO 308	DOWNLIGHTS	37	DIM	CFL	4500	184	--
38	3RD FLOOR CORRIDOR	WALLWASHERS - WOODEN BOX	38	DIM	FLUORESCENT	4500	1152	--
39	MULTIPURPOSE 301	DOWNLIGHTS	39	DIM	CFL	4500	480	--
40	MULTIPURPOSE 301	DOWNLIGHTS - FRONT	40	DIM	CFL	4500	92	--
41	MULTIPURPOSE 301	WALL GRAZER	41	DIM	FLUORESCENT	4500	42	--
42	MULTIPURPOSE 301	ACCENT LIGHTS	42	DIM	CFL	4500	92	--
43	MULTIPURPOSE 301	DECORATIVE PENDANTS	43	DIM	LED	4500	80	--
44	RECEPTION 202	DOWNLIGHTS	44	DIM	CFL	4500	322	--
45	--	SPARE	45	DIM	--	4500	--	--
46	--	SPARE	46	DIM	--	4500	--	--
47	--	SPARE	47	DIM	--	4500	--	--
48	--	SPARE	48	DIM	--	4500	--	--


<u>GENERAL NOTES:</u>	CONNECTED LOAD =	19.42	KVA
A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.	DEMAND LOAD =	19.42	KVA
	MIN AIC RATING =	25,000	AMPS SYM
	LOCATION	_____	


WIRING SCHEDULE: PANEL EP4														
480 / 277 VOLTS			3 PHASE 4 WIRE			100 AMP MAINS			SURFACE MOUNTED					
CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER POLE	AMP	KVA / Ø			CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER POLE	AMP
						AØ	BØ	CØ						
1	1	LTG - COURT LTS (VIA ELSP4)	#12-3/4"C	1	20	2.3	0.5			2	2	LTG - ELEVATOR SHAFT	#12-3/4"C	1 20
3	3	LTG - COURT LTS (VIA ELSP4)	#12-3/4"C	1	20			2.2	1.0	4	4	LTG - 3RD FLOOR EXIT SIGNS	#10-3/4"C	1 20
5	5	LTG - COURT LTS (VIA ELSP4)	#12-3/4"C	1	20					6	6	LTG - STAIR 3	#12-3/4"C	1 20
7	7	LTG - COURT LTS (VIA ELSP4)	#12-3/4"C	1	20	1.7	2.2			8	8	LTG - SKYBOX RESTROOMS	#12-3/4"C	1 20
9	9	LTG - COURT LTS (VIA ELSP4)	#12-3/4"C	1	20			2.2	0.5	10	10	SMOKE DAMPERS	#10-3/4"C	1 20
11	11	LTG - COURT LTS (VIA ELSP4)	#12-3/4"C	1	20					12		SPARE		1 20
13	13	LTG - SEATING LTS (VIA ELSP4)	#12-3/4"C	1	20	2.3				14		SPARE		1 20
15	15	LTG - TRUSS LEVEL LTG (VIA ELSP4)	#12-3/4"C	1	20			1.1		16		SPARE		1 20
17	17	LTG - 3RD FLOOR LTG (VIA ELSP4)	#12-3/4"C	1	20				0.5	18		SPARE		1 20
19	19	LTG - STAIR 7 (VIA ELSP4)	#12-3/4"C	1	20	0.8				20		SPARE		1 20
21	21	LTG - ROOFTOP	#12-3/4"C	1	20			0.7		22		SPARE		1 20
23		SPARE		1	20					24		SPARE		1 20
25		SPARE		1	20					26		SPARE		1 20
27		SPARE		1	20					28		SPARE		1 20
29		SPARE		1	20					30		SPARE		1 20
-	31	SPACE & PROVISIONS	-	1	-	-	-	-	-	-	32	SPACE & PROVISIONS	-	1 -
-	33	SPACE & PROVISIONS	-	1	-	-	-	-	-	-	34	SPACE & PROVISIONS	-	1 -
-	35	SPACE & PROVISIONS	-	1	-	-	-	-	-	-	36	SPACE & PROVISIONS	-	1 -
-	37	SPACE & PROVISIONS	-	1	-	-	0.5	-	-	38	38	DIMMER PANEL ELDP4	4#8+ #10G- 3/4"C	3 50
-	39	SPACE & PROVISIONS	-	1	-	-	-	0.5	-	-	40			
-	41	SPACE & PROVISIONS	-	1	-	-	-	-	0.5	-	42			
CONNECTED LOAD =						24.9	KVA	7.1	3.2	6.2	2.0	4.9	1.5	
DEMAND LOAD =						24.8	KVA	10.3	8.2	6.4				
MIN AIC RATING =						18,000	AMPS SYMMETRICAL	NOTE: PROVIDE SEPARATE NEUTRAL FOR EACH CIRCUIT			MAIN BREAKER		100	AMPS
									LOCATION			ABOVE SKYBOX		

WIRING SCHEDULE: PANEL LP4														
480 / 277 VOLTS			3 PHASE 4 WIRE			400 AMP MAINS			SURFACE MOUNTED					
CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER POLE	AMP	KVA / Ø			CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER POLE	AMP
						AØ	BØ	CØ						
1	1	LTG - SPORT LIGHT SHUTTERS (VIA LSP4A)	#12-3/4"C	1	20	0.9	0.2			2	2	LTG - 3RD FLOOR STORAGE RMS	#12-3/4"C	1 20
3	3	LTG - COURT LTG (VIA LSP4A)	#12-3/4"C	1	20			2.2	0.4	4	4	LTG - 3RD FLOOR STORAGE & JAN	#12-3/4"C	1 20
5	5	LTG - COURT LTG (VIA LSP4A)	#12-3/4"C	1	20					6		SPARE		1 20
7	7	LTG - COURT LTG (VIA LSP4A)	#12-3/4"C	1	20	2.9				8		SPARE		1 20
9	9	LTG - COURT LTG (VIA LSP4A)	#12-3/4"C	1	20			1.5		10		SPARE		1 20
11	11	LTG - COURT LTG (VIA LSP4A)	#12-3/4"C	1	20					12		SPARE		1 20
13	13	LTG - COURT LTG (VIA LSP4A)	#12-3/4"C	1	20	2.2				14		SPARE		1 20
15	15	LTG - COURT LTG (VIA LSP4A)	#12-3/4"C	1	20			3.3		16		SPARE		1 20
17	17	LTG - COURT LTG (VIA LSP4A)	#12-3/4"C	1	20					18		SPARE		1 20
19	19	LTG - COURT LTG (VIA LSP4A)	#12-3/4"C	1	20	2.2				20		SPARE		1 20
21	21	LTG - COURT LTG (VIA LSP4A)	#12-3/4"C	1	20			2.9		22		SPARE		1 20
23	23	LTG - COURT LTG (VIA LSP4A)	#12-3/4"C	1	20					24		SPARE		1 20
25	25	LTG - MECH RM 325 (VIA LSP4A)	#12-3/4"C	1	20	1.2				26		SPARE		1 20
27		SPARE		1	20					28		SPARE		1 20
29		SPARE		1	20					30		SPARE		1 20
31	31	PANEL RP4A (VIA XFMR TRP4A)	3#1/0+ #6G- 2"C	3	150**	23.3	16.8			32	32	SWITCHING PANEL LSP4	4#2+ #8G- 1-1/4"C	3 100
-	33							23.3	16.8	-	34			
-	35								21.7	16.8	-	36		
37	37	PANEL RP4 (VIA XFMR TRP4)	3#4/0+ #4G- 3"C	3	225**	40.2	6.5			38	38	DIMMING PANEL LDP4	4#8+ #10G- 1"C	3 50
-	39	(SUB-FEED CIRCUIT BREAKER)						37.0	6.5	-	40			
-	41								41.0	6.5	-	42		
CONNECTED LOAD =						284.4	KVA	72.9	23.5	70.2	23.7	70.8	23.3	
DEMAND LOAD =						236.6	KVA	96.4	93.9	94.1				
MIN AIC RATING =						4	25,000	NOTES: PROVIDE SEPARATE NEUTRAL FOR EACH CIRCUIT			MAIN BREAKER		400	AMPS
									** PROVIDE SUB-FEED CIRCUIT BREAKER			LOCATION		ABOVE SKYBOX

WIRING SCHEDULE: PANEL EP2															
480 / 277 VOLTS			3 PHASE 4 WIRE			100 AMP MAINS			SURFACE MOUNTED						
CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER POLE AMP	KVA / Ø			CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER POLE AMP			
					AØ	BØ	CØ								
1	1	LTG - CONCOURSE LOBBIES (VIA ELS2)	#10-3/4"	1 20	1.2	2.2				2	2	LTG - 2ND FLOOR RESTROOMS	#10-3/4"	1 20	
3	3	LTG - CONCOURSE (VIA ELS2)	#10-3/4"	1 20			2.5	0.1		4	4	LTG - 2ND FLOOR EXITS	#10-3/4"	1 20	
5	5	LTG - LINK (VIA ELS2)	#10-3/4"	1 20					1.2	0.1	6	6	SMOKE DAMPER	#10-3/4"	1 20
7	7	LTG - UPPER DECK STAIRS (VIA ELS2)	#10-3/4"	1 20	1.8						8	8	SPARE		1 20
9	9	LTG - UPPER DECK STAIRS (VIA ELS2)	#10-3/4"	1 20				0.9			10	10	SPARE		1 20
11	11	SPARE		1 20							12	12	SPARE		1 20
13	13	SPARE		1 20							14	14	SPARE		1 20
15	15	SPARE		1 20							16	16	SPARE		1 20
17	17	SPARE		1 20							18	18	SPARE		1 20
19	19	SPARE		1 20							20	20	SPARE		1 20
21	21	SPARE		1 20							22	22	SPARE		1 20
23	23	SPARE		1 20							24	24	SPARE		1 20
-	25	SPACE & PROVISIONS	-	1 -	-	-	-	-	-	-	26	26	SPACE & PROVISIONS	-	1 -
-	27	SPACE & PROVISIONS	-	1 -	-	-	-	-	-	-	28	28	SPACE & PROVISIONS	-	1 -
-	29	SPACE & PROVISIONS	-	1 -	-	-	-	-	-	-	30	30	SPACE & PROVISIONS	-	1 -
-	31	SPACE & PROVISIONS	-	1 -	-	-	-	-	-	-	32	32	SPACE & PROVISIONS	-	1 -
-	33	SPACE & PROVISIONS	-	1 -	-	-	-	-	-	-	34	34	SPACE & PROVISIONS	-	1 -
-	35	SPACE & PROVISIONS	-	1 -	-	-	-	-	-	-	36	36	SPACE & PROVISIONS	-	1 -
37	37	PANEL EP4	4#3+ #8G- 1 1/4"	3 100	10.3	1.4				38	38	DIMMER PANEL ELDP2	4#8+ #10G- 3/4"	3 50	
-	39						6.2	1.4		-	40				
-	41								6.4	1.4	-	42			
CONNECTED LOAD =					39.0 KVA			13.3 3.6 11.6 1.5 7.6 1.5			MAIN BREAKER 100 AMPS				
DEMAND LOAD =					38.8 KVA			16.9 13.1 9.1			NOTE: PROVIDE SEPARATE NEUTRAL FOR EACH CIRCUIT				
MIN AIC RATING =					25,000 AMPS SYMMETRICAL			LOCATION ELECT RM 246							

WIRING SCHEDULE: PANEL LP2															
480 / 277 VOLTS			3 PHASE 4 WIRE			225 AMP MAINS			SURFACE MOUNTED						
CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER POLE AMP	KVA / Ø			CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER POLE AMP			
					AØ	BØ	CØ								
1	1	LTG - WEST LOBBY 260 (VIA LSP2)	#12-3/4"	1 20	0.9	0.7				2	2	LTG - JAN & STORAGE	#12-3/4"	1 20	
3	3	LTG - DECORATIVE PENDANTS (VIA LSP2)	#12-3/4"	1 20			0.3			4	4	SPARE		1 20	
5	5	LTG - WEST CONCOURSE (VIA LSP2)	#12-3/4"	1 20					1.1		6	6	SPARE		1 20
7	7	LTG - RECEPTION 125 (VIA LSP2)	#12-3/4"	1 20	0.9						8	8	SPARE		1 20
9	9	LTG - HALL OF FAME 225 (VIA LSP2)	#12-3/4"	1 20			0.3				10	10	SPARE		1 20
11	11	LTG - TICKETING 203 (VIA LSP2)	#12-3/4"	1 20					0.6		12	12	SPARE		1 20
13	13	LTG - VESTIBULE 124 (VIA LSP2)	#12-3/4"	1 20	0.1						14	14	SPARE		1 20
15	15	SPARE		1 20							16	16	SPARE		1 20
17	17	SPARE		1 20							18	18	SPARE		1 20
19	19	SPARE		1 20							20	20	SPARE		1 20
21	21	SPARE		1 20							22	22	SPARE		1 20
23	23	SPARE		1 20							24	24	SPARE		1 20
-	25	SPACE & PROVISIONS	-	1 -	-	-	-	-	-	-	26	26	SPACE & PROVISIONS	-	1 -
-	27	SPACE & PROVISIONS	-	1 -	-	-	-	-	-	-	28	28	SPACE & PROVISIONS	-	1 -
-	29	SPACE & PROVISIONS	-	1 -	-	-	-	-	-	-	30	30	SPACE & PROVISIONS	-	1 -
-	31	SPACE & PROVISIONS	-	1 -	-	-	-	-	-	-	32	32	SPACE & PROVISIONS	-	1 -
-	33	SPACE & PROVISIONS	-	1 -	-	-	-	-	-	-	34	34	SPACE & PROVISIONS	-	1 -
-	35	SPACE & PROVISIONS	-	1 -	-	-	-	-	-	-	36	36	SPACE & PROVISIONS	-	1 -
37	37	PANEL RP2 (VIA XFMR TRP2)	3#1/0+ #6G- 2"	3 150**	26.1	4.0				38	38	DIMMING PANEL LDP2	4#8+ #10G- 3/4"	3 50	
-	39	(SUB-FEED CIRCUIT BREAKER)					23.9	4.0		-	40				
-	41								22.7	4.0	-	42			
CONNECTED LOAD =					89.6 KVA			28.0 4.7 24.5 4.0 24.4 4.0			MAIN BREAKER 200 AMPS				
DEMAND LOAD =					71.7 KVA			32.7 28.5 28.4			NOTES: PROVIDE SEPARATE NEUTRAL FOR EACH CIRCUIT ** PROVIDE SUB-FEED CIRCUIT BREAKER				
MIN AIC RATING =					4 35,000 AMPS SYMMETRICAL			LOCATION ELEC. RM 246							

WIRING SCHEDULE: PANEL EP1A																												
480 / 277 VOLTS				3 PHASE 4 WIRE				100 AMP MAINS				SURFACE MOUNTED																
CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER POLE	AMP	KVA / Ø			CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER POLE	AMP														
						AØ	BØ	CØ																				
1	1	LTG - MECHANICAL 147 (VIA LSP1A)	#10-3/4"C	1	20	0.9	0.3				2	2	LTG - ELEC RM 146	#10-3/4"C	1	20												
3	3	LTG - STORAGE RMS (VIA LSP1A)	#10-3/4"C	1	20			0.8	0.1		4	4	LTG - 1ST FLOOR EXITS	#10-3/4"C	1	20												
5	5	LTG - 1ST FLOOR CORRIDORS (VIA LSP1A)	#10-3/4"C	1	20					1.1	2.2	6	6	LTG - 1ST FLOOR RESTROOMS	#10-3/4"C	1	20											
7	7	LTG - EXTERIOR LTG (VIA LSP1A)	#10-3/4"C	1	20	2.4	-					8	8	SPARE	-	1	20											
9	9	SPARE	-	1	20			-	-			10	10	SPARE	-	1	20											
11	11	SPARE	-	1	20					-	-	12	12	SPARE	-	1	20											
13	13	SPARE	-	1	20	-	-					14	14	SPARE	-	1	20											
15	15	SPARE	-	1	20			-	-			16	16	SPARE	-	1	20											
17	17	SPARE	-	1	20					-	-	18	18	SPARE	-	1	20											
19	19	SPARE	-	1	20	-	-					20	20	SPARE	-	1	20											
21	21	SPARE	-	1	20			-	-			22	22	SPARE	-	1	20											
23	23	SPARE	-	1	20					-	-	24	24	SPARE	-	1	20											
-	25	SPACE & PROVISIONS	-	-	-	-	-					-	26	SPACE & PROVISIONS	-	-	-											
-	27	SPACE & PROVISIONS	-	-	-	-	-					-	28	SPACE & PROVISIONS	-	-	-											
-	29	SPACE & PROVISIONS	-	-	-	-	-					-	30	SPACE & PROVISIONS	-	-	-											
CONNECTED LOAD =						7.8	KVA	<table border="1"> <tr> <td>3.3</td> <td>0.3</td> <td>0.8</td> <td>0.1</td> <td>1.1</td> <td>2.2</td> </tr> <tr> <td>3.6</td> <td></td> <td>0.9</td> <td></td> <td>3.3</td> <td></td> </tr> </table>			3.3	0.3	0.8	0.1	1.1	2.2	3.6		0.9		3.3		MAIN BREAKER 60 AMPS					
3.3	0.3	0.8	0.1	1.1	2.2																							
3.6		0.9		3.3																								
DEMAND LOAD =						7.8	KVA	NOTE: PROVIDE SEPARATE NEUTRAL FOR EACH CIRCUIT																				
MIN AIC RATING =						25,000	AMPS SYMMETRICAL	LOCATION 																				

WIRING SCHEDULE: PANEL LP1A																												
480 / 277 VOLTS				3 PHASE 4 WIRE				100 AMP MAINS				SURFACE MOUNTED																
CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER POLE	AMP	KVA / Ø			CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER POLE	AMP														
						AØ	BØ	CØ																				
1	1	LTG - MECH RM (VIA LSP1A)	#12-3/4"C	1	20	0.4	0.2				2	2	LTG - TELE/DATA 106	#12-3/4"C	1	20												
3	3	LTG - STORAGE (VIA LSP1A)	#12-3/4"C	1	20			2.3				4	4	SPARE		1	20											
5	5	LTG - 1ST FLOOR CORRIDORS (VIA LSP1A)	#12-3/4"C	1	20					1.1		6	6	SPARE		1	20											
7	7	LTG - EXTERIOR LTG (VIA LSP1A)	#12-3/4"C	1	20							8	8	SPARE		1	20											
9	9	LTG - EXTERIOR LTG (VIA LSP1A)	#12-3/4"C	1	20			1.1				10	10	SPARE		1	20											
11	11	LTG - EXTERIOR LTG (VIA LSP1A)	#12-3/4"C	1	20							12	12	SPARE		1	20											
		SPARE		1	20							14	14	SPARE		1	20											
		SPARE		1	20							16	16	SPARE		1	20											
		SPARE		1	20							18	18	SPARE		1	20											
		SPARE		1	20							20	20	SPARE		1	20											
		SPARE		1	20							22	22	SPARE		1	20											
		SPARE		1	20							24	24	SPARE		1	20											
		SPARE		1	20							26	26	SPARE		1	20											
		SPARE		1	20							28	28	SPARE		1	20											
		SPARE		1	20							30	30	SPARE		1	20											
CONNECTED LOAD =						5.1	KVA	<table border="1"> <tr> <td>0.4</td> <td>0.2</td> <td>3.4</td> <td>0.0</td> <td>1.1</td> <td>0.0</td> </tr> <tr> <td>0.6</td> <td></td> <td>3.4</td> <td></td> <td>1.1</td> <td></td> </tr> </table>			0.4	0.2	3.4	0.0	1.1	0.0	0.6		3.4		1.1		MAIN BREAKER 100 AMPS					
0.4	0.2	3.4	0.0	1.1	0.0																							
0.6		3.4		1.1																								
DEMAND LOAD =						5.1	KVA	NOTE: PROVIDE SEPARATE NEUTRAL FOR EACH CIRCUIT																				
MIN AIC RATING =						25,000	AMPS SYMMETRICAL	LOCATION 																				

SCHEDULE OF DIMMER PANEL LDP2								
277 VOLTS		3 PHASE 4 WIRE		50A MLO		SURFACE MOUNTED		
DIMMER CIRCUIT NO.	LOCATION	DESCRIPTION	CONTROL ZONE	DIM/SWITCH	LOAD TYPE	DIMMER CAPACITY (WATTS)	CIRCUIT LOAD (WATTS)	NOTES
1	VESTIBULE 201	DOWNLIGHTS	1	DIM	CFL	4500	184	--
2	VESTIBULE 201	DOWNLIGHTS	2	DIM	CFL	4500	276	--
3	RECEPTION 202	DOWNLIGHTS	3	DIM	CFL	4500	184	--
4	RECEPTION 202	ACCENT LIGHTS	4	DIM	CFL	4500	322	--
5	---	SPARE	5	DIM	---	4500	--	--
6	NORTH CONCOURSE	LINEAR	6	DIM	FLUORESCENT	4500	2800	--
7	NORTH CONCOURSE	LINEAR	7	DIM	FLUORESCENT	4500	3080	--
8	NORTH CONCOURSE	LINEAR	8	DIM	FLUORESCENT	4500	2520	--
9	NORTH CONCOURSE	ACCENT LIGHTS	9	DIM	LED	4500	205	--
10	NORTH CONCOURSE	WALLWASHERS - WOODEN BOX	10	DIM	FLUORESCENT	4500	1600	--
11	WEST LOBBY 260	DOWNLIGHTS	11	DIM	FLUORESCENT	4500	322	--
12	HALL OF FAME 255	DOWNLIGHTS	12	DIM	CFL	4500	348	--
13	HALL OF FAME 255	MEDIA WALL - NORTH	14	DIM	LED	4500	102	--
14	HALL OF FAME 255	MEDIA WALL - SOUTH	15	DIM	LED	4500	102	--
15	---	SPARE	16	DIM	---	4500	--	--
16	---	SPARE	16	DIM	---	4500	--	--
17	---	SPARE	17	DIM	---	4500	--	--
18	---	SPARE	18	DIM	---	4500	--	--
19	---	SPARE	19	DIM	---	4500	--	--
20	---	SPARE	20	DIM	---	4500	--	--
21	---	SPARE	21	DIM	---	4500	--	--
22	---	SPARE	22	DIM	---	4500	--	--
23	---	SPARE	23	DIM	---	4500	--	--
24	---	SPARE	24	DIM	---	4500	--	--

<u>GENERAL NOTES:</u>	CONNECTED LOAD =	12.05	KVA
A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.	DEMAND LOAD =	12.05	KVA
	MIN AIC RATING =	25,000	AMPS SYM
	LOCATION	_____	

SCHEDULE OF DIMMER PANEL ELDP2								
277 VOLTS		3 PHASE 4 WIRE			50A MLO		SURFACE MOUNTED	
DIMMER CIRCUIT NO.	LOCATION	DESCRIPTION	CONTROL ZONE	DIM/SWITCH	LOAD TYPE	DIMMER CAPACITY (WATTS)	CIRCUIT LOAD (WATTS)	NOTES
1	VESTIBULE 201	DOWNLIGHTS	1	DIM	CFL	4500	92	--
2	VESTIBULE 201	DOWNLIGHTS	2	DIM	CFL	4500	92	--
3	RECEPTION 202	DOWNLIGHTS	3	DIM	CFL	4500	92	--
4	NORTH CONCOURSE	LINEAR	4	DIM	FLUORESCENT	4500	840	--
5	NORTH CONCOURSE	LINEAR	5	DIM	FLUORESCENT	4500	1400	--
6	NORTH CONCOURSE	LINEAR	6	DIM	FLUORESCENT	4500	1400	--
7	HALL OF FAME 225	COVE	7	DIM	FLUORESCENT	4500	165	--
8	---	SPARE	11	DIM	---	4500	--	--
9	---	SPARE	11	DIM	---	4500	--	--
10	---	SPARE	11	DIM	---	4500	--	--
11	---	SPARE	11	DIM	---	4500	--	--
12	---	SPARE	12	DIM	---	4500	--	--
13	---	SPARE	13	DIM	---	4500	--	--
14	---	SPARE	14	DIM	---	4500	--	--
15	---	SPARE	15	DIM	---	4500	--	--
16	---	SPARE	16	DIM	---	4500	--	--

GENERAL NOTES:
A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.

CONNECTED LOAD = 4.08 KVA
DEMAND LOAD = 4.08 KVA
MIN AIC RATING = 25,000 AMPS SYM
LOCATION _____

SCHEDULE OF DIMMER PANEL LDP1								
277 VOLTS		3 PHASE 4 WIRE			50A MLO		SURFACE MOUNTED	
DIMMER CIRCUIT NO.	LOCATION	DESCRIPTION	CONTROL ZONE	DIM/SWITCH	LOAD TYPE	DIMMER CAPACITY (WATTS)	CIRCUIT LOAD (WATTS)	NOTES
1	PRESS RM 127	LINEAR FLUORESCENTS	1	DIM	FLUORESCENT	4500	900	--
2	PRESS RM 127	WALL GRAZER	2	DIM	FLUORESCENT	4500	118	--
3	PRESS RM 127	FUTURE VIDEO SPOTLIGHTS	3	DIM	FLUORESCENT	4500	450	--
4	PRODUCTION 129	FLUORESCENT TROFFERS	4	DIM	FLUORESCENT	4500	272	--
5	--	SPARE	5	DIM	--	4500	--	--
6	--	SPARE	6	DIM	--	4500	--	--
7	--	SPARE	7	DIM	--	4500	--	--
8	--	SPARE	8	DIM	--	4500	--	--

GENERAL NOTES:
A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.

CONNECTED LOAD = 1.74 KVA
DEMAND LOAD = 1.74 KVA
MIN AIC RATING = 25,000 AMPS SYM
LOCATION _____

Updated Panelboard Schedules:

For Panel LSP4 I edited circuits 1-19 odd and I decreased the load that the original MEP firm calculated. I sized the wire larger due to voltage drop on the conductors. The cutsheet for the sports light fixture does not give a load for the shutter motor so I gave it an arbitrary load of 150 kW because the existing panelboards have a load of 150 kW for shutter control. Panel LSP4A's circuit numbering is counterintuitive as multiple relays are on the same circuit, so the sports lighting fixtures on Panel LSP4A are designated by the relay number.

My lighting designs didn't need the amount of lights or circuits that were previously designed. So there are panelboards that have spares where previous circuits existed. I added load for each of these circuit breakers at 65% of the ampacity rating. The panelboards' demand factors were set to 1 because most or all of the loads are lighting, which is a continuous load. It is an added safety factor as well. Panel LSP4A AND PANEL ELSP4 are both "FEED-THRU" so I assume that means that a main circuit breaker is not needed. Also, panels LDP4, LDP2, ELDP2, and LDP1 are MLO so a main circuit breaker is not needed. Most of the lighting dimming and switching panels do not yet have a location, so I will assume that panels LSP4A, ELSP4, LDP4, LDP2, ELDP2, AND LDP1 will be fed from panels in the same room because on the lighting control riser diagram, the panels are shown fed from panels on the same floor. Please see attached drawing in the appendix for reference to the Lighting Control Riser Diagram.

The following tables show my calculations for the new lighting circuits as well as panelboard sizing. Following these tables are the updated panelboards. The short circuit current rating from the Square D catalog for main lug interiors is 65,000 A. For Branch circuit short circuit ratings for breakers 1-3 poles and 15-60A is 35,000 A for EGB.

Reception		
	Recessed	Pendant
kW	53	39
Voltage	277	277
Input Current	0.191	0.17
VA/Fixture	52.907	47.09
# of Fixtures	13	16
Total VA	687.791	753.44
VA/Circuit	3545.6	3545.6
Fixtures/Circuit	67.01571	75.29412
Voltage	480	
Voltage Drop	0.10%	
Load in A	5.203	
length in feet	32	
Copper Conductor	#12	
Ground	#12	
AC 3PH 60Hz		
75C		
Aluminum Conduit		
Single cccs		

Court		
	Widelite	
kW	1000	
Voltage	277	
Input Current	4.7	4.7
VA/Fixture	1301.9	
# of Fixtures	20	20
Total VA	26038	
VA/Circuit	3545.6	
Fixtures/Circuit	2.723404	
Voltage	480	208
Voltage Drop	4.10%	3.90%
Load in A	94	94
length in feet	100	100
Copper Conductor	#10	#6
Ground	#12	#12
AC 3PH 60Hz		
75C		
Aluminum Conduit		
Single cccs		

EXTERIOR		
	Recessed	Pole
kW	53	40
Voltage	277	277
Input Current	0.191	0.160433
VA/Fixture	52.907	44.44
# of Fixtures	36	17
Total VA	1904.652	755.48
VA/Circuit	3545.6	3545.6
Fixtures/Circuit	67.01571	79.78398
PF		0.9
Voltage	480	
Voltage Drop	0.10%	
Load in A	9.603365	2.727365
length in feet	32	
Copper Conductor	#12	
Ground	#12	
AC 3PH 60Hz		
75C		
Aluminum Conduit		
Single cccs		

PRESS ROOM		
	Recessed	Wallwasher
kW	53	53
Voltage	277	277
Input Current	0.191	0.191
VA/Fixture	52.907	52.907
# of Fixtures	12	6
Total VA	634.884	317.442
VA/Circuit	3545.6	3545.6
Fixtures/Circuit	67.01571	67.01570681
Voltage	480	
Voltage Drop	0.10%	
Load in A	3.438	
length in feet	32	
Copper Conductor	#12	
Ground	#12	
AC 3PH 60Hz		
75C		
Aluminum Conduit		
Single cccs		

Note: Existing Circuits are Single Pole 20A Breakers(Max 16 Amps)

Note: Lighting circuits are derated for continuous load and breaker

	KVA	VOLTAGE	VOLTAGE	FLA	FLA	FEEDER SIZE		Ground		Main	MLO	busbar	Conduit	fed from	Length	Volt Drop (%)
LSP4	86.418	480		103.9		#2		#6		110		225	1-1/4	LSP2	212.4	1.6
LSP4A	35.82	480	208	43.1	99.4	#8	#3	#10	#8	-		100	3/4	LSP4	2.0	0
ELSP4	30.366	480	208	36.5	84.3	#8	#4	#10	#8	-		100	3/4	LSP4	4.0	0
LDP4	67.235	480		80.9		#4		#8		-	90	100	1	ELSP4	2.0	0
EP4	113.1	480		136.0		#1/0		#6		150		225	1-1/2	EP2	212.4	1.4
LP4	439.15	480		528.2		(2) #300		#4		300		400	2-1/2	SWB	186.3	0.6
EP2	155.94	480		187.6		#3/0		#6		200		225	2	EP1	104.0	0.6
LP2	221.67	480		266.6		300		#4		300		400	2-1/2	SWB	104.0	0.6
EP1A	86.1	480		103.6		#2		#6		125		225	1-1/4	EP1	176.0	1.3
LP1A	92.6	480		111.4		#2		#6		125		225	1-1/4	SWB	176.0	1.4
LDP2	46.869	480		56.4		#6		#8		-	70	100	1	ELSP2	2.0	0
ELDP2	33.239	480		40.0		#8		#10		-	50	100	3/4	LDP2	2.0	0
LDP1	18.776	480		22.6		#10		#10		-	30	100	3/4	ELSP1	4.0	0

0.1
0.1

NOTE:

THE FOLLOWING IS THE FORMULA FOR CALCULATING FLA IN A 3 PHASE SYSTEM
 $FLA = KVA/VOLTAGE/3^{.5}$
 PANELS LSP4A AND ELSP4 ARE "FEED-THRU" DUAL VOLTAGE LIGHTING SWITCHING
 PANELS SO TWO FEEDERS GO TO PANELBOARD FOR 208V & 480V
 ALSO, PANELS DO NOT HAVE MCB

Updated Panelboards:

SCHEDULE OF LIGHTING SWITCHING PANEL LSP4							
277/480 VOLTS		3PHASE 4 WIRE	110A MCB / 225A BUS		SURFACE MOUNTED		
RELAY NUMBER	CIRCUIT NUMBER	LOCATION	NORMAL/ EMERG.	RELAY & CIRCUIT BREAKER CAPACITY (AMPS)	CIRCUIT LOAD (WATTS)	WIRE/ CONDUIT	NOTES
1	1	SPORTS COURT FLOODLIGHTING	N/E	20	2160	#10-3/4"C + #12 G	-
2	3	SPORTS COURT FLOODLIGHTING	N/E	20	2160	#10-3/4"C + #12 G	-
3	5	SPORTS COURT FLOODLIGHTING	N/E	20	2160	#10-3/4"C + #12 G	-
4	7	SPORTS COURT FLOODLIGHTING	N/E	20	2160	#10-3/4"C + #12 G	-
5	9	SPORTS COURT FLOODLIGHTING	N/E	20	2160	#10-3/4"C + #12 G	-
6	11	SPORTS COURT FLOODLIGHTING	N/E	20	2160	#10-3/4"C + #12 G	-
7	13	SPORTS COURT FLOODLIGHTING	N/E	20	2160	#10-3/4"C + #12 G	-
8	15	SPORTS COURT FLOODLIGHTING	N/E	20	2160	#10-3/4"C + #12 G	-
9	17	SPORTS COURT FLOODLIGHTING	N/E	20	2160	#10-3/4"C + #12 G	-
10	19	SPORTS COURT FLOODLIGHTING	N/E	20	2160	#10-3/4"C + #12 G	-
11	21	SPARE	N	20	3601	-	-
12	23	SPARE	N	20	3601	-	-
13	25	SPARE	N	20	3601	-	-
14	27	SPARE	N	20	3601	-	-
15	2	SPARE	N	20	3601	-	-
16	4	SPARE	N	20	3601	-	-
17	6	SPARE	N	20	3601	-	-
18	8	SPARE	N	20	3601	-	-
19	10	SPARE	N	20	3601	-	-
20	12	SPARE	N	20	3601	-	-
21	14	SPARE	N	20	3601	-	-
22	16	SPARE	N	20	3601	-	-
23	18	SPARE	N	20	3601	-	-
24	20	SPARE	N	20	3601	-	-
25	22	SPARE	N	20	3601	-	-
26	24	SPARE	N	20	3601	-	-
27	26	SPARE	N	20	3601	-	-
28	28	SPARE	N	20	3601	-	-

GENERAL NOTES:
A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.
B. TIMECLOCK SCHEDULING SHALL BE COORDINATED WITH FACILITIES AND PROGRAMMED ACCORDINGLY.

CONNECTED LOAD = 86.418 KVA
DEMAND LOAD = 86.418 KVA
MIN AIC RATING = 35,000 AMPS SYM
LOCATION _____

SCHEDULE OF LIGHTING SWITCHING PANEL LSP4A							
120/277 VOLTS (DUAL VOLTAGE)			FEED-THRU / 100A BUS		SURFACE MOUNTED		
RELAY NUMBER	CIRCUIT NUMBER	LOCATION	NORMAL/ EMERG.	RELAY CAPACITY (AMPS)	CIRCUIT LOAD (WATTS)	WIRE/ CONDUIT	NOTES
1	1	COURT FLOODLIGHTING SHUTTER CONTROL	N/E	20	150	#12-3/4"C + #12 G	-
2	2	COURT FLOODLIGHTING SHUTTER CONTROL	N/E	20	150	#12-3/4"C + #12 G	-
3	3	COURT FLOODLIGHTING SHUTTER CONTROL	N/E	20	150	#12-3/4"C + #12 G	-
4	4	COURT FLOODLIGHTING SHUTTER CONTROL	N/E	20	150	#12-3/4"C + #12 G	-
5	5	COURT FLOODLIGHTING SHUTTER CONTROL	N/E	20	150	#12-3/4"C + #12 G	-
6	6	COURT FLOODLIGHTING SHUTTER CONTROL	N/E	20	150	#12-3/4"C + #12 G	-
7	7	COURT FLOODLIGHTING SHUTTER CONTROL	N/E	20	150	#12-3/4"C + #12 G	-
8	8	COURT FLOODLIGHTING SHUTTER CONTROL	N/E	20	150	#12-3/4"C + #12 G	-
9	9	COURT FLOODLIGHTING SHUTTER CONTROL	N/E	20	150	#12-3/4"C + #12 G	-
10	10	COURT FLOODLIGHTING SHUTTER CONTROL	N/E	20	150	#12-3/4"C + #12 G	-
11	-	SPARE	N	20	1560		-
12	-	SPARE	N	20	1560		-
13	-	SPARE	N	20	1560		-
14	-	SPARE	N	20	1560		-
15	-	SPARE	N	20	1560		-
16	-	SPARE	N	20	1560		-
17	-	SPARE	N	20	1560		-
18	-	SPARE	N	20	1560		-
19	-	SPARE	N	20	1560		-
20	-	SPARE	N	20	1560		-
21	-	SPARE	N	20	1560	-	-
22	-	SPARE	N	20	1560	-	-
23	-	SPARE	N	20	1560	-	-
24	-	SPARE	N	20	1560	-	-
25	-	SPARE	N	20	1560	-	-
26	-	SPARE	N	20	1560	-	-
27	-	SPARE	N	20	1560	-	-
28	-	SPARE	N	20	1560	-	-
29	-	SPARE	N	20	1560	-	-
30	-	SPARE	N	20	1560	-	-
31	-	SPARE	N	20	1560	-	-
32	-	SPARE	N	20	1560	-	-

GENERAL NOTES:
A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.

CONNECTED LOAD =	35.82	KVA
DEMAND LOAD =	35.82	KVA
MIN AIC RATING =	35,000	AMPS SYM
LOCATION	ELEC 132	

SCHEDULE OF EMERGENCY LIGHTING SWITCHING PANEL ELSP4							
120/277 VOLTS (DUAL VOLTAGE)			FEED-THRU / 100A BUS		SURFACE MOUNTED		
RELAY NUMBER	CIRCUIT NUMBER	LOCATION	NORMAL/ EMERG.	RELAY CAPACITY (AMPS)	CIRCUIT LOAD (WATTS)	WIRE/ CONDUIT	NOTES
1	EP4-1	SPARE	N	20	1560	-	-
2	EP4-3	SPARE	N	20	1560	-	-
3	EP4-3	SPARE	N	20	1560	-	-
4	EP4-5	SPARE	N	20	1560	-	-
5	EP4-5	SPARE	N	20	1560	-	-
6	EP4-7	SPARE	N	20	1560	-	-
7	EP4-9	SPARE	N	20	1560	-	-
8	EP4-11	SPARE	N	20	1560	-	-
9	EP4-11	SPARE	N	20	1560	-	-
10	EP4-13	SPARE	N	20	1560	-	-
11	EP4-13	SPARE	N	20	1560	-	-
12	EP4-15	SPARE	N	20	1560	-	-
13	EP4-15	NORTH VIDEO AREA	N	20	132	#12-3/4"C	-
14	EP4-17	3RD FLOOR LOBBY	N	20	450	#12-3/4"C	-
15	EP4-19	STAIR 7	N	20	384	#12-3/4"C	-
16	EP4-19	STAIR 7	N	20	384	#12-3/4"C	-
17	EP4-21	ROOF LTG	N	20	680	#12-3/4"C	-
18	EP4-17	MECHANICAL ROOM 325	N	20	256	#12-3/4"C	-
19	-	SPARE	N	20	1560	-	-
20	-	SPARE	N	20	1560	-	-
21	-	SPARE	N	20	1560	-	-
22	-	SPARE	N	20	1560	-	-
23	-	SPARE	N	20	1560	-	-
24	-	SPARE	N	20	1560	-	-

GENERAL NOTES:
A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.

CONNECTED LOAD =	<u>30.366</u>	KVA
DEMAND LOAD =	<u>30.366</u>	KVA
MIN AIC RATING =	<u>35,000</u>	AMPS SYM
LOCATION	<u>ELEC 132</u>	

SCHEDULE OF DIMMER PANEL LDP4								
277 VOLTS		3PHASE 4 WIRE		90A MLO / 100A BUS		SURFACE MOUNTED		
DIMMER CIRCUIT NO.	LOCATION	DESCRIPTION	CONTROL ZONE	DIM/SWITCH	LOAD TYPE	DIMMER CAPACITY (WATTS)	CIRCUIT LOAD (WATTS)	NOTES
1	-	SPARE	1	DIM	-	4500	2925	-
2	-	SPARE	2	DIM	-	4500	2925	-
3	-	SPARE	3	DIM	-	4500	2925	-
4	-	SPARE	4	DIM	-	4500	2925	-
5	-	SPARE	5	DIM	-	4500	2925	-
6	-	SPARE	6	DIM	-	4500	2925	-
7	-	SPARE	7	DIM	-	4500	2925	-
8	-	SPARE	8	DIM	-	4500	2925	-
9	-	SPARE	9	DIM	-	4500	2925	-
10	-	SPARE	10	DIM	-	4500	2925	-
11	-	SPARE	11	DIM	-	4500	2925	-
12	-	SPARE	12	DIM	-	4500	2925	-
13	-	SPARE	13	DIM	-	4500	2925	-
14	-	SPARE	14	DIM	-	4500	2925	-
15	-	SPARE	15	DIM	-	4500	2925	-
16	-	SPARE	16	DIM	-	4500	2925	-
17	-	SPARE	17	DIM	-	4500	2925	-
18	SUITE 311	DOWNLIGHTS - MAIN	18	DIM	CFL	4500	116	-
19	SUITE 311	DOWNLIGHTS - FRONT	19	DIM	CFL	4500	58	-
20	SUITE 311	COVE	20	DIM	LED	4500	182	-
21	SUITE 312	DOWNLIGHTS - MAIN	21	DIM	CFL	4500	290	-
22	SUITE 312	DOWNLIGHTS - FRONT	22	DIM	CFL	4500	145	-
23	SUITE 312	COVE	23	DIM	LED	4500	238	-
24	SUITE 313	DOWNLIGHTS - MAIN	24	DIM	CFL	4500	290	-
25	SUITE 313	DOWNLIGHTS - FRONT	25	DIM	CFL	4500	145	-
26	SUITE 313	COVE	26	DIM	LED	4500	238	-
27	SUITE 314	DOWNLIGHTS - MAIN	27	DIM	CFL	4500	116	-
28	SUITE 314	DOWNLIGHTS - FRONT	28	DIM	CFL	4500	58	-
29	SUITE 314	COVE	29	DIM	LED	4500	182	-
30	SUITE 316	DOWNLIGHTS - REAR	30	DIM	CFL	4500	261	-
31	SUITE 316	DOWNLIGHTS - FRONT	31	DIM	CFL	4500	319	-
32	SUITE 316	DOWNLIHGTS - WINDOW	32	DIM	CFL	4500	118	-
33	SUITE 316	REFRESHMENTS	33	DIM	CFL	4500	58	-
34	SUITE 316	LINEAR SLOTS	34	DIM	FLUORESCENT	4500	320	-
35	SUITE 316	COVE	35	DIM	LED	4500	136	-
36	SUITE 317	DOWNLIGHTS	36	DIM	CFL	4500	116	-

37	VIDEO 308	DOWNLIGHTS	37	DIM	CFL	4500	184	-
38	3RD FLOOR CORRIDOR	WALLWASHERS - WOODEN BOX	38	DIM	FLUORESCENT	4500	1152	-
39	MULTIPURPOSE 301	DOWNLIGHTS	39	DIM	CFL	4500	480	-
40	MULTIPURPOSE 302	DOWNLIGHTS - FRONT	40	DIM	CFL	4500	92	-
41	MULTIPURPOSE 303	WALL GRAZER	41	DIM	FLUORESCENT	4500	42	-
42	MULTIPURPOSE 304	ACCENT LIGHTS	42	DIM	CFL	4500	92	-
43	MULTIPURPOSE 305	DECORATIVE PENDANT	43	DIM	LED	4500	60	-
44	RECEPTION 202	DOWNLIGHTS	44	DIM	CFL	4500	322	-
45	-	SPARE	45	DIM	-	4500	2925	-
46	-	SPARE	46	DIM	-	4500	2925	-
47	-	SPARE	47	DIM	-	4500	2925	-
48	-	SPARE	48	DIM	-	4500	2925	-

GENERAL NOTES:

A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.

CONNECTED LOAD =	<u>67.235</u>	KVA
DEMAND LOAD =	<u>67.235</u>	KVA
MIN AIC RATING =	<u>65,000</u>	AMPS SYM
LOCATION		

WIRING SCHEDULE: PANEL EP4																	
480/277 VOLTS			3 PHASE 4 WIRE						150 AMP MAINS / 225A BUS				SURFACE MOUNTED				
CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER								CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER	
				POLE	AMP	A ϕ	B ϕ	C ϕ	POLE	AMP							
1	1	SPARE		1	20	3.6	0.5					2	2	LTG - ELEVATOR SHAFT	#12-3/4"C	1	20
3	3	SPARE		1	20			3.6	1			4	4	LTG - 3RD FLOOR EXIT SIGNS	#10-3/4"C	1	20
5	5	SPARE		1	20					3.6	1	6	6	LTG - STAIR 3	#12-3/4"C	1	20
7	7	SPARE		1	20	3.6	2.2					8	8	LTG - SKYBOX RESTROOMS	#12-3/4"C	1	20
9	9	SPARE		1	20			3.6	0.5			10	10	SMOKE DAMPERS	#10-3/4"C	1	20
11	11	SPARE		1	20					3.6	3.6	-	12	SPARE	-	1	20
13	13	SPARE		1	20	3.6	3.6					-	14	SPARE	-	1	20
15	15	SPARE		1	20			3.6	3.6			-	16	SPARE	-	1	20
17	17	LTG - 3RD FLOOR LTG (VIA ELSP4)	#12-3/4"C	1	20					0.5	3.6	-	18	SPARE	-	1	20
19	19	LTG - STAIR 7 (VIA ELSP4)	#12-3/4"C	1	20	0.8	3.6					-	20	SPARE	-	1	20
21	21	LTG - ROOFTOP	#12-3/4"C	1	20			0.7	3.6			-	22	SPARE	-	1	20
-	23	SPARE	-	1	20					3.6	3.6	-	24	SPARE	-	1	20
-	25	SPARE	-	1	20	3.6	3.6					-	26	SPARE	-	1	20
-	27	SPARE	-	1	20			3.6	3.6			-	28	SPARE	-	1	20
-	29	SPARE	-	1	20					3.6	3.6	-	30	SPARE	-	1	20
-	31	SPACE & PROVISIONS	-	1	-	2.8	2.8					-	32	SPACE & PROVISIONS	-	1	-
-	33	SPACE & PROVISIONS	-	1	-			2.8	2.8			-	34	SPACE & PROVISIONS	-	1	-
-	35	SPACE & PROVISIONS	-	1	-					2.8	2.8	-	36	SPACE & PROVISIONS	-	1	-
-	37	SPACE & PROVISIONS	-	1	-	2.8	0.5					38	38	DIMMER PANEL ELDP4	4#8+	3	50
-	39	SPACE & PROVISIONS	-	1	-			2.8	0.5			-	40		#10G-		
-	41	SPACE & PROVISIONS	-	1	-					2.8	0.5	-	42		3/4"C		
CONNECTED LOAD =			113.1 KVA		20.8	16.8	20.7	15.6	20.5	18.7							
					37.6		36.3		39.2								
DEMAND LOAD =			113.1 KVA		NOTE: PROVIDE SEPARATE NEUTRAL FOR EACH CIRCUIT												
MIN AIC RATING =			35,000 AMPS SYMMETRICAL								MAIN BREAKER		150 AMPS				
											LOCATION		ABOVE SKYBOX				

WIRING SCHEDULE: PANEL LP4																
480/277 VOLTS			3 PHASE 4 WIRE				300 AMP MAINS / 400 A BUS				SURFACE MOUNTED					
CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER					CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	POLE			
				POLE	AMP	Aφ	Bφ	Cφ								
1	1	SPARE	-	1	20	3.6	0.2				2	2	LTG - 3RD FLOOR STORAGE RMS	#12-3/4"C		
3	3	SPARE	-	1	20			3.6	0.4		4	4	LTG - 3RD FLOOR STORAGE & JAN	#12-3/4"C		
5	5	SPARE	-	1	20					3.6	3.6	6	6	SPARE	-	
7	7	SPARE	-	1	20	3.6	3.6					8	8	SPARE	-	
9	9	SPARE	-	1	20			3.6	3.6			10	10	SPARE	-	
11	11	SPARE	-	1	20					3.6	3.6	-	12	SPARE	-	
13	13	SPARE	-	1	20	3.6	3.6					-	14	SPARE	-	
15	15	SPARE	-	1	20			3.6	3.6			-	16	SPARE	-	
17	17	SPARE	-	1	20					3.6	3.6	-	18	SPARE	-	
19	19	SPARE	-	1	20	3.6	3.6					-	20	SPARE	-	
21	21	SPARE	-	1	20			3.6	3.6			-	22	SPARE	-	
23	23	SPARE	-	1	20					3.6	3.6	-	24	SPARE	-	
25	25	LTG - MECH RM 325 (VIA LSP4A)	#12-3/4"C	1	20	1.2	3.6					-	26	SPARE	-	
-	27	SPARE	-	1	20			3.6	3.6			-	28	SPARE	-	
-	29	SPARE	-	1	20					3.6	3.6	-	30	SPARE	-	
32	31	PANEL RP4A (VIA XFMR TRP4A)	3#10+ #6G- 2"C	3	150**	23.3	28.8					32	32	SWITCHING PANEL LSP4	4#2+ #6G- 1-1/4"C	
-	33							23.3	28.8			-	34			
-	35									21.7	28.8	-	36			
37	37	PANEL RP4 (VIA XFMR TRP4A) (SUB-FEED CIRCUIT BREAKER)	3#4/0+ #4G- 3"C	3	225**	40.2	22.4					38	38	DIMMING PANEL LDP4	4#4+ #8G- 1"C	
-	39							37.0	22.4			-	40			
-	41									41.0	22.4	-	42			
CONNECTED LOAD =						439.2	KVA	79.1	65.8	78.3	66.0	80.7	69.2			
DEMAND LOAD =						439.2	KVA	144.9		144.3		149.9		MAIN BREAKER		
MIN AIC RATING =						35,000	AMPS SYMMETRICAL	NOTE: PROVIDE SEPARATE NEUTRAL FOR EACH CIRCUIT ** PROVIDE SUB-FEED CIRCUIT BREAKER						LOCATION		ABOVE SKYBOX

WIRING SCHEDULE: PANEL EP2																	
480/277 VOLTS			3 PHASE 4 WIRE				200 AMP MAINS / 225A BUS				SURFACE MOUNTED						
CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER					CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER				
				POLE	AMP	Aφ	Bφ	Cφ					POLE	AMP			
1	1	LTG - LED RECEPTION RM 125	#12-3/4"C	1	20	1.4	2.2				2	2	LTG - 2ND FLOOR RESTROOMS	#10-3/4"C	1	20	
3	3	LTG - CONCOURSE (ELSP2)	#10-3/4"C	1	20			2.5	0.1		4	4	LTG - 2ND FLOOR EXITS	#10-3/4"C	1	20	
5	5	LTG - LINK (VIA ELSP2)	#10-3/4"C	1	20					1.2	0.1	6	6	SMOKE DAMPER	#10-3/4"C	1	20
7	7	LTG - UPPER DECK STAIRS (VIA ELSP2)	#10-3/4"C	1	20	1.8						8	8	SPARE		1	20
9	9	LTG - UPPER DECK STAIRS (VIA ELSP2)	#10-3/4"C	1	20			0.9	3.6			10	10	SPARE		1	20
-	11	SPARE		1	20					3.6	3.6	12	12	SPARE		1	20
-	13	SPARE		1	20	3.6	3.6					14	14	SPARE		1	20
-	15	SPARE		1	20			3.6	3.6			16	16	SPARE		1	20
-	17	SPARE		1	20					3.6	3.6	18	18	SPARE		1	20
-	19	SPARE		1	20	3.6	3.6					20	20	SPARE		1	20
-	21	SPARE		1	20			3.6	3.6			22	22	SPARE		1	20
-	23	SPARE		1	20					3.6	3.6	24	24	SPARE		1	20
-	25	SPACE & PROVISIONS	-	1	-	2.8	2.8					26	26	SPACE & PROVISIONS	-	1	20
-	27	SPACE & PROVISIONS	-	1	-			2.8	2.8			28	28	SPACE & PROVISIONS	-	1	20
-	29	SPACE & PROVISIONS	-	1	-					2.8	2.8	30	30	SPACE & PROVISIONS	-	1	20
-	31	SPACE & PROVISIONS	-	1	-	2.8	2.8					32	32	SPACE & PROVISIONS	-	1	20
-	33	SPACE & PROVISIONS	-	1	-			2.8	2.8			34	34	SPACE & PROVISIONS	-	1	20
-	35	SPACE & PROVISIONS	-	1	-					2.8	2.8	36	36	SPACE & PROVISIONS	-	1	20
37	37	PANEL RP2 (VIA XFMR TRP2)	3#1/0+	3	150	10.3	11.1					38	38	DIMMER PANEL ELDP2	4#8+	3	50
-	39	(SUB-FEED CIRCUIT BREAKER)	#6G-					8.2	11.1			40	40		#10G-		
-	41		2"C							6.4	11.1	42	42		3/4"C		
CONNECTED LOAD =			155.9 KVA		26.3 26.1 24.4 27.6 24.0 27.6		52.4 52.0 51.6						MAIN BREAKER		200 AMPS		
DEMAND LOAD =			155.9 KVA		NOTE: PROVIDE SEPARATE NEUTRAL FOR EACH CIRCUIT												
MIN AIC RATING =			35,000 AMPS SYMMETRICAL		LOCATION ELECT RM 246												

WIRING SCHEDULE: PANEL LP2																
480/277 VOLTS			3 PHASE 4 WIRE				300 AMP MAINS / 400A BUS				SURFACE MOUNTED					
CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER		KVA/φ			CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BRE POLE			
				POLE	AMP	Aφ	Bφ	Cφ								
1	1	LTG - WEST LOBBY 260 (VIA LSP2)	#12-3/4"C	1	20	0.9	0.7				2	2	LTG - JAN & STORAGE	#12-3/4"C	1	
3	3	SPARE	-	1	20			3.6	3.6		4	4	SPARE		1	
5	5	LTG - WEST CONCOURSE (VIA LSP2)	#12-3/4"C	1	20					1.1	3.6	6	6	SPARE	1	
7	7	SPARE		1	20	3.6	3.6					8	8	SPARE	1	
9	9	LTG - HALL OF FAME 225 (VIA LSP2)	#12-3/4"C	1	20			0.3	3.6			10	10	SPARE	1	
11	11	LTG - TICKETING 203 (VIA LSP2)	#12-3/4"C	1	20					0.6	3.6	12	12	SPARE	1	
13	13	LTG - VESTIBULE 124 (VIA LSP2)	#12-3/4"C	1	20	0.1	3.6					14	14	SPARE	1	
	15	SPARE		1	20			3.6	3.6			16	16	SPARE	1	
	17	SPARE		1	20					3.6	3.6	18	18	SPARE	1	
	19	SPARE		1	20	3.6	3.6					20	20	SPARE	1	
	21	SPARE		1	20			3.6	3.6			22	22	SPARE	1	
	23	SPARE		1	20					3.6	3.6	24	24	SPARE	1	
-	25	SPACE & PROVISIONS	-	1	20	2.8	2.8					26	26	SPACE & PROVISIONS	-	1
-	27	SPACE & PROVISIONS	-	1	20			2.8	2.8			28	28	SPACE & PROVISIONS	-	1
-	29	SPACE & PROVISIONS	-	1	20					2.8	2.8	30	30	SPACE & PROVISIONS	-	1
-	31	SPACE & PROVISIONS	-	1	20	2.8	2.8					32	32	SPACE & PROVISIONS	-	1
-	33	SPACE & PROVISIONS	-	1	20			2.8	2.8			34	34	SPACE & PROVISIONS	-	1
-	35	SPACE & PROVISIONS	-	1	20					2.8	2.8	36	36	SPACE & PROVISIONS	-	1
37	37	PANEL RP2 (VIA XFMR TRP2) (SUB-FEED CIRCUIT BREAKER)		3	150**	26.1	15.6					38	38	DIMMING PANEL LDP2	4#6+	3
-	39							23.9	15.6			40	40		#8G-	
-	41									22.7	15.6	42	42		1"C	
CONNECTED LOAD =			221.7	KVA	72.6		76.2		72.8							
DEMAND LOAD =			221.7	KVA												
MIN AIC RATING =			35,000	AMPS SYMMETRICAL												
												MAIN BREAKER	300	AMPS		
												LOCATION	ELECT RM 246			

NOTE: PROVIDE SEPARATE NEUTRAL FOR EACH CIRCUIT
** PROVIDE SUB - FEED CIRCUIT
BREAKER

WIRING SCHEDULE: PANEL EP1A																
480/277 VOLTS			3 PHASE 4 WIRE				125 AMP MAINS / 225A BUS				SURFACE MOUNTED					
CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER		KVA/φ			CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	B PO			
				POLE	AMP	Aφ	Bφ	Cφ								
1	1	LTG - MECHANICAL 147 (VIA LSP1A)	#10-3/4"C	1	20	0.9	0.3					2	2	LTG - ELEC RM 146	#10-3/4"C	1
3	3	LTG - STORAGE RMS (VIA LSP1A)	#10-3/4"C	1	20			0.8	0.1			4	4	LTG - 1ST FLOOR EXITS	#10-3/4"C	1
5	5	LTG - 1ST FLOOR CORRIDORS (VIA LSP1A)	#10-3/4"C	1	20					1.1	2.2	6	6	LTG - 1ST FLOOR RESTROOMS	#10-3/4"C	1
7	7	LTG - EXTERIOR ENTRANCE & PATHWAY	#12-3/4"C	1	20	2.7	3.6					8	8	SPARE	-	1
9	9	SPARE	-	1	20			3.6	3.6			10	10	SPARE	-	1
11	11	SPARE	-	1	20					3.6	3.6	12	12	SPARE	-	1
13	13	SPARE	-	1	20	3.6	3.6					14	14	SPARE	-	1
15	15	SPARE	-	1	20			3.6	3.6			16	16	SPARE	-	1
17	17	SPARE	-	1	20					3.6	3.6	18	18	SPARE	-	1
19	19	SPARE	-	1	20	3.6	3.6					20	20	SPARE	-	1
21	21	SPARE	-	1	20			3.6	3.6			22	22	SPARE	-	1
23	23	SPARE	-	1	20					3.6	3.6	24	24	SPARE	-	1
-	25	SPACE & PROVISIONS	-	1	20	2.8	2.8					26	26	SPACE & PROVISIONS	-	-
-	27	SPACE & PROVISIONS	-	1	20			2.8	2.8			28	28	SPACE & PROVISIONS	-	-
-	29	SPACE & PROVISIONS	-	1	20					2.8	2.8	30	30	SPACE & PROVISIONS	-	-
CONNECTED LOAD =						86.1	KVA	13.6	13.9	14.4	13.7	14.7	15.8			
								27.5	28.1	30.5						
DEMAND LOAD =						86.1	KVA	NOTE: PROVIDE SEPARATE NEUTRAL FOR EACH CIRCUIT								
MIN AIC RATING =						35,000	AMPS SYMMETRICAL	MAIN BREAKER <u>125</u> AMP								
						LOCATION <u>ELECT RM 146</u>										

WIRING SCHEDULE: PANEL LP1A															
480/277 VOLTS			3 PHASE 4 WIRE				125 AMP MAINS / 225A BUS				SURFACE MOUNTED				
CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	BREAKER		KVA/φ			CIR- CUIT	POLE	DESCRIPTION	WIRE/ CONDUIT	POLE		
				POLE	AMP	Aφ	Bφ	Cφ							
1	1	LTG - MECH RM (VIA LSP1A)	#12-3/4"C	1	20	0.4	0.2				2	2	LTG - TELE/DATA 106	#12-3/4"C	
3	3	LTG - STORAGE (VIA LSP1A)	#12-3/4"C	1	20			2.3	3.6		4	4	SPARE		
5	5	LTG - 1ST FLOOR CORRIDORS (VIA LSP1A)	#12-3/4"C	1	20					1.1	3.6	6	6	SPARE	
7	7	SPARE		1	20	3.6	3.6					8	8	SPARE	
9	9	LTG - EXTERIOR LTG (VIA LSP1A)	#12-3/4"C	1	20			1.1	3.6			10	10	SPARE	
11	11	LTG - EXTERIOR LTG (VIA LSP1A)	#12-3/4"C	1	20					1.1	3.6	12	12	SPARE	
	13	SPARE		1	20	3.6	3.6					14	14	SPARE	
	15	SPARE		1	20			3.6	3.6			16	16	SPARE	
	17	SPARE		1	20					3.6	3.6	18	18	SPARE	
	19	SPARE		1	20	3.6	3.6					20	20	SPARE	
	21	SPARE		1	20			3.6	3.6			22	22	SPARE	
	23	SPARE		1	20					3.6	3.6	24	24	SPARE	
	25	SPARE		1	20	3.6	3.6					26	26	SPARE	
	27	SPARE		1	20			3.6	3.6			28	28	SPARE	
	29	SPARE		1	20					3.6	3.6	30	30	SPARE	
CONNECTED LOAD =						92.6	KVA	14.8	14.6	14.2	18	13	18		
DEMAND LOAD =						92.6	KVA	29.4			32.2			31	
MIN AIC RATING =						35,000	AMPS SYMMETRICAL	NOTE: PROVIDE SEPARATE NEUTRAL FOR EACH CIRCUIT							
												MAIN BREAKER	125	AMP	
												LOCATION	ELECT RM 146		

SCHEDULE OF DIMMER PANEL LDP2								
277 VOLTS		3PHASE 4 WIRE		70A MLO / 100A BUS		SURFACE MOUNTED		
DIMMER CIRCUIT NO.	LOCATION	DESCRIPTION	CONTROL ZONE	DIM/SWITCH	LOAD TYPE	DIMMER CAPACITY (WATTS)	CIRCUIT LOAD (WATTS)	NOTES
1	VESTIBULE 201	DOWNLIGHTS	1	DIM	CFL	4500	184	-
2	-	SPARE	2	DIM	-	4500	2925	-
3	RECEPTION 202	DOWNLIGHTS	3	DIM	CFL	4500	184	-
4	RECEPTION 202	ACCENT LIGHTS	4	DIM	CFL	4500	322	-
5	-	SPARE	5	DIM	-	4500	2925	-
6	NORTH CONCOURSE	LINEAR	6	DIM	FLUORESCENT	4500	2800	-
7	NORTH CONCOURSE	LINEAR	7	DIM	FLUORESCENT	4500	3080	-
8	NORTH CONCOURSE	LINEAR	8	DIM	FLUORESCENT	4500	2520	-
9	NORTH CONCOURSE	ACCENT LIGHTS	9	DIM	LED	4500	205	-
10	NORTH CONCOURSE	WALLWASHERS - WOODEN BOX	10	DIM	FLUORESCENT	4500	1600	-
11	WEST LOBBY 260	DOWNLIGHTS	11	DIM	FLUORESCENT	4500	322	-
12	HALL OF FAME 255	DOWNLIGHTS	12	DIM	CFL	4500	348	-
13	HALL OF FAME 255	MEDIA WALL - NORTH	13	DIM	LED	4500	102	-
14	HALL OF FAME 255	MEDIA WALL - SOUTH	14	DIM	LED	4500	102	-
15	-	SPARE	15	DIM	-	4500	2925	-
16	-	SPARE	16	DIM	-	4500	2925	-
17	-	SPARE	17	DIM	-	4500	2925	-
18	-	SPARE	18	DIM	-	4500	2925	-
19	-	SPARE	19	DIM	-	4500	2925	-
20	-	SPARE	20	DIM	-	4500	2925	-
21	-	SPARE	21	DIM	-	4500	2925	-
22	-	SPARE	22	DIM	-	4500	2925	-
23	-	SPARE	23	DIM	-	4500	2925	-
24	-	SPARE	24	DIM	-	4500	2925	-

GENERAL NOTES:
A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.

CONNECTED LOAD =	46.869	KVA
DEMAND LOAD =	46.869	KVA
		AMPS
MIN AIC RATING =	65,000	SYM
LOCATION	_____	

SCHEDULE OF DIMMER PANEL ELDP2								
277 VOLTS		3PHASE 4 WIRE		50A MLO / 100A BUS		SURFACE MOUNTED		
DIMMER CIRCUIT NO.	LOCATION	DESCRIPTION	CONTROL ZONE	DIM/SWITCH	LOAD TYPE	DIMMER CAPACITY (WATTS)	CIRCUIT LOAD (WATTS)	NOTES
1	VESTIBULE 201	DOWNLIGHTS	1	DIM	CFL	4500	92	-
2	-	SPARE	2	DIM	-	4500	2925	-
3	RECEPTION 202	DOWNLIGHTS	3	DIM	CFL	4500	92	-
4	NORTH CONCOURSE	LINEAR	4	DIM	FLUORESCENT	4500	840	-
5	NORTH CONCOURSE	LINEAR	5	DIM	FLUORESCENT	4500	1400	-
6	NORTH CONCOURSE	LINEAR	6	DIM	FLUORESCENT	4500	1400	-
7	HALL OF FAME 225	COVE	7	DIM	FLUORESCENT	4500	165	-
8	-	SPARE	8	DIM	-	4500	2925	-
9	-	SPARE	9	DIM	-	4500	2925	-
10	-	SPARE	10	DIM	-	4500	2925	-
11	-	SPARE	11	DIM	-	4500	2925	-
12	-	SPARE	12	DIM	-	4500	2925	-
13	-	SPARE	13	DIM	-	4500	2925	-
14	-	SPARE	14	DIM	-	4500	2925	-
15	-	SPARE	15	DIM	-	4500	2925	-
16	-	SPARE	16	DIM	-	4500	2925	-

GENERAL NOTES:

A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.

CONNECTED LOAD =	33.239	KVA
DEMAND LOAD =	33.239	KVA
MIN AIC RATING =	65,000	AMPS SYM
LOCATION		

SCHEDULE OF DIMMER PANEL LDP1								
277 VOLTS		3PHASE 4 WIRE		30A MLO / 100A BUS		SURFACE MOUNTED		
DIMMER CIRCUIT NO.	LOCATION	DESCRIPTION	CONTROL ZONE	DIM/SWITCH	LOAD TYPE	DIMMER CAPACITY (WATTS)	CIRCUIT LOAD (WATTS)	NOTES
1	PRESS RM 127	DOWNLIGHTS & WALLWASHER	1	DIM	LED	4500	954	-
2	-	SPARE	2	DIM	-	4500	2925	-
3	-	SPARE	3	DIM	-	4500	2925	-
4	PRODUCTION 129	FLUORESCENT TROFFERS	4	DIM	FLUORESCENT	4500	272	-
5	-	SPARE	5	DIM	-	4500	2925	-
6	-	SPARE	6	DIM	-	4500	2925	-
7	-	SPARE	7	DIM	-	4500	2925	-
8	-	SPARE	8	DIM	-	4500	2925	-

GENERAL NOTES:

A. PROVIDE SEPARATE NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT.

CONNECTED LOAD	=	<u>18.776</u>	KVA	1.74
DEMAND LOAD =		<u>18.776</u>	KVA	
MIN AIC RATING =		<u>65,000</u>	AMPS SYM	
LOCATION		_____		

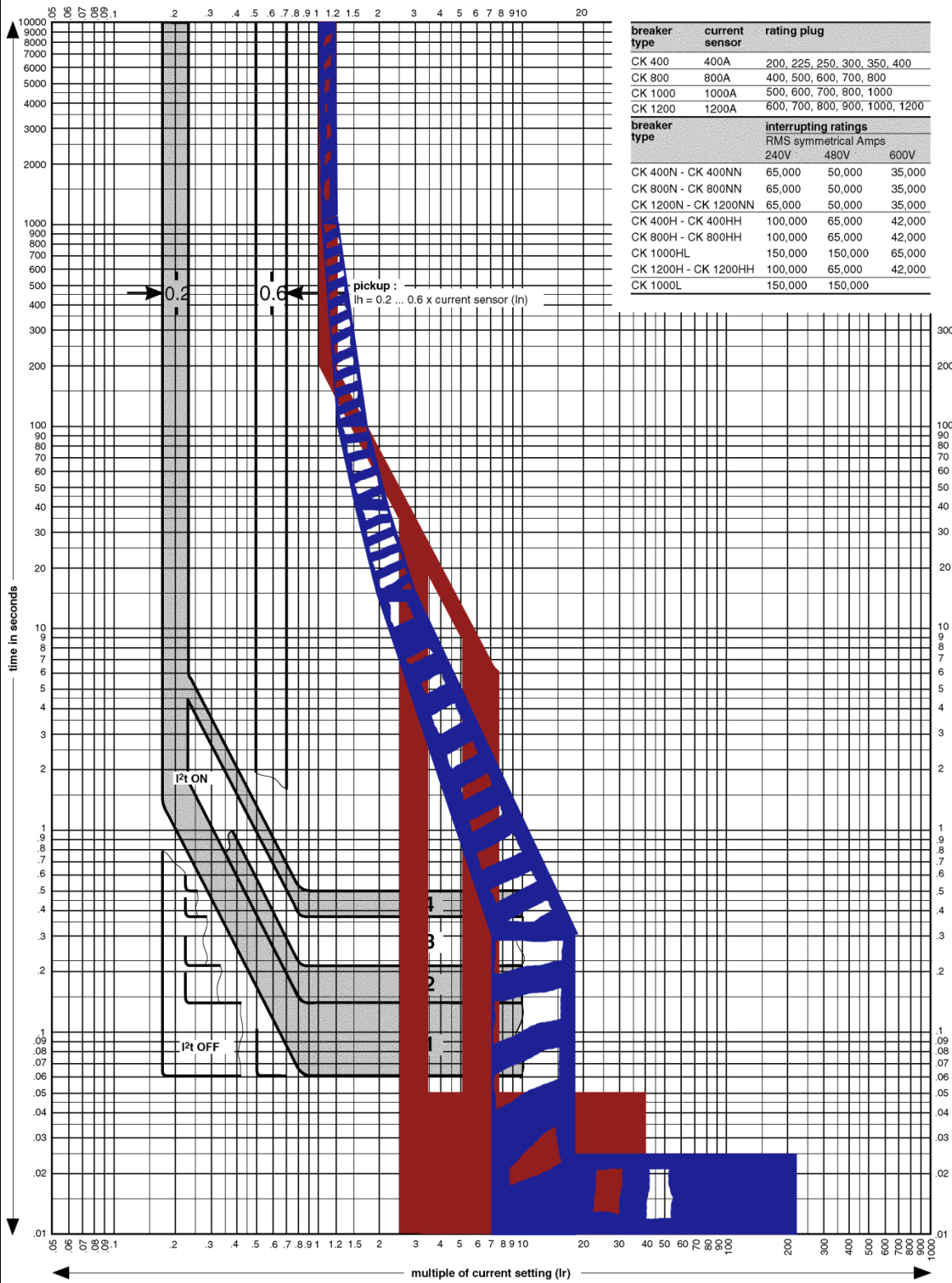
Short Circuit Study:

For part of the electrical thesis requirements a short circuit study is required. We are to address a single path through the electrical distribution system. I have chosen to go from the switchboard to panel MCT and then to panel RCT. The breakers go respectively in size from 3000A to 300A to 50A. I found TCC curves from Schneider Electric's website and overlaid them in photoshop to see how they overlap.

The **grey** outline is the 300A breaker and the **red** is the 3000A breaker. The **blue** is the 50A breaker TCC. As can be seen the breakers cross paths and are not coordinated. The TCC cutsheets are included in the appendix.

**molded case circuit breakers
Compact CK**

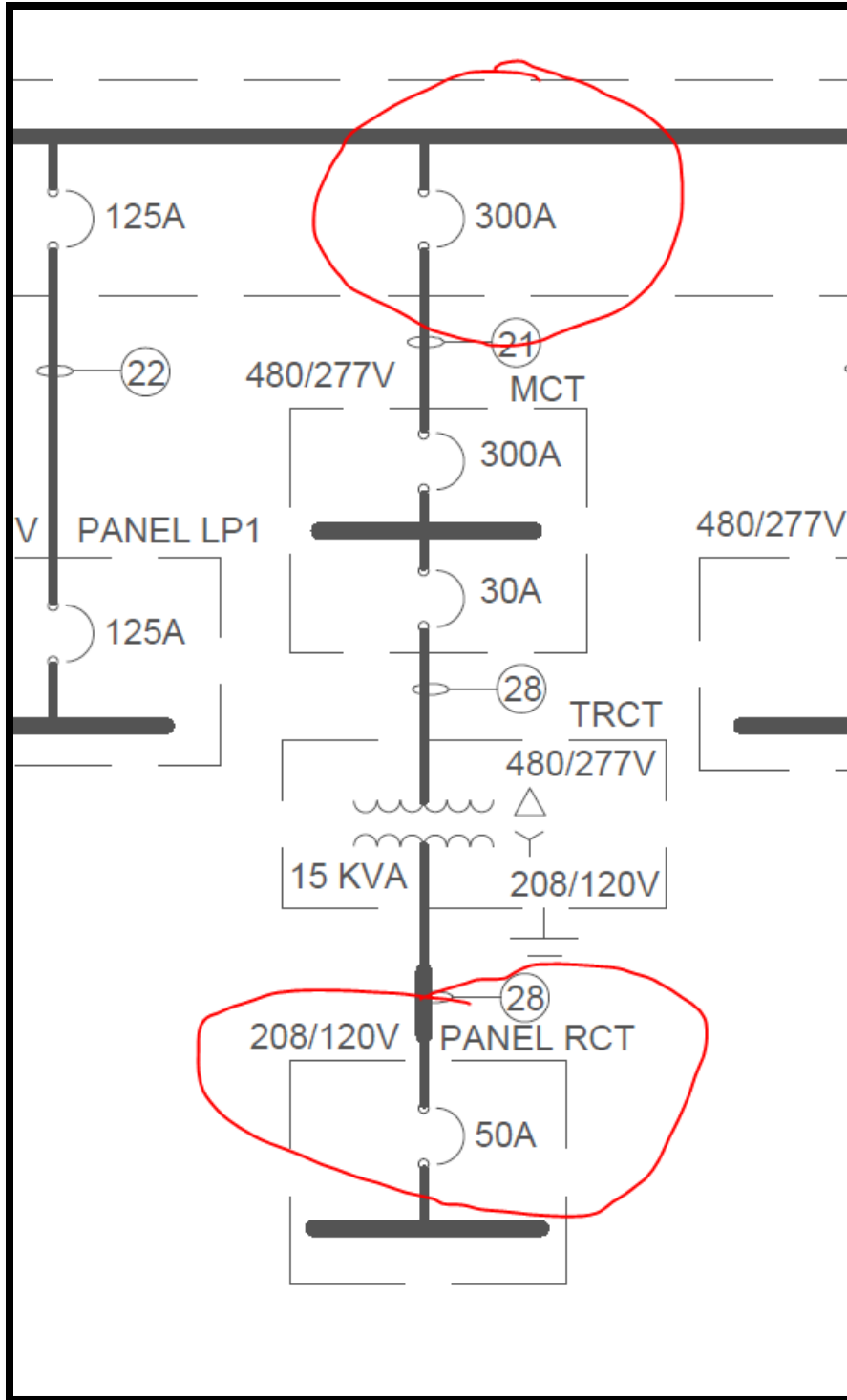
**ground fault protection
STR 55UP**



Short Circuit Calculations:

For the short-circuit calculations the wire is THWN, and the utility short circuit kVA is 100000 and the system kVA is 3000. The conduit is aluminum. Panel MCT is 220' away from the switchboard outside. The following are the calculations and an image of the single line.

System KVA	Utility Kva												
3000	100000												
Utility X = BASE KVA/UTILITY S. C. KVA = .03													
Panel Bkr	Base KVA	Voltage	Wire	Length	Sets	XL table	R table	XL calc	R calc	ΣXL calc	ΣR calc	Z	Isc
SWB 300A bkr	3000	480	#500	10	11	3.03	2.44	0.002755	0.002218	0.035866	0.028883	0.046050	78361.37
MCT 300A bkr	3000	480	#350	220	1	3.11	3.33	0.684200	0.732600	8.908854	9.539063	13.052256	276.4691
RCT 50A bkr	3000	208	#10	5	1	3.71	101.8	0.018550	0.509000	1.286289	35.294933	35.318364	235.7813
Equation for Z		$((\sum X)^2 + (\sum R)^2)^{.5}$											
Equation for Isc		base KVA/sqrt(3)/kV/Z											
Equation for XL & R calc		$(\text{Length}/1000 * (\text{XL or R}) * 1/\# \text{ of sets})$											
Equation for XL(p.u.) & R (p.u.)		$(\text{XL or R calc}) * \text{base KVA}/1000/\text{kV}^2$											



Emergency Generator Analysis:

Introduction:

For the first electrical depth topic I did an emergency generator system cost analysis. I took the existing system and found the loads and costs. Then I came up with three new system costs based on generator size, breaker size, and panel load size. Once I found the three different loads, I came up with pricing for the new systems.

Hypothesis:

For the cost analysis, my hypothesis was that calculating the system needs based on panelboard loads would be the least expensive. I figured that the generators would be sized the largest with the largest factor for safety. The individual loads would not be quite as large and therefore would be cheaper.

Method:

As I have said before I calculated the needs of the emergency generator system based on the generator size, feeder size, and the panelboard size. The existing system has three generators, and to lower costs I have designed a system using two generators. The following is a breakdown of the loads and costs.

The RS Means 2010 Electrical Cost Data was used. A diesel-engine-driven generator set was used that includes the battery, charger, muffler, automatic transfer switch & day tank.

Generator Sizing:

The existing system uses three 150 kW generators and I would like to compare the cost of two 250 kW generators.

RS MEANS ELECTRICAL COST DATA 2010 PACKAGED GENERATOR ASSEMBLIES												
	Amount	Size	Crew	Daily Output	Labor Hours	Unit	2010 Base Costs					
							Material	Labor	Equipment	Total	Total Incl O&P	System Total
Existing	3	150	R3	0.26	76.92	Ea.	43500	3725	530	47755	54000	162000
Redesign	2	250	R3	0.23	86.96	Ea.	57500	4200	600	62300	70000	140000

The cheaper solution appears to be a redesign with two 250 kW generators.

Circuit Breaker Sizing:

The loads go to two separate buildings. With a two generator emergency system, the larger of the two building loads will need to be accounted for. By the table below, the generator will need to handle roughly 500 kW due to sizing the generator so that loads are 80% of the generator size.

Circuit Breaker Sizes							
BUILDING		CB SIZE	TAG	VOLTAGE	AMPS	KVA	kW
TC	ATS 2	3P-125A	17	480	125	103.92	83.13844
TC	ATS 4	3P-100A	19	480	100	83.14	66.51075
TA	ATS 1	3P-125A	17	480	125	103.92	83.13844
TA	ATS 3	3P-100A	19	480	100	83.14	66.51075
TA	ATS 5A	3P-150A	15	480	150	124.71	99.76613
TA	ATS 5B	3P-150A	15	480	150	124.71	99.76613
TA	JOCKEY	3P-60A	13	480	60	49.88	39.90645
						TC TOTAL	149.65
Design Size = 538x1.25=673kW						TA TOTAL	389.09

RS MEANS ELECTRICAL COST DATA 2010 PACKAGED GENERATOR ASSEMBLIES												
	Amount	Size	Crew	Daily Output	Labor Hours	Unit	2010 Base Costs					
							Material	Labor	Equipment	Total	Total Incl O&P	System Total
Existing	3	150	R3	0.26	76.92	Ea.	43500	3725	530	47755	54000	\$162000
Redesign	2	350	R3	0.2	100	Ea.	70000	4825	690	75515	85000	\$170000

It appears that the existing system of three generators is the cheaper solution by about \$8000.

The final method of calculating a cost analysis will be to calculate the loads on the panels that are fed through the ATSS. I have broken the panels down by Towson Center and Towson Arena.

Panelboard Load Sizing:

TOWSON ARENA PANEL LOADS				
PANEL	VOLT.	TOTAL	DEMAND	kW
EP1	480	61.5	60.2	48.16
SP1	480	104.2	81	64.8
SE4A	480	114	91.2	72.96
SE4B	480	100.8	80.6	64.48
JOCKEY	480	22.45	22.45	17.9579
TOTAL				268.35

TOWSON CENTER PANEL LOADS				
PANEL	VOLT.	TOTAL	DEMAND	kW
E1	480	12.8	12.8	10.24
S1	480	52	35.8	28.64
TOTAL				38.88

This puts the load for emergency panels at around 307.24. With a size up factor, the total is 384 kW. So two 200 kW generators can service this need.

RS MEANS ELECTRICAL COST DATA 2010 PACKAGED GENERATOR ASSEMBLIES												
	Amount	Size	Crew	Daily Output	Labor Hours	Unit	2010 Base Costs					System Total
							Material	Labor	Equipment	Total	Total Incl O&P	
Existing	3	150	R3	0.26	76.92	Ea.	43500	3725	530	47755	54000	162000
Redesign	2	200	R3	0.24	83.3	Ea.	48800	4025	575	53400	60000	120000

It appears that having 2 larger generators to cover the emergency panels' loads is cheaper than the existing 3 backup generator system.

Conclusion:

Based on the results, there are two options that provide a cheaper solution for the emergency generator system. If the system is sized based on the existing generators, having two generators instead of three is cheaper. If the system is sized by the circuit breakers, then having 3 generators at 150kW each is cheaper. Finally if the system is sized for the emergency panel load, then the cheaper solution is to use 2 200kW generators. Sizing the system based on the emergency panels is the cheapest solution, however it may have the least safety in its design.

SKM System Model:

My second electrical depth was creating a SKM model for the electrical distribution system for the Towson Arena. The program allows you to run diagnostics tests on the system once a building model is complete.

It is very easy to calculate demand loads for the system. Once all of the panels, breakers, buses and transformers are set up in the model, a simple calculation will give the demand loads for all of the panels. Load flow and Arc Flash can also be calculated with SKM.

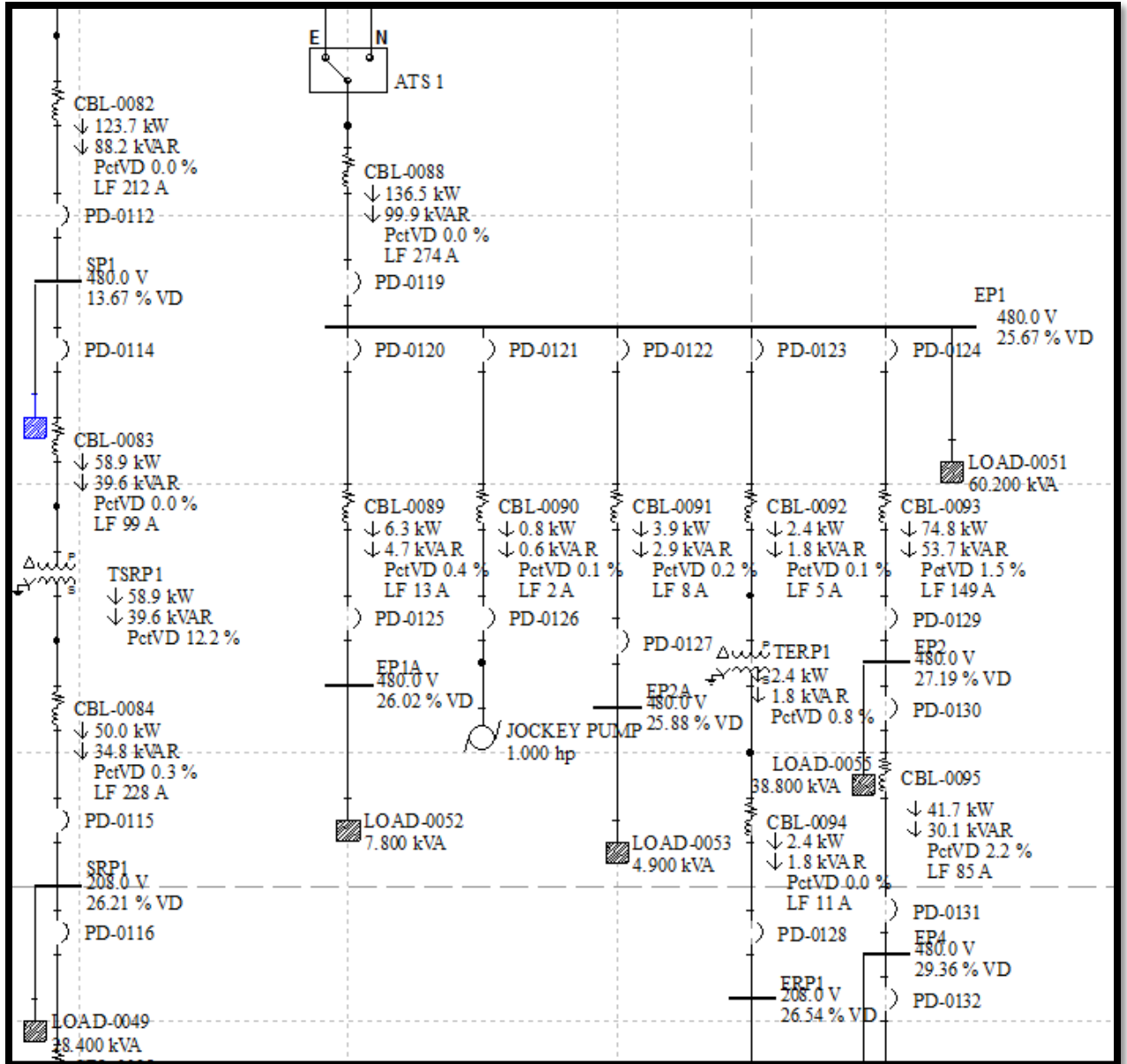
SKM is a very useful tool when calculating the short circuit rating of the system. The short circuit rating is easily calculated, and saves lots of time from hand calculations or even using an excel spreadsheet. The short circuit rating for each panel is labeled right beside it in the model. With short circuit rating calculations, SKM can also give time current curves for circuit breakers in the system.

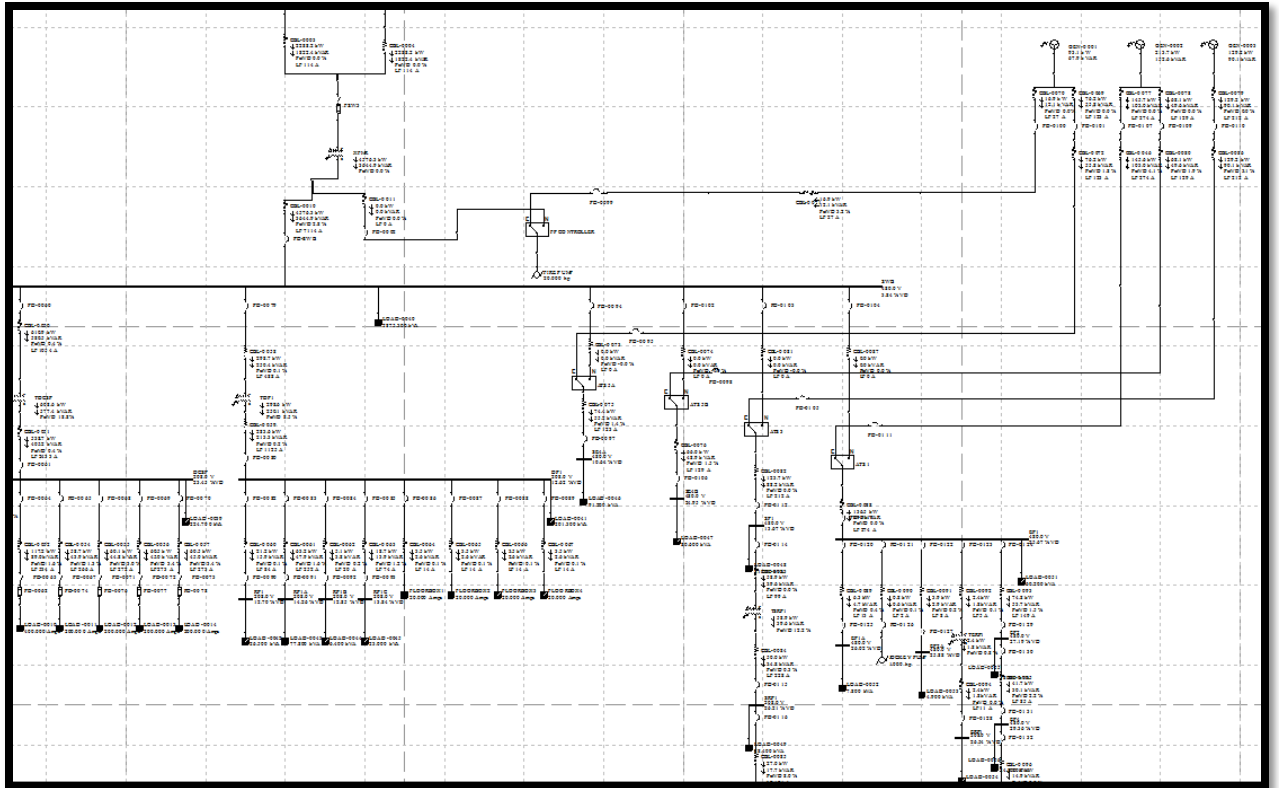
Voltage drop is another reason why SKM is such a useful tool. After the model is complete, voltage drop is easily calculated for each panel, transformer and cable that connects loads. The voltage drop on each device is clearly labeled to the side.

The user can choose from a multitude of cable, transformer, breaker, fuses, ATs, and many other equipment in SKM. There is a library for the chooser to select specifically, exactly which equipment should be used in the system model.

SKM can be very problematic to a novice user. The model is very sensitive to the slightest malfunctions of a connection or incompatible equipment. If one part of the system model is built incorrectly, none of the analyses will run. Another drawback is the time that it takes to complete the model. A lot of time is spent tweaking every finite detail to make the system correct. In the end the user saves time with the quickness of the calculations. There is a limitation to the number of connections and equipment that can be used in the trial/student version. Only 100 electrical devices can be created within one model, so this can be a burden if a model is created for a large system.

In the end SKM is a very useful and time saving tool for electrical engineers. The information is calculated accurately and reliably once a model is correctly made. The calculations can be transferred into several different file types and formats. The user can use their discretion for the best way to view each bit of information. The following are images from the SKM model I created showing panels, breakers, pumps, ATs, transformers and their respective loads.





Acoustic Breadth:

For my acoustical breadth I studied the acoustical characteristics of the court area. The court's primary purpose is for sporting events, but it can also be used as a concert hall or ceremony space. In my calculations I show the requirements for each space and suggestions for the best design.

The court's dimensions are 187'x137'x74'. I chose to analyze the space with the method of calculating Reverberation time. Depending on the use of the space, different reverberation times are desired. Wallace Sabine originally used reverberation time, and identified reverberation with the time it took for the sound of a room to decrease by 60 dB(4).

In Egan's book on Architectural Acoustics there is a figure that gives the designed reverberation times for multiple occupancies, which can be seen in the figure below. I decided to set the court space to be used for a multipurpose auditorium and Dance and Rock concerts. The desired reverberation time for a multipurpose auditorium is 1.4-1.9s and 0.8-1.3s for rock concerts.

The court space has painted walls and wood floors above concrete. There is also a steel truss system at the top of the space with metal deck above that. Seating also covers a large area of the court, and it has different absorptive values depending on if the seats are full or empty.

The following information and tables display the design criteria for calculating reverberation time. The equation is displayed, and my calculations are also visible.

$$T = (0.05) * \text{Volume} / a$$

The following equation takes a constant multiplied by the volume divided by the average of the sabins at 500 and 1000 hertz. I took the area of the interior of the court and found the corresponding sabin level for all the materials. Once I found the average sabins for 500 and 1000 hertz and the volume of the court I could find the reverberation time. The following figure shows my calculations:

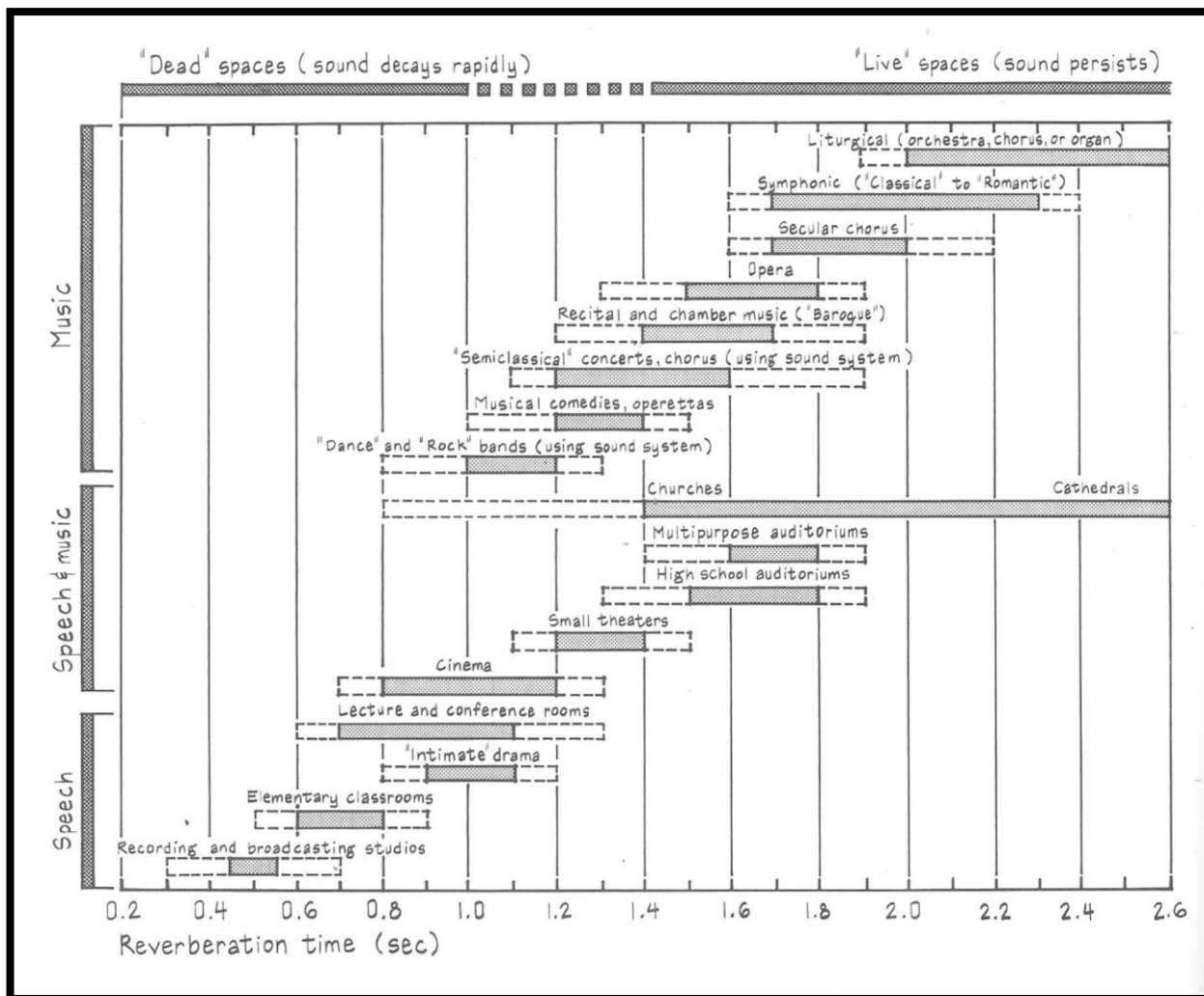


Figure: Reverberation Times
from Egan

Towson Center Arena Addition
Joseph Becker

Location	Finish	Length	Width	Area	Material	500 Sabins	Sabin*ft2	1000 Sabins	S*ft2
Wall	paint	642	61	39162	conc. Blk painted	0.06	2349.72	0.07	2741.34
Floor	wood	187	134	25058	wood parquet on conc.	0.07	1754.06	0.06	1503.48
long trus		10	134	1340	steel	0.1	134	0.1	134
lat trus		4	187	748	steel	0.1	74.8	0.1	74.8
scrbd		5	256	1280	linoleum	0.03	38.4	0.03	38.4
mtl deck				22970	1.5" Acoustic Deck	0.79	18146.3	1.01	23199.7
Upper Deck Seating	unoccupied seats	464	24	11136	chair	0.22	2449.92	0.39	4343.04
Lower Tier Seating	unoccupied seats	496	42	20832	chair	0.22	4583.04	0.39	8124.48
Audience Upper	upholstered seats	464	24	11136	seated person	0.8	8908.8	0.94	10467.84
Audience Lower	upholstered seats	496	42	20832	seated person	0.8	16665.6	0.94	19582.08
						Total	55104.64	Total	70209.16

Figure: Sabin Calculations

Finally I calculated the reverberation time which can be seen in the figure below. The court with no spectators had a reverberation time of 2.19s and 1.44s with the audience. With the audience filling up the space, the reverberation time is ideal as a multipurpose auditorium. For example a graduation would fill up the arena and meet the suggested criteria. However, for a rock concert the reverberation time should be lowered even further.

Attaching acoustical panels to the top of the arena below the steel truss system, the echo could be reduced significantly. Using a highly absorptive material, 15000 square feet could lower the reverberation time to 1.14 seconds. This is right in the range of 0.8-1.3 for rock concerts. This would be a relatively easy alteration by running the acoustical material the length of the arena. With a length of 187', 80 strips would cover the 15000 square feet needed to drop the reverberation time. A smaller amount of acoustical material could get the reverberation time to split the two criteria at 1.35 seconds. Only 4000 square feet of the acoustical material would be needed which would be 22 strips at 187 feet long. This is however assuming that the arena is nearly full of occupants, but having removable acoustical strips would be a good solution. The catwalk would be an easy way to mount this material.

Glazing Breadth:

The Court space is circumscribed by a clerestory at the top of the space. This allows light and heat in and is susceptible to higher heat losses than a regular wall as well. I did an analysis of several different types of glazing and how the cooling load is affected during the course of a year.

I created a model in revit for the court. The court space is 187' x 137' x 74'. I used the same wall types and window types as the architect's model only my model was dumbed down for simplicity reasons. I used one space with exterior walls, and included the clerestory around the top of the court with five different types of glass. Using the five different types of glass I calculated solar gain sensible in Btu/hr, glass transmission sensible in Btu/hr, and total cooling load in tons. Please see the appendix for specific calculation sheets from Trace that gives the loads for each glass type. Below is a table of my results from my Trace model.

The five glass types that I used in Trace are 5mm single low iron, single clear ¼", double clear ¼", 3mm Double Low-E(e2 = 0.1) Clear 6mm Air, and 3mm Double Low-E(e2 = 0.04) Clear 13mm Air. The Low(e2) means that two of the glass panes are coated with the shading material

that helps to block out sunlight(5). The U-factors for the glass types decrease with the previous list. So as the U-factor decreases(Btu/hr/F/ft²), the amount of heat that is transferred through the material also decreases. So a higher U-factor for the glass meant more heat was being transferred. The shading coefficient of the glass also followed this trend of decreasing from the previous list. Once again as the shading coefficient decreases, less light is allowed through and therefore less heat as well.

In trace I set the occupancy to sports arena, and it automatically calculated the amount of air required. I also included the lighting for the space. My results verified that the glass with a higher U-factor and shading coefficient had the larger total cooling load. The 5mm Single Low Iron had a total cooling load in tons of 240.4 while the 3mm Double Low-E(e2=0.04) Clear 13mm Air had a total cooling load of 220.8 tons.

This translates into a difference of 20 tons of cooling. A ton of cooling load is 12,000 Btu/hr(6). It is also the amount of heat removed that would melt 2000 lbs of ice in 24 hours. A lot of energy can be saved over the course of a year by using the Low-E glass.

Trace Designation	U-Factor	Shading Coefficient	Solar Gain Sensible Btu/hr	Glass Transmission Sensible Btu/hr	Total Cooling Load ton
5mm Single Low Iron	1.037	1.04	311,753	75,628	240.4
Single Clear ¼"	0.95	0.95	292,987	67,750	238.4
Double Clear ¼"	0.6	0.82	261,496	43,312	233.7
3mm Double Low-E (e2=.1) Clear 6mm Air	0.432	0.69	179,578	31,711	225.7
3mm Double Low-E (e2=.04) Clear 13mm Air	0.295	0.5	131,021	21,685	220.8

Work Cited

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9. "Panelboards - Schneider Electric Schneider Electric." *Panelboards - Schneider Electric Schneider Electric*. Web. 28 May 2012. <<http://products.schneider-electric.us/products-services/products/panelboards/>>.

Appendix:

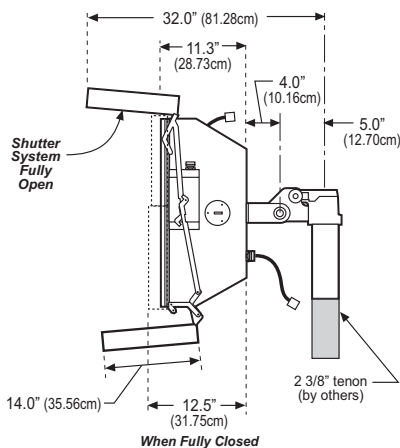
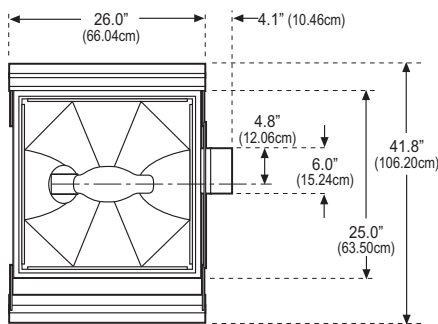
AE2 Series

Arena Eclipse Indoor Sports Floodlight, 1000W HID

Type:	Job:	Approvals:	
Catalog Number:			
AE2M-1000 - - MADJ - MW(X)CBLKMP			
Series/Source-Wattage (Fixture Series)	Optics (Reflector)	Mounting (Standard)	Standard Features (X = Cord length in feet: 8 or 10)
1000-MPBM -			
(Remote Ballast Series)		Voltage (Specify with or without Shutter System)	Options (Factory Installed)
		Date: Page 1 of 6	

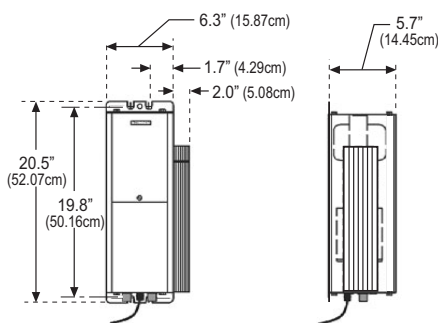
Overall Dimensions *For Reference Only*

Optic Assembly



Weight
65 lbs (29.48 kgs)

Remote Ballast



Weight
45 lbs (20.41 kgs)

Specifications

Housing

The Arena Eclipse blackout luminaire is of heavy duty construction consisting of a separate optical assembly completely enclosed by an aluminum and steel housing. Standard unit constructed to IP52.

Optics (Reflector)

Reflectors shall be segmented, of high purity anodized aluminum, "Super Sheet" with inorganic dielectric coating with a minimum reflectivity of 94%.

Lamp Access

Lamp access is through the side so as not to disturb the luminaire aiming. Relamp door has a silicone gasket and is secured by four captive screws to ensure the optical assembly is sealed from particulate entry. Safety cable provided to retain the relamp door while relamping.

Lens Door / Frame Assembly

Heat and impact resistant tempered glass lens is held in place by an extruded aluminum door frame with mitered corners. Lens assembly is sealed from particulate entry by means of a continuous extruded silicone gasket.

Lamp Socket

Pre-wired grip-type mogul base socket. Glass end of lamp is held in precise photometric alignment and protected from breakage by a Stabilux socket.

Lamp Socket Monitor

E39 position-oriented lamp socket, designed for high output lamps, will also accept any clear universal mount BT37 lamp. The Lamp Socket Monitor; a circular, externally adjustable socket mounting plate equipped with a built-in level is standard. Regardless of final fixture aiming, adjustment of the high output lamp to proper burn position assures optimum performance.

Shutter System

Shutter system is provided to simulate instant on/off of the luminaire for special theatrical effects. Shutter motor is reversible high torque and permanently lubricated for long life. Motor is rated to operate at 120 volts from a tap on the ballast (no external power source required for shutter system operation). Fixture is capable of operating with the shutter closed indefinitely. Fail-safe mechanism extinguishes lamp should the shutter fail to close within three seconds and is reset by turning primary voltage to the luminaire off and on, or by pressing re-set button on "Eclipse" module.

Ballast

SilentGuard high power factor MPB remote indoor Eclipse Series ballast is enclosed in an extruded aluminum housing. Core and coil are encapsulated in a polyester resin compound (standard SilentGuard feature) to minimize ballast noise and ensure cooler operation. Ballast has Class H, 180°C (356°F) rated insulation. Crest factor does not exceed 1.8. Ballast starting current is less than operating with reliable starting down to -29°C (-20°F). Primary side of ballast is pre-wired with 6 ft. SO cord and twist-lock plug. Modular receptacles are provided to simplify secondary wiring of the HID socket and the motorized shutter. External "Eclipse" module featuring Red/Green LED status indicators of mechanical and electrical ballast function. Control override input jack allows direct control via hand-held controller.

Mounting

Cast aluminum mastfitter with Memory Aiming Device (MADJ) fits a 2-3/8" O.D. x 4" tall vertical tenon (by others). Remote "MPB" ballast is adaptable for wall, platform or rack mounting.

Finish

Standard finish for luminaire and remote ballast shall be black UltraClad polyester powder coating, 2.5 mil nominal thickness, electrostatically applied and oven cured. All components shall be thoroughly cleaned by a 5 stage pre-treatment process including iron phosphate bath and non-chromic acid etching stages, ensuring optimum performance characteristics.

Listings

UL/cUL Listed Luminaire, UL 1598, suitable for Dry Locations. The quality systems of this facility have been Registered by UL to the ISO 9000 Series Standards.

Warranty / Terms and Conditions

Standard 5 Year Limited Warranty

The current Philips Wide-Lite Warranty may be found at www.wide-lite.com (keyword: warranty) as well as the current Standard Terms and Conditions of Sale (keyword: terms).

All sales of items in this catalogue shall be subject to the Philips Wide-Lite Standard Terms and Conditions of Sale current at the time of shipment. If you do not have a copy of the Philips Wide-Lite Warranty and Standard Terms, please contact the factory for same prior to ordering.



Some luminaires use fluorescent or high intensity discharge (HID) lamps that contain small amounts of mercury. Such lamps are labeled 'Contain Mercury' and/or with the symbol 'Hg'. Lamps that contain mercury must be disposed of in accordance with local requirements. Information regarding lamp recycle and disposal can be found at www.lamprecycle.org.

AE2 Series

Arena Eclipse Indoor Sports Floodlight, 1000W HID

Type:	Job:	Page 2 of 6
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Fixture Series/Source-Wattage	Optics (Reflector)	Mounting										
Metal Halide <input checked="" type="checkbox"/> AE2M-1000	<table border="0"> <tr> <td>with Shutter System</td> <td>less Shutter System</td> </tr> <tr> <td><input type="checkbox"/> A</td> <td><input type="checkbox"/> ALS</td> </tr> <tr> <td><input type="checkbox"/> B</td> <td><input type="checkbox"/> BLS</td> </tr> <tr> <td><input type="checkbox"/> N</td> <td><input type="checkbox"/> NLS</td> </tr> <tr> <td><input type="checkbox"/> U</td> <td><input type="checkbox"/> ULS</td> </tr> </table>	with Shutter System	less Shutter System	<input type="checkbox"/> A	<input type="checkbox"/> ALS	<input type="checkbox"/> B	<input type="checkbox"/> BLS	<input type="checkbox"/> N	<input type="checkbox"/> NLS	<input type="checkbox"/> U	<input type="checkbox"/> ULS	<input checked="" type="checkbox"/> MADJ Mastfitter Cast aluminum mastfitter with Memory Aiming Device
with Shutter System	less Shutter System											
<input type="checkbox"/> A	<input type="checkbox"/> ALS											
<input type="checkbox"/> B	<input type="checkbox"/> BLS											
<input type="checkbox"/> N	<input type="checkbox"/> NLS											
<input type="checkbox"/> U	<input type="checkbox"/> ULS											

Remote Ballast Series	Voltage												
Metal Halide <input checked="" type="checkbox"/> 1000-MPBM Fixtures are furnished with regulating HPF single voltage ballasts: 120V, 208V, 277V, 347V or 480V.	<table border="0"> <tr> <td>with Shutter System</td> <td>less Shutter System</td> </tr> <tr> <td><input type="checkbox"/> 120ESCM-MW-6C-L2320P</td> <td><input type="checkbox"/> 120-MW-6C-L2320P</td> </tr> <tr> <td><input type="checkbox"/> 208ESCM-MW-6C-L2320P</td> <td><input type="checkbox"/> 208-MW-6C-L2320P</td> </tr> <tr> <td><input type="checkbox"/> 277ESCM-MW-6C-L2320P</td> <td><input type="checkbox"/> 277-MW-6C-L2320P</td> </tr> <tr> <td><input type="checkbox"/> 347ESCM-MW-6C-L2320P</td> <td><input type="checkbox"/> 347-MW-6C-L2320P</td> </tr> <tr> <td><input type="checkbox"/> 480ESCM-MW-6C-L2320P</td> <td><input type="checkbox"/> 480-MW-6C-L2320P</td> </tr> </table>	with Shutter System	less Shutter System	<input type="checkbox"/> 120ESCM-MW-6C-L2320P	<input type="checkbox"/> 120-MW-6C-L2320P	<input type="checkbox"/> 208ESCM-MW-6C-L2320P	<input type="checkbox"/> 208-MW-6C-L2320P	<input type="checkbox"/> 277ESCM-MW-6C-L2320P	<input type="checkbox"/> 277-MW-6C-L2320P	<input type="checkbox"/> 347ESCM-MW-6C-L2320P	<input type="checkbox"/> 347-MW-6C-L2320P	<input type="checkbox"/> 480ESCM-MW-6C-L2320P	<input type="checkbox"/> 480-MW-6C-L2320P
with Shutter System	less Shutter System												
<input type="checkbox"/> 120ESCM-MW-6C-L2320P	<input type="checkbox"/> 120-MW-6C-L2320P												
<input type="checkbox"/> 208ESCM-MW-6C-L2320P	<input type="checkbox"/> 208-MW-6C-L2320P												
<input type="checkbox"/> 277ESCM-MW-6C-L2320P	<input type="checkbox"/> 277-MW-6C-L2320P												
<input type="checkbox"/> 347ESCM-MW-6C-L2320P	<input type="checkbox"/> 347-MW-6C-L2320P												
<input type="checkbox"/> 480ESCM-MW-6C-L2320P	<input type="checkbox"/> 480-MW-6C-L2320P												

Options (Factory Installed)	Accessories (Field Installed - Shipped Separately)
<input type="checkbox"/> BL Bi-Level (for Less Shutter System) <input type="checkbox"/> BLEM Bi-Level (for Shutter System) <input type="checkbox"/> F1 Single Fuse (120/277/347V) <input type="checkbox"/> F2 Double Fuse (208/240/480V)	<input type="checkbox"/> F1-KIT Single Fuse Kit (120/277/347V) <input type="checkbox"/> F2-KIT Double Fuse Kit (208/240/480V) <input type="checkbox"/> AMB-S Single Fixture Mounting Bracket <input type="checkbox"/> AMB-D Double Fixture Mounting Bracket <input type="checkbox"/> AE2-STY-CBL Fixture Safety Cable <input type="checkbox"/> SRB Strain Relief Bracket

AE2 Series

Arena Eclipse Indoor Sports Floodlight, 1000W HID

Type:	Job:	Page 3 of 6
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Distribution Guide & Ballast Data ^(1,2)

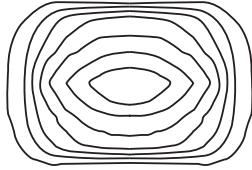
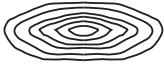


Source Type ⁽¹⁾	Catalog Number	Reflector Type	Lamp ⁽²⁾ Envelope	.ies File Name	Ballast Type ⁽³⁾	ANSI Code	Line Current 120 / 208 / 277 / 347 / 480	Line Watts
MH	AE2M-1000	A	BT37	Consult factory	CWA	M47 / H36	9.2 / 5.6 / 4.7 / 4.1 / 3.2 / 2.4	1080
	AE2M-1000	B	BT37	Consult factory	CWA	M47 / H36	9.2 / 5.6 / 4.7 / 4.1 / 3.2 / 2.4	1080
	AE2M-1000	N	BT37	Consult factory	CWA	M47 / H36	9.2 / 5.6 / 4.7 / 4.1 / 3.2 / 2.4	1080
	AE2M-1000	U	BT37	Consult factory	CWA	M47 / H36	9.2 / 5.6 / 4.7 / 4.1 / 3.2 / 2.4	1080

1) MH = Metal Halide.

2) The Arena Eclipse is designed and installed using high output BT37 clear lamps. Lamp socket will accept any universal burn BT37 clear lamp, however performance will be negatively affected.

3) CWA = Constant Wattage Autotransformer.

Beam Spreads and Distribution Patterns

BEAM PATTERNS Reflector Type	Wattage/ Source	Max Candle Power	H x V NEMA	BEAM SPREADS	
				Horizontal 10% Field Angle	Vertical 50% Beam Angle
A 	1000W MH	210,981	5 x 4	86° x 62°	44° x 23°
B 	1000W MH	399,650	4 x 2	67° x 26°	27° x 11°
N 	1000W MH	432,750	4 x 3	66° x 31°	27° x 12°
U 	1000W MH	115,000	4 x 2	67° x 28°	27° x 11°

AE2 Series

Arena Eclipse Indoor Sports Floodlight, 1000W HID

Type:	Job:	Page 4 of 6
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Option details (Factory Installed)

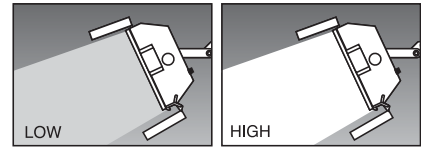
BL Bi-Level dimming ballast for Less Shutter Systems

BLEM Bi-Level dimming ballast for Shutter Systems

Bi-Level feature is specified as a Ballast Option.

Bi-Level provides high/low level of lamp output with up to 50% power consumption.

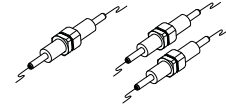
Zero crossover network avoids strobing and lamp dropout.



F1 Single fuse (120/277/347V)

F2 Double fuse (208/240/480V)

Fuses are DTK/KLK 30 amp unless otherwise specified.



AE2 Series

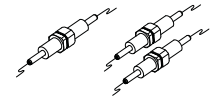
Arena Eclipse Indoor Sports Floodlight, 1000W HID

Type:	Job:	Page 5 of 6
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Accessory details (Field Installed - Shipped Separately)

- F1-KIT** Single fuse kit (120/277/347V)
- F2-KIT** Double fuse kit (208/240/480V)

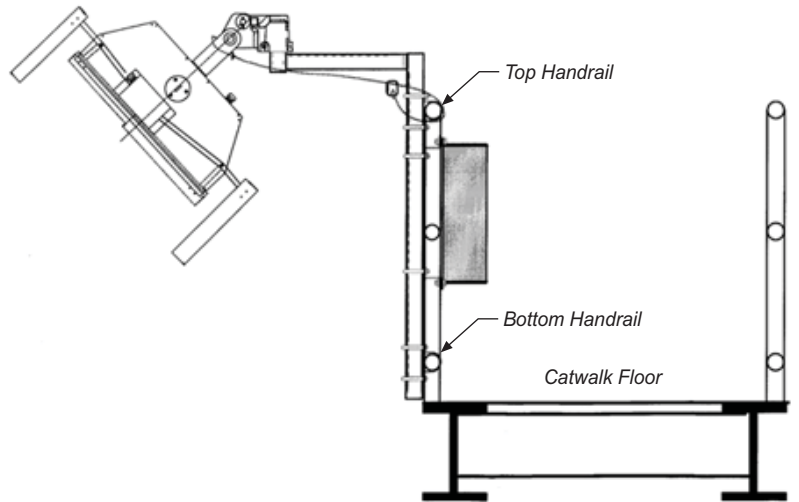
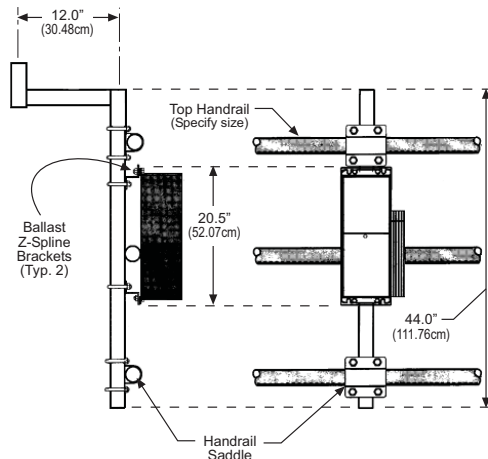
Consists of 1 or 2 fuse holders and 1 or 2 KTK 20 amp fuses. Field installed.



AMB-S Single fixture mounting bracket

Bracket for mounting single fixture to catwalk.
Handrail size must be specified. Consult factory.

Shown with Fixture Safety Cables securing fixture at yoke to handrail of catwalk.

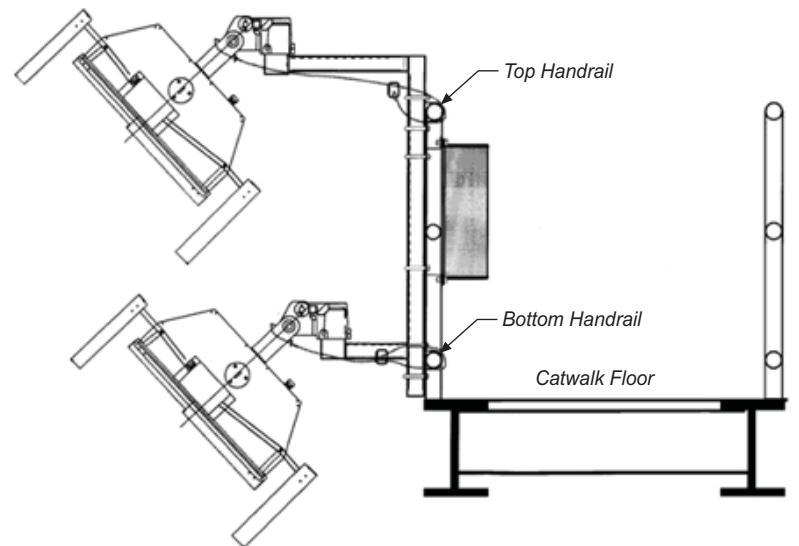
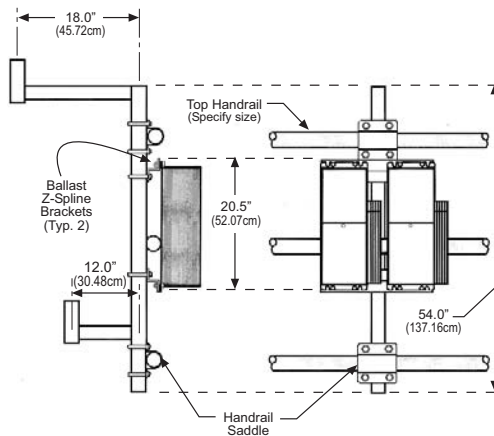


All steel parts are finished Semi-gloss Black.
 All hardware zinc plated.
 Ends of all exposed tubes are fitted with plastic closures.
 Ballasts mount to "Z-Spline" Brackets, attached to fixture mounting bar by U Bolts.
 Shipping Wt: 18 lbs. Shipped Unassembled.

AMB-D Double fixture mounting bracket

Bracket for mounting two stacked fixtures to catwalk.
Handrail size must be specified. Consult factory.

Shown with Fixture Safety Cables securing fixture at yoke to handrail of catwalk.



All steel parts are finished Semi-gloss Black.
 All hardware zinc plated.
 Ends of all exposed tubes are fitted with plastic closures.
 Ballasts mount to "Z-Spline" Brackets, attached to fixture mounting bar by U Bolts.
 Shipping Wt: 20 lbs. Shipped Unassembled.

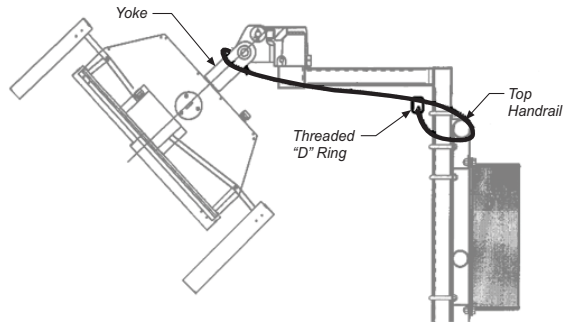
AE2 Series

Arena Eclipse Indoor Sports Floodlight, 1000W HID

Type:	Job:	Page 6 of 6
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Accessory details continued (Field Installed - Shipped Separately)

AE2-STY-CBL *Fixture Safety Cable*
1/8" stainless steel aircraft cable
for securing fixture head to
catwalk handrail.



SRB *Strain relief bracket* Provides strain relief and shielding for modular wiring cable protection. Also provides convenient handling of ballast.

Notes



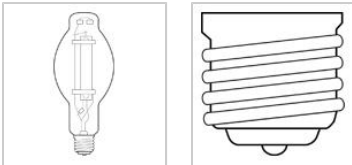
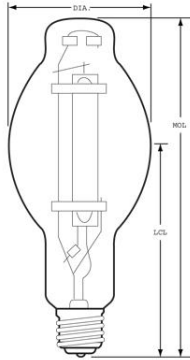
ISO 9001
Certified



GE
Lighting

18205 - MVR1000/U/BT37

GE Multi-Vapor® Quartz Metal Halide BT37



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>

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 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.
 - 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.
- 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

Graphs_Spectral Power Distribution

GENERAL CHARACTERISTICS

Lamp Type	High Intensity Discharge - Quartz Metal Halide
Bulb	BT37
Base	Mogul Screw (E39)
Bulb Finish	Clear
Rated Life (TYP)	12000.0 h
Rated Life (AVG)	9000.0 h
Bulb Material	Hard glass
Lamp Enclosure Type (LET)	Enclosed fixtures only
Base Temperature (MAX)	250.0 °C
Bulb Temperature (MAX)	430.0 °C
LEED-EB MR Credit	139 picograms Hg per mean lumen hour

PHOTOMETRIC CHARACTERISTICS

Initial Lumens (TYP)	115000.0
Initial Lumens (AVG)	105000.0
Mean Lumens (TYP)	90000.0
Mean Lumens (AVG)	82000.0
Nominal Initial Lumens per Watt	105
Color Temperature	3700.0 K
Color Rendering Index (CRI)	65.0

ELECTRICAL CHARACTERISTICS

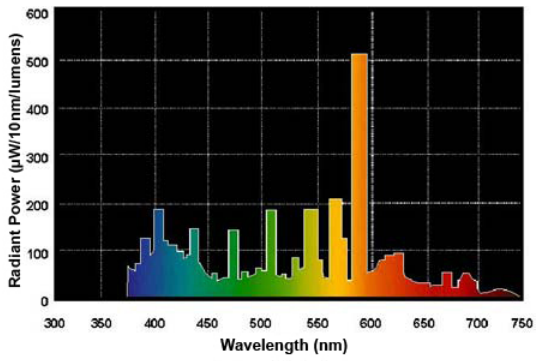
Wattage	1000.0
Burn Position	Universal burning position
Open Circuit Voltage (peak lead ballast) (MIN)	750.0 V
Open Circuit Voltage (RMS lag ballast) (MIN)	530.0 V
Warm Up Time to 90% (MIN)	2.0 min
Warm Up Time to 90% (MAX)	5.0 min
Hot Restart Time to 90%	15.0 min

DIMENSIONS

Maximum Overall Length (MOL)	11.5000 in(292.1 mm)
Nominal Length	11.500 in(292.1 mm)
Bulb Diameter (DIA)	4.625 in(117.5 mm)
Light Center Length (LCL)	7.000 in(177.8 mm)

PRODUCT INFORMATION

Product Code	18205
Description	MVR1000/U/BT37
ANSI Code	M47
Standard Package	Case
Standard Package GTIN	10043168182055
Standard Package Quantity	6
Sales Unit	Unit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	6
UPC	043168182058



Architectural Downlighting

OM8LED 3000 8" LED 3000 Lumen Downlight



Specifier's Reference

Project
Type
Model No.
Comments

application

- Philips Omega Revelation LED utilizes proprietary remote phosphor technology to produce one of the most efficient and advanced LED systems available for general illumination. This is the ideal lighting solution for office, corridor, commercial, retail and hospitality environments.

light engine

- Philips Omega mixing chamber/optical assembly: Remote phosphor technology provides increased efficiency and color stability by redirecting back reflected light. Phosphor lens assembly converts high brightness blue light into white light for an even, diffused pattern, eliminating bright spots often created by individual LEDs. This technology provides consistent, stable color with CCT color control of +/- 100K over the life of the light engine and provides 20% higher efficiency.
- LED Array: The LED Array consists of a metal core circuit board with 22 high brightness royal blue LEDs.
- Color: Available in three CCT options, 3000K, 3500K or 4000K with 80CRI +/-2%.
- Electrical: The LED power supply/ driver by Advance Xitanium is available 120VAC or 277VAC, 60Hz with an overload and short circuit protected feature and it is thermally regulated to prevent overheating. 120VAC dedicated driver provides both 0-10V analog and (ELV) Trailing Edge dimming capabilities. 277VAC provides standard 0-10V analog dimming. Driver has a rated lifetime of 50,000 hours. Refer to 0-10V dimming capability spec sheet on www.omegalighting.com for complete details.
- Lifetime/Lumen Maintenance: 50,000 hour lifetime at 70% lumen maintenance light engine.

construction

- Thermal Management: A proprietary die-cast aluminum heat sink allows for easy and tool-less installation to the housing yoke. The heat sink is designed to properly maintain junction temperatures in recessed Non-IC

applications to provide reliable performance over the life of the light engine. The heat sink incorporates alignment tabs to properly position with the housing. Rust resistant springs are used to secure the reflector to the light engine. Fixtures should not operated or exceed ambient temperature above 40°C.

- Housing: Precision die stamped 18ga galvanized steel mounting pan and yoke assembly. Allows for ceiling thickness up to 1-3/8". Yoke supports weight of heat sink and light engine assembly to prevent stress on finished reflector.
- Reflector: The lower trim is die-formed of 0.40 low iridescent aluminum and is self-flanged with a variety of finishes available. White flange is standard. Optional polished flange matching trim finish is available, add FF to the catalog number. Optics are designed to provide a 50° visual and reflective cutoff.
- C-Channels: Philips Omega Revelation C-Channels are included and provide vertical and horizontal adjustments. These allow for fast and adjustment free installation in T-bar ceilings with 1/2" tile. C-Channels simply snap on grid for proper alignment in 24" O.C. grid systems.
- Junction Box: 16ga galvanized steel. UL listed for 8 No. 12 AWG, 90C through branch circuit conductors. Allows inspection below ceiling.
- Service: Modular construction allows for easy maintenance of complete system below ceiling. Removing reflector provides easy access to heat sink and light engine assembly. This assembly may be removed by de-pressing the springs which attach to the yoke and then simply opening protective cover and unplugging the push in connector from the LED board.

listings & warranty

- ETL, cUL Listed. (Suitable for wet location applications.)
- LED life calculations are based upon application junction temperatures and driver currents at or below IESNA - LM-80-08 manufacturer's test data. IES test performed per IESNA - LM-79-08.
- 5 year Warranty



Green Choice: OM8LED53120-R8LED5330KWDCS

HOUSING

OM8LED

Family
OM8LED –
8 inch Housing

53

Wattage
53 – 53 watts
input watts
(3000 lumens)

Voltage

120 – 120 VAC
60Hz
277 – 277 VAC
60Hz
347 – Stepdown
(347:120/277)

Options¹

EM – Bodine
B5L17C
Emergency
backup

LIGHT ENGINE - REFLECTOR

R8LED

Omega Reflector
R8LED –
8" Reflector

53

Wattage
53 – 53 watts
input watts
(3000 lumens)

WD

Distribution
WD – Wide

CCT

30K – 3000K
35K – 3500K
40K – 4000K

Reflector Finish

CS – Clear Specular
CSS – Clear Semi-
Specular
HZ – Haze
GS – Gold Specular
WT – Wheat
PW – Pewter
BZ – Bronze
WH – White, Paint
FF – Finish Flange
(as suffix to color)

Footnotes

1. Delivered lumen output in emergency mode ranges from 500-550 lumens.

General Notes

Lumen output varies depending on CCT and distribution, refer to specific IES files for details.

Accessories (ordered separately)

SA8 - Sloped ceiling adapter (must specify in 5° increments)

OMTCA8 - Thick ceiling adapter

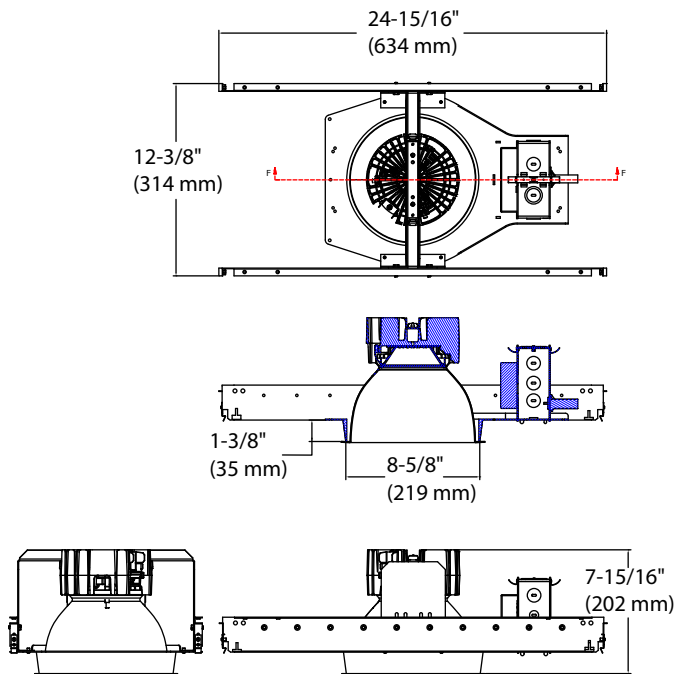
(specify finish to match reflector, ie. CS 2-1/2" thick max.)

energy data

Input Voltage	Input Current	Drive Current	Input* Power	LED Power	THD %	Power Factor
120	0.442	700mA	53	50	20%	>0.9
277	0.191	700mA	53	50	20%	>0.9

* +/- 5%

dimension



photometrics

OM8LED53120-R8LED5330KWDCS

Tested to LM-79 standards.

Clear Specular Reflector Test No. 30246 S/MH (0 degree plane) 1.2 Lamp Type 53W LED Total Fixture Lumens 3023 IES File 30246.ies Input Watts 53 Luminaire Efficacy 57 LPW	Candlepower				Average Luminance																																																																																																					
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	5	2492	2490	2492	65	389	389	389																																																																																																		
	15	2439	2439	2434	75	212	212	212																																																																																																		
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	35	1265	1275	1291	Coefficients of Utilization <table border="1"> <tr> <td>pcc</td> <td colspan="3">80</td> <td colspan="3">70</td> </tr> <tr> <td>pw</td> <td>70</td> <td>50</td> <td>30</td> <td>70</td> <td>50</td> <td>30</td> </tr> <tr> <td>RCR</td> <td colspan="6"></td> </tr> <tr> <td>0</td> <td>118</td> <td>118</td> <td>118</td> <td>115</td> <td>115</td> <td>115</td> </tr> <tr> <td>1</td> <td>112</td> <td>110</td> <td>108</td> <td>111</td> <td>108</td> <td>106</td> </tr> <tr> <td>2</td> <td>107</td> <td>102</td> <td>97</td> <td>105</td> <td>101</td> <td>96</td> </tr> <tr> <td>3</td> <td>102</td> <td>94</td> <td>90</td> <td>100</td> <td>93</td> <td>89</td> </tr> <tr> <td>4</td> <td>95</td> <td>88</td> <td>81</td> <td>93</td> <td>86</td> <td>81</td> </tr> <tr> <td>5</td> <td>91</td> <td>81</td> <td>76</td> <td>89</td> <td>81</td> <td>75</td> </tr> <tr> <td>6</td> <td>85</td> <td>76</td> <td>69</td> <td>83</td> <td>76</td> <td>69</td> </tr> <tr> <td>7</td> <td>81</td> <td>70</td> <td>65</td> <td>80</td> <td>70</td> <td>65</td> </tr> <tr> <td>8</td> <td>77</td> <td>67</td> <td>60</td> <td>76</td> <td>66</td> <td>59</td> </tr> <tr> <td>9</td> <td>72</td> <td>63</td> <td>56</td> <td>71</td> <td>61</td> <td>56</td> </tr> <tr> <td>10</td> <td>68</td> <td>58</td> <td>53</td> <td>68</td> <td>57</td> <td>53</td> </tr> </table>				pcc	80			70			pw	70	50	30	70	50	30	RCR							0	118	118	118	115	115	115	1	112	110	108	111	108	106	2	107	102	97	105	101	96	3	102	94	90	100	93	89	4	95	88	81	93	86	81	5	91	81	76	89	81	75	6	85	76	69	83	76	69	7	81	70	65	80	70	65	8	77	67	60	76	66	59	9	72	63	56	71	61	56	10	68	58	53	68	57	53
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Comp Yearly Energy Cost at \$0.08/KWh = \$4.21

OM8LED53120-R8LED5335KWDCS

Tested to LM-79 standards.

Clear Specular Reflector Test No. 30245 S/MH (0 degree plane) 1.1 Lamp Type 53W LED Total Fixture Lumens 3254 IES File 30245.ies Input Watts 53 Luminaire Efficacy 61 LPW	Candlepower				Average Luminance																																																																																																					
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Comp Yearly Energy Cost at \$0.08/KWh = \$3.93

OM8LED53120-R8LED5340KWDCS

Tested to LM-79 standards.

Clear Specular Reflector Test No. 30237 S/MH (0 degree plane) 1.1 Lamp Type 53W LED Total Fixture Lumens 3398 IES File 30237.ies Input Watts 53 Luminaire Efficacy 64 LPW	Candlepower				Average Luminance																																																																																																					
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Comp Yearly Energy Cost at \$0.08/KWh = \$3.75



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 776 South Green Street • Tupelo, MS 38804
 p. 800.234.1890 • f. 662.841.5501
 www.omegalighting.com
 Canadian Division
 189 Bullock Drive • Markham, Ontario L3P 1W4
 p. 905.294.9570 • f. 905.294.9811

Contact Factory for Additional Configurations.
 Specifications are subject to change without notice.
 Some luminaires use fluorescent or high intensity discharge (HID) lamps that contain small amounts of mercury. Such lamps are labeled, "Contain Mercury" and/or the symbol "HG". Lamps that contain mercury must be disposed of in accordance with local requirements. Information regarding lamp recycling and disposal can be found at www.lamprecycle.org





LEONIS

SERIES

Product Overview and Technical information >>



>>
LUMINAIRE > LENS



LEN / LED

LEN / HID

LEONIS

SERIES

Landmark of a new world / On all continents and in every discipline, people are creating the environments that we'll inhabit tomorrow. The Leonis is the culmination of years of effort from design professionals dedicated to improving the outdoor lighting environment so that the future will not only be ecologically sound but also aesthetically pleasing. >>





>>
LUMINAIRE > LENS

BEAUTY

A well-designed product transcends fashion and has a long life because its form is continuously appreciated and contributes to the beautification of its surroundings. The Leonis is not only a technological marvel, it is a work of art that will stand, and withstand, the test of time. Leonis adds value to any project, large or small, simply by being what it is: A landmark of a new world.

INTELLIGENCE

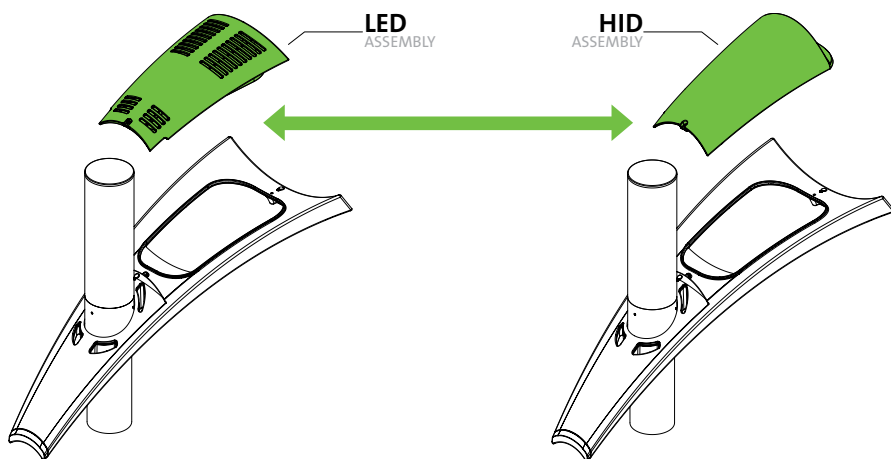
Philips Lumec has created the Leonis with beauty, sustainability and durability in mind. Environmental responsibility is part of the Philips Lumec company culture and is demonstrated through the Leonis by its efficiency and state-of-the-art light sources as well as its low life-cycle cost. The Leonis allows you to create a beautiful, durable project while providing energy savings and safety. For Philips Lumec, that is the definition of Intelligence. The choice is yours: the outcome is beauty, visible quality, and considerable energy savings. >>>

BENEFITS

- › Reduced energy costs and maintenance costs.
- › Reduced light pollution.
- › Modular design allows HID to LED system upgrade.
- › Highly optimized light distribution performance.
- › Increased design life with its pure lines and dynamic shapes.

VERSATILITY

Thanks to a forward thinking design team, the polyvalent Leonis can be fitted with either LED or HID lighting technologies. And if you opt for the latter, a LifeLED module can be retrofitted into your existing Leonis and easily replace your HID optics when you are ready to take advantage of our award-winning LED engine.



LIFESPAN

The sturdy and high-quality materials chosen when manufacturing the Leonis make it a durable and dependable luminaire. But what will truly make it stand out, even in a few decades, is its aesthetics. The curves and lines of its unique design, the eloquent simplicity of its looks, and the futuristic elegance of its shape ensure the Leonis a long-term presence in public spaces.



ENVIRONMENTAL RESPECT

Designed with the environment in mind, the Leonis truly changes the way the game is played when it comes to sustainability. This luminaire offers exceptional photometric performances, while casting no light up to help preserve the Dark Sky, and will allow for unparalleled energy savings when powered by LifeLED. Furthermore, because it is made in aluminum, the luminaire is 94% recyclable when it reaches the end of its life.



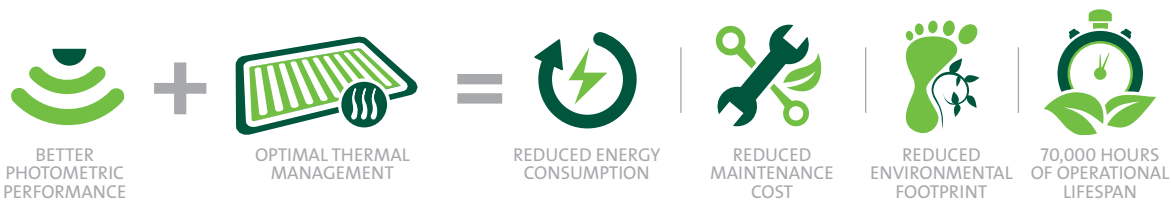
POWERED BY LIFELED

The LifeLED light engine represents Philips Lumec's pioneering contribution to the world of lighting. Still unmatched in terms of performance, photometry, and pricing, it is engineered to power a variety of luminaires and has been specially adapted to seamlessly blend into the Leonis' sleek assembly.

The LifeLED offers more than 70,000 hours of operational lifespan, far surpassing any other lighting technology, and guarantees perfect photometric light distribution, greater pole spacing, as well as far superior light quality. Because it has been so meticulously engineered, the LifeLED will consume less electricity while still delivering the target lumens you need.

The LifeLED is equipped with an advanced aluminum heat sink and mounted on a specialized aluminum circuit board, ensuring optimal heat dissipation and management, and allowing it to function at peak performance levels.

The high-end technology of the LifeLED will reduce energy consumption, maintenance cost, and the environmental footprint of the Leonis.



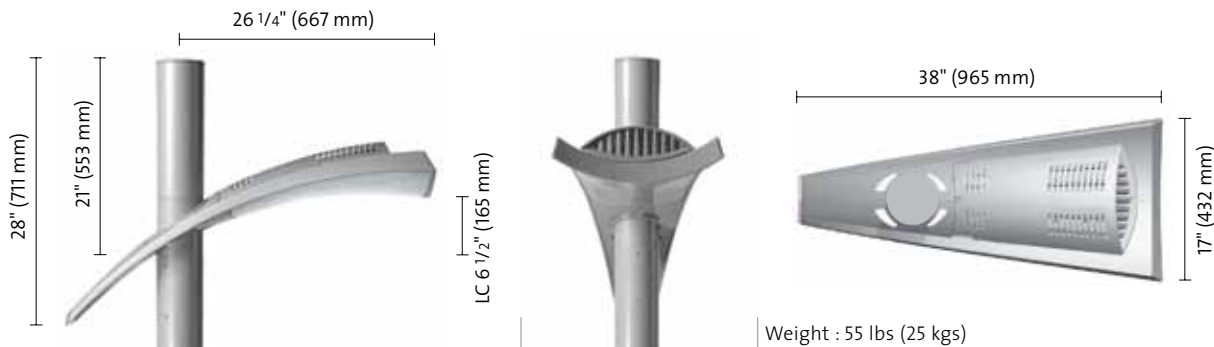
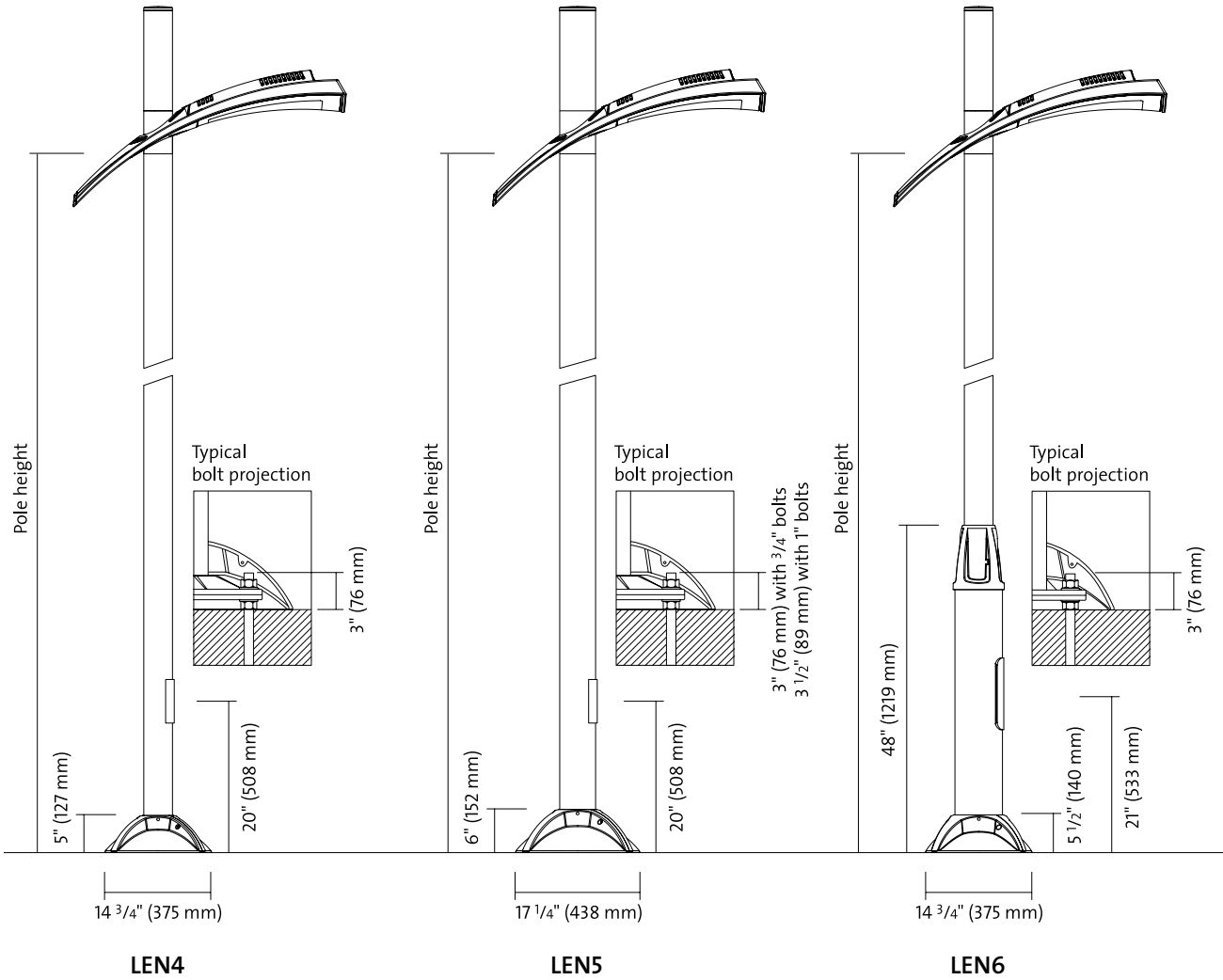
LEONIS

SERIES



LUMINAIRES / LED

Conforme aux normes UL 1598 et CSA C22.2 n° 250.0-08.

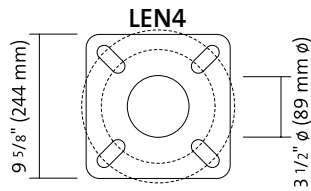


OPTIONAL
DECORATIVE
LUMINOUS
ELEMENT



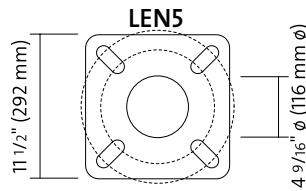
Philips Lumec se réserve le droit d'apporter des modifications aux caractéristiques de ses produits dans le cadre de son programme permanent de développement, et ce, sans préavis. Pour la dernière mise à jour, consultez www.lumec.com.

ANCHOR PLATES



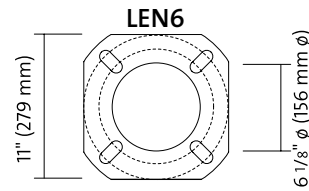
ALUMINUM
Bolt circle : 8 1/2" (216 mm)
B.C. from : 6 3/4" to 10" (171 to 254 mm)
Anchor bolts :
 3/4" - 20" (19 - 508 mm)

STEEL (S)
Bolt circle : 8 1/2" (216 mm)
B.C. from : 6 3/4" to 10 1/2" (171 to 267 mm)
Anchor bolts :
 3/4" - 20" (19 - 508 mm)



ALUMINUM
Bolt circle : 12 1/2" (318 mm)
B.C. from : 9 1/4" to 12 3/4" (235 to 324 mm)
Anchor bolts :
 3/4" - 20" (19 - 508 mm)

STEEL (S)
Bolt circle : 12 1/2" (318 mm)
B.C. from (BLN 3/4") : 8" to 12 1/2" (203 to 324 mm)
B.C. from (BLN 1") : 8" to 12 7/8" (203 to 327 mm)
Anchor bolts :
 1" - 36" (25 - 914 mm)



ALUMINUM
Bolt circle : 10 1/2" (267 mm)
B.C. from : 8 3/4" to 11" (222 to 279 mm)
Anchor bolts :
 3/4" - 20" (19 - 508 mm)

STEEL (S)
Bolt circle : 10 1/2" (267 mm)
B.C. from : 8 3/4" to 11 1/8" (222 to 283 mm)
Anchor bolts :
 3/4" - 20" (19 - 508 mm)

LEN4 / LED

Wind speed (mph)	Maximum pole height (ft.)	
	ALUMINUM	STEEL (S)
90	18	20
110	18	20
120	18	20
150	16	20

LEN5 / LED

Wind speed (mph)	Maximum pole height (ft.)	
	ALUMINUM	STEEL (S)
90	20	22
110	20	22
120	20	22
150	20	22

LEN6 / LED

Wind speed (mph)	Maximum pole height (ft.)	
	ALUMINUM	STEEL (S)
90	20	22
110	20	22
120	20	22
150	20	22

SPECIFICATIONS

Lens

Tempered soda lime etched glass lens, permanently sealed onto the lower housing.

Lamp (included) see photometric section at the end of document

3500, 5000 or 6300 Lumens LED (light emitting diode) package (40,65 or 90 Watt). Composed of 49 High intensity white LEDs 4000K +/-300K with a CRI of 70, operating 70 000 hours after which 50% still have over 70% original lumen output. Supplied with a minimum of 100 lumens per watt LED technology.

Light engine the LifeLED is composed of 3 main components :

Optical system : (IP66) has an individual pre oriented lens to achieve desired distribution.

Upper housing : Made of gravity die cast 356 aluminum alloy c/w an extruded silicone gasket (duro 60 shore A) and a cast aluminum heat sink optimising the LEDs efficiency and life.

Driver

High power factor of 90%. Electronic driver with full range input 120V-277V, operating range 50 60 Hz. Lamp starting capacity -40F(-40C) degrees. Shall be rated by UL1310 for Class 2 operation with constant current output. Weathertightness rating IP66. Assembled on a unitized removable tray with quick disconnect plug.

Housing

The lower housing is made of gravity die cast 356 Aluminum alloy 0.180" (4.6 mm) minimum thickness. Welded to the luminaire central adaptor.

Luminaire Options

Luminous decorative element integrating light emitting diodes (LED). Powered by an independant driver.

Luminaire Central Adaptor

Made of aluminum 6061 T6, 4" (102 mm) (LEN4 / LEN6) or 5" (127 mm) (LEN5) outside diameter, complete with a tenon penetrating 9" (229 mm) inside the pole. The tenon shall be mechanically fastened to the pole by two sets of three set screws at 120 degrees around the pole.

*LEN4 pole shaft

Made from a 4" (102 mm) round extruded 6061 T6 aluminum tubing, having a 0.226" (5.7 mm) wall thickness, welded to both the bottom and top of the anchor plate.

SPECIFICATIONS (continued)

*LEN5 pole shaft

Made from a 5" (127 mm) round extruded 6061 T6 aluminum tubing, having a 0.219" (5.6 mm) wall thickness, welded to both the bottom and top of the anchor plate.

*LEN6 pole shaft

Made from a one piece, seamless 4" round (102 mm) tube of extruded-aluminum welded over and in a 6 5/8" round (168 mm) extruded-aluminum pole base. The assembly is welded to both the top and bottom of a cast-aluminum anchor plate.

Maintenance Opening

2" x 4 1/2" (51 mm x 114 mm) (LEN4 / LEN5) or 4 1/2" x 10" (114 mm x 254 mm) (LEN6) maintenance opening centered 20" (508 mm) (LEN4 / LEN5) or 21" (533 mm) (LEN6) from the bottom of the anchor plate, complete with a weatherproof aluminum cover and a copper ground lug.

Base Cover

Two piece base cover made from cast 356 aluminum, mechanically fastened with stainless steel screws.

Finish

"Hot dip" chemical etching preparation. Lumital™ polyester powder coat finish. Excellent color retention as per #ASTM D2244, and outstanding salt-spray resistance according to #ASTM D2247 testing procedures.

Note

EPA recommendations are calculated according to AASHTO 2001 standards.

* **steel pole also available with the option (5).**

ORDERING INFORMATION

PRODUCT	LAMP ⁵	OPTIC	VOLTAGE	LUMINAIRE OPTIONS	LEN4	LEN5	LEN6	POLE OPTIONS	FINISH ³		
					POLE HEIGHT ²						
LEN4	40W49LED4K	2	120	LEDA (amber) ^{1,4}	8 to 20	8 to 22	8 to 22	PH (photocell)	BE2/TX	GN/TX	RD4/TX
LEN5	65W49LED4K	3	208	LEDB (blue) ^{1,4}					BE6/TX	GN4/TX	WH/TX
LEN6	90W49LED4K	4	240	LEDG (green) ^{1,4}					BE8/TX	GN6/TX	NP
		5	277	LEDR (red) ^{1,4}					BG2/TX	GN8/TX	TG
			347 ⁶	LEDW (white) ¹					BK/TX	GY3/TX	TS
			480 ^{6,7}						BR/TX	RD2/TX	

¹ Unselected option : offered without decorative illumination.

² Pole height is in 6 inches increments.

³ Consult Philips Lumec's color chart.

⁴ See LED visual effects towards the end of document.

⁵ See more LED lamps details towards the end of document.

⁶ Not available with 40W49LED4K and 65W49LED4K lamps.

⁷ Decorative luminous element not available with this voltage.

ORDERING SAMPLE

PRODUCT	LAMP	OPTIC	VOLTAGE	LUMINAIRE OPTION	POLE HEIGHT	POLE OPTIONS	FINISH
LEN5	65W49LED4K	2	208	LEDB	16	—	NP

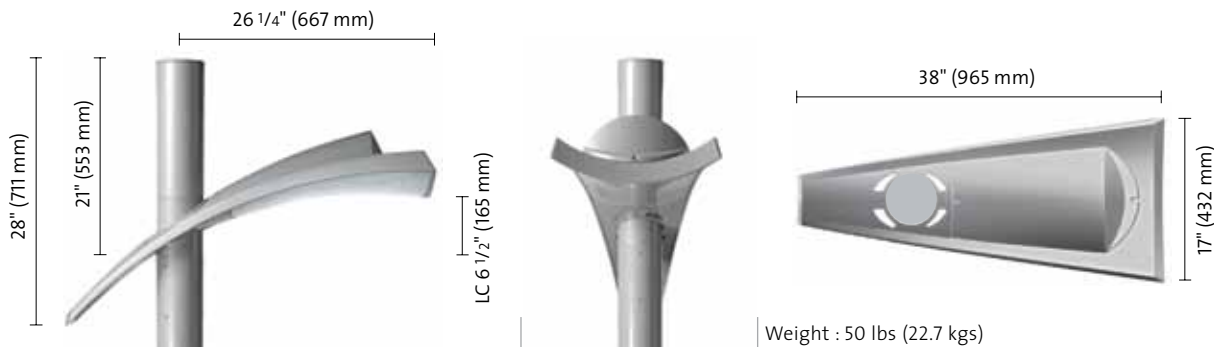
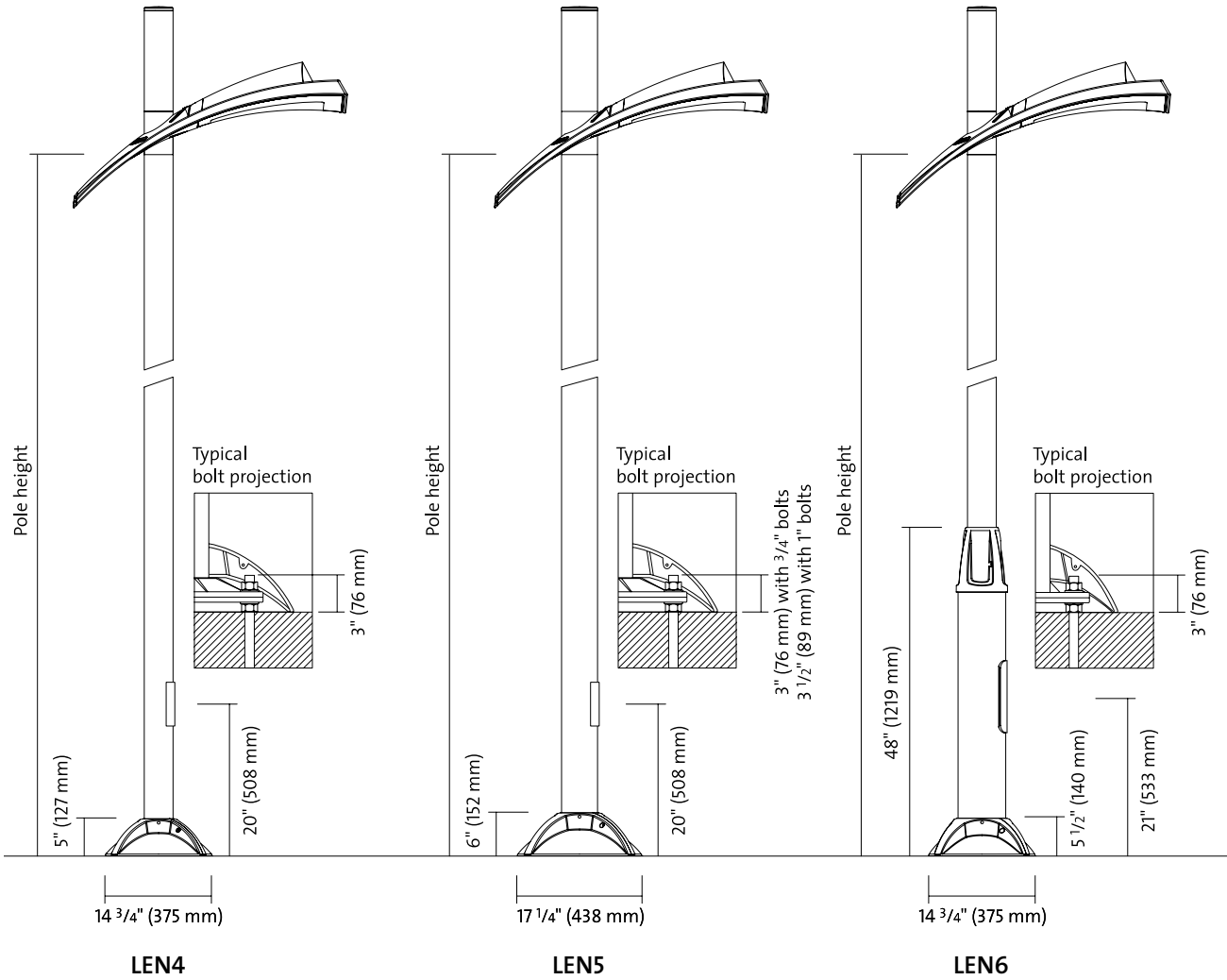
LEONIS

SERIES



LUMINAIRES / HID

Conforme aux normes UL 1598 et CSA C22.2 n° 250.0-08.

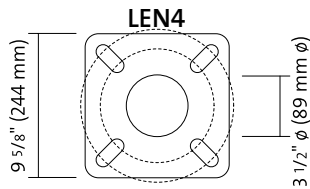


OPTIONAL
DECORATIVE
LUMINOUS
ELEMENT



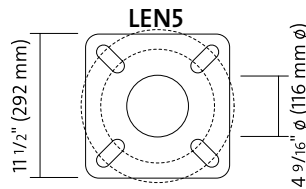
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ANCHOR PLATES



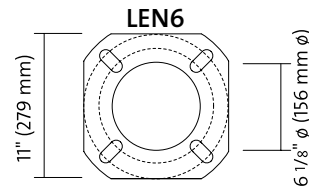
ALUMINUM
Bolt circle : 8 1/2" (216 mm)
B.C. from : 6 3/4" to 10" (171 to 254 mm)
Anchor bolts :
 3/4" - 20" (19 - 508 mm)

STEEL (S)
Bolt circle : 8 1/2" (216 mm)
B.C. from : 6 3/4" to 10 1/2" (171 to 267 mm)
Anchor bolts :
 3/4" - 20" (19 - 508 mm)



ALUMINUM
Bolt circle : 12 1/2" (318 mm)
B.C. from : 9 1/4" to 12 3/4" (235 to 324 mm)
Anchor bolts :
 3/4" - 20" (19 - 508 mm)

STEEL (S)
Bolt circle : 12 1/2" (318 mm)
B.C. from (BLN 3/4") : 8" to 12 1/2" (203 to 324 mm)
B.C. from (BLN 1") : 8" to 12 7/8" (203 to 327 mm)
Anchor bolts :
 1" - 36" (25 - 914 mm)



ALUMINUM
Bolt circle : 10 1/2" (267 mm)
B.C. from : 8 3/4" to 11" (222 to 279 mm)
Anchor bolts :
 3/4" - 20" (19 - 508 mm)

STEEL (S)
Bolt circle : 10 1/2" (267 mm)
B.C. from : 8 3/4" to 11 1/8" (222 to 283 mm)
Anchor bolts :
 3/4" - 20" (19 - 508 mm)

LEN4 / HID

Wind speed (mph)	Maximum pole height (ft.)	
	ALUMINUM	STEEL (S)
90	18	20
110	18	20
120	18	20
150	16	20

LEN5 / HID

Wind speed (mph)	Maximum pole height (ft.)	
	ALUMINUM	STEEL (S)
90	20	22
110	20	22
120	20	22
150	20	22

LEN6 / HID

Wind speed (mph)	Maximum pole height (ft.)	
	ALUMINUM	STEEL (S)
90	20	22
110	20	22
120	20	22
150	20	22

SPECIFICATIONS

Lens

Tempered soda lime etched glass lens, permanently sealed onto the lower housing.

Optical system: Smartseal™ System (IP66) composed of 2 main components :

Upper housing: Made of gravity die cast 356 aluminum alloy c/w an extruded silicone gasket (duro 60 shore A).

Multi faceted reflector: Made of hydroformed 3002-0 aluminum alloy chemically brightened and anodized (5 micron min).

Ballast

High power factor of 90%. Lamp starting capacity 20°F (30°C) degrees. Assembled on a unitized removable tray with quick disconnect plug.

Housing

The lower housing is made of gravity die cast 356 Aluminum alloy 0.180" (4.6 mm) minimum thickness. Welded to the luminaire central adaptor.

Luminaire Options

Luminous decorative element integrating light emitting diodes (LED). Powered by an independant driver.

Luminaire Central Adaptor

Made of aluminum 6061 T6, 4" (102 mm) (LEN4 / LEN6) or 5" (127 mm) (LEN5) outside diameter, complete with a tenon penetrating 9" (229 mm) inside the pole. The tenon shall be mechanically fastened to the pole by two sets of three set screws at 120 degrees around the pole.

*LEN4 pole shaft

Made from a 4" (102 mm) round extruded 6061 T6 aluminum tubing, having a 0.226" (5.7 mm) wall thickness, welded to both the bottom and top of the anchor plate.

*LEN5 pole shaft

Made from a 5" (127 mm) round extruded 6061 T6 aluminum tubing, having a 0.219" (5.6 mm) wall thickness, welded to both the bottom and top of the anchor plate.

*LEN6 pole shaft

Made from a one piece, seamless 4" round (102 mm) tube of extruded-aluminum welded over and in a 6 5/8" round (168 mm) extruded-aluminum pole base. The assembly is welded to both the top and bottom of a cast-aluminum anchor plate.

Maintenance Opening

Philips Lumec se réserve le droit d'apporter des modifications aux caractéristiques de ses produits dans le cadre de son programme permanent de développement, et ce, sans préavis. Pour la dernière mise à jour, consultez www.lumec.com.

SPECIFICATIONS (continued)

2" x 4 1/2" (51 mm x 114 mm) (LEN4 / LENS5) or 4 1/2" x 10" (114 mm x 254 mm) (LEN6) maintenance opening centered 20" (508 mm) (LEN4 / LENS5) or 21" (533 mm) (LEN6) from the bottom of the anchor plate, complete with a weatherproof aluminum cover and a copper ground lug.

Base Cover

Two piece base cover made from cast 356 aluminum, mechanically fastened with stainless steel screws.

Finish

"Hot dip" chemical etching preparation. Lumital™ polyester powder coat finish. Excellent color retention as per #ASTM D2244, and outstanding salt-spray resistance according to #ASTM D2247 testing procedures.

Note

EPA recommendations are calculated according to AASHTO 2001 standards.

* *steel pole also available with the option (S).*

ORDERING INFORMATION

PRODUCT	LAMP	REFLECTOR	VOLTAGE	LUMINAIRE OPTIONS	LEN4	LEN5	LEN6	POLE OPTIONS	FINISH ¹	
					POLE HEIGHT ³					
LEN5 LEN6	50MH 50HPS	2H 4H	120	LEDA (amber) ¹ LEDB (blue) ¹ LEDG (green) ¹ LEDR (red) ¹ LEDW (white) ¹	8 to 20	8 to 22	8 to 22	PH (photocell) S (steel)	BE2/TX	RD4/TX
	70MH 70HPS		208						BE6/TX	WH/TX
	100MH 100HPS		240						BE8/TX	NP
	150MH 150HPS		277						BG2/TX	TG
	35HPS		347 ⁴						BK/TX	TS
LEN4 LEN5 LEN6	18CF 26CF 32CF 42CF	4H		HS (house shield)				BR/TX	GN8/TX	
LEN5	60 CW							240	GN/TX	GY3/TX
	90CW							277	GN4/TX	RD2/TX
	140CW								GN6/TX	

¹ Unselected option : offered without decorative illumination.

² Pole height is in 6 inches increments.

³ Consult Philips Lumec's color chart.

⁴ 347 Voltage not available for LEN4.

> Medium base socket / ED17 lamp for HID (lamp not included).

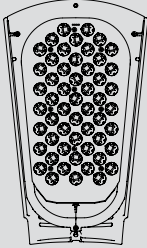
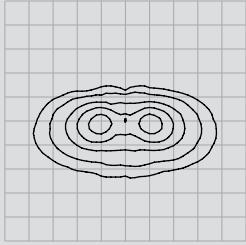
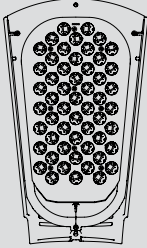
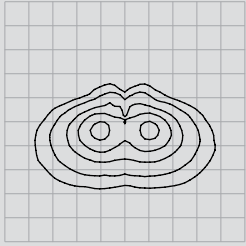
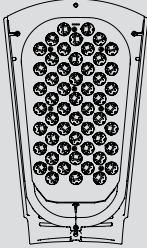
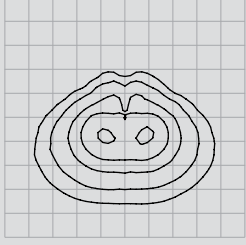
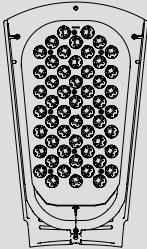
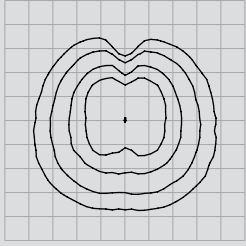
> Socket: GX24Q-2 (18W), GX24Q-3 (26W)(32W), GX24Q-4 (42W), triple tube for compact fluorescent (lamp not included).

ORDERING SAMPLE

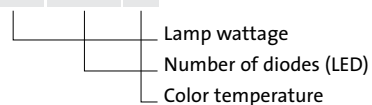
PRODUCT	LAMP	REFLECTOR	VOLTAGE	LUMINAIRE OPTIONS	POLE HEIGHT	POLE OPTIONS	FINISH
LEN5	100MH	2H	120	LEDW	20	S	NP

PHOTOMETRY

LED: High-Intensity Light-Emitting Diode

<p>2</p> <p>Type II Asymmetrical distribution spreads light forward and on both sides.</p> <p>Recommended applications</p> <ul style="list-style-type: none"> > Pedestrian walkway/bicycle path > Building entryway > Narrow roadway > Interior and exterior pedestrian malls 		<p>> 2</p> 
<p>3</p> <p>Type III Asymmetrical distribution spreads light forward and on both sides.</p> <p>Recommended applications</p> <ul style="list-style-type: none"> > Pedestrian walkway/bicycle path > Building entryway > Narrow roadway > Interior and exterior pedestrian malls 		<p>> 3</p> 
<p>4</p> <p>Type IV Asymmetrical distribution spreads light forward.</p> <p>Recommended applications</p> <ul style="list-style-type: none"> > Parking lot > Interior and exterior pedestrian malls > Building perimeter (security) > Roadway 		<p>> 4</p> 
<p>5</p> <p>Type V Symmetrical distribution spreads light in a square pattern.</p> <p>Recommended applications</p> <ul style="list-style-type: none"> > Middle of parking lot > Interior and exterior pedestrian malls > Building entryway > Parks 		<p>> 5</p> 

LAMP CODE DEFINITION / 40W 49LED 4K



LAMP	RATED LIFE HRS ¹	INITIAL LUMENS	CRI	COLOR TEMPERATURE ²	WATTAGE	
					LAMP	SYSTEM ³
40W49LED4K	70000	4600	70	4000K	42	47
65W49LED4K	70000	5890	70	4000K	65	72
90W49LED4K	70000	6860	70	4000K	90	102

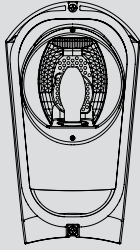
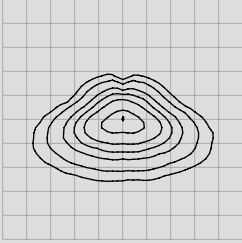
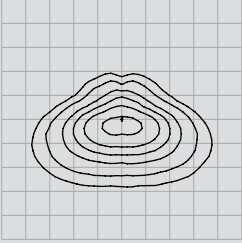
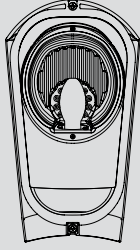
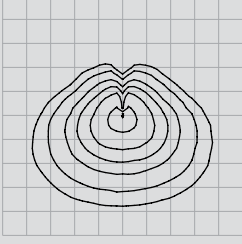
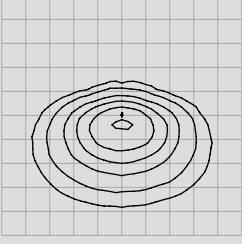
¹ Rated life represents the time it takes for the LED system to reach 70% of initial lumen output.

² On average.

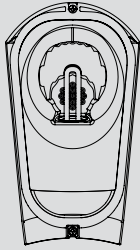
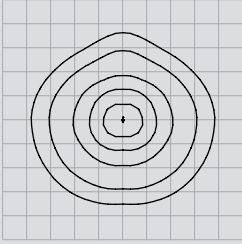
³ System wattage includes the lamp and the LED driver.

> Lamp lumen depreciation factor : 85%

HID: High-Intensity Discharge Sources

<p>2H</p> <p>Type II Asymmetrical distribution spreads light forward and on both sides.</p> <p>Recommended applications</p> <ul style="list-style-type: none"> > Pedestrian walkway/bicycle path > Building entryway > Narrow roadway > Interior and exterior pedestrian malls 		<p>> 2H</p> 	<p>> 2HS</p> 
<p>4H</p> <p>Type IV Asymmetrical distribution spreads light forward.</p> <p>Recommended applications</p> <ul style="list-style-type: none"> > Parking lot > Interior and exterior pedestrian malls > Building perimeter (security) > Roadway 		<p>> 4H</p> 	<p>> 4HS</p> 

Compact Fluorescent

<p>4H</p> <p>Type IV Asymmetrical distribution spreads light forward.</p> <p>Recommended applications</p> <ul style="list-style-type: none"> > Interior and exterior pedestrian malls > Building entryway > Entry hall and drop-off area 		<p>>4H</p> 
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LUMINAIRE > LENS



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/ Some luminaires use fluorescent or high intensity discharge (HID) lamps that contain small amounts of mercury. Such lamps are labeled "Contains Mercury" and/or with the symbol "Hg." Lamps that contain mercury must be disposed of in accordance with local requirements. Information regarding lamp recycling and disposal can be found at www.lamprecycle.org



The choice to not print paper brochures anymore but to make them available on-line is an example of the positive environmental actions that Philips Lumec has decided to undertake. This not only considerably reduces our paper consumption but also guarantees the exactitude of the information our clients receive.

Architectural Downlighting

OM8LED 3000
8" LED 3000 Lumen
Open Wall Wash



Specifier's Reference

Project
Type
Model No.
Comments

application

- Philips Omega Revelation LED wall wash downlight utilizes proprietary remote phosphor technology to produce one of the most efficient and advanced LED systems available for general illumination. Wall washing provides uniform light distribution which are ideal for office, retail, hospitality, commercial and institutional applications.

light engine

- Philips Omega mixing chamber/optical assembly: Remote phosphor technology provides increased efficiency and color stability by redirecting back reflected light. Phosphor lens assembly converts high brightness blue light into white light for an even, diffused pattern, eliminating bright spots often created by individual LEDs. This technology provides consistent, stable color with CCT color control of +/- 100K over the life of the light engine and provides 20% higher efficiency.
- LED Array: The LED Array consists of a metal core circuit board with 22 high brightness royal blue LEDs.
- Color: Available in three CCT options, 3000K, 3500K or 4000K with 80CRI +/-2%.
- Electrical: The LED power supply/ driver by Advance Xitanium is available 120VAC or 277VAC, 60Hz with an overload and short circuit protected feature and it is thermally regulated to prevent overheating. 120VAC dedicated driver provides both 0-10V analog and (ELV) Trailing Edge dimming capabilities. 277VAC provides standard 0-10V analog dimming. Driver has a rated lifetime of 50,000 hours. Refer to 0-10V dimming capability spec sheet on www.omegalighting.com for complete details.
- Lifetime/Lumen Maintenance: 50,000 hour lifetime at 70% lumen maintenance light engine.

tabs to properly position with the housing. Rust resistant springs are used to secure the reflector to the light engine. Fixtures should not operated or exceed ambient temperature above 40°C.

- Housing: Precision die stamped 18ga galvanized steel mounting pan and yoke assembly. Allows for ceiling thickness up to 1-3/8". Yoke supports weight of heat sink and light engine assembly to prevent stress on finished reflector.
- Reflector: The lower trim is die-formed of 0.40 low iridescent aluminum and is self-flanged with a variety of finishes available. White flange is standard. Optional polished flange matching trim finish is available, add FF to the catalog number. Optics are designed to provide a 50° visual and reflective cutoff.
- C-Channels: Philips Omega Revelation C-Channels are included and provide vertical and horizontal adjustments. These allow for fast and adjustment free installation in T-bar ceilings with 1/2" tile. C-Channels simply snap on grid for proper alignment in 24" O.C. grid systems.
- Junction Box: 16 ga galvanized steel. UL listed for 8 No. 12 AWG, 90C through branch circuit conductors. Allows inspection below ceiling.
- Service: Modular construction allows for easy maintenance of complete system below ceiling. Removing reflector provides easy access to heat sink and light engine assembly. This assembly may be removed by de-pressing the springs which attach to the yoke and then simply opening protective cover and unplugging the push in connector from the LED board.

listings & warranty

- ETL, cUL Listed. (Suitable for wet location applications.)
- LED life calculations are based upon application junction temperatures an driver currents at or below IESNA - LM-80-08 manufacturer's test data. IES test performed per IESNA - LM-79-08.
- 5 year Warranty



construction

- Thermal Management: A proprietary die-cast aluminum heat sink allows for easy and tool-less installation to the housing yoke. The heat sink is designed to properly maintain junction temperatures in recessed Non-IC applications to provide reliable performance over the life of the light engine. The heat sink incorporates alignment

Green Choice: OM8LED53120-R8LED5330KWWCS

HOUSING

OM8LED	53	Voltage	Option
Family	Wattage	120 – 120 VAC 50/60Hz 277 – 277 VAC 50/60Hz 347 – Stepdown (347:120/277)	EM – Bodine BSL17C Emergency Back-up ¹
OM8LED – 8 inch Housing	53 – 53 watts input watts (3000 lumens)		

LIGHT ENGINE - REFLECTOR

R8LED	53	CCT	Reflector Finish
Omega Reflector	Wattage	30K – 3000K 35K – 3500K 40K – 4000K	CS – Clear Specular CSS – Clear Semi-Specular HZ – Haze GS – Gold Specular WT – Wheat PW – Pewter BZ – Bronze WH – White, Paint FF – Finish Flange (as suffix to color)
R8LED – 8" Reflector	53 – 53 watts input watts (3000 lumens)		
			Distribution
			WW – Wall Wash

Footnotes

1. Delivered lumen output in emergency mode ranges from 500-550 lumens.

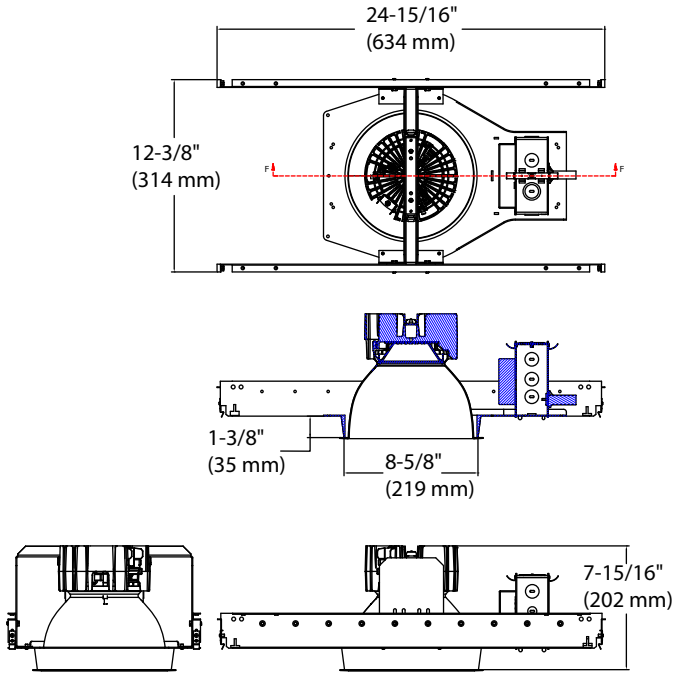
General Notes

Lumen output varies depending on CCT.
Refer to specific IES files for details.

Input Voltage	Input Current	Drive Current	Input* Power	LED Power	THD %	Power Factor
120	0.442	700mA	53	50	20%	>0.9
277	0.191	700mA	53	50	20%	>0.9

* +/-5%

dimensions



photometrics

OM8LED53120-R8LED5335KWWCS

Tested to LM-79 standards.

Wall Washer with Clear Reflector

Source: (1) 22 Royal Blue LEDs

Reflectances: 80% ceiling, 50% walls, 20% floor

IES File: 30292.IES

Distance from ceiling (ft)	3' from wall, 3' on center		3' from wall, 4' on center		2'-6" from wall, 3' on center	
	Below Fixtures	Between Fixtures	Below Fixtures	Between Fixtures	Below Fixtures	Between Fixtures
1	54.0	55.0	49.0	36.0	77.0	66.0
2	78.0	79.0	66.0	54.0	72.0	76.0
3	41.0	40.0	35.0	29.0	47.0	44.0
4	41.0	42.0	33.0	33.0	56.0	53.0
5	48.0	47.0	39.0	36.0	55.0	59.0
6	47.0	49.0	37.0	38.0	51.0	51.0
7	46.0	44.0	34.0	36.0	46.0	43.0
8	41.0	40.0	33.0	32.0	39.0	39.0
9	37.0	36.0	30.0	29.0	35.0	35.0



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189 Bullock Drive • Markham, Ontario L3P 1W4
p. 905.294.9570 • f. 905.294.9811

Contact Factory for Additional Configurations.
Specifications are subject to change without notice.



Some luminaires use fluorescent or high intensity discharge (HID) lamps that contain small amounts of mercury. Such lamps are labeled, "Contain Mercury" and/or the symbol "HG". Lamps that contain mercury must be disposed of in accordance with local requirements. Information regarding lamp recycling and disposal can be found at www.lamprecycle.org

LED - Dimming Compatibility

LED 0 -10V Dimming

CAT. NO:

TYPE:	PROJECT:
-------	----------

PRODUCT INFORMATION

1.0-10V Dimming Driver: The Philips Advance 0-10V series of LED dimming drivers offer maximum versatility with low voltage dimming. These drivers allow for flicker free continuous dimming from 100-10%.

Philips Omega is providing the following information as a convenience to assist in developing dimming systems. The manufacturers provided spelling of the company name, their phone number or numbers, part numbers and the function of the device or devices. Philips Omega does not warrant or guarantee the correctness or accuracy of this control compatibility guide. The user is advised to consult the control manufacturer to ascertain and verify that the control selected is the appropriate and correct choice for the user's requirements.

CONTROL MANUFACTURER	DIMMER	POWER BOOSTER AVAILABLE
Crestron Electronics, Inc.	CLS-EXP-DIMFLV GLX-DIMFLV8 GLXP-DIMFLV8 DIN-4DIMFLV4	N/A
Douglas Lighting Controls	WPC-5721	N/A
Entertainment Technology	Tap Glide TG600FAM120(120V) Tap Glide Heatsink TGH1500FAM120(120V) Oasis OA2000FAMU(120/277V)	N/A
Honeywell, Inc.	EL7315A1019 and EL7315A1009	EL7305A1010 (optional)
Hunt Dimming	Preset slide: PS-010-IV-120V and PS-010-WH-120V Preset slide: PS-010-3W-IV-120V and PS-010-WH-120V Preset slide: PS-010-IV-277V and PS-010-WH-277V Preset slide: PS-010-3W-IV-277V and PS-010-WH-277V Preset slide, controls FD-010:PS-IFC-010-IV- and PS-IFC-010-WH-120/277V Preset slide, controls FD-010:PS-IFC-010-3W-IV- and PS-IFC-010-3W-WH-120/277V Remote mounted unit: FD-010-120V and FD-010-277V	N/A
Lehigh Electric Products Co.	Solitaire	PBX
Leviton Lighting Controls Division	Leviton Centura Fluorescent Control System IllumaTech™ IP7 Series	CN100 PE300
Lightolier Controls	Sunrise Preset Slider ZP600FAM120 (120V) Momentum Preset Slider MP1500FAM120 (120V) Vega Slider V2000FAMU(120/277V)	N/A
Lithonia Controls	ISD BC SLD LPCS Digital Equinox (DEQ BC)	RDM FC
Lutron Electronics Co., Inc.	Visit www.lutron.com/advance for the latest control information and selection	N/A
PDM Electrical Products	WPC-5721	N/A
Starfield Controls	TR61 with DALI Interface port	RT03 DALInet Router
The Watt Stopper, Inc.	LS-4 used with LCD-101 and LCD-103	N/A

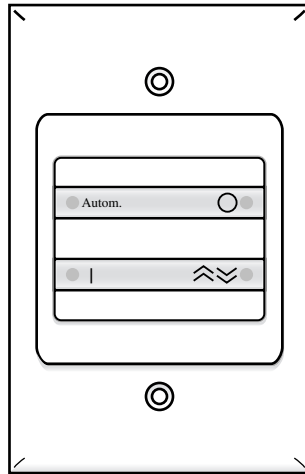
LS-4 Dimming Control Low Voltage Wall Switch

Specification

Supply Voltage 5 VDC

Description

The LS-4 is a dimming control low voltage wall switch designed to work with the LCD series of dimming controllers. The LS-4 provides the ability to override the LCD controller for manual light level adjustment.



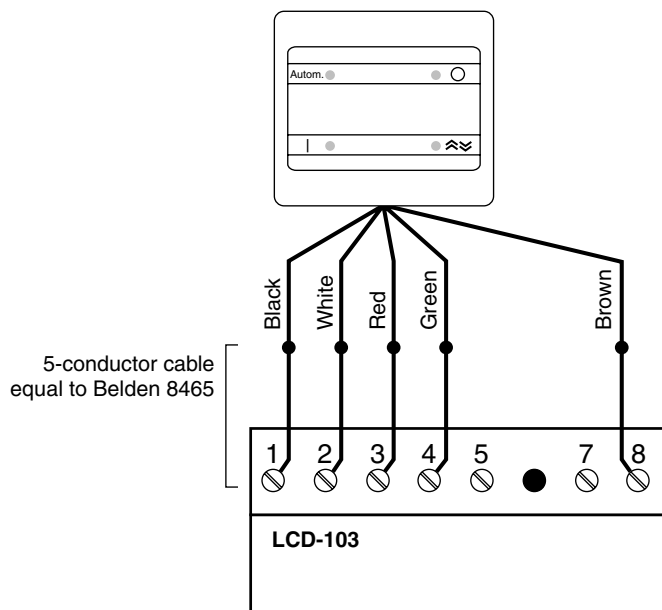
Wiring

Use 18AWG 5 conductor cable to connect the switch to the LCD controller. Use Belden 8465 or equal.

The maximum wire length from the control module is 150 feet.

Note: Low voltage wiring must be isolated from the line voltage wiring.

The LS-4 is supplied with color coded wire leads. Please follow the wiring diagram, below, to make wiring connections.



Operation

The LS-4 has 4 buttons and an LED indicator.

Automatic LED indicator

When the LED indicator is on, the controller is automatically dimming the lights. If the LED is off, the LCD controller is operating in the manual mode.

Automatic button

The upper left button switches the controller into automatic operation. Note that if the controller is already in automatic pressing this button does nothing.

Off button

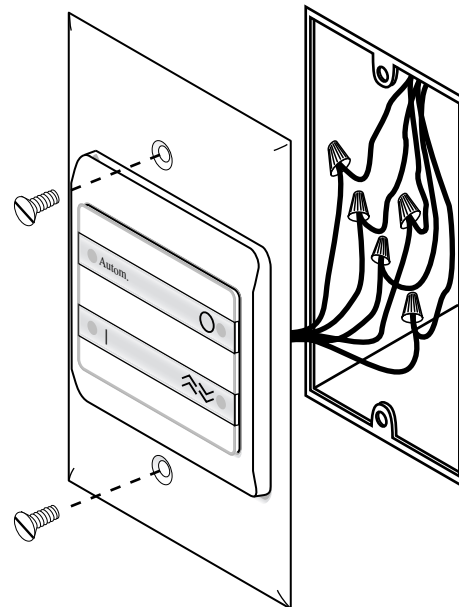
Pressing the upper right button dims the lights to a 0 VDC signal.

On button

Pressing the button at the bottom left corner sets the output signal to its full output. Note, continuing to press this button will cause the lights to dim.

Dimming button

The first time that the button at the bottom right corner is pressed, the output signal increases to the maximum level. Continuing to press the button will cause the signal to move through the dimming cycle, initially dimming the lights to the minimum and then beginning to increase the light level. When the button is released, the signal will stay at the light level present when the button was last pressed. If the button is pressed again within 30 seconds, it will continue to cycle as if it had been continuously pressed. After 30 seconds of inactivity, pressing the button will cause the LCD controller to re-initiate the dimming cycle.



REV.	DESCRIPTION	INT:	REV. DATE	APPROVED
1	ECO#xxxxxxx			

Installation Instructions



Technical Support:
1(800)879-8585 1(972)578-1699

xxxxxr1 8/00

MATERIAL: Paper, white, glossy
80# Book
FLAT (cut) SIZE: 5" W x 7" H
FOLDING: Quarter fold
INK COLOR: Black



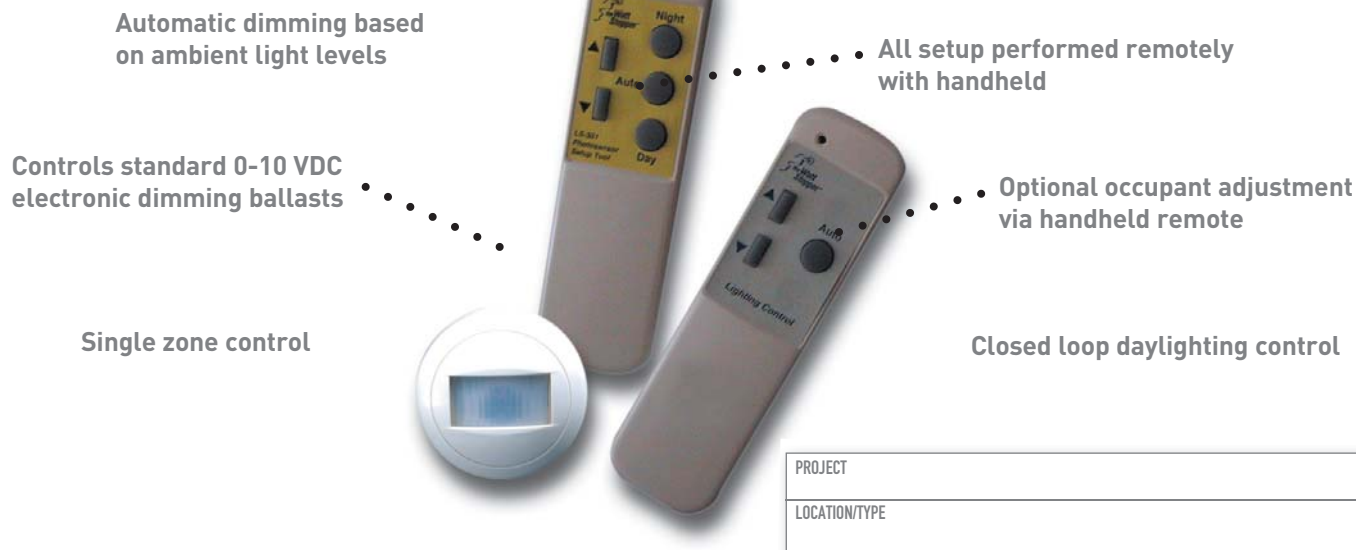
All information in this drawing is the property of The Watt Stopper Inc. and cannot be copied or used without the written approval of The Watt Stopper Inc.

DRAFT

Drawn by:	HUCKABONE	the Watt Stopper Inc.		
PLM:		SANTA CLARA, CALIFORNIA		
Project Engr:		Title: LS-150 Photocell series Installation Instructions		
MarComm Dir:				
Sheet: 1 of 1	Scale: 1 : 1	Drawing #:	Original Drwg. Date: 15 AUG 00	Rev #:
		xxxxx	Rev. Date: 15 AUG 00	d2



LightSaver® LS-301 Dimming Photosensor



Product Overview

Description

The LightSaver LS-301 is a closed loop, ceiling mount, low voltage indoor photosensor that works with standard, 0-10 VDC electronic dimming ballasts to dim lighting as daylight increases.

Operation

The LS-301 mounts on a ceiling and utilizes a spectral filtering system to measure daylight and electric light levels. A closed loop daylighting system, the LS-301 measures the total light level from daylight and electric light in the controlled area to adjust electric lighting levels. As the daylight contribution increases, the lights dim down. The photosensor utilizes sliding setpoint control, which responds to the different spatial distribution qualities of electric light and daylight. The LS-301 calculates the required light level for current daylight contribution based on two setpoints. One represents the target level when no daylight is present (night setpoint) and the other when significant daylight is present (day setpoint).

Features

- Provides precise control of lighting to maintain desired light level
- Extremely linear photocell response with greater than 1% accuracy
- Designed to measure light as the human eye perceives it, eliminating "overreporting" illumination levels provided by daylight
- California Title 24-2008 compliant
- Separate handheld remote controls for setup and occupant adjustment to prevent tampering
- Boosts energy savings by reducing maximum lamp output, often resulting in a 20% reduction or more compared with lights at full output
- Achieves lumen maintenance by holding target light level as lamp output decreases over time
- Qualifies for use on ARRA-funded public works projects

Adjustment via Handheld Remote Control

All LS-301 adjustments are made with one of two handheld remotes. The FDR-301-S provides five buttons for initial set-up, which is easily completed by first raising or lowering electric light levels to desired levels, then programming this target level into the photosensor. The LSR-301-P provides three buttons for occupants to adjust light levels. With this optional tool, users can increase target light levels by up to 25% or reduce them to the lamp/ballast minimum level. Pressing the "Auto" button returns the control to programmed levels.

Applications

The LS-301 is designed to blend into its surroundings when installed in any environment. It provides one zone of daylighting control in a private office or classroom. In these applications, the LS-301 can be combined with an occupancy sensor. Often, it is possible for the LS-301 to share a single power pack with occupancy sensor(s).

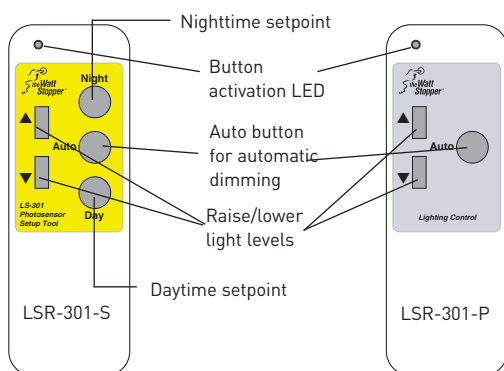


Specifications

- Full range dimming: .2 VDC (minimum) to 10 VDC (100% lighting) output voltage
- Current consumption: 30 mA @ 24 VDC
- In typical applications, setpoints are adjustable from 20-60 footcandles (210-640 lux)
- Controls up to 50 standard dimming ballasts in one zone
- Sensor leads: gray and violet to ballast, red and black to 24 VDC
- Dimensions: 2.35" diameter. x 0.875" depth (60mm x 22mm), threaded piece extends 1.25" (31.8mm) from back, fits .5" knockout
- Five year warranty

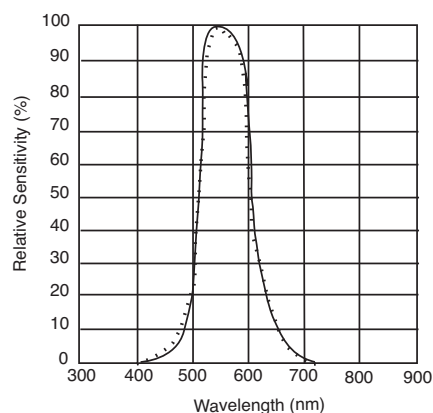
Product Controls

Remote Controls



Remote handheld (above left) enables easy set-up while optional occupant remote provides adjustability for individual lighting preferences.

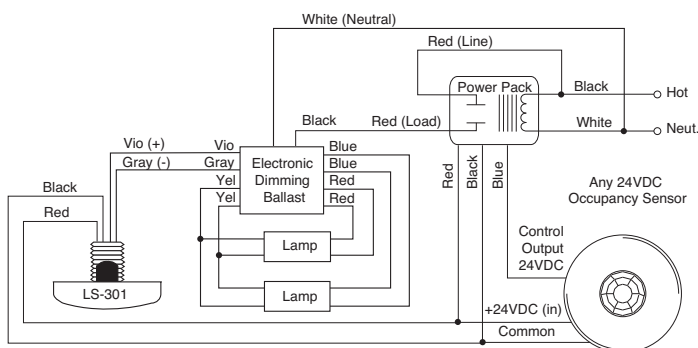
Spectral Response Curve



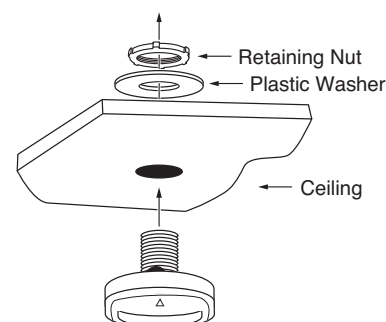
The spectral response of the LS-301 photocell closely matches the sensitivity of the human eye.

Wiring & Installation

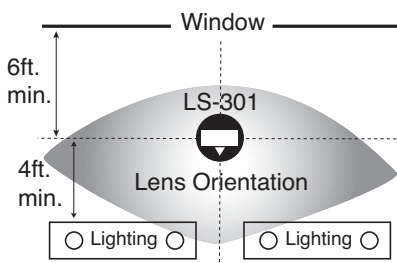
Wiring



Mounting and Installation



Coverage



Placement Guidelines

- Mount photocell between 6 and 12 feet (1.8m - 3.7m) from window.
- Do not mount directly above direct/indirect pendant fixtures. Mount at least 4 feet (1.2m) from pendant fixtures.

Ordering Information

Catalog No.	Description	Input Voltage
<input type="checkbox"/> LS-301	Dimming Photosensor	24 VDC
<input type="checkbox"/> LS-301-U	Dimming Photosensor, ARRA-compliant	24 VDC
<input type="checkbox"/> LS-301-FTA	Dimming Photosensor, ARRA-compliant (FTA exception)	24 VDC
<input type="checkbox"/> LSR-301-S	Setup Remote Control (2 AAA batteries included)	
<input type="checkbox"/> LSR-301-P	Occupant Remote Control (2 AAA batteries included)	

LS-301 works with WattStopper power packs

application

- Philips Omega Revelation LED Cylinders utilizes proprietary remote phosphor technology to produce one of the most efficient and advanced LED systems available for general illumination.

light engine

- Philips Omega mixing chamber/optical assembly: Remote phosphor technology provides increased efficiency and color stability by redirecting back reflected light. The phosphor lens assembly converts high brightness royal blue light into white light for an even diffused pattern, eliminating bright spots often created by individual LEDs. This technology provides consistent, stable color with CCT color control of +/- 100K over the life of the light engine and provides 20% higher efficiency.
- LED Array: The LED Array consist of a metal core circuit board with 22 high brightness royal blue LEDs.
- Color: Available in three CCT options, 3000K, 3500K or 4000K with 80CRI +/-2%. 70C maximum operating temperature, -20C minimum starting temperature.
- Electrical: The power supply/driver features Advance Intelli-volt 120-277VAC 50/60hz, standard dimming driver with 0-10V analog dimming capability. The power supply is overload and short circuit protected as well as thermally regulated to prevent overheating. Sound rating A. Refer to dimming compatibility spec sheet for complete details. Driver has rated lifetime of 50,000 hours. 70C maximum operating temperature, -20C minimum starting temperature.
- Lifetime/Lumen Maintenance: 50,000 hour lifetime at 70% lumen maintenance light engine. (L70)
- 2000 lumens is an average lumen value. Lumen values vary from 1900 to over 2450 lumens depending on kelvin temperature and reflector type.

construction

- Thermal Management: A proprietary die-cast aluminum heat sink allows for easy and tool-less installation to the housing yoke. The heat sink is designed to properly maintain junction temperatures to provide reliable performance over the life of the light engine. The heat sink incorporates alignment tabs to properly position with the housing. Rust resistant springs are used to secure the reflector to the light engine. Fixtures should not operated or exceed ambient temperature above 40°C.
- Housing: Extruded aluminum cylinder is painted textured white with baked polyester powder coat finish, UV stabilized.
- Reflector: Precision spun .050 aluminum reflectors are self flanged and snap to heat sink for consistent alignment to the optical assembly. Provides 50 degree visual cutoff to source and source image.
- Service: Modular construction allows for easy maintenance of complete system. Removing reflector provides easy access to heat sink and light engine assembly. This assembly may be removed by depressing the springs which attach to the yoke and then simply opening protective cover and unplugging push in connector from LED board.
- Aligning Canopy: Self aligning outlet box cover. Attaches to 3-1/4" or 4" octagon outlet box (by others). Allows for up to 45° adjustability for use with sloped ceilings or seismic requirements.

listings & warranty

- Approvals: ETL, cUL (Suitable for damp location. Must specify for wet location.)
- LED life calculations are based upon application junction temperatures an driver currents at or below IESNA - LM-80-08 manufacturer's test data. IES test performed per IESNA - LM-79-08.
- 5 year Warranty



Specifier's Reference

Project
Type
Model No.
Comments

Green Choice: OM6LED39PC30KMDCSU

OM6LED39

Family

OM6LED39 – 6 inch aperture

CCT

30K – 3000K
35K – 3500K
40K – 4000K

Product Family

SC – Surface Cylinder
WC – Wall Cylinder
PC – Pendant Cylinder²

Distribution

MD – Medium Distribution
WD – Wide Distribution

Reflector Finish

CS – Clear Specular
CSS – Clear Semi-Specular
HZ – Haze
GS – Gold Specular
WT – Wheat
PW – Pewter
BZ – Bronze
WH – White, Paint
FF – Finish Flange (as suffix to color)

Housing Finish

BLANK – White
BZ – Bronze
BK – Black
ALA – Aluminum

U

Supply Voltage

U – 120/277

Options

WL – Wet Location
EM – Emergency Remote Mount¹

Footnotes

- Not available on wall mounted version: Delivered lumen output in emergency mode ranges from 500-550 lumens.
- Pendant stem length is 21" standard, consult factory for other lengths.

General Notes

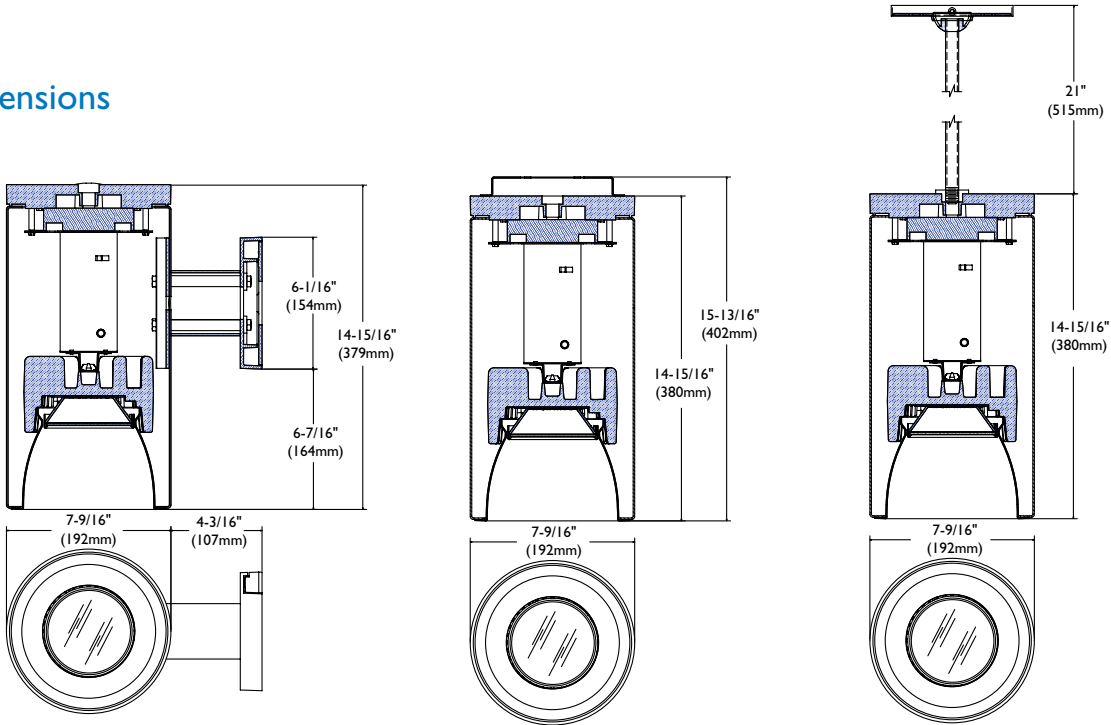
Lumen output varies depending on CCT and distribution. Refer to specific IES files for details.

energy data

2000 Lumen Package

Input Voltage	Input Current	Drive Current	Input Power	LED Power	THD %	Power Factor
120	0.36	520mA	39	35.4	10%	>0.9
277	0.17	520mA	39	35.4	10%	>0.9

dimensions



photometrics

OM6LED39PC30KMDCSU

Tested to LM-79 standards.

Clear Specular Reflector Test No. 28989D2 S/MH (0 degree plane) .86 Lamp Type (1) 22 Royal Blue LEDs Total Fixture Lumens 2102 IES File 28989D2.ies Input Watts 39 Beam Angle 59.30 Luminaire Efficacy 52.6 LPW		Candela Degrees At 0° At 90° Foot Lamberts			Lighting Performance Data Ceiling Height (feet) Initial Footcandles Beam Diameter (Ft/In)
		90 0 0	8 77.8 6 - 3		
		85 0 0	10 41.8 8 - 6		
		75 1 1	12 26.1 10 - 10		
		65 1 1	14 17.8 13 - 1		
		55 3 3	16 12.9 15 - 4		
		45 77 77			
		35 517 517			
		25 1978 1978			
		15 2194 2194			
5 2321 2321					
0 2352 2352					
Coefficients of Utilization				Lighting Performance Data Ceiling Height (feet) Initial Footcandles Beam Diameter (Ft/In)	
pcc pw RCR				80 70 50	
0 118 118 118 118 115 115					
1 113 111 109 107 111 109					
2 109 104 100 96 106 102					
3 103 96 93 89 101 95					
4 97 91 85 81 96 90					
5 93 85 80 76 92 84					
6 89 81 75 70 88 80					
7 84 76 70 66 83 76					
8 81 71 66 61 80 70					
9 77 68 63 58 76 68					
10 73 65 58 55 72 64					

OM6LED39PC30KWDCS

Tested to LM-79 standards.

Clear Specular Reflector Test No. 28990D2 S/MH (0 degree plane) 1.2 Lamp Type (1) 22 Royal Blue LEDs Total Fixture Lumens 2391 IES File 28990D2.ies Input Watts 39 Beam Angle 82.27 Luminaire Efficacy 59.8 LPW		Candela Degrees At 0° At 90° Foot Lamberts			Lighting Performance Data Ceiling Height (feet) Initial Footcandles Beam Diameter (Ft/In)
		90 0 0	8 49.6 9 - 7		
		85 0 0	10 26.7 13 - 1		
		75 1 1	12 16.6 16 - 7		
		65 2 2	14 11.3 20 - 1		
		55 8 8	16 8.2 23 - 7		
		45 310 310			
		35 1243 1243			
		25 1600 1600			
		15 1621 1621			
5 1502 1502					
0 1501 1501					
Coefficients of Utilization				Lighting Performance Data Ceiling Height (feet) Initial Footcandles Beam Diameter (Ft/In)	
pcc pw RCR				80 70 50	
0 118 118 118 118 115 115					
1 112 110 107 105 111 108					
2 107 102 96 93 105 100					
3 101 93 88 83 98 92					
4 94 86 80 76 93 84					
5 89 80 73 68 88 79					
6 83 73 68 63 81 72					
7 79 68 61 57 78 68					
8 75 64 56 53 72 63					
9 69 59 53 48 68 58					
10 66 56 48 45 65 55					



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NF Circuit Breaker Panelboards

Catalog
1670CT0701

2008
Class 1670



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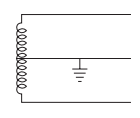
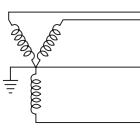
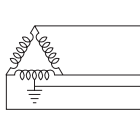
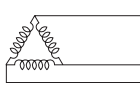
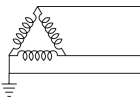
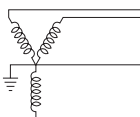
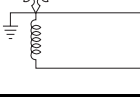
by Schneider Electric



NF Circuit Breaker Panelboards Standards and Ratings

Standards and Ratings

NF circuit breaker panelboards are for use on ac systems. They are UL[®] Listed under File E33139 and marked cULus. NF circuit breaker panelboards accept EDB, EGB, and EJB branch circuit breakers.

Voltage	System	System Diagram
120/240 Vac	1 ϕ 3W	
208Y/120 Vac	3 ϕ 4W	
240/120 Vac	3 ϕ 4W Delta	
240 Vac	3 ϕ 3W Delta	
240 Vac	3 ϕ 3W Grounded B ϕ Delta	
480Y/277 Vac	3 ϕ 4W	
600Y/347 Vac	3 ϕ 4W	

Standards

NF circuit breaker panelboards are designed, manufactured, and tested to comply with the following standards:

- UL 67—Standard for Panelboards
- UL 50—Enclosures for Electrical Equipment
- UL Listed Class CTL panelboard
- CSA C22.2, No. 29-M1989—Panelboards and Enclosed Panelboards
- CSA C22.2, No. 94-M91—Special Purpose Enclosures
- NEMA PB 1—Panelboards
- NFPA 70—National Electrical Code[®] (NEC[®])
- Federal Specification W-P-115C Type I Class 1—Circuit Breaker Panelboards
- 2003 IBC, NFPA 5000, ASCE/SE17—Seismic Qualification

Ratings

- Main lugs: 125–800 A
- Main circuit breaker: 125–600 A

NF Circuit Breaker Panelboards

Main Circuit Breakers

Main Circuit Breakers



HDL

- 125 A maximum field-installable EDB, EGB, or EJB (110 A max at 600Y/347 Vac)
- 100 A maximum field-installable FI
- 125 A maximum field-installable HDL, HGL, HJL, or HLL
- 250 A maximum field-installable JDL, JGL, JJL, or JLL
- 400 A maximum field-installable LAL or LHL
- 400 A or 600 A maximum factory-installed LCL or LIL (LCL is 480Y/277 Vac maximum)

Factory-Installed Circuit Breaker Accessories

FIL, HDL, HGL, HJL, HLL, JDL, JGL, JJL, JLL, and KIL circuit breakers are available with shunt trip, ground fault shunt trip, undervoltage trip, time delay, auxiliary switches, and alarm switches.



JDL

Table 1: Main Circuit Breaker Adapter Kits (Circuit Breaker Not Included)

Adapter Kit Catalog Number	Ampere Rating	Main Circuit Breaker ¹
N100MFI	20–100 A	FIL
N150MH ²	15–125 A ³	HDL, HGL, HJL, HLL
N250MJ	150–250 A	JDL, JGL, JJL, JLL
N250MKC	110–250 A	KIL
N400M	125–400 A	LAL, LHL

¹ Main circuit breakers are not included in the adapter kits. Order them separately.

² For single phase applications of HDL and HGL, select a 3-pole main circuit breaker. For single-phase applications of HJL and HLL, select a 2-pole main circuit breaker.

³ RTI kit accepts maximum 125 A H-frame circuit breaker.

NOTE: See “Main Circuit Breaker Terminal Data” on page 18.

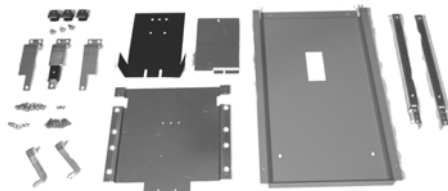
Field-Installable Circuit Breaker Accessories

Field-installable undervoltage release, alarm switch, shunt trip, and auxiliary contacts are available for LAL, LHL, LCL, and LIL 400 A main circuit breaker interiors.

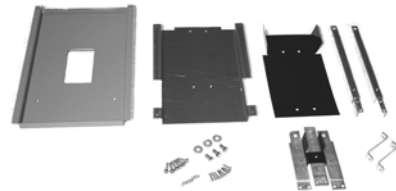
NOTE: See Supplemental Digest for additional accessories.



LAL



N250MJ Main Circuit Breaker Kit



N400M Main Circuit Breaker Kit

Branch Circuit Breakers (Bolt-on)



Table 2: Standard Branches, 600Y/347 Vac Maximum

Branch Prefix	Availability			Short Circuit Current Rating ¹	
	1-Pole	2-Pole	3-Pole	at 480Y/277 Vac	at 600Y/347 Vac
EDB	15-70 A	15-125 A ²	15-125 A ²	18,000 A	14,000 A
EGB	15-70 A	15-125 A ²	15-125 A ²	35,000 A	18,000 A
EJB	15-70 A	15-125 A ²	15-125 A ²	65,000 A	25,000 A

¹ Series ratings are also available.
In **Canada**: See Series Rating Guide (Data Bulletin #S1600PD0302EP).
In **USA**: See Switchboard/Panelboard Short Circuit Current Ratings (Data Bulletin #2700DB9901) or the Digest.
² 600Y/347 Vac is 110 A maximum.



Table 3: EPD Branches – 30 mA Ground Fault Equipment Protection Devices, 277 Vac Maximum

Branch Prefix	Availability 1-Pole ¹	Short Circuit Current Rating ² at 277 Vac
EDB-EPD	15-70A	18,000 A
EGB-EPD	15-70A	35,000 A
EJB-EPD	15-70A	65,000 A

¹ EPD branches are single-pole only, and require two pole spaces in the panelboard.
² Also available with series ratings.



Table 4: Standard and EPD Branches – Terminal Lug Data

Branch Circuit Breaker Prefix	Ampere Rating	Wire Size	
		Aluminum	Copper
EDB, EGB, EJB, EDB-EPD, EGB-EPD, EJB-EPD	15-30 A	#12 - #6	#14 - #6
	35-125 A	#12 - 2/0	#14 - 2/0

EDB Branch Circuit Breakers

NF Circuit Breaker Panelboards Interiors

Interiors

Main Lug Interiors



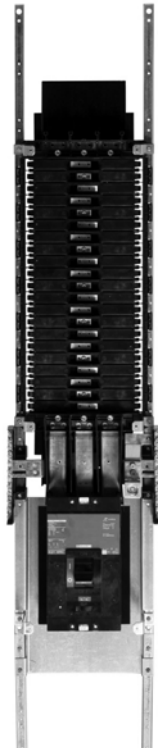
**250 A Maximum
Main Lugs Interior
(Deadfronts Installed)**

- Will accept bolt-on branch circuit breakers
- Top or bottom feed
- 65,000 A Short Circuit Current Rating (SCCR) maximum branch circuit breakers at 480Y/277 Vac
- 25,000 A SCCR maximum branch circuit breakers at 600Y/347 Vac
- Series rated to 200,000 A SCCR maximum when supplied by remote I-Limiter[®] circuit breaker at 480Y/277 Vac
- Series rated to 65,000 A SCCR maximum when supplied by remote I-Limiter circuit breaker at 600Y/347 Vac
- 125 A and 250 A interiors are suitable for use as cULus service entrance with back-fed EDB, EGB, or EJB circuit breakers
- Factory-installed main lugs on all interiors
- 125–400 A main lug interiors are convertible to main circuit breaker interiors by adding a main circuit breaker adapter kit and a main circuit breaker
- Several bus options:
 - Silver-plated copper or tin-plated aluminum bus (aluminum is standard)
 - Tin-plated copper bus is available as an option
 - 600 A and 800 A only available with copper
- Branch connector fingers are tin-plated copper
 - Silver-plated branch connector fingers are optional
- Line lugs are suitable for 75^o C copper or aluminum wire

Factory-Installed Options for Main Lugs and Main Breaker Interiors

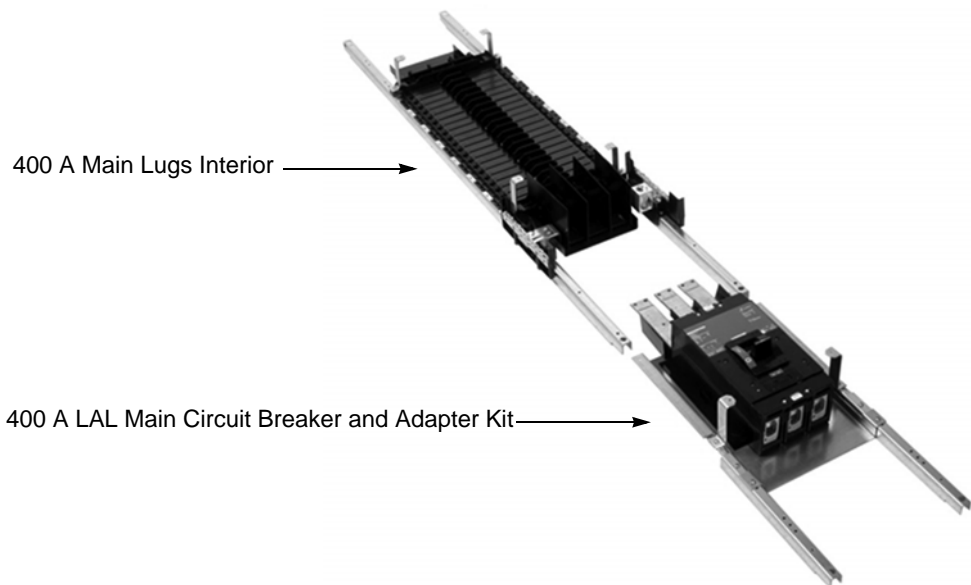
- Sub-Feed Lugs (on the Main)
NOTE: Only available on 1 ϕ or 3 ϕ , 125–800 A main lug interiors
- Feed-Through Lugs
NOTE: Available on 1 ϕ or 3 ϕ , 125–800 A main lug or 100–600 A main circuit breaker interiors
- Sub-Feed Circuit Breakers
NOTE: Available on 1 ϕ or 3 ϕ , 125–800 A main lug or 100–600 A main circuit breaker interiors
 - One sub-feed HDL, HGL, HJL, HLL, JDL, JGL, JJL, or JLL circuit breaker per 250 A panelboard
 - Two sub-feed HDL, HGL, HJL, HLL, JDL, JGL, JJL, or JLL circuit breakers per 400 A panelboard
 - One sub-feed LA, LH, LC, or LI circuit breaker (400 A maximum) and one HDL, HGL, HJL, HLL, JDL, JGL, JJL, or JLL circuit breaker, or two sub-feed HDL, HGL, HJL, HLL, JDL, JGL, JJL, or JLL circuit breakers per 600 A or 800 A panelboard**NOTE:** LC/LI circuit breakers cannot be combined with JJL or JLL circuit breakers
- Split bus
- Lighting contactors
- Compression lugs

Main Circuit Breaker Interiors



**400 A LAL
Main Circuit
Breaker Interior**

- Will accept bolt-on branch circuit breakers
- Suitable for use as UL service entrance (statement found on wiring label on back of deadfront); meets local electrical codes (CSA type service entrance available factory-assembled)
- Top or bottom feed
- 65 k AIR maximum branch circuit breakers at 480Y/277 Vac
- 25 K AIR maximum branch circuit breakers at 600Y/347 Vac
- Series rated to 200 k AIR maximum when supplied by remote I-Limiter circuit breaker at 480Y/277 Vac
- Series rated to 65 k AIR maximum when supplied by remote I-Limiter circuit breaker at 600Y/347 Vac
- Available with silver-plated copper or tin-plated aluminum bus (aluminum is standard). Tin-plated copper bus is available as an option; 600 A only available with copper
- Branch connector fingers are tin-plated copper; silver-plated branch connector fingers are optional
- 125 A at 480Y/277 Vac (110 A at 600Y/347 Vac) main circuit breaker interiors contain back-fed EDB, EGB, or EJB main circuit breakers
- 100–250 A main circuit breaker panelboards consist of:
 - Standard main lug interiors
 - Main circuit breaker adapter kit (N150MH, N100MFI, N250MKC, N250MJ)
 - Appropriate FIL, HDL, HGL, HJL, HLL, JDL, JGL, JLL, JLL, or KIL circuit breakers
 - Line lugs are suitable for 75° C copper or aluminum wire
- 400 A main circuit breaker panelboard consists of:
 - Standard main lug interior
 - Main circuit breaker adapter kit (N400M)
 - Appropriate LAL or LHL circuit breaker
 - Factory-installed LCL or LIL main circuit breaker with 8 in. (203 mm) deep enclosure (Type 1 only)
- 600 A main circuit breaker panelboard:
 - Factory-assembled only
 - Use LCL, LIL main circuit breakers
 - 8.75 in. (223 mm) deep enclosure (Type 1 only)



400 A Main Lugs Interior with 400 A Main Circuit Breaker and Adapter Kit

NF Circuit Breaker Panelboards Interiors



400 A Main Lug Interior with Sub-Feed Lugs



400 A Sub-Feed Main Lug Kits



Compression Lugs

Field-Installable Options

- Feed-Through Lug Kits
 - NF125FTL, NF250FTL, NF400FTL available for 125–400 A, 1 ϕ or 3 ϕ interiors
- Sub-Feed Circuit Breaker Kits
 - NF250SFBH allows a single sub-feed HDL, HGL, HJL, or HLL circuit breaker on 250 A interiors
 - NF250SFBJ allows a single sub-feed JDL, JGL, JJL, or JLL circuit breaker on 250 A interiors
 - NF600SFBH allows twin sub-feed HDL, HGL, HJL OR HLL circuit breaker on 400 A main lug or main circuit breaker interiors and 600A main lug interiors
 - N600SFBJ allows twin sub-feed JDL, JGL, JJL, or JLL circuit breakers on 400 A main lug or main circuit breaker interiors and 600 A main lug interiors

- Sub-Feed Lug Kits

Amperes	Catalog Number
125 A	NF125SFL
250 A	NF250SFL
400 A	NF400SFL

- 200% Neutral Kits

Amperes	Catalog Number
100 A	NFNL1
125 A	NFNL1
250 A	NFNL2
400 A	NFNL4 ¹

¹ 200% neutrals not available with FTL, SFL, or SFB.

- Copper 100% Kits

Copper 100% Amperes	Copper Neutral Kits Catalog Number
125 A	NFN1CU
250 A	NFN2CU
400 A	NFN6CU
600 A	NFN6CU ¹

¹ Not to be used with SFL, FTL, or SFB. These combinations are factory-assembled only.

Compression Lugs

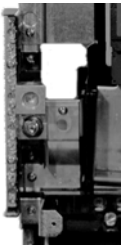
Compression lugs are available for 125–600 A main lug interiors and 100–400 A main circuit breaker interiors.

Neutrals

Neutral Assembly

- All lugs are suitable for copper or aluminum wire
- 125–250 A interiors have a split neutral located on the same end as the mains
- 400–800 A interior neutrals can be located on either end depending on the configuration
- Neutral may be bonded for use as a UL service entrance
- Branch terminals are suitable for #14-2/0 copper or aluminum and #14-#6 copper or aluminum
- Provisions for larger branch terminal lug kits are available as options
- Suitable lug provided on neutrals for termination of the grounding conductor
- All unused neutral terminals may be used to terminate equipment grounding conductors when the panelboard is used as UL service equipment
- 100% rated neutrals are standard; one neutral termination provided per circuit in the panelboard
- 200% rated neutrals are optional see, “200% Neutral Kits” below

Neutral Bonding Provisions



125–250 A Neutral Bonding Provisions

The bonding strap may be field installed for UL service equipment requirements on 125–800 A interiors. Not applicable for CSA service entrance panels in Canada.

Table 5: Copper 100% Neutral Kits for Use with Single or Three Phase 125-600 A Interiors

Amperage	125 A	250 A	400 A	600 A	800 A
Catalog Number	NFN1CU	NFN2CU	NFN6CU	NFN6CU ¹	Kit not available, Factory-assembled only

¹ Not to be used with SFL, FTL or SFB. These combinations are factory-assembled only.

200% Neutral Kits

Table 6: 200% Neutral Kits for Use with Single or Three Phase 125-400 A Interiors

Amperage	125 A	250 A	400 A	600 A	800 A
Catalog Number	NFNL1	NFNL2	NFNL4 ¹	Kit not available, Factory-assembled only	

¹ Not to be used with SFL, FTL or SFB. These combinations are factory-assembled only.



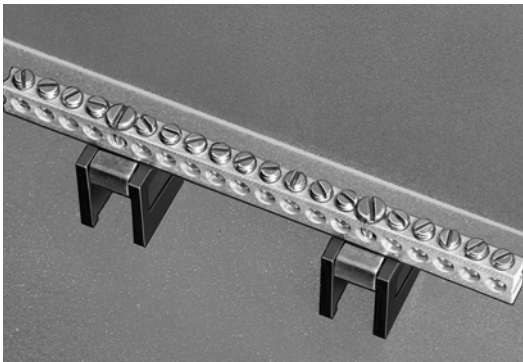
NFNL2

NF Circuit Breaker Panelboards

Ground Bar Kits



Ground Bar Kit



Ground Bar with Insulator Kit

Ground Bar Kits

- Field installable in all panelboards
- Wire size of terminals (refer to the technical information below)

Table 7: Ground Bar Kits

Catalog Number	Terminals	Material
PK23GTAL	23	AL
PK27GTA	25 ¹	CU
PK27GTACU	27	AL

¹ 24 small terminals and 1 large terminal

- Order enough ground bar kits to accommodate all the ground conductors used in the panel

Ground Bar Insulator Kits (Catalog No. PKGTAB)

- The insulator kit isolates the standard panelboard ground bar from the panelboard
- The insulator kit is field installable, and panelboard enclosures have ground bar mounting provisions in all four corners

Technical Information

All PK equipment grounding kits are supplied with mounting screws, installation instructions, and an "Equipment Grounding Terminal" self-adhesive label.

Table 8: Technical Information

Catalog Number	Terminals			Approximate Overall Length Inches (mm)	Distance Between Mounting Holes Inches (mm)
	Number of Terminals	Quantity Available for Each Size			
		Material	I / II ¹		
PK23GTAL	24	AL	23 / 1	9.125 (232)	3.125 (79)
PK27GTA	27	AL	24 / 1	9.125 (232)	3.125 (79)
PK27GTACU	27	CU	27 / 0	9.125 (232)	3.125 (79)

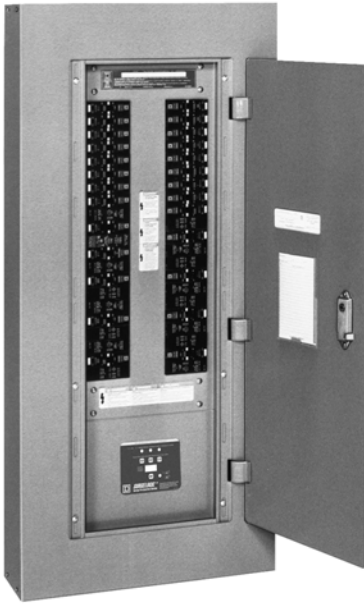
¹ See wire range table below.

Table 9: Wire Range

Size	Cu	Al
I	(1) #14 to #4 or (2) #14 or #12	(1) #12 to #4 or (2) #12 or #10
II	(1) #1 to 4/0	(1) #1 to 4/0

Surge Protection

The Surgelogic® IMA series surge protective device is a modular parallel transient voltage surge suppressor (TVSS). The IMA device is a multi-stage suppression circuit consisting of field-proven, fast-acting, 34 mm metal oxide varistors (MOVs).



A surge suppression path is provided for each mode, line-to-neutral (L-N), line-to-line (L-L), line-to-ground (L-G), and neutral-to-ground (N-G). Each surge suppression mode is individually fused and uses circuitry with thermal cutouts to isolate the TVSS and ensure shutdown in the event of MOV damage during severe overvoltages, even when operated on high fault current power systems.

The suppression elements are encapsulated in a UL recognized potting material—another performance element that provides additional protection. A filter provides a high level of EMI/RFI noise attenuation. On-line diagnostics continuously monitor the device status, and LEDs signal loss of a suppression circuit. An audible alarm with an enable/disable feature and dry contacts are included in the standard diagnostic package.

NF Main Lugs Panelboard with Integral TVSS

Table 10: NF Interiors with TVSS¹

Mains Rating	Max Circuit Breaker Spaces	TVSS Rating		Interior Catalog Number ²	Components for Adding a Vertical Main Circuit Breaker	
		Voltage	Surge Rating		Main Circuit Breaker Kit	Main Circuit Breaker Frames
250 A	42	480Y/277 Vac	120	NF442L2TVS412	N150MH ³ N250MJ N250MKC	HD, HG, HJ or HL JD, JG, JJ or, JL KI
			160	NF442L2TVS416		
		600Y/347 Vac	120	NF442L2TVS812		
400 A	42	480Y/277 Vac	120	NF442L4TVS412	N400M	LAL/LHL (LC and LI F/A only)
			160	NF442L4TVS416		
		600Y/347 Vac	120	NF442L4TVS812		

¹ These interiors are available as catalog numbered devices. TVSS is not available as a field-installable kit.

² To order an interior with copper bus, add a "C" to the end of the catalog number (example: NR442L2TVS412C).

³ RTI kit accepts maximum 125 A H-frame circuit breaker.

Table 11: IMA Series Voltage Specifications

Service Voltage	UL Suppression Voltage Rating (SVR)				
	L-N	L-G	N-G	L-L	MCOV ¹
120/240 Vac, 1-phase	400	400	400	800	150
208Y/120 Vac, 3-phase, 4-wire	400	400	400	800	150
240/120 Vac, 3-phase, high-leg delta	800/400	800/400	400	1500/800	275/150
480Y/277 Vac, 3-phase, 4-wire	800	800	800	1600	320
600Y/347 Vac, 3-phase, 4-wire	1200	1200	1200	2000	420

¹ MCOV: maximum continuous operating voltage.

NF Circuit Breaker Panelboards

Surge Protection

Table 12: Performance Features

Surge Capacity	L–N	L–G	N–G (3-Phase Rating)
100 kA / phase	50 kA	50 kA	100 kA
120 kA / phase	60 kA	60 kA	120 kA
200 kA / phase	100 kA	100 kA	200 kA
160 kA / phase	80 kA	80 kA	120 kA
240 kA / phase	120 kA	120 kA	120 kA

Table 13: Specifications

Relative Humidity	0 to 95% non-condensing
Operating Frequency	47–63 Hz
Storage Temperature	-40 to +65 °C (-40 to +149 °F)
Operating Temperature	-40 to +65 °C (-40 to +149 °F)
Display Operating Temperature	-10 to +50 °C (+14 to +122 °F)
Standards	C-UL, UL 1449 Second Edition UL Category Section 37.3 (200 kA short-circuit current module rating)
Fusing	Individually fused suppression modules
Audible Alarm	Provides audible indication that there is a loss of protection
Dry Contacts	Provides remote indication of the TVSS device's operating status to a computer interface board or emergency management system

Table 14: Other Options

Option	Description
Surge Counter	Displays the combined total number of transient voltage surges detected from L–G, L–L, L–N, and N–G since the counter was last reset.
Remote Monitor	Displays the alarm status of the surge protective device up to 1,000 ft. (305 m) away from the unit. This option uses the dry contacts.

Design Features

- Individually fused suppression modules
- Thermal cutout
- Inline, copper bus bar connection
- Solid state bi-directional
- Push-to-Test on-line diagnostic display
- Audible alarm with enable/disable switch
- LED indicators indicate loss of protection, or fully operational circuit
- High-energy parallel design for IEEE C62.41 category A, B, and C3 applications
- Available in main circuit breaker and main lug only panelboards with sub-feed circuit breakers, feed-through lugs, or sub-feed lugs
- AC tracking filter with EMI/RFI filtering up to -50 dB from 100 kHz to 100 MHz

Enclosures

Enclosure Types



Mono-Flat Type 1 Enclosure for 100–250 A Interiors

Type	Environment	Protects Against
Type 1	Indoor	Contact with the enclosed equipment, falling dirt
Type 2	Indoor	Type 1, plus <ul style="list-style-type: none"> • Dripping and light splashing of non-corrosive liquids
Type 3R	Outdoor	Type 2, plus <ul style="list-style-type: none"> • Rain, snow, and sleet
Type 4	Indoor/outdoor	Type 3R, plus <ul style="list-style-type: none"> • Circulating dust, lint, fibers and flyings • Settling airborne dust, lint, fibers and flyings • Windblown dust • Hosedown and splashing water
Type 4X	Indoor/outdoor	Type 4, plus <ul style="list-style-type: none"> • Corrosive agents
Type 5	Indoor	Type 2, plus <ul style="list-style-type: none"> • Settling airborne dust, lint, fibers, and flyings
Type 12	Indoor	Type 2, plus <ul style="list-style-type: none"> • Circulating dust, lint, fibers, and flyings • Settling airborne dust, lint, fibers, and flyings • Oil and coolant seepage

Indoor Enclosures (Types 1 and 2)



Type 1 Enclosure for 400–800 A Interiors

MH type Box

- Standard boxes are 20 in. (508 mm) wide by 5.75 in. (223 mm) deep
 - NF interiors with an LC or LI main circuit breaker or with an 800 A MLO interior require an 8.75 in. (223 mm) deep box — therefore, they are available factory-assembled and fully-assembled only
 - Boxes are galvanized steel with removable endwalls. On standard 5 3/4 inch depth boxes, one endwall is provided with knockouts, and the other endwall is blank. On deeper boxes, both are blank. Endwalls are removable and interchangeable
 - Box and interior mounting instructions are included in the documentation shipped with the interior
 - Keyhole slots are located in the box backwall to ease installation
- NOTE:** Interiors mount directly to studs in MH boxes. No interior mounting brackets are required.
- NOTE:** 800 A interiors and interiors that have LC/LI main circuit breakers require elevating brackets, due to the requirement of an 8.75 in. (223 mm) deep box.
- Type 2 boxes include a drip hood (available with surface mounted trim only)

NF Circuit Breaker Panelboards Enclosures

Type 1 and 2 Trim Fronts

- Finished with gray-baked enamel electrodeposited over cleaned, phosphatized steel (ANSI 49)
- Order flush or surface mounted
- Door with flush lock; uses NSR-251 key
- Directory card located on the inside of the door
- Mono-Flat® fronts on 100–250 A interiors mount to the interior trim with trim screws. Both trim mounting screws and door hinges are concealed; fronts are not removable with the door closed and locked
- Fronts for 400–800 A interiors are ventilated and mount to the enclosure with trim screws; door hinges are concealed
- Fronts 56 in. (1422 mm) high or more on 250 A interiors or 74 in. (1880 mm) high or more on 600 A and 800 A interiors have two flush locks
- Fronts 68 in. (1727 mm) high or more on interiors with LC/LI main circuit breakers or LC sub-feed circuit breakers use a sliding vault lock with 3-point latching



Key NSR-251
(Catalog No. LP9618)



Concealed Hinge for 100–800 A Trim Fronts



Interiors Mount Directly to Enclosure Studs



Standard Flush Lock
(Catalog No. PK4FL)



Optional Sliding Vault Lock (Catalog No. PK5FL)



MH Box

NF Circuit Breaker Panelboards Enclosures

Rainproof (Type 3R) Dust tight (Type 5 and 12)



- Finished with gray-baked enamel electrodeposited over cleaned, phosphatized galvanized steel (ANSI 49)
- Gasketed door with lockable vault handle (PK4NVL); uses NSR-251 key
- Directory card located on the inside of the door
- No knockouts in endwalls
- Trim kit included for end and side gutters
- Provisions for two ground bars
- 125 A, 250 A, 400 A main lug and main circuit breaker interiors
- 600 A and 800 A main lug only



Type 3R, 5, and 12 Enclosures



Vault Handle with Lock
(Catalog No. PK4NLV)



Type 4X Enclosure

Corrosion-Resistant Fiberglass-Reinforced Polyester (Type 4X)

- Watertight and dust-tight
- Gasketed door with trunk latches
- Directory card located on the inside of the door

Stainless Steel (Type 4 and 4x)

- Water and dust tight
- Gasketed door
- Directory card located on inside of door

NF Circuit Breaker Panelboards

Single Row (Column-Width) Panelboards

Single Row (Column-Width) Panelboards

Application Data



Column-Width
Panelboard

Ratings

- Main lugs: 125 A, 225 A
- Main circuit breaker: 100 A, 225 A

Interiors

- 60 A maximum branch circuit breaker
- Bolt-on EDB/EGB/EJB circuit breakers
- Solid neutral opposite mains

Enclosures

- 8-5/8 in. (219 mm) wide by 5-5/8 in. (143 mm) deep for 10 in. (254 mm) H- or I-beam
- Galvanized steel
- Removable endwalls

Trim Fronts

- Screw mounted
- Door with two flush latches
- Finish: gray-baked enamel electrodeposited over cleaned, phosphatized steel

Line Lugs

- All lugs are suitable for 75° C copper or aluminum wire

Table 15: Branch Circuit Breaker Short-Circuit Current Ratings

Branch Breaker Prefix 1, 2 and 3 pole 15 to 60A	Short Circuit Current Rating ¹	
	@ 480Y/277 Vac	@ 600Y/347 Vac
EDB	18,000 A	14,000 A
EGB	35,000 A	18,000 A
EJB	65,000 A	25,000 A

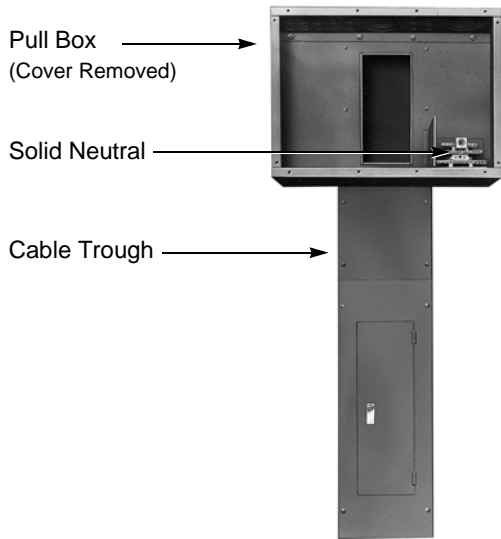
¹ Series ratings are also available.

Canada: See the Series Rating Guide (data bulletin S1600PD0302EP R__).

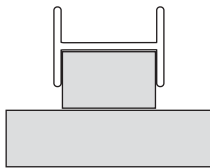
USA: See Switchboard/Panelboard Short-Circuit Ratings (data bulletin 2700DB9901), or the Digest (<http://ecatalog.squared.com/category.cfm>).

NF Circuit Breaker Panelboards

Single Row (Column-Width) Panelboards



Single Row (Column-Width) Panelboard



Cable Trough Top View with I-Beam

Cable Trough

- Cable trough is stackable
- 8-5/8 in. (219 mm) wide by 5-5/8 in. (143 mm) deep for 10 in. (254 mm) I-beam or H-beam
- Galvanized steel trough uses enclosure endwall
- Screw-mounted two-piece front
 - 15 in. (381 mm) long top piece of front removable for pull box mounting
 - Finish: gray-baked enamel electrodeposited over cleaned, phosphatized steel

Table 16: Column-Width Cable Trough

Length of Cable Trough	Catalog No.
36 in. (914 mm)	NTX836
48 in. (1219 mm)	NTX848
56 in. (1422 mm)	NTX856
66 in. (1676 mm)	NTX866
84 in. (2134 mm)	NTX884
96 in. (2438 mm)	NTX896
104 in. (2642 mm)	NTX8104
112 in. (2845 mm)	NTX8112

Pull Box

(catalog number MPX81542)

- Mounts on cable trough
- 20 in. (508 mm) wide by 5-3/4 in. (146 mm) deep by 15 in. (381 mm) high
- Screw-mounted front
- Finish: gray-baked enamel electrodeposited over cleaned, phosphatized steel
- Removable top endwall with knockouts
- Solid neutral included

NF Circuit Breaker Panelboards

Terminal Data

Terminal Data

Main Lugs Terminal Data

Table 17: Standard Aluminum and Copper Lugs

Amperes	Aluminum				Copper			
	Aluminum Mechanical		Aluminum Compression		Copper Mechanical		Copper Compression	
	Cat. #	Lug Wire Range	Cat. #	Lug Wire Range	Cat. #	Lug Wire Range	Cat. #	Lug Wire Range
125	NFALM1	(1) #6 - 2/0 ¹	NFALV1	(1) #4-300 kcmil	NFCUM1	(1) #6 - 350 kcmil	NFCUV1	(1) #6 - 1/0
250	NFAML2	(1) #6 - 350 kcmil	NFALV2	(1) 250-350 kcmil	NFCUM2	(1) #6 - 350 kcmil	NFCUV2	(1) 2/0 - 300 kcmil
400	NFALM4	(1) 1/0-750 kcmil or (2) 1/0-350 kcmil	NFALV4	(2) 2/0-500 kcmil	NFCUM4	(1) 1/0-750 kcmil or (2) 1/0-350 kcmil	NFCUV4	(1) 400-750 kcmil
600	NFALM6	(2) 1/0-600 kcmil	NFALV6	(2) 2/0-500 kcmil	NFCUM6	(2) 1/0-750 kcmil	NFCUV6	(2) 250-750 kcmil
800	Contact the Technical Applications Group (TAG)							

¹ Neutral accepts #6-2/0 Al/Cu.

Main Circuit Breaker Terminal Data

See Digest section 7 for copper lugs.

Table 18: Standard Aluminum Mechanical Lugs

Panelboard Type	Ampere Rating	Circuit Breaker Type	Lug Wire Range
NF	100 A	FIL	(1) #14-1/0 Cu or (1) #12-1/0 Al
	125 A ¹	EDB, EGB, EJB	(1) #14-2/0 Al/Cu
	150 A	HDL, HGL, HJL, HLL	(1) #14-3/0 Al/Cu
	250 A	JDL, JGL, JJL, JLL, KI	(1) 3/0-350 kcmil Al/Cu
	400 A	LAL, LHL	(1) #1-600 kcmil Al/Cu or (2) #1-250 kcmil Al/Cu
	600 A	LCL, LIL, LEL, LXL LXIL	(2) 4/0-500 kcmil Al/Cu
	800 A	800 A main breaker panelboard not available.	

¹ 110 A maximum at 600Y/347 Vac.

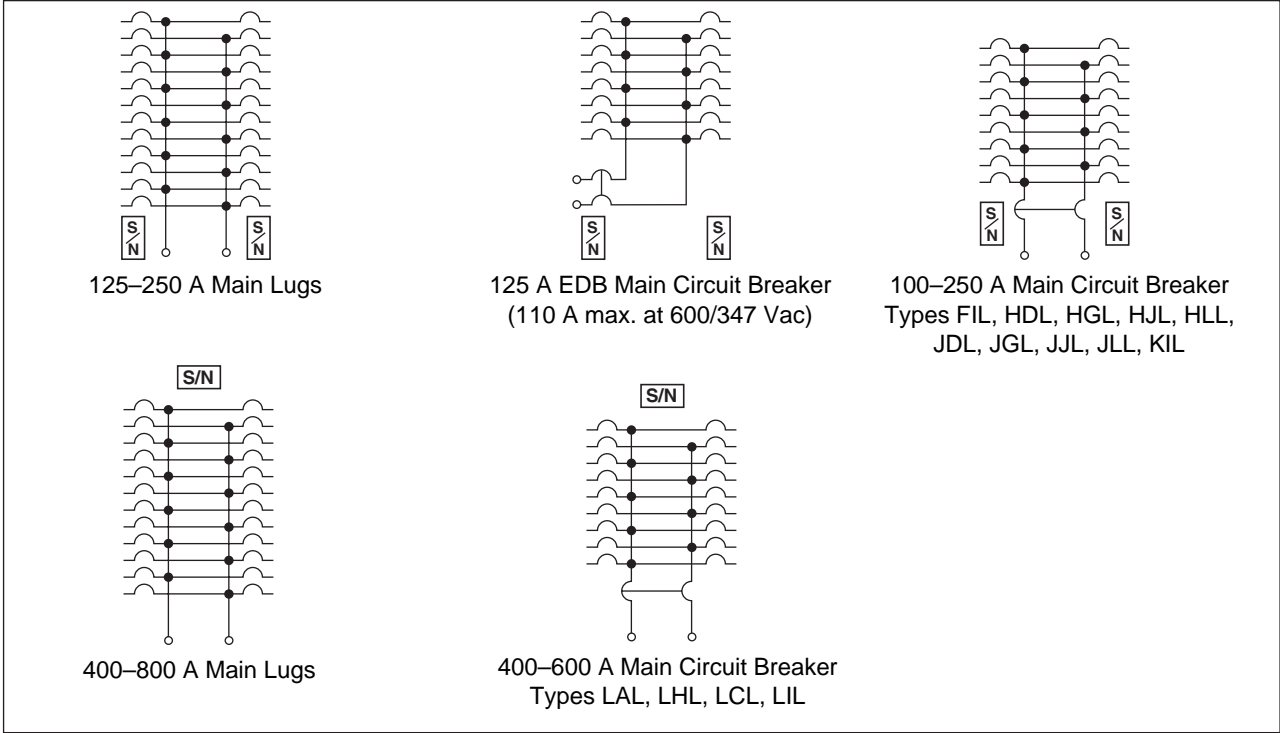
Table 19: Aluminum Compression Lugs

Panelboard Type	Ampere Rating	Circuit Breaker Type	Catalog No.	Lug Wire Range
NF	100 A	FC, FI	VC100FA	(1) #8-1/0 Al/Cu
	125 A ¹	ED, EG, EJ	VC100FD	(1) #8-1/0 Al/Cu
	150 A	HDL, HGL, HJL, HLL	YA150HD	(1) #1-4/0 Al/Cu
	250 A	JDL, JGL, JJL, JLL	YA250J35	(1) 3/0-350 kcmil Al/Cu
	250 A	KI	VC250KA3	(1) #4-300 kcmil Al/Cu
	400 A	LA, LH	VC400LA5 ²	(1) 2/0-500 kcmil Al/Cu
	600 A	LC, LI, LE, LX, LXI	—	—
	800 A	800 A main breaker panelboard not available.		

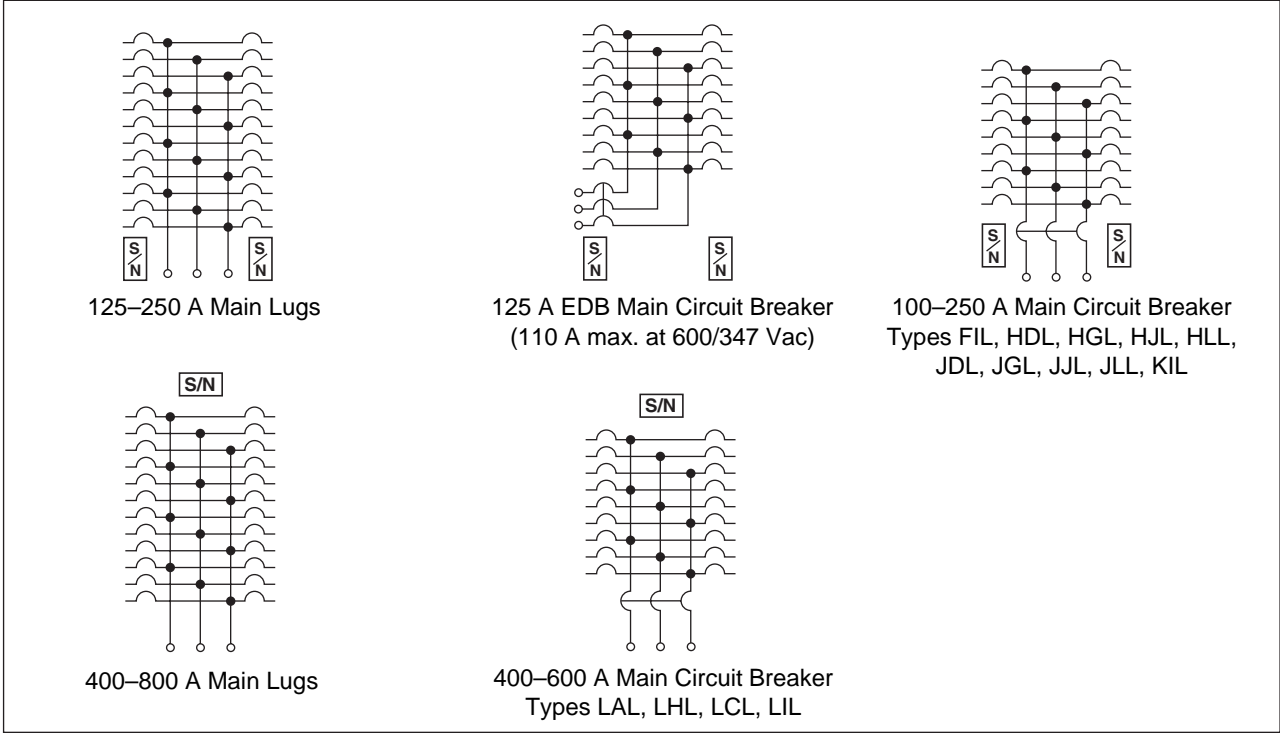
¹ 110 A maximum at 600Y/347 Vac.

² Other lug sizes available.

Typical Wiring Diagrams



1-Phase, 3-Wire



3-Phase, 4-Wire

Schneider Electric USA

252 North Tippecanoe
Peru, IN 46970 USA
1-888-SquareD
(1-888-778-2733)
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Schneider Electric Canada

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1-800-565-6699
www.schneider-electric.ca

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EDB-EPD, EGB-EPD and EJB-EPD (Equipment Protection Device) Circuit Breakers for Ground Fault Protection in NF Panelboards



**One-pole EDB-EPD
with optional
alarm switch**

Square D® EDB-EPD, EGB-EPD and EJB-EPD (Equipment Protection Device) Circuit Breakers are 1-pole thermal-magnetic circuit breakers with integral equipment ground fault protection. The ground fault protection level is fixed at 30 milliamperes per UL1053 and is designed to protect equipment from damage. Like standard branch breakers, these EPDs also provide branch circuit overload and short-circuit protection per UL 489 at 277 Vac. The EDB-EPD, EGB-EPD and EJB-EPD Circuit Breakers mount in NF circuit breaker panelboards and interiors, each circuit breaker occupying two poles of space.

Benefits of EDB-EPD, EGB-EPD and EJB-EPDs

More than 90% of short circuits initially involve ground faults (also called earth leakage or residual current). Detecting ground faults before they reach hazardous levels helps to avoid damage to critical equipment. This allows preventive maintenance to be scheduled before damage occurs, thus minimizing costly downtime.

Benefits to the Equipment User

- Protects expensive electrical equipment from damage due to ground faults
- Reduces equipment and employee downtime by preventing damage from ground faults
- Provides warning that the equipment needs preventive maintenance
- Reduced potential for hazards associated with ground fault-related fires and equipment malfunction

Benefits for OEMs

- Provides a more reliable machine for your customers – a competitive advantage
- Reduces warranty expense by limiting damage to equipment that might have otherwise occurred during the warranty period

EDB-EPD, EGB-EPD and EJB-EPD (Equipment Protection Device) Circuit Breakers for ground fault Protection in NF Panelboards

Applications

The NEC permits the use of an EPD for heat trace as a means of preventing freezing of pipes, rain gutters, etc. Other applications include protection of well pumps and other electrical equipment.

- Oil & gas/chemical
- Pharmaceuticals
- Water and waste treatment
- Food & beverage
- Other applications that require 30 mA ground fault protection

Key Features

- Designed for 30 mA equipment protection in commercial and industrial applications. Ideal for use with heat trace, pumps, etc.
- Can be installed in any Square D® NF Circuit Breaker Panelboard (each EPD occupies two pole spaces)
- Provides equipment protection at 30 mA
- One pole at 277 Vac
- Continuous current ratings of 15 A, 20 A, 30 A, 40 A and 50 A available
- Push-to-test button to test ground fault protection circuitry
- A wide range of interrupting ratings (AIR): EDB = 18kA; EGB = 35kA; EJB = 65kA
- Thermal-magnetic trip curve identical to equivalent circuit breaker without ground fault protection
- Optional alarm switch with one normally open contact
- All amperages are UL Listed as HID (high intensity discharge); 15 A and 20 A are UL Listed as SWD (switching duty rated)
- ground fault protection meets UL 1053 and CSA C22.2 No. 144-M91 standards
- Overload and short circuit protection meets UL489 and CSA C22.2 No. 5-02

How EPDs Operate

An EPD compares outgoing load currents with returning currents to determine if there is leakage of current to ground. If it detects a ground fault greater than 30 mA, the EPD will trip and display the “red flag” of the Visi-Trip® indicator.

NOTE: Unlike residential GFCIs (ground fault circuit interrupters), EPDs are not designed for people protection (UL943 Class A calls for protection above 6 mA). EPDs are designed to meet the UL1053 standard for equipment protection. Although not designed for people protection, they do create a safer environment by reducing the potential for hazards associated with ground faults including fires, and equipment malfunction.

These Square D® EPDs are also designed to minimize nuisance tripping in an environment with electrical noise or harmonics.

An optional factory-installed alarm switch provides a set of contacts to remotely indicate if the EPD is in the tripped position. The alarm switch does not distinguish between ground fault, thermal, or magnetic trip.

Testing

EPD Circuit Breakers include a black test button to test the ground fault circuitry, as required by UL 1053. Pushing the test button causes the circuit breaker to trip, placing the handle into the tripped (middle) position. When the breaker is tripped (by ground fault, short-circuit, or overload conditions), the Visi-Trip trip indication (red flag) appears in a window on the front of the circuit breaker case.

Catalog Numbers for EDB-EPD, EGB-EPD and EJB-EPDs

Continuous Current Rating @ 40 C	AC Magnetic Trip (Amps @277V)		Catalog Numbers			Terminal Wire Range (AWG)
	Trip	Hold	EDB (18kA)	EGB (35kA)	EJB (65kA)	
15	270	875	EDB14015EPD	EGB14015EPD	EJB14015EPD	#6 - #14 AWG CU or #4 - #12 AWG AL
20			EDB14020EPD	EGB14020EPD	EJB14020EPD	
30			EDB14030EPD	EGB14030EPD	EJB14030EPD	
40	630	1800	EDB14040EPD	EGB14040EPD	EJB14040EPD	
50			EDB14050EPD	EGB14050EPD	EJB14050EPD	

Accessories

- Optional alarm switch (bell alarm), Factory-installed only – Add BA suffix; (Cable with #12-#22 AWG CU wire only)
- No other electrical accessories are available
- HPAFD handle padlock attachment (locks ON or OFF)

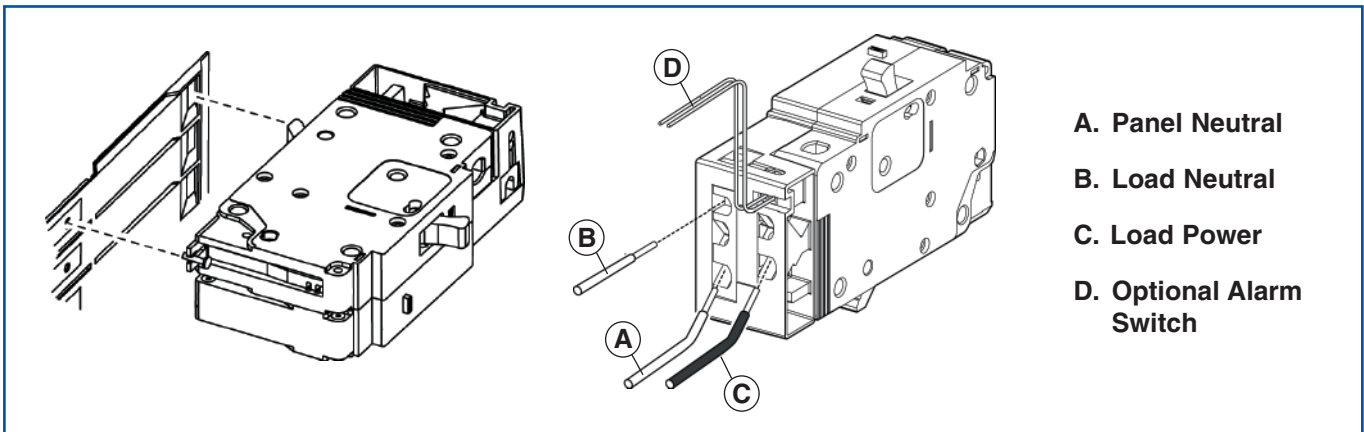
EDB-EPD, EGB-EPD and EJB-EPD (Equipment Protection Device) Circuit Breakers for ground fault Protection in NF Panelboards



Installation

The EDB-EPD, EGB-EPD and EJB-EPDs occupy two pole positions in NF Circuit Breaker Panelboards. They are approximately one inch longer than the EDB, EGB, or EJB breakers, yet still allow wire bending space in the gutter of the panelboard.

See Instruction Bulletin 48840-522-01 for installation details.



A Complete Range of Ground Fault Protection Equipment

Schneider Electric provides ground fault protection products for a wide range of applications, from QO® GFCIs and EPDs to large Masterpact® Circuit Breakers with Micrologic® Trip Units.

Schneider Electric North American Operating Division

1415 S. Roselle Road
Palatine, IL 60067
Tel: 847-397-2600
Fax: 847-925-7500

REPLACEMENT PARTS

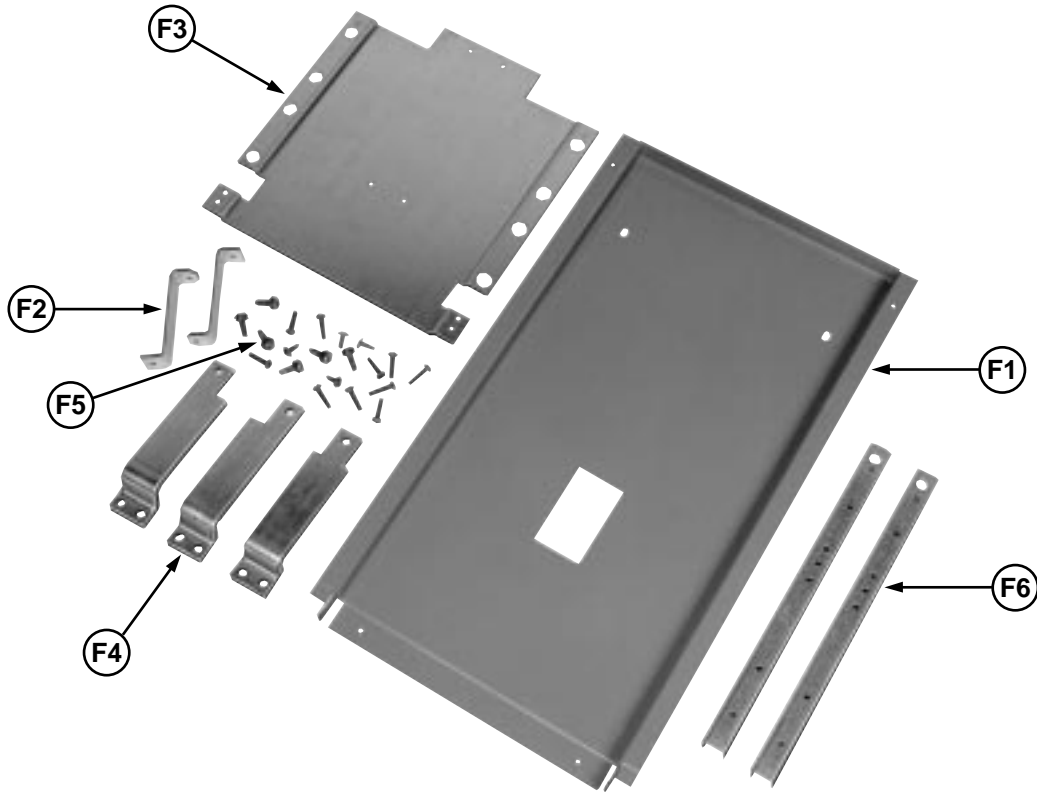
NF Panelboards Main Lugs and Main Circuit Breaker

CONTENTS

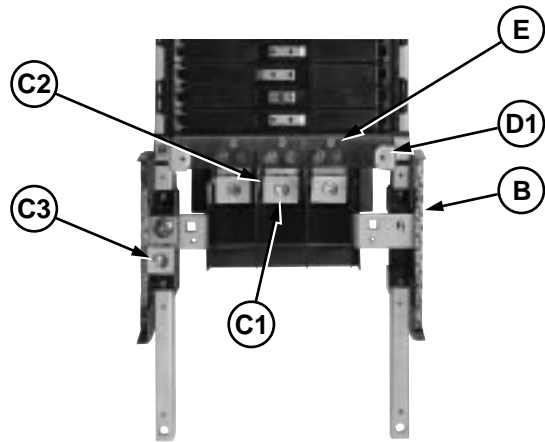
Panelboard Type and Rating	Page
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600 Ampere Maximum	4
Modifications	6
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SQUARE D
GROUPE SCHNEIDER



F. 250 A Main Circuit Breaker Kit



A. 250 A Interior



DANGER: HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION. Turn off all power supplying this equipment before working on it. Failure to observe this instruction will result in death or serious injury.

Table 1: 125/250 A Interiors

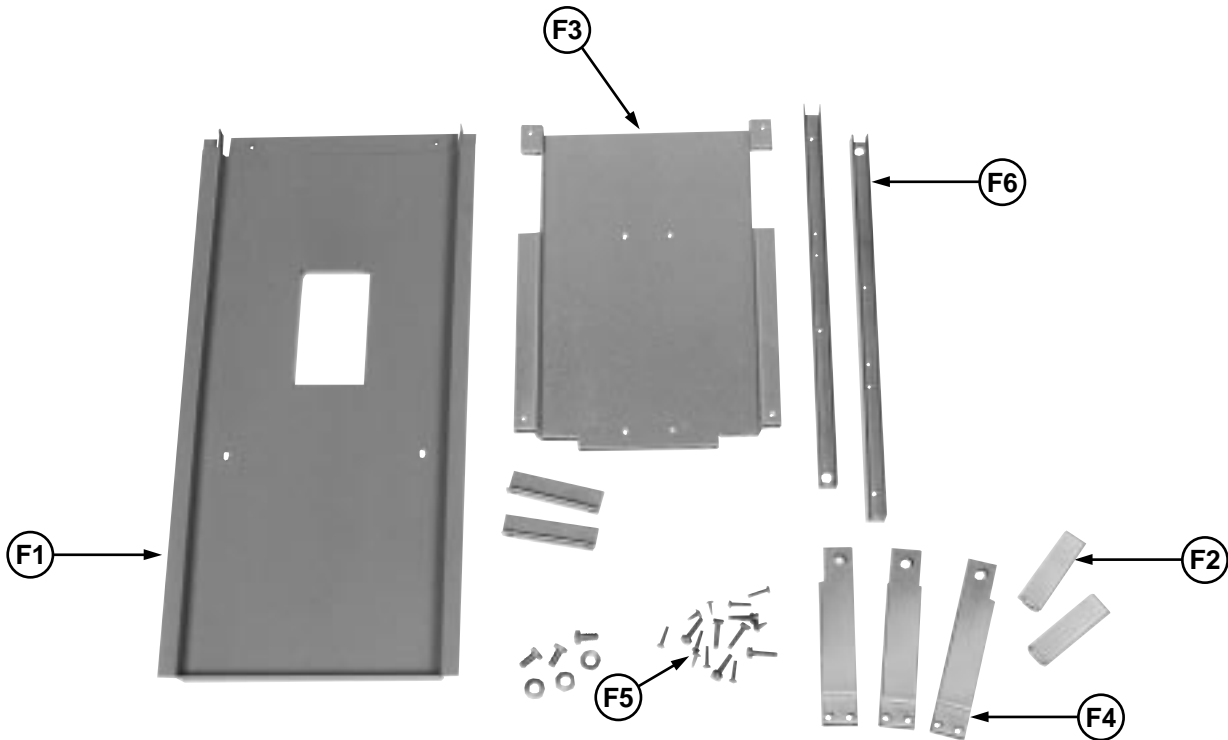
Code Letter	Description	Part Number							
		1-12 Circuits	13-18 Circuits	19-30 Circuits	31-42 Circuits	43-54 Circuits			
A	Main Lug Interior								
	1PH3W	125 A	NF12L1	NF18L1	—	—	—		
		250 A	NF12L1C	NF18L1C	—	—	—		
	3PH4W	125 A	NF412L1	NF418L1	NF30L2	NF42L2	NF54L2		
		250 A	NF412L1C	NF418L1C	NF30L2C	NF42L2C	NF54L2C		
	B	Solid Neutral Assembly							
		B1	125 A	80114-045-50	80114-045-51	80114-045-52	—	—	
			250 A	—	—	80114-009-50	80114-009-51	80114-009-52	
B2		Neutral Insulator Kit	80113-283-50	80113-283-50	80113-283-50	80113-283-50	80113-283-50		
		Neutral Insulator Cover	80113-057-01	80113-057-01	80113-057-01	80113-057-01	80113-057-01		
Neutral Bonding Strap		80114-034-01	80114-034-01	80114-034-01	80114-034-01	80114-034-01			
Screw, Neutral Bonding Strap		(2) 80114-005-01	(2) 80114-005-01	(2) 80114-005-01	(2) 80114-005-01	(2) 80114-005-01			
C		Lugs							
	C1	125 A	80114-031-01	80114-031-01	80114-031-01	—	—		
		250 A	—	—	80114-031-01	80114-031-01	80114-031-01		
	C2	Screw, Main Lug Mtg.	(2) 80114-001-01	(2) 80114-001-01	(2) 80114-001-01	(2) 80114-001-01	(2) 80114-001-01		
		Vertical Lug Barrier	80113-005-01	80113-005-01	80113-005-01	80113-005-01	80113-005-01		
	C3	Neutral Main Lug Kit	250 A	—	80114-040-53	80114-040-53	80114-040-53		
	D	Interior Deadfront Trim▲							
		▲	Main Lugs Deadfront	125 A	80113-170-50	80113-170-50	80113-170-50	80113-170-50	
250 A			80113-171-50	80113-171-50	80113-171-50	80113-171-50	80113-171-50		
▲		Branch Deadfront	1PH3W	125 A	NFRPL12L1	NFRPL18L1	—	—	
			3PH4W	125 A	NFRPL412L1	NFRPL418L1	—	—	
			1PH3W	250 A	—	—	NFRPL30L2	NFRPL42L2	NFRPL54L2
			3PH4W	250 A	—	—	NFRPL430L2	NFRPL442L2	NFRPL454L2
▲		Load End Deadfront	125 A	80113-174-57	80113-174-50	80113-174-50	—	—	
			250 A	—	—	80113-175-50	80113-175-50	80113-175-50	
D1		Screw, Deadfront Mtg.	80114-004-01	80114-004-01	80114-004-01	80114-004-01	80114-004-01		
		Deadfront Support Bracket	80113-051-01	80113-051-01	80113-051-01	80113-051-01	80113-051-01		
		Screw, Support Bracket Mtg.	80114-005-01	80114-005-01	80114-005-01	80114-005-01	80114-005-01		
E	Line End Barrier Kit	80113-270-50	80113-270-50	80113-270-50	80113-270-50	80113-270-50			

Table 2: 100/250 A Main Circuit Breaker

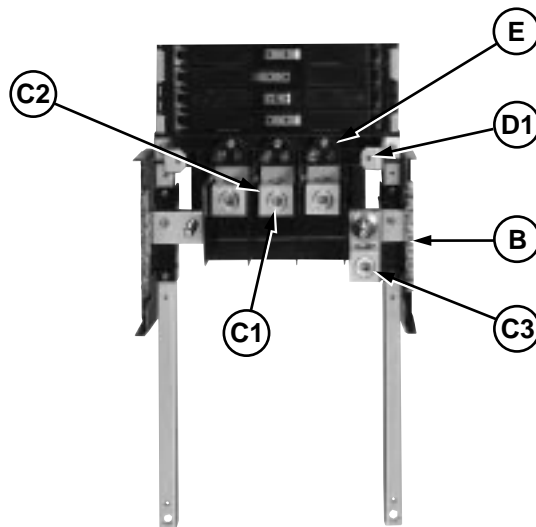
Code	Description	Part Number				
		125 A Main Circuit Breaker	N100M★	N100MFC■	N100MFI◆	N250MKC●
	Main Circuit Breaker Kit	Factory Assembled, EDB	FDL, FGL & FJL	FCL	FIL	KAL, KHL, KCL & KIL
F1	Main Circuit Breaker Type	—	80113-170-55	80113-170-60	80113-171-51	80113-171-51
	Mains End Deadfront	—	80114-004-01	80114-004-01	80114-004-01	80114-004-01
F2	Deadfront Support Bracket	—	80113-051-02	80113-051-02	80113-051-02	80113-051-02
	Screw, Support Bracket Mounting	—	80114-005-01	80114-005-01	80114-005-01	80114-005-01
F3	Main Circuit Breaker Mounting Pan	—	80113-071-01	80113-293-01	80113-079-01	80113-079-01
	Screws, Mounting Pan	—	80113-277-50	80113-277-50	80113-277-50	80113-277-50
F4	Main Bus Connector	A PH	80113-076-01	80113-284-50	80113-284-50	80113-276-50
		● B PH	80113-275-50	80113-284-51	80113-284-51	80113-276-51
		C PH	80113-073-01	80113-284-50	80113-284-50	80113-276-52
F5	Connector Screw Kit (Per phase)	—	80113-278-50	80113-294-50	80113-279-50	80113-279-50
F6	Rail Extension Kit	—	80113-070-51	80113-070-51	80113-070-51	80113-070-51
	Mounting Pan Insulator	—	80113-072-01	—	—	—
▲	Bus Connector Cover Assembly	—	80113-271-50	—	—	—

- ▲ Not shown.
- Not required on single-phase devices.
- ★ The same parts are used in the following assemblies: N2100FDMB, N2100FGMB, N3100FDMB and N3100FGMB.
- The same parts are used in the following assemblies: N2100FCMB and N3100FCMB.
- ◆ The same parts are used in the following assemblies: N2100FIMB and N3100FIMB.
- The same parts are used in the following assemblies: N2250KAMB, N2250KCMB, N2250KHMB, N2250KIMB, N3250KAMB, N3250KCMB, N3250KHMB and N3250KIMB.

⚠ DANGER: HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION. Turn off all power supplying this equipment before working on it. Failure to observe this instruction will result in death or serious injury.



F. 400 A Main Circuit Breaker Kit



A. 400 A Interior



DANGER: HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION. Turn off all power supplying this equipment before working on it. Failure to observe this instruction will result in death or serious injury.

Table 3: 400/600 A Interiors


Code Letter	Description	Part Number					
		1-30 Circuits	31-42 Circuits	43-54 Circuits			
A	Main Lug Interior						
	1PH3W	400 A	NF30L4	NF42L4	NF54L4		
		600 A	NF30L4C	NF42L4C	NF54L4C		
	3PH4W	400 A	NF30L6C	NF42L6C	NF54L6C		
		600 A	NF430L4	NF442L4	NF454L4		
			NF430L4C	NF442L4C	NF454L4C		
		NF430L6C	NF442L6C	NF454L6C			
B	Solid Neutral Assembly						
		400 A	80114-010-50	80114-010-51	80114-010-52		
		600 A	80114-012-50	80114-012-51	80114-012-52		
	▲	Neutral Bonding Strap		(2) 80114-034-01	(2) 80114-034-01		
	Screw, Neutral Bonding Strap		(2) 80114-005-01	(2) 80114-005-01			
C	Lugs						
	C1	Main Lug	400 A	80114-100-01	80114-100-01	80114-100-01	
				600 A	80114-054-01	80114-054-01	80114-054-01
		Screw, Main Lug Mtg.		(2) 80114-001-02	(2) 80114-001-02	(2) 80114-001-02	
	C2	Vertical Lug Barrier		80113-005-01	80113-005-01	80113-005-01	
	C3	Neutral Main Lug Kit	400 A	80114-040-54	80114-040-54	80114-040-54	
			600 A	80114-040-55	80114-040-55	80114-040-55	
	D	Interior Deadfront Trim▲					
▲		Main Lugs Deadfront	400 A	80113-178-50	80113-178-50	80113-178-50	
			600 A	80113-179-50	80113-179-50	80113-179-50	
▲		Branch Deadfront	1PH3W	400 A	NFRPL30L4	NFRPL42L4	NFRPL54L4
			3PH4W	400 A	NFRPL430L4	NFRPL442L4	NFRPL454L4
			1PH3W	600 A	NFRPL30L6	NFRPL42L6	NFRPL54L6
			3PH4W	600 A	NFRPL430L6	NFRPL442L6	NFRPL454L6
▲		Load End Deadfront	400 A	80113-182-50	80113-182-50	80113-182-50	
			600 A	80113-183-50	80113-183-50	80113-183-50	
		Screw, Deadfront Mtg.		80114-004-01	80114-004-01	80114-004-01	
D1		Deadfront Support Bracket		80113-051-01	80113-051-01	80113-051-01	
		Screw, Support Bracket Mtg.		80114-005-01	80114-005-01	80114-005-01	
E	Line End Barrier Kit		80113-270-50	80113-270-50	80113-270-50		

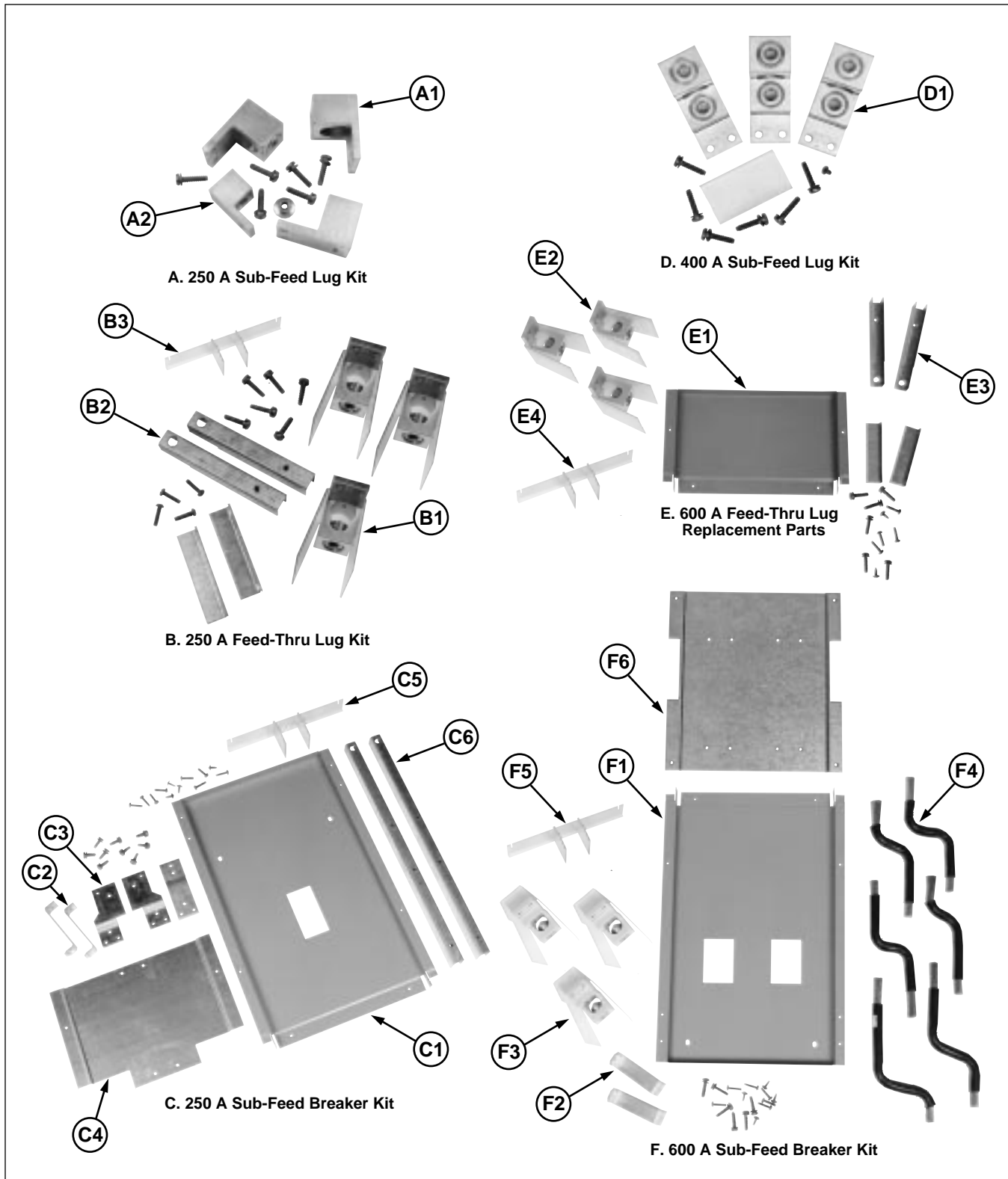
Table 4: 400 A Main Circuit Breaker

Code Letter	Description	Part Number	
	Main Circuit Breaker Kit	N400M	
	Main Circuit Breaker Type	LAL, LHL	
F1	Mains End Deadfront	80113-178-51	
	Screw, Deadfront Mtg.	80114-004-01	
F2	Deadfront Support Bracket	80113-051-02	
	Screw, Support Bracket Mounting	80114-005-01	
F3	Main Circuit Breaker Mounting Pan	80113-084-01	
	Screws, Mounting Pan	80113-277-50	
F4	Main Bus Connector	A PH	80113-280-50
		● B PH	80113-280-51
		C PH	80113-280-52
F5	Connector Screw Kit (Per phase)	80113-281-50	
F6	Rail Extension Kit	80113-070-51	

▲ Not shown.

● Not required on single-phase devices.

 **DANGER: HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION.** Turn off all power supplying this equipment before working on it. Failure to observe this instruction will result in death or serious injury.



DANGER: HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION. Turn off all power supplying this equipment before working on it. Failure to observe this instruction will result in death or serious injury.

Table 5: 125/250 A Modification – Replacement Parts

Code Letter	Description	Part Number				
		N125SFL	N125SFLC	N250SFL	N250SFLC	
A	Sub-Feed Lug Kit					
	A1 Main Lugs (per phase)	(2) 80110-194-01	(2) 80110-195-01	80114-100-01	80114-100-02	
	Screw, Line Lug Mtg. (per phase)	(2) 80114-001-01	(2) 80114-001-01	(2) 80114-001-01	(2) 80114-001-01	
	▲ Sub-Feed Lug Pad Assy. (per phase)	80114-178-53	80114-178-53	—	—	
	A2 Neutral Main Lug	80110-194-01	80110-195-01	80114-030-01	80114-030-02	
	Keps Nut, Neutral Lug Mtg.	23427-02200	23427-02200	23427-02200	23427-02200	
B	Feed-Thru Lug Kit	N125FTL	N125FTLC	N250FTL	N250FTLC	
	▲ Deadfront Trim	80113-174-51	80113-174-51	80113-175-51	80113-175-51	
	Screw, Deadfront Mtg.	80114-004-01	80114-004-01	80114-004-01	80114-004-01	
	▲ Deadfront Support Bracket	80113-051-02	80113-051-02	80113-051-02	80113-051-02	
	Screw, Support Bracket Mtg.	80114-005-01	80114-005-01	80114-005-01	80114-005-01	
	B1 A, B and C PH Line Lug Assy.	(3) 80114-233-50	(3) 80114-233-51	(3) 80114-233-50	(3) 80114-233-51	
	Screw, Line Lug Mtg.	(6) 80114-001-01	(6) 80114-001-01	(6) 80114-001-01	(6) 80114-001-01	
	▲ Neutral Main Lug	80110-194-01	80110-195-01	80114-030-01	80114-030-02	
	Keps Nut, Neutral Lug Mtg.	23427-02200	23427-02200	23427-02200	23427-02200	
	B2 Rail Extension Kit	80113-070-50	80113-070-50	80113-070-51	80113-070-51	
	B3 Line End Barrier	80113-270-50	80113-270-50	80113-270-50	80113-270-50	
	C	Sub-Feed Breaker Kit	N250SFB1KC/N250SFBKC			
C1 Deadfront Trim		80113-175-52	—	—	—	
Screw, Deadfront Mtg.		80114-004-01	—	—	—	
C2 Deadfront Support Bracket		80113-051-02	—	—	—	
Screw, Support Bracket Mtg.		80114-005-01	—	—	—	
C3 Connector		A PH	80113-282-50	—	—	—
		● B PH	80113-282-51	—	—	—
		C PH	80113-282-52	—	—	—
Connector Screw Kit (Per phase)		80113-279-50	—	—	—	
C4 Mounting Pan		80113-218-01	—	—	—	
Screw, Pan Mtg.		(4) 80114-005-01	—	—	—	
C5 Line End Barrier		80113-270-50	—	—	—	
C6 Rail Extension Kit	80113-070-52	—	—	—		

Table 6: 400/600 A Modification – Replacement Parts

Code Letter	Description	Part Number				
		N400SFL	N400SFLC	N600SFL	N600SFLC	
D	Sub-Feed Lug Kit					
	D1 A and C PH Main Lug Assy.	(2) 80114-054-01	(2) 80114-054-02	—	—	
	B PH Main Lug Assy.	(1) 80114-183-50	(1) 80114-183-51	—	—	
	Screw, Line Lug Mtg.	(6) 80114-001-02	(6) 80114-001-02	—	—	
	▲ Neutral Main Lug	40251-136-50	80048-002-01	—	—	
	Keps Nut, Neutral Lug Mtg.	23427-02800	23427-02800	—	—	
E	Feed-Thru Lug Kit	N400FTL	N400FTLC	—	—	
	E1 Deadfront Trim	80113-182-51	80113-182-51	80113-183-51	80113-183-51	
	Screw, Deadfront Mtg.	80114-004-01	80114-004-01	80114-004-01	80114-004-01	
	E2 A, B and C PH Line Lug Assy.	(3) 80114-234-50	(3) 80114-234-51	(3) 80114-183-50	(3) 80114-183-51	
	Screw, Line Lug Mtg.	(6) 80114-001-02	(6) 80114-001-02	(6) 80114-001-02	(6) 80114-001-02	
	▲ Neutral Main Lug	40251-136-50	80048-002-01	40251-287-50	80048-002-01	
	Keps Nut, Neutral Lug Mtg.	23427-02800	23427-02800	23427-02800	23427-02800	
	E3 Rail Extension Kit	80113-070-50	80113-070-50	80113-070-50	80113-070-50	
	E4 Line End Barrier	80113-270-50	80113-270-50	—	—	
	F	Sub-Feed Breaker Kit	N600SFB1KC	N600SFB2KC/N600SFBKC	—	—
		F1 Deadfront Trim	80113-183-55	80113-183-56	—	—
		▲ Closing Plate	80113-228-01	—	—	—
Screw, Deadfront Mtg.		80114-004-01	80114-004-01	—	—	
F2 Deadfront Support Bracket		80113-051-02	80113-051-02	—	—	
Screw, Support Bracket Mtg.		80114-005-01	80114-005-01	—	—	
F3 A, B and C PH Line Lug Assy.		(3) 80113-230-50	(3) 80113-230-50	—	—	
Screw, Line Lug Mtg.		(6) 80114-001-02	(6) 80114-001-02	—	—	
F4 Cable Connector		A PH	80113-226-01	80113-226-01	—	—
		—	—	80113-226-04	—	—
		● B PH	80113-226-02	80113-226-02	—	—
		—	—	80113-226-05	—	—
F5 Line End Barrier	—	80113-226-03	80113-226-03	—	—	
	—	—	80113-226-06	—	—	
F6 Mounting Pan	80113-270-50	80113-270-50	—	—		
▲ Screw, Pan Mtg.	(4) 80114-005-01	(4) 80114-005-01	—	—		
▲ Line End Barrier	80113-270-50	80113-270-50	—	—		
▲ Rail Extension Kit	80113-070-52	80113-070-52	—	—		
▲ Vertical Barrier	80113-005-01	80113-005-01	—	—		

▲ Not shown. ● Not required on single-phase devices.

⚠ DANGER: HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION. Turn off all power supplying this equipment before working on it. Failure to observe this instruction will result in death or serious injury.

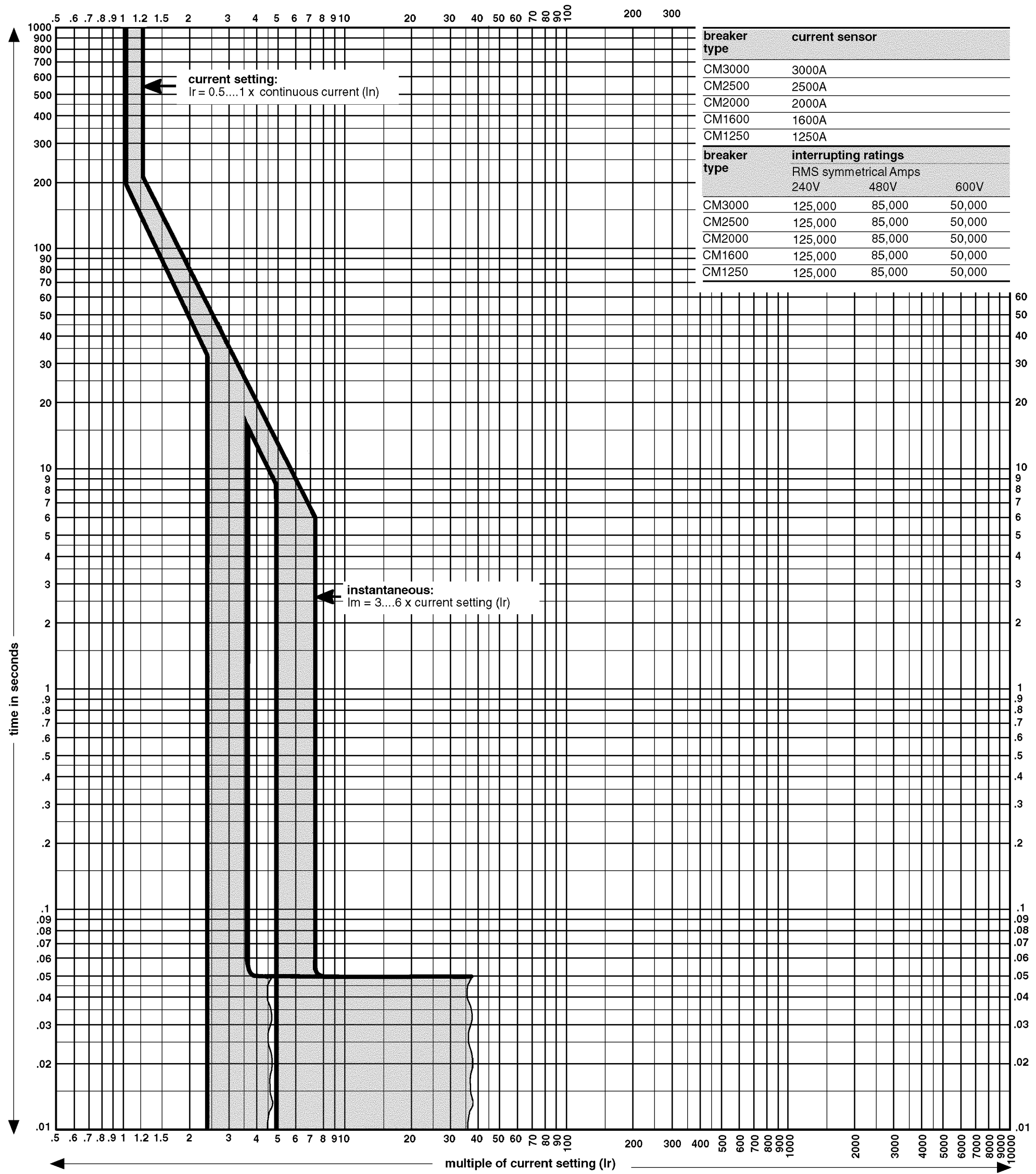
Table 7: NF Panelboard Accessories

	Description	Catalog Number
Not Shown	Circuit I.D. number strips:	
	Odd/even #1-42 (5 per package)	NF42D
	Odd/even #55-84 (5 per package)	NF84D
	Sequential #1-42 (5 per package)	NF42S
	Sequential #55-84 (5 per package)	NF84S
Not Shown	Filler plate	EFP
Not Shown	Lock – NEMA Type 1 enclosures	PK22FL
Not Shown	Keys – (2) NSR-251 (for all locks)	LP9618
Not Shown	Directory card (10 per package)	NFDC
Not Shown	Plastic stick-on directory pouch (5 per package)	NFDCH
Not Shown	Nut – interior mounting (4 per package)	NFNIM
Not Shown	Leveling nut (flush mount only – 4 per package)	NFLN
Not Shown	Trim Mounting Screws/Hardware:	
	250 A max interiors (10 per package)	NFTMS1
	600 A max interiors (8 per package)	LP9502
Not Shown	125/250 A Branch Connector Kit	SKNF250
Not Shown	400/600 A Branch Connector Kit	SKNF600



DANGER: HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION. Turn off all power supplying this equipment before working on it. **Failure to observe this instruction will result in death or serious injury.**



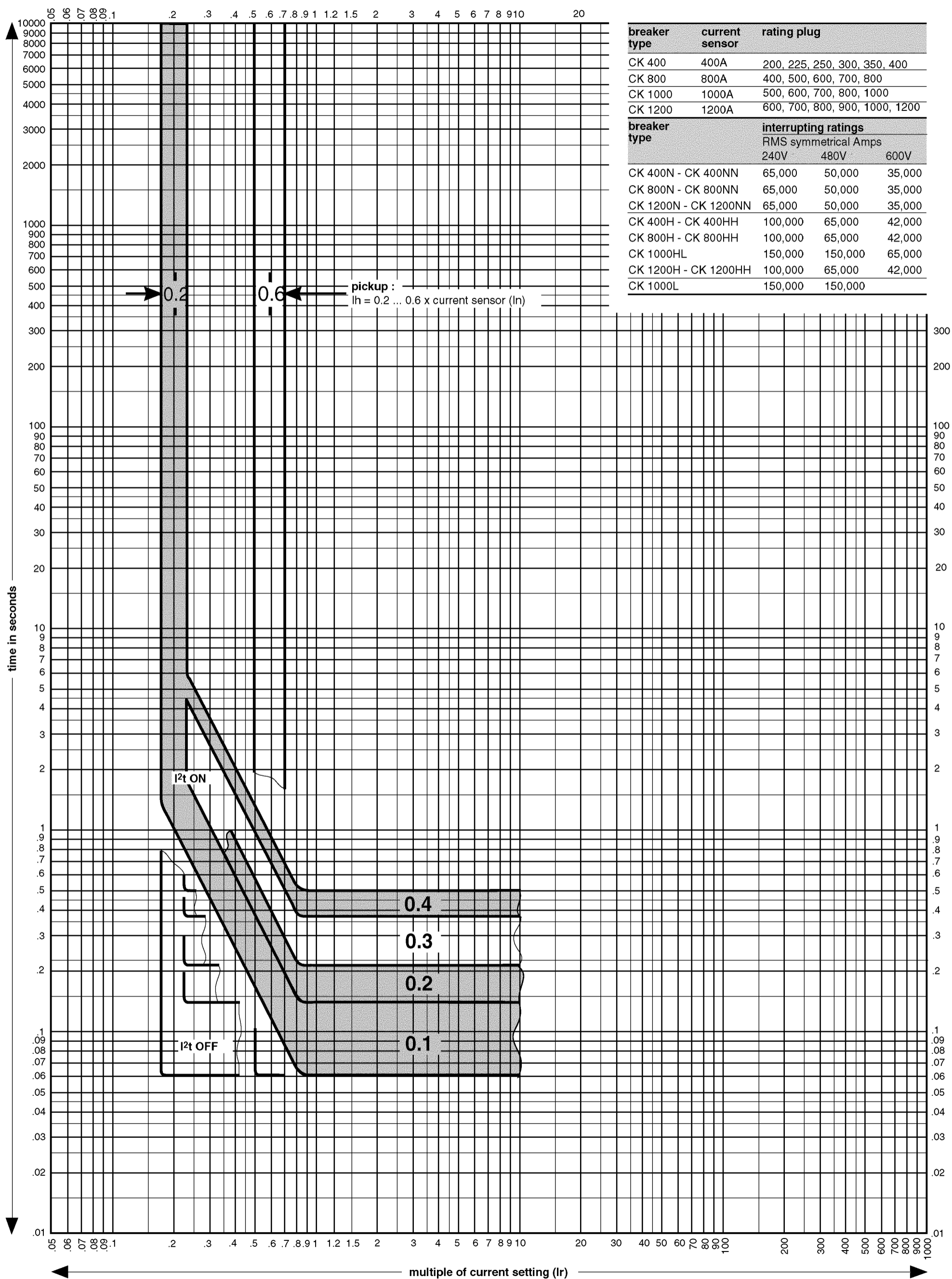


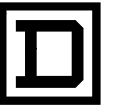
molded case circuit breakers

Compact CK

ground fault protection

STR 55UP





MULTIPLES OF RATED CURRENT

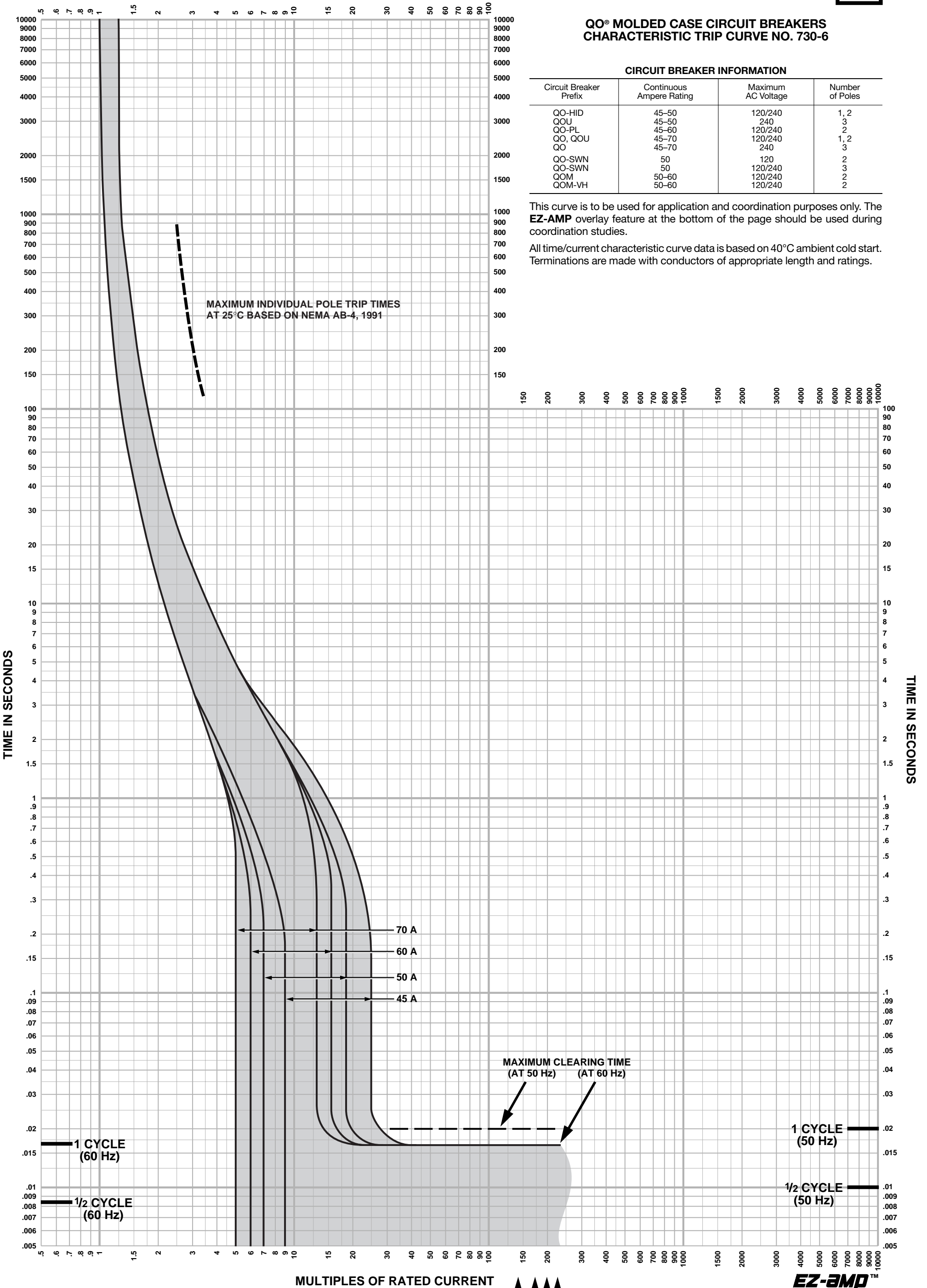
QO® MOLDED CASE CIRCUIT BREAKERS
CHARACTERISTIC TRIP CURVE NO. 730-6

CIRCUIT BREAKER INFORMATION

Circuit Breaker Prefix	Continuous Ampere Rating	Maximum AC Voltage	Number of Poles
QO-HID	45-50	120/240	1, 2
QOU	45-50	240	3
QO-PL	45-60	120/240	2
QO, QOU	45-70	120/240	1, 2
QO	45-70	240	3
QO-SWN	50	120	2
QO-SWN	50	120/240	3
QOM	50-60	120/240	2
QOM-VH	50-60	120/240	2

This curve is to be used for application and coordination purposes only. The **EZ-AMP** overlay feature at the bottom of the page should be used during coordination studies.

All time/current characteristic curve data is based on 40°C ambient cold start. Terminations are made with conductors of appropriate length and ratings.

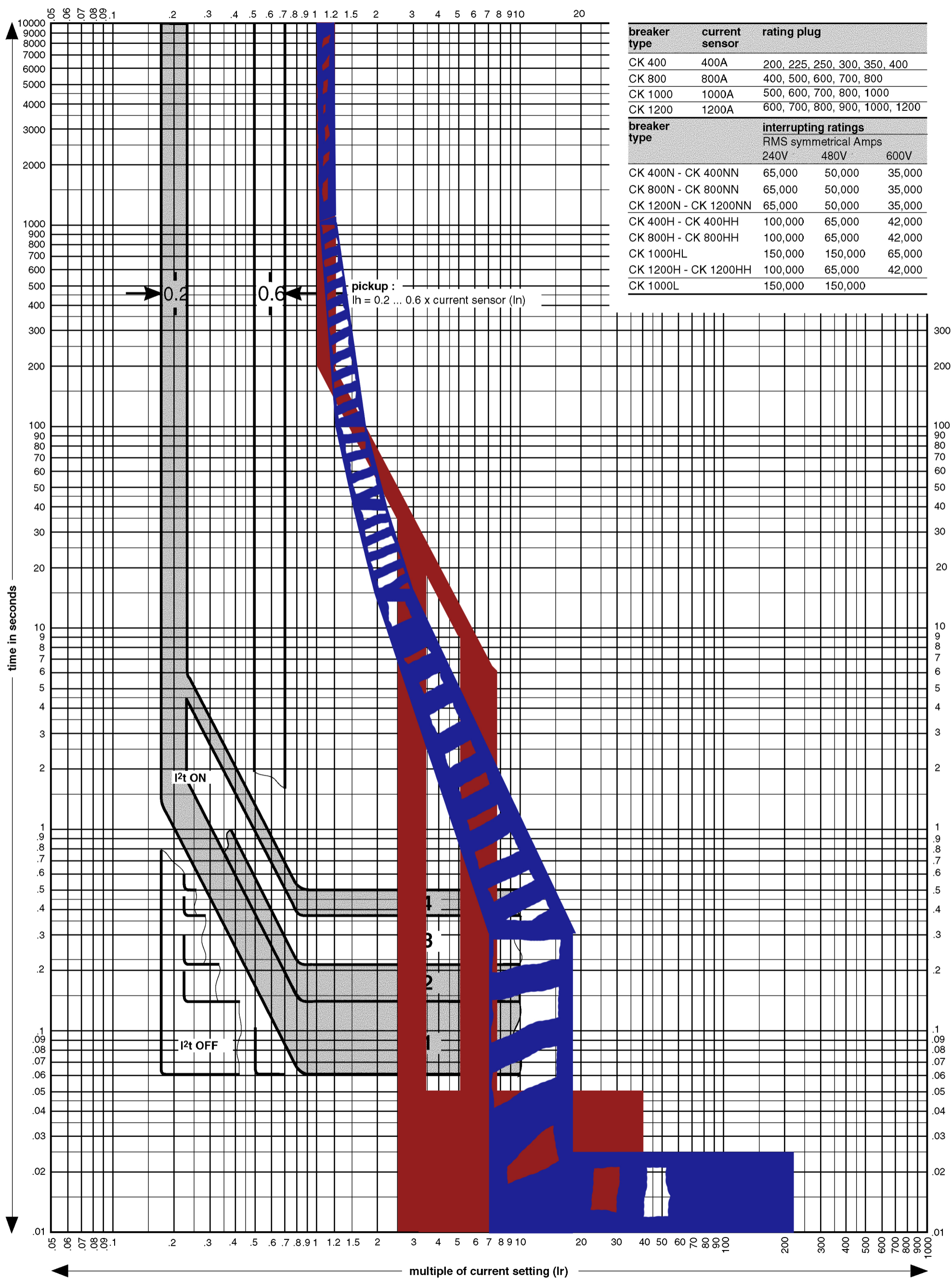


molded case circuit breakers

Compact CK

ground fault protection

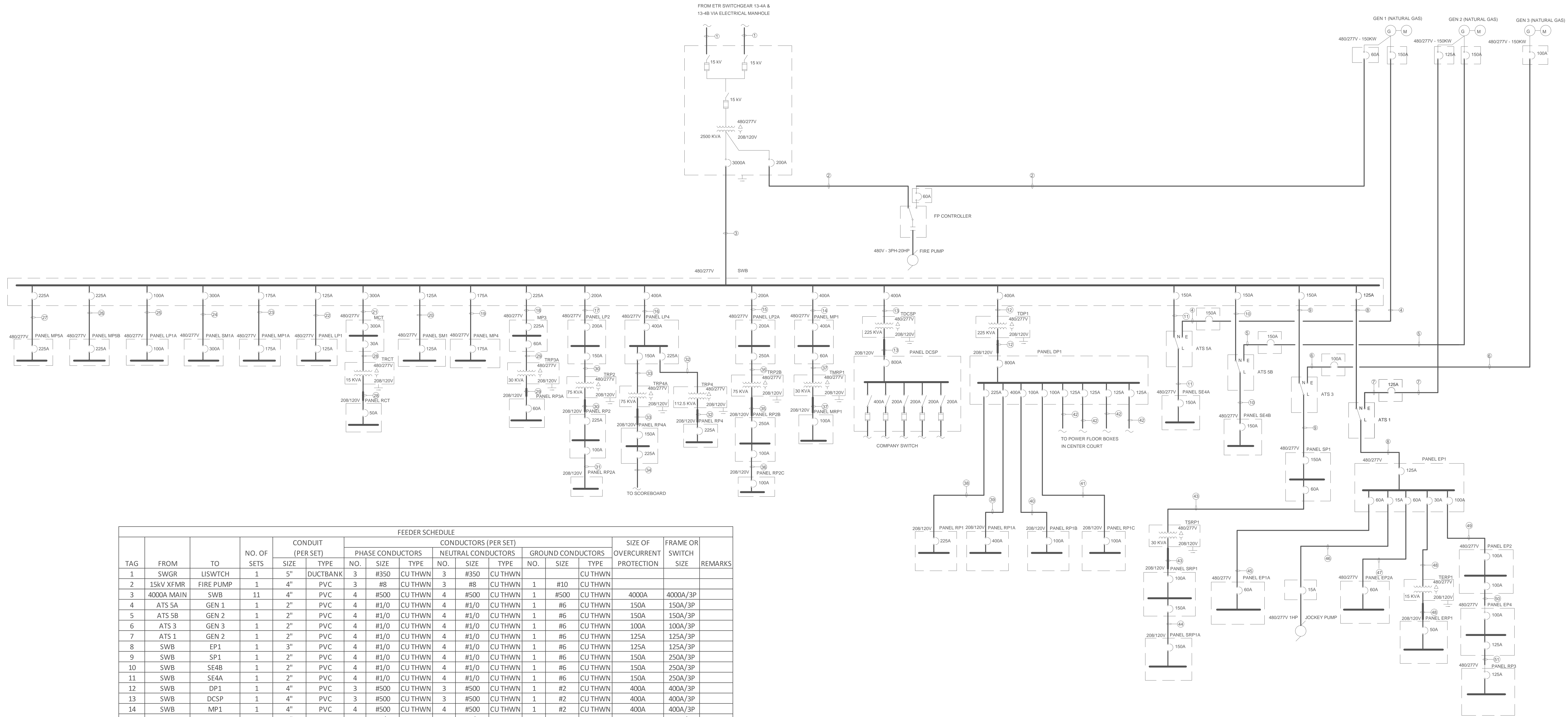
STR 55UP



breaker type	current sensor	rating plug
CK 400	400A	200, 225, 250, 300, 350, 400
CK 800	800A	400, 500, 600, 700, 800
CK 1000	1000A	500, 600, 700, 800, 1000
CK 1200	1200A	600, 700, 800, 900, 1000, 1200

breaker type	interrupting ratings		
	RMS symmetrical Amps		
	240V	480V	600V
CK 400N - CK 400NN	65,000	50,000	35,000
CK 800N - CK 800NN	65,000	50,000	35,000
CK 1200N - CK 1200NN	65,000	50,000	35,000
CK 400H - CK 400HH	100,000	65,000	42,000
CK 800H - CK 800HH	100,000	65,000	42,000
CK 1000HL	150,000	150,000	65,000
CK 1200H - CK 1200HH	100,000	65,000	42,000
CK 1000L	150,000	150,000	

TOWSON ARENA
TOWSON
UNIVERSITY
8000 YORK ROAD
TOWSON, MD
21252



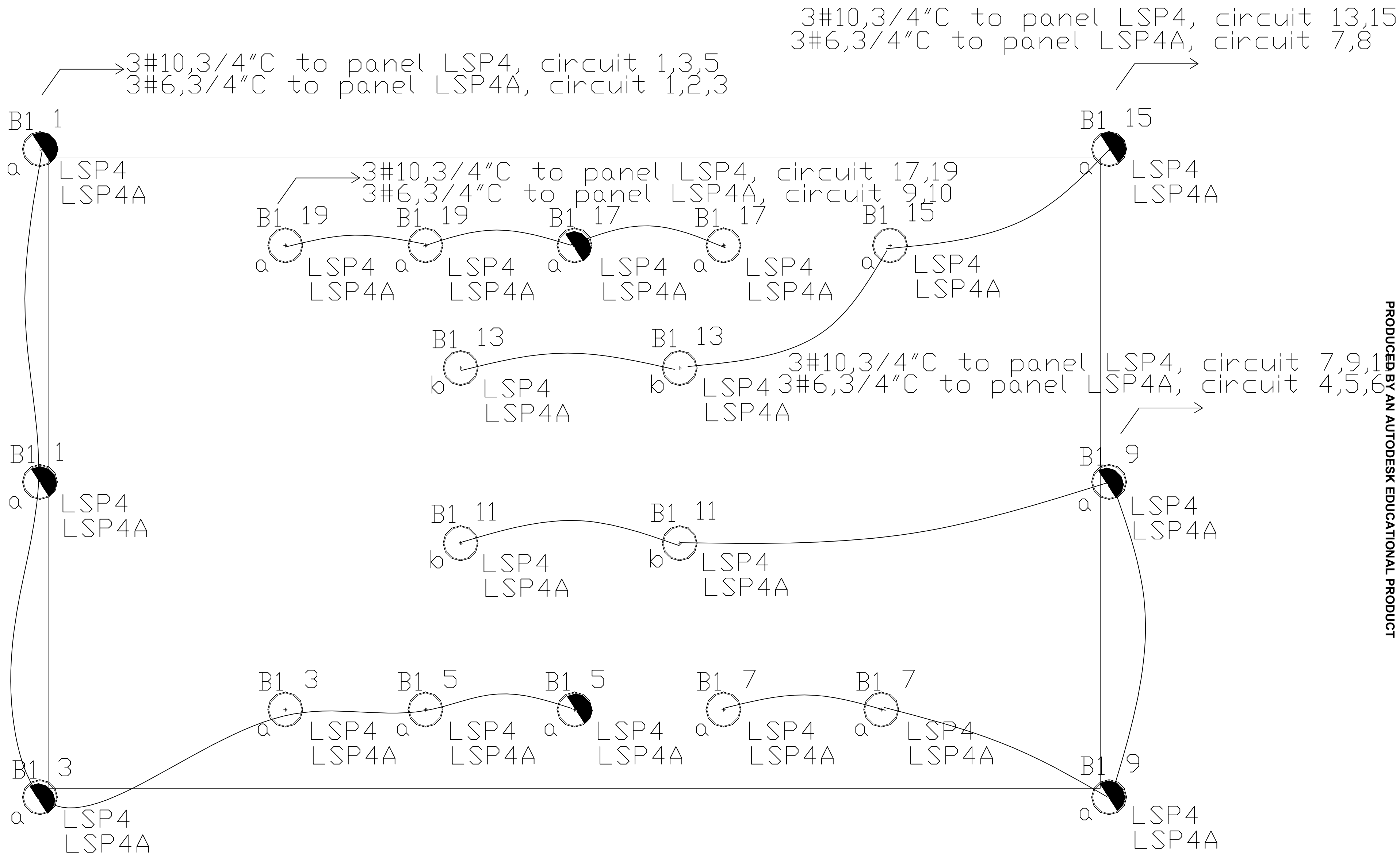
TAG	FROM	TO	NO. OF SETS	CONDUIT (PER SET)		CONDUCTORS (PER SET)			SIZE OF OVERCURRENT PROTECTION	FRAME OR SWITCH SIZE	REMARKS				
				SIZE	TYPE	PHASE CONDUCTORS		NEUTRAL CONDUCTORS				GROUND CONDUCTORS			
						NO.	SIZE	TYPE				NO.	SIZE	TYPE	NO.
1	SWGR	LISWTCH	1	5"	DUCTBANK	3	#350	CU THWN	3	#8	CU THWN	1	#10	CU THWN	
2	15KV XFMR	FIRE PUMP	1	4"	PVC	3	#6	CU THWN	3	#8	CU THWN	1	#10	CU THWN	
3	4000A MAIN	SWB	11	4"	PVC	4	#500	CU THWN	4	#500	CU THWN	1	#500	CU THWN	4000A/3P
4	ATS 5A	GEN 1	1	2"	PVC	4	#1/0	CU THWN	4	#1/0	CU THWN	1	#6	CU THWN	150A/3P
5	ATS 5B	GEN 2	1	2"	PVC	4	#1/0	CU THWN	4	#1/0	CU THWN	1	#6	CU THWN	150A/3P
6	ATS 3	GEN 3	1	2"	PVC	4	#1/0	CU THWN	4	#1/0	CU THWN	1	#6	CU THWN	100A/3P
7	ATS 1	GEN 2	1	2"	PVC	4	#1/0	CU THWN	4	#1/0	CU THWN	1	#6	CU THWN	125A/3P
8	SWB	EP1	1	3"	PVC	4	#1/0	CU THWN	4	#1/0	CU THWN	1	#6	CU THWN	125A/3P
9	SWB	SP1	1	2"	PVC	4	#1/0	CU THWN	4	#1/0	CU THWN	1	#6	CU THWN	150A/3P
10	SWB	SE4B	1	2"	PVC	4	#1/0	CU THWN	4	#1/0	CU THWN	1	#6	CU THWN	250A/3P
11	SWB	SE4A	1	2"	PVC	4	#1/0	CU THWN	4	#1/0	CU THWN	1	#6	CU THWN	250A/3P
12	SWB	DP1	1	4"	PVC	3	#500	CU THWN	3	#500	CU THWN	1	#2	CU THWN	400A/3P
13	SWB	DCSP	1	4"	PVC	3	#500	CU THWN	3	#500	CU THWN	1	#2	CU THWN	400A/3P
14	SWB	MP1	1	4"	PVC	4	#500	CU THWN	4	#500	CU THWN	1	#2	CU THWN	400A/3P
15	SWB	LP2A	1	4"	PVC	4	#3/0	CU THWN	4	#3/0	CU THWN	1	#6	CU THWN	200A/3P
16	SWB	LP4	1	4"	PVC	4	#500	CU THWN	4	#500	CU THWN	1	#2	CU THWN	400A/3P
17	SWB	LP2	1	3"	PVC	4	#3/0	CU THWN	4	#3/0	CU THWN	1	#6	CU THWN	200A/3P
18	SWB	MP3	1	3"	PVC	4	#4/0	CU THWN	4	#4/0	CU THWN	1	#4	CU THWN	225A/3P
19	SWB	MP4	1	2"	PVC	4	#2/0	CU THWN	4	#2/0	CU THWN	1	#6	CU THWN	175A/3P
20	SWB	SM1	1	2"	PVC	4	#1/0	CU THWN	4	#1/0	CU THWN	1	#6	CU THWN	125A/3P
21	SWB	MCT	1	4"	PVC	4	#350	CU THWN	4	#350	CU THWN	1	#4	CU THWN	300A/3P
22	SWB	LP1	1	1-1/4"	PVC	4	#2	CU THWN	4	#2	CU THWN	1	#8	CU THWN	100A/3P
23	SWB	MP1A	1	2"	PVC	4	#2/0	CU THWN	4	#2/0	CU THWN	1	#6	CU THWN	175A/3P
24	SWB	SM1A	1	3"	PVC	4	#350	CU THWN	4	#350	CU THWN	1	#4	CU THWN	300A/3P
25	SWB	LP1A	1	1-1/4"	PVC	4	#2	CU THWN	4	#2	CU THWN	1	#8	CU THWN	100A/3P
26	SWB	MP5B	1	3"	PVC	4	#4/0	CU THWN	4	#4/0	CU THWN	1	#4	CU THWN	225A/3P
27	SWB	MP5A	1	3"	PVC	4	#4/0	CU THWN	4	#4/0	CU THWN	1	#4	CU THWN	225A/3P
28	MCT	RCT	1	3/4"	PVC	3	#10	CU THWN	3	#10	CU THWN	1	#10	CU THWN	30A/3P
29	MP3	RP3A	1	1"	PVC	3	#6	CU THWN	3	#6	CU THWN	1	#10	CU THWN	60A/3P
30	LP2	RP2	1	2"	PVC	3	#1/0	CU THWN	3	#1/0	CU THWN	1	#6	CU THWN	150A/3P
31	RP2	RP2A	1	1-1/4"	PVC	4	#2	CU THWN	4	#2	CU THWN	1	#8	CU THWN	100A/3P
32	LP4	RP4	1	3"	PVC	3	#4/0	CU THWN	3	#4/0	CU THWN	1	#4	CU THWN	225A/3P
33	LP4	RP4A	1	2"	PVC	3	#1/0	CU THWN	3	#1/0	CU THWN	1	#6	CU THWN	150A/3P
34	RP4A	SCOREBOARD	1	3"	PVC	4	#4/0	CU THWN	4	#4/0	CU THWN	1	#4	CU THWN	225A/3P
35	LP2A	RP2B	1	2"	PVC	3	#1/0	CU THWN	3	#1/0	CU THWN	1	#6	CU THWN	150A/3P
36	RP2B	RP2C	1	1-1/4"	PVC	4	#2	CU THWN	4	#2	CU THWN	1	#8	CU THWN	100A/3P
37	MP1	MRP1	1	1"	PVC	3	#6	CU THWN	3	#6	CU THWN	1	#10	CU THWN	60A/3P
38	DP1	RP1	1	3"	PVC	4	#4/0	CU THWN	4	#4/0	CU THWN	1	#4	CU THWN	225A/3P
39	DP1	RP1A	1	4"	PVC	4	#500	CU THWN	4	#500	CU THWN	1	#2	CU THWN	400A/3P
40	DP1	RP1B	1	1-1/4"	PVC	4	#2	CU THWN	4	#2	CU THWN	1	#8	CU THWN	100A/3P
41	DP1	RP1C	1	1-1/4"	PVC	4	#2	CU THWN	4	#2	CU THWN	1	#8	CU THWN	100A/3P
42	DP1	PWR FLR BOX	1	2"	PVC	4	#2/0	CU THWN	4	#2/0	CU THWN	1	#4	CU THWN	125A/3P
43	SP1	SRP1	1	1"	PVC	3	#6	CU THWN	3	#6	CU THWN	1	#10	CU THWN	60A/3P
44	SRP1	SRP1A	N/A	N/A	PVC	N/A	N/A	CU THWN	N/A	N/A	CU THWN	N/A	N/A	CU THWN	150A/3P
45	EP1	EP1A	1	1"	PVC	4	#6	CU THWN	4	#6	CU THWN	1	#10	CU THWN	30A/3P
46	EP1	JOCKEY PUMP	1	3/4"	PVC	3	#10	CU THWN	3	#10	CU THWN	1	#10	CU THWN	15A/3P
47	EP1	EP2A	1	1"	PVC	4	#6	CU THWN	4	#6	CU THWN	1	#10	CU THWN	60A/3P
48	EP1	ERP1	1	3/4"	PVC	3	#10	CU THWN	3	#10	CU THWN	1	#10	CU THWN	30A/3P
49	EP1	EP2	1	1-1/4"	PVC	4	#3	CU THWN	4	#3	CU THWN	1	#8	CU THWN	100A/3P
50	EP2	EP4	1	1-1/4"	PVC	4	#3	CU THWN	4	#3	CU THWN	1	#8	CU THWN	100A/3P
51	EP4	RP3	N/A	N/A	PVC	N/A	N/A	CU THWN	N/A	N/A	CU THWN	N/A	N/A	CU THWN	125A/3P

Notes:
1. REFER TO RISER DIAGRAM FOR FEEDER TAGS
2. PANEL SRP1A & RP3 DO NOT INCLUDE FEEDER INFORMATION
3. CU = COPPER

SINGLE LINE DIAGRAM

SCALE: 3/16" = 1' - 0"

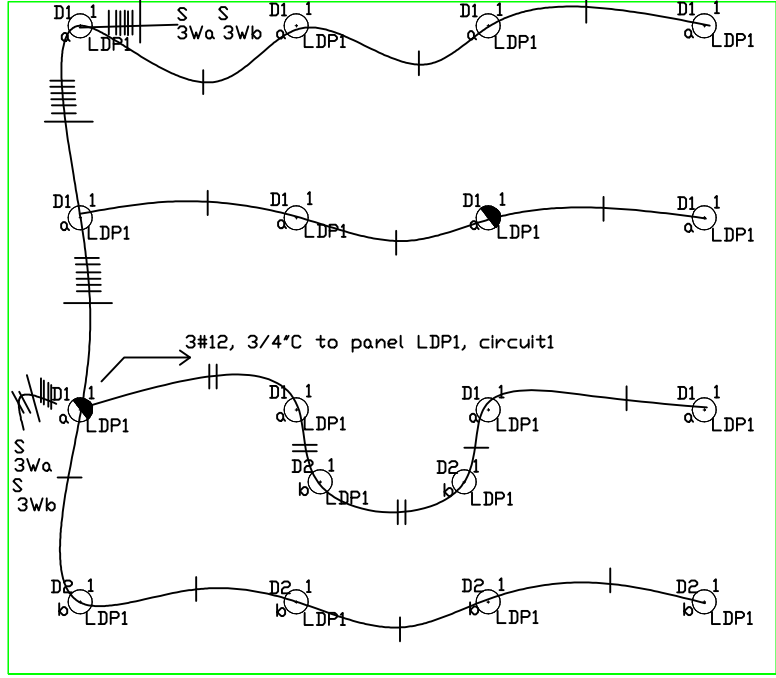
S_{3Wa} S_{3Wb}

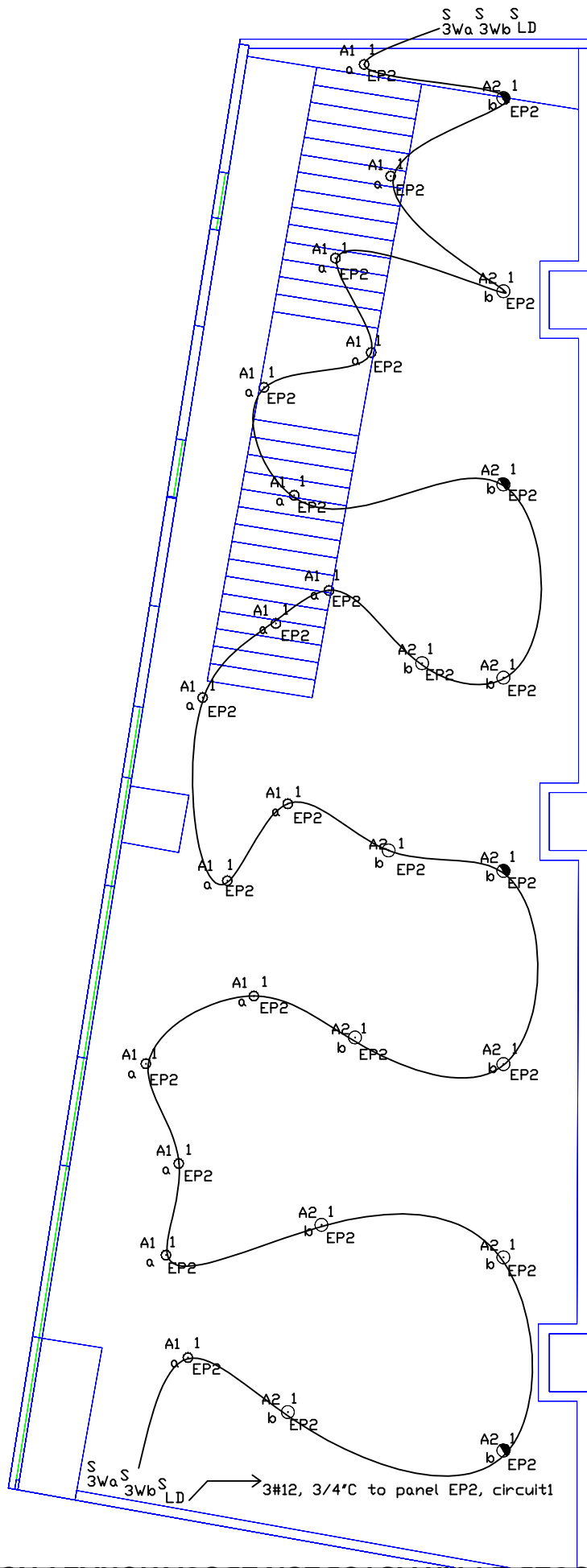


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S_{3Wa} S_{3Wb}







Acoustic Properties of Perforated Steel Deck

Introduction

Steel deck is generally a structural product designed to resist gravity loads. However, from the time it was first commercially introduced, there have been successful attempts to utilize deck to perform more than one function. Acoustic roof deck is one example of using the decking material to perform multiple functions with very little increased cost. The acoustic deck provides a finished ceiling with noise reduction capabilities while still providing the required vertical and horizontal load resistance.

The noise reduction is achieved by the perforations and the acoustical insulation or material shown in Figure 1. The sound penetrates the deck through the perforations and is absorbed by the insulation. The perforations in the deck do cause a small reduction in strength and stiffness. The reduction varies from 5 to 10%. You should consult your deck supplier for the exact capacity.

Noise Reduction

Table 1 shows the minimum sound absorption data at various frequencies for typical acoustically treated

roof deck. This data is obtained by conducting the ASTM C423 test, with mounting conforming to ASTM E795, at an accredited acoustical laboratory. The sound absorption coefficients represent the percentage of noise that the tested surface converts to other energy forms which does not reflect as sound. The usual tested frequencies are 125, 250, 500, 1000, 2000 and 4000 Hertz and the Noise Reduction Coefficient (NRC) is the average is rounded to the nearest 0.05. Because of the measurement methods, the sound absorption coefficient for a particular frequency can be greater than 1; but, for any specific use at that frequency the value should be taken as 1.

The sound absorption at any particular frequency and the NRC is a function of the total construction. Higher NRC values can be obtained by using fiberglass insulation board for the insulation material on top of the deck system in lieu of the commonly used foam board insulation. Consult individual CSSBI member companies for their recommendations and be aware that insulation board selected for its thermal characteristics will not have the same NRC as fiberglass board. Substitution of

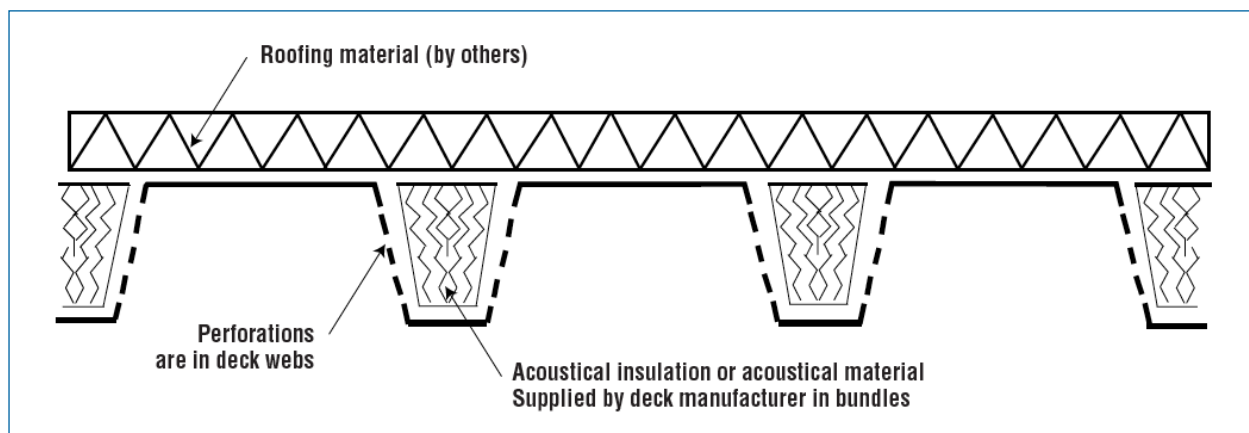


Figure 1: 1-1/2" and 3" acoustic roof deck

	FREQUENCY (HERTZ)						
	125	250	500	1000	2000	4000	NRC
1-1/2" Acoustic Deck	0.13	0.55	0.79	1.01	0.53	0.25	0.70
3" Acoustic Deck	0.13	0.53	0.93	0.92	0.45	0.30	0.70

Table 1: Sound absorption coefficients for acoustic steel deck (Canadian manufacturers)

specified roofing components will affect acoustical performance.

Table 2 lists the Noise Reduction Coefficients (NRC) values for various interior surfaces and materials. Complete tables of coefficients of the various materials that normally constitute the interior finish a building may be found in the reference books on architectural acoustics.

It is interesting to note that suspended acoustical ceilings normally have an NRC of 0.50 to 0.75 - a common base design value is 0.60 - and the NRC of acoustical roof deck is in the 0.70 range. The excellent performance of the steel deck is often a surprise to many designers.

In various working environments a worker's exposure to sound may be limited to the times shown in Table 3. This table illustrates the importance of acoustical treatment. A one decibel drop in the noise level allows about 13% more exposure time. (A one decibel difference is about the smallest change discernible by the human ear.) It is not difficult to estimate the dollar savings and also appreciate the improved comfort of the working

environment provided by improved acoustics. With the use of acoustic deck, productivity is also improved because speech intelligibility is enhanced. This results in employees being able to hear clearly and understand instructions.

The total absorption of an area (room) is obtained by multiplying the noise reduction coefficient (NRC) by the surface area: the result is expressed in Sabins. A Sabin is defined as the sound absorption of one square foot of surface area with an absorption coefficient of 1.00.

$$A = C_1S_1 + C_2S_2 \dots \text{etc.}$$

Where A is the total absorption in Sabins; C₁, C₂, etc. are the NRC values and S₁, S₂, etc. are the corresponding square foot surface areas. The reduction, R, in decibels is then found by;

$$R = 10 \log_{10} (A_a / A_b)$$

Where A_a is the sound absorption after acoustical treatment, and A_b is the sound absorption before. A_a and A_b are in Sabins or metric Sabins.

MATERIALS	FREQUENCY (HERTZ)						NRC
	125	250	500	1000	2000	4000	
Brick	.03	.03	.03	.04	.05	.07	.05
Carpet on heavy concrete	.02	.06	.14	.37	.60	.65	.30
Carpet with heavy pad	0.8	.24	.57	.69	.71	.73	.55
Carpet with impermeable backing	0.8	.27	.39	.34	.48	.63	.35
Concrete block - course	.36	.44	.31	.29	.39	.25	.35
Concrete block - painted	.10	.05	.06	.07	.09	.08	.05
Light fabric	.03	.04	.11	.17	.24	.35	.15
Medium fabric	.07	.31	.49	.75	.70	.60	.55
Heavy fabric	.14	.35	.55	.72	.70	.65	.60
Concrete, terrazzo, marble or glazed tile	.01	.01	.015	.02	.02	.02	.00
Wood	.15	.11	.10	.07	.06	.07	.10
Heavy glass	.18	.06	.04	.03	.02	.02	.05
Ordinary glass	.35	.25	.18	.12	.07	.04	.15
Gypsum board 1/2"	.29	.10	.05	.04	.07	.09	.05
Plaster	.013	.015	.02	.03	.04	.05	.05
Water Surface	.008	.008	.013	.015	.020	.025	.00
Steel plate - flat							.05
Steel plate - corrugated*							.15
Typical Acoustical Steel Roof Deck							.70

Table 2: Noise reduction coefficients for various materials

* May be used for Non-Acoustical Deck

DURATION (h)	MAXIMUM SUSTAINED SOUND IN INTENSITY (dB(A))					SOUND SOURCE		dB
	BRITISH COLUMBIA ALBERTA SASKATCHEWAN NEW BRUNSWICK NOVA SCOTIA PRINCE EDWARD ISLAND NEWFOUNDLAND	FEDERAL JURISDICTION COMPANIES	MANITOBA	ONTARIO QUEBEC				
16	82	84	87	85			Threshold of Feeling	120
8	85	87	90	90			Thunder	115
4	88	90	93	95			Noisy Factory	110
1	94	96	99	105			Subway	100
0.50	97	99	102	110			Loud Street Noise	90
0.25	100	102	105	115			Noisy Office	80
							Average Street Noise	70
							Average Conversation	50
							Quiet Conversation	20
							Whisper	15
							Soundproof Room	10
							Threshold of Hearing	5

Table 3: Time limits for exposure to steady noise level

Table 4: Decibel reading for various sounds

Table 4 shows levels that commonly exist, and may or may not be acceptable.

Summary of Canadian regulations.

Regulations may change over the years and specific maximum exposure for a given activity should be verified with the regulatory body having jurisdiction.

An owner wants to duplicate an existing manufacturing plant but would like to improve the acoustics in the new building. The existing plant has a noise level of 94 decibels (dB) and the construction is:

SIZE: 100' x 200' x 20' (high) {30 m x 60 m x 6 m (high)}

WALLS: painted concrete block NRC = 0.05

CEILING: precast plank NRC = 0.05

FLOOR: concrete slab NRC = 0

PEOPLES: 20 (4.5 Sabins per person) {20 (0.4 metric Sabins per person)}

The total Sabins for the existing construction is:

WALLS: 12,000 sq. ft. x 0.05 = 600 {1 080 sq. m x 0.05 = 54}

CEILING: 20,000 sq. ft. x 0.05 = 1,000 {1 800 sq. m x 0.05 = 90}

FLOOR: 20,000 sq. ft. x 0.00 = 0 {1 800 sq. m x 0 = 0}

PEOPLES: 20 x 4.5 Sabins per person = 90 {20 person x 0.4 = 8}

TOTAL = 1,690 Sabins = 152 metric Sabins

Instead of precast planks, use acoustic roof deck with an NRC of 0.70. The total Sabins would then become. (1,690 - 1,000) + (20,000 x 0.70) = 14,690 Sabins. { (152 - 90) + (1 800 x 0.70) = 1,322 metric Sabins}.

The sound level reduction would be: $R = 10 \log_{10} (14,690 / 1,690) = 9.39$ dB: use 9,4.

The sound level for the proposed construction is then 94 - 9.4 = 84.6 dB.

By replacing the precast plank ceiling construction by acoustical steel deck ceiling construction, the sound absorption of the ceiling surface would decrease the sound level in the workplace and allow longer exposure to the ambient sound produced by the same equipment.

Example Problem 1

SI Values

A System International (SI) unit has not been designated to measure sound absorption. However, a metric Sabin is the sound absorption effect of 1 square metre area of absorbing material with a NRC of 1.00. One can then use the listed NRC values to obtain a noise reduction coefficient in metric Sabin by multiplying the NRC value of the material by the surface in square metres of this material. The metric Sabin number will be 10.8 times less than the Sabin number and formula using Sabins may require adjustment when using metric Sabins.

Reflection and Reverberation

Sound reaches a listener's ear inside an enclosed area in two ways - directly from the source and as reflection from surfaces. Multiple reflection will occur as the sound ricochets from surface to surface. At each reflection some absorption occurs and the sound gradually diminishes. But, if the sound source is continuous, such as a machine, reverberation can add to the effect. Reverberation time is the time, in seconds, required for the sound level in a room to decrease by 60 dB after the source is stopped. The time may vary from 1/2 second in a "dead" room to 5 or 10 seconds in a live reverberant large room. The maximum reverberation time for clear speech is about 2 seconds. As the reverberation time gets longer (than 2 seconds) speech becomes increasingly difficult to understand. At 4 to 10 seconds, speech is unintelligible. By the same measure, speech is increasingly easier to understand as reverberation times go below 2 seconds. Classrooms and lecture areas are ideally at less than 1 second. Music is best enjoyed at 1-1/2 to 2 seconds. Chamber and organ music is ideal at 3 seconds (as in churches).

Other Considerations

Sound Transmission Class (STC) values are a measure of a different acoustical problem than noise reduction. While acoustic roof deck is intended to reduce the noise level inside an area, an STC value expresses the airborne noise that either enters or leaves an area by going through the construction.

Room Crossover

Room crossover, or flanking, of sound can occur through penetrations and cracks under and around doors for example. Sealing around penetrations can help to minimize the effect. Noise can travel along the underside or through an acoustic roof deck ceiling and enter an adjoining area across the top of a partition. Rubber closures shaped to fit the deck ribs can be supplied by the deck manufacturer to help reduce sound crossover. Concrete or mortar can be used to fill between CMU and deck or in flutes above partitions.

General

Hard, reflective, non porous interior building surfaces such as glass, wood, plaster, brick and concrete absorb 2 to 5% of the sounds striking the surface and, therefore, reflect 95% or more of the sound. Acoustic steel deck is one of the best and most cost effective products that can help absorb more of the sound. There are, of course, other materials and methods available that can be used alone or with acoustic deck to achieve significant reductions in noise such as acoustical wall panels, acoustical baffles and acoustical carpets.

The purpose of this paper has been to demonstrate how acoustic steel deck can be used as an economical and effective method to reduce noise. The information presented was prepared in accordance with generally recognized acoustical principles but it is a general treatment and is only intended to introduce topics that can give insight into a complex subject. The CSSBI recommends that professional analysis and evaluation be conducted by an experienced acoustical consultant for either a building in the design stage or for existing buildings that need treatment.

For More Information

For more information on sheet steel building products, or to order any CSSBI publications, contact the CSSBI at the address shown below or visit the website at www.cssbi.ca.

Design Cooling Load Summary

By ACADEMIC
Towson Arena
Towson, MD

System - Default System

Type - Bypass VAV with Reheat (30% Min Flow Default)

Coil Location - System

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 91 / 77 / 118

COOLING COIL LOAD INFORMATION

COOLING COIL SELECTION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	261,496		261,496	9.3%
Glass Transmission	43,312		43,312	1.5%
Wall Transmission	588,320		588,320	21.0%
Roof Transmission	0	0	0	0.0%
Floor Transmission	0	0	0	0.0%
Adj Floor Transmission	0		0.00	0.0%
Partition Transmission	0		0	0.0%
Net Ceiling Load	0		0	0.0%
Lighting	35,444		35,444	1.3%
People	813,585	379,673	1,193,258	42.5%
Misc. Equipment Loads	88,610	0	88,610	3.2%
Cooling Infiltration	0	0	0	0.0%
Sub-Total ==>	1,830,767	379,673	2,210,440	78.8%
Ventilation Load	146,847	300,139	446,986	15.9%
Exhaust Heat	-12,816	0	-12,816	-0.5%
Supply Fan Load	1		1	0.0%
Return Fan Load	1		1	0.0%
Net Duct Heat Pickup	0		0	0.0%
Wall Load to Plenum	159,789		159,789	5.7%
Roof Load to Plenum	0		0	0.0%
Adj Floor to Plenum	0		0	0.0%
Lighting Load to Plenum	0		0	0.0%
Misc. Equip. Load to Plenum	0	0	0	0.0%
Glass Transmission to Plenum	0		0	0.0%
Glass Solar to Plenum	0		0	0.0%
Over/Under Sizing	0		0	0.0%
Reheat at Design	0	0	0	0.0%
Underfloor Sup Heat Pickup	0		0	0.0%
Supply Air Leakage	0	0	0	0.0%
Total Cooling Loads	2,124,589	679,812	2,804,401	100.0 %

Coil Selection Parameters	
Coil Entering Air (DB / WB)	76.8 / 63.7 °F
Coil Entering Humidity Ratio	67.83 gr/lb
Coil Leaving Air (DB / WB)	55.0 / 53.2 °F
Coil Leaving Humidity Ratio	57.77 gr/lb
Coil Sensible Load	2,124.59 MBh
Coil Total Load	2,804.40 MBh
Cooling Supply Air Temperature	55.01 °F
Total Cooling Airflow	89,694.37 cfm
Resulting Room Relative Humidity	49.95 %

General Engineering Checks

Total Cooling Load	233.7 ton
Area / Load	111.09 ft²/ton
Total Floor Area	25,962 ft²
Cooling Airflow	3.45 cfm/ft²
Airflow / Load	383.80 cfm/ton
Percent Outdoor Air	8.7 %
Cooling Load Methodology	TETD-TA1

Design Cooling Load Summary

By ACADEMIC
Towson Arena
Towson, MD

System - Default System

Type - Bypass VAV with Reheat (30% Min Flow Default)

Coil Location - System

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 91 / 77 / 118

COOLING COIL LOAD INFORMATION

COOLING COIL SELECTION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	179,578		179,578	6.6%
Glass Transmission	31,711		31,711	1.2%
Wall Transmission	588,320		588,320	21.7%
Roof Transmission	0	0	0	0.0%
Floor Transmission	0	0	0	0.0%
Adj Floor Transmission	0	0	0.00	0.0%
Partition Transmission	0	0	0	0.0%
Net Ceiling Load	0	0	0	0.0%
Lighting	35,444		35,444	1.3%
People	813,585	379,673	1,193,258	44.1%
Misc. Equipment Loads	88,610	0	88,610	3.3%
Cooling Infiltration	0	0	0	0.0%
Sub-Total ==>	1,737,248	379,673	2,116,921	78.2%
Ventilation Load	146,847	299,553	446,400	16.5%
Exhaust Heat	-13,988	0	-13,988	-0.5%
Supply Fan Load	0	0	0	0.0%
Return Fan Load	0	0	0	0.0%
Net Duct Heat Pickup	0	0	0	0.0%
Wall Load to Plenum	159,210		159,210	5.9%
Roof Load to Plenum	0	0	0	0.0%
Adj Floor to Plenum	0	0	0	0.0%
Lighting Load to Plenum	0	0	0	0.0%
Misc. Equip. Load to Plenum	0	0	0	0.0%
Glass Transmission to Plenum	0	0	0	0.0%
Glass Solar to Plenum	0	0	0	0.0%
Over/Under Sizing	0	0	0	0.0%
Reheat at Design	0	0	0	0.0%
Underfloor Sup Heat Pickup	0	0	0	0.0%
Supply Air Leakage	0	0	0	0.0%
Total Cooling Loads	2,029,318	679,226	2,708,544	100.0 %

Coil Selection Parameters	
Coil Entering Air (DB / WB)	77.1 / 63.9 °F
Coil Entering Humidity Ratio	68.43 gr/lb
Coil Leaving Air (DB / WB)	54.2 / 52.7 °F
Coil Leaving Humidity Ratio	57.15 gr/lb
Coil Sensible Load	2,029.32 MBh
Coil Total Load	2,708.54 MBh
Cooling Supply Air Temperature	54.17 °F
Total Cooling Airflow	81,234.80 cfm
Resulting Room Relative Humidity	50.03 %

General Engineering Checks

Total Cooling Load	225.7 ton
Area / Load	115.02 ft²/ton
Total Floor Area	25,962 ft²
Cooling Airflow	3.13 cfm/ft²
Airflow / Load	359.90 cfm/ton
Percent Outdoor Air	9.6 %
Cooling Load Methodology	TETD-TA1

Design Cooling Load Summary

By ACADEMIC
Towson Arena
Towson, MD

System - Default System

Type - Bypass VAV with Reheat (30% Min Flow Default)

Coil Location - System

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 91 / 77 / 118

COOLING COIL LOAD INFORMATION

COOLING COIL SELECTION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	131,021		131,021	4.9%
Glass Transmission	21,685		21,685	0.8%
Wall Transmission	588,320		588,320	22.2%
Roof Transmission	0		0	0.0%
Floor Transmission	0		0	0.0%
Adj Floor Transmission	0		0.00	0.0%
Partition Transmission	0		0	0.0%
Net Ceiling Load	0		0	0.0%
Lighting	35,444		35,444	1.3%
People	813,585	379,673	1,193,258	45.0%
Misc. Equipment Loads	88,610	0	88,610	3.3%
Cooling Infiltration	0	0	0	0.0%
Sub-Total ==>	1,678,664	379,673	2,058,337	77.7%
Ventilation Load	146,847	299,463	446,310	16.8%
Exhaust Heat	-14,541	0	-14,541	-0.5%
Supply Fan Load	0		0	0.0%
Return Fan Load	0		0	0.0%
Net Duct Heat Pickup	0		0	0.0%
Wall Load to Plenum	158,936		158,936	6.0%
Roof Load to Plenum	0		0	0.0%
Adj Floor to Plenum	0		0	0.0%
Lighting Load to Plenum	0		0	0.0%
Misc. Equip. Load to Plenum	0	0	0	0.0%
Glass Transmission to Plenum	0		0	0.0%
Glass Solar to Plenum	0		0	0.0%
Over/Under Sizing	0		0	0.0%
Reheat at Design	0	0	0	0.0%
Underfloor Sup Heat Pickup	0		0	0.0%
Supply Air Leakage	0	0	0	0.0%
Total Cooling Loads	1,969,908	679,136	2,649,043	100.0 %

Coil Selection Parameters	
Coil Entering Air (DB / WB)	77.2 / 64.0 °F
Coil Entering Humidity Ratio	68.69 gr/lb
Coil Leaving Air (DB / WB)	54.0 / 52.5 °F
Coil Leaving Humidity Ratio	56.87 gr/lb
Coil Sensible Load	1,969.91 MBh
Coil Total Load	2,649.04 MBh
Cooling Supply Air Temperature	53.97 °F
Total Cooling Airflow	77,713.52 cfm
Resulting Room Relative Humidity	50.05 %

General Engineering Checks

Total Cooling Load	220.8 ton
Area / Load	117.61 ft²/ton
Total Floor Area	25,962 ft²
Cooling Airflow	2.99 cfm/ft²
Airflow / Load	352.04 cfm/ton
Percent Outdoor Air	10.0 %
Cooling Load Methodology	TETD-TA1

Design Cooling Load Summary

By ACADEMIC
Towson Arena
Towson, MD

System - Default System

Type - Bypass VAV with Reheat (30% Min Flow Default)

Coil Location - System

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 91 / 77 / 118

COOLING COIL LOAD INFORMATION

COOLING COIL SELECTION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	311,753		311,753	10.8%
Glass Transmission	75,628		75,628	2.6%
Wall Transmission	588,320		588,320	20.4%
Roof Transmission	0	0	0	0.0%
Floor Transmission	0	0	0	0.0%
Adj Floor Transmission	0	0	0.00	0.0%
Partition Transmission	0	0	0	0.0%
Net Ceiling Load	0	0	0	0.0%
Lighting	35,444		35,444	1.2%
People	813,585	379,673	1,193,258	41.3%
Misc. Equipment Loads	88,610	0	88,610	3.1%
Cooling Infiltration	0	0	0	0.0%
Sub-Total ==>	1,913,339	379,673	2,293,012	79.4%
Ventilation Load	146,847	300,349	447,196	15.5%
Exhaust Heat	-12,173	0	-12,173	-0.4%
Supply Fan Load	1		1	0.0%
Return Fan Load	1		1	0.0%
Net Duct Heat Pickup	0		0	0.0%
Wall Load to Plenum	160,107		160,107	5.5%
Roof Load to Plenum	0		0	0.0%
Adj Floor to Plenum	0		0	0.0%
Lighting Load to Plenum	0		0	0.0%
Misc. Equip. Load to Plenum	0	0	0	0.0%
Glass Transmission to Plenum	0		0	0.0%
Glass Solar to Plenum	0		0	0.0%
Over/Under Sizing	0		0	0.0%
Reheat at Design	0	0	0	0.0%
Underfloor Sup Heat Pickup	0		0	0.0%
Supply Air Leakage	0	0	0	0.0%
Total Cooling Loads	2,208,122	680,022	2,888,143	100.0 %

Coil Selection Parameters	
Coil Entering Air (DB / WB)	76.7 / 63.6 °F
Coil Entering Humidity Ratio	67.53 gr/lb
Coil Leaving Air (DB / WB)	55.3 / 53.4 °F
Coil Leaving Humidity Ratio	58.10 gr/lb
Coil Sensible Load	2,208.12 MBh
Coil Total Load	2,888.14 MBh
Cooling Supply Air Temperature	55.25 °F
Total Cooling Airflow	95,029.09 cfm
Resulting Room Relative Humidity	49.92 %

General Engineering Checks

Total Cooling Load	240.7 ton
Area / Load	107.87 ft²/ton
Total Floor Area	25,962 ft²
Cooling Airflow	3.66 cfm/ft²
Airflow / Load	394.84 cfm/ton
Percent Outdoor Air	8.2 %
Cooling Load Methodology	TETD-TA1

Design Cooling Load Summary

By ACADEMIC
Towson Arena
Towson, MD

System - Default System

Type - Bypass VAV with Reheat (30% Min Flow Default)

Coil Location - System

Coil Peak Calculation Time: July, hour 15
Ambient DB/WB/HR: 91 / 77 / 118

COOLING COIL LOAD INFORMATION

COOLING COIL SELECTION

Load Component	Sensible Btu/h	Latent Btu/h	Total Btu/h	Percent of Total
Solar Gain	292,987		292,987	10.2%
Glass Transmission	67,750		67,750	2.4%
Wall Transmission	588,320		588,320	20.6%
Roof Transmission	0		0	0.0%
Floor Transmission	0		0	0.0%
Adj Floor Transmission	0		0.00	0.0%
Partition Transmission	0		0	0.0%
Net Ceiling Load	0		0	0.0%
Lighting	35,444		35,444	1.2%
People	813,585	379,673	1,193,258	41.7%
Misc. Equipment Loads	88,610	0	88,610	3.1%
Cooling Infiltration	0	0	0	0.0%
Sub-Total ==>	1,886,695	379,673	2,266,368	79.2%
Ventilation Load	146,847	300,282	447,129	15.6%
Exhaust Heat	-12,389	0	-12,389	-0.4%
Supply Fan Load	1		1	0.0%
Return Fan Load	1		1	0.0%
Net Duct Heat Pickup	0		0	0.0%
Wall Load to Plenum	160,000		160,000	5.6%
Roof Load to Plenum	0		0	0.0%
Adj Floor to Plenum	0		0	0.0%
Lighting Load to Plenum	0		0	0.0%
Misc. Equip. Load to Plenum	0	0	0	0.0%
Glass Transmission to Plenum	0		0	0.0%
Glass Solar to Plenum	0		0	0.0%
Over/Under Sizing	0		0	0.0%
Reheat at Design	0	0	0	0.0%
Underfloor Sup Heat Pickup	0		0	0.0%
Supply Air Leakage	0	0	0	0.0%
Total Cooling Loads	2,181,155	679,954	2,861,110	100.0 %

Coil Selection Parameters	
Coil Entering Air (DB / WB)	76.7 / 63.6 °F
Coil Entering Humidity Ratio	67.63 gr/lb
Coil Leaving Air (DB / WB)	55.2 / 53.3 °F
Coil Leaving Humidity Ratio	57.96 gr/lb
Coil Sensible Load	2,181.16 MBh
Coil Total Load	2,861.11 MBh
Cooling Supply Air Temperature	55.17 °F
Total Cooling Airflow	93,175.72 cfm
Resulting Room Relative Humidity	49.93 %

General Engineering Checks

Total Cooling Load	238.4 ton
Area / Load	108.89 ft²/ton
Total Floor Area	25,962 ft²
Cooling Airflow	3.59 cfm/ft²
Airflow / Load	390.80 cfm/ton
Percent Outdoor Air	8.4 %
Cooling Load Methodology	TETD-TA1