

Newseum & Freedom Forum Headquarters

Washington, D.C.

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Lighting/Electrical Option

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[FINAL THESIS REPORT]

Newseum & Freedom Forum Headquarters

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Architecture/Features

Occupancy: Mixed use - Gallery/Exhibits, office, retail, residential, 500 seat theatre

Size: 550,000 sf

Stories: 7

Overall cost: \$200 million

Construction Dates: 2003-November 2007

Delivery Method: Design-bid-build

- 60 ft. high plane of marble on the south facade engraved with the first ammendment
- Berlin Wall exhibit including Check Point Charlie, and 9/11 exhibit including the antaena from the World Trade Center Building

Mechanical

- (4) 742 ton cooling towers giving a total flow rate of 5,940 gpm
- Uses radiant floor heating system
- Conditioned air into display cases to control humidity

Project Team

Architect: Polshek Partnership Architects, LLP

General Contractor: Turner Construction Company

Lighting Design: Brandston Partnership, Inc.

MEP Engineer: Flack & Kurtz Consulting Engineers

Structural Engineer: Leslie E. Robertson Associates

Exhibition Plan & Design: Ralph Applebaum Associates

Lighting/Electrical

- Power supplied by PEPCO
- Newseum running on 460Y/265V 3P 4 wire
- Residential running on 208Y/120V 3P 4 wire
- 2250 kW generator for emergency lighting
- Use of daylighting with glass facade
- Galleries are primarily recessed down lights with accent lighting
- Offices use 2x2 fluorescent troffers

Structural

- Continuous poured concrete foundation against bentonite panels for waterproofing
- Concrete slab on metal deck flooring
- Superstructure composed of structural steel columns and beams
- Glass facade envelope with concrete slab roof deck



CPEP address: <http://www.engr.psu.edu/ae/thesis/portfolios/2008/rmw210/>

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Executive Summary

The main purpose of this report is to look at the many systems of the Newseum & Freedom Forum Headquarters building, and provide a detailed analysis and redesign of them. These include a depth study of the lighting, a depth study of the electric system, and breadth studies on architectural and mechanical systems.

In the lighting depth study, a redesign of the lighting for four spaces was completed. They are the Welcoming Lobby, News History Gallery, Freedom Forum Offices, and Exterior Porch Entry. Each of these spaces involves first examining the spaces dimensions and materials. Then a list of design criteria was established. After selecting equipment to satisfy the design ideas, AGI32 was used to perform lighting calculations and renderings. The ASHRAE Standard 90.1 was also used to ensure proper energy limitations.

With a total redesign of lighting for some of the spaces, it is necessary to also redesign the panel boards and circuits which feed these spaces. This was involved as part of the electrical depth. A short circuit analysis was also performed. Two other areas of study were also involved in the electrical depth. They are a comparison of using energy efficient transformers instead of standard transformers. It was found that the Newseum would greatly benefit from the energy efficient transformers. There would be a decrease in electric costs of 5% and they would pay for themselves in only 1.57 years. The idea of incorporating wind turbines into the Newseum's electrical system was also looked into. This was done by comparing energy production of the turbines and the energy costs from the Newseum's provider, PEPCO. It was found that one turbine would only save about \$351 per year and would take about 30 years to pay for itself.

As the architectural breadth, I continued looking into wind turbines. I assumed that electrical study determined that they were a promising idea. The layout and placement of the turbines was looked into. First environmental data was collected to ensure the turbines would be oriented correctly and be facing the wind. Then ideal placement on the roof line was determined.

Finally, as a mechanical breadth study, I went back to the News History Gallery to look at the environmental control of the display cases. They have existing humidity control in them to protect the artifacts. I wanted to make sure that the accent lighting I installed in the lighting redesign did not have any bad effects due to temperature or radiation on the exhibit.

Building Background

Building Name:	Newseum and Freedom Forum Headquarters
Location and Site:	555 Pennsylvania Avenue, N.W., Washington, D.C.
Building Occupant Name:	The Freedom Forum
Occupancy:	Mixed use – Gallery/Exhibits, residential, office, retail, 500 seat auditorium
Size:	550,000 square feet
Number of Stories:	7
Dates of Construction:	2003 - November 2007
Overall Project Cost:	\$200 million

Architecture:

The Newseum and Freedom Forum Headquarters is meant to be a gateway between the media and the public. It emphasizes the importance of free press in society. This is done with 14 gallery spaces, theatres, broadcast studios, and exhibits including Checkpoint Charlie from the Berlin Wall, and a radio antenna from the World Trade Center Building on 9/11. Other spaces include a 500 seat 4-D theatre equipped with moving seats; a restaurant, The Source, run by Wolfgang Puck; 140,000 square feet of residential housing; and retail space. Means of egress is also a major part of the design. All guests enter the bottom floor into an orientation room. From there they are taken by elevator to the top floor where they can then see all the galleries and exhibits on the way back down. This keeps the flow of traffic running smoothly. Another feature is the layout of the broadcast rooms. They are oriented so that the backdrop of the show being recorded is looking down Pennsylvania Avenue to the Capitol building.

Zoning:

DD/C4 – Downtown development – Maximum height of 130 feet, and a maximum floor area ratio of 6.0 – 10.0

Building Envelope: The predominant south facing façade along Pennsylvania Avenue is a glass curtain wall which allows views from the street of the atrium and media wall. Also on the south façade is a 60 foot high plane of marble which is engraved with the first amendment. Transparent glass covers most of the rest of the building.

Construction:

The Newseum and Freedom Forum Headquarters is located on Pennsylvania Avenue, a few blocks from the capitol building. There are seven stories above grade, with three basement levels. A design-bid-build delivery method was used, with a price tag of around \$200 million. Construction started in 2003 and is expected to be completed in November of 2007. Spring of 2008 is when it should be open to the public. For some of the galleries a crane was used to put exhibits in place during construction and the building was then built around them.

Electrical:

Power is supplied to the Newseum by PEPCO electric service in Washington, D.C. The service entrance to the building is on the B-1 Mezzanine level. A total of three main services, all connected to a totalization meter, enter the building. Each goes to a 4000 A main switchboard. The newseum is served on a 480Y/227V, 3PH, 4W system, while the residential section is served by a 208Y/120V, 3 PH, 4 W system. A 2250 kW diesel engine powered generator is used for the buildings emergency power.

Lighting:

Downlighting in the atrium is running on 277V, while lighting in the rest of the building is running on 120V. Daylighting is also a main part of the atrium lighting due to the glass curtain façade. Recessed par lamp downlights are used in all circulation areas. The freedom forum offices use recessed 2x2 direct/indirect fixtures with fluorescent lamps.

Gallery spaces use a variety of lighting systems. They use track lighting to accent exhibits. Fiber optic lighting is also used inside of the display cases. Lighting in the galleries is controlled by dimmable switching.

Mechanical:

The Newseum building uses a radiant floor heating system. There are four 742 ton cooling towers that provide a total flow rate of 5940 gpm. A roof top A/C unit is above the residential roof. It flows at 6000 cfm. Air quality inside some of the display cases is of high importance because of the historic documents. Conditioned air which is run through a humidifier/dehumidifier system is supplied inside of these display cases.

Structural:

The Newseum building utilizes a continuous poured concrete foundation. It is poured against a bentonite panels for waterproofing. The flooring is concrete slab on metal deck. Structural steel beams and columns form the superstructure of the building. A glass façade envelope covers the structure. There is a concrete slab roof deck.

Building Systems

Fire protection:

The fire alarm system is composed of bells with strobes to comply with ADA standards. A sprinkler system also runs throughout the building. Magnetic door holders are also used in circulation areas to allow for quick evacuation.

Transportation:

The Newseum is serviced by three main elevators. The idea is to have guests enter and take the elevator to the top level. From here they work their way down viewing galleries on each floor.

Telecommunications:

The main telecommunication room for the Newseum is located on basement level B-2, on the east end. (4) – 4” conduits then run to each floors telecommunication room. The residential portion has a separate main telecommunication room located at the west end of level B-2. (1) – 1” conduit goes to each apartment supplying telephone and cable.

Lighting Depth

The Newseum & Freedom Forum Headquarters is a multi-purpose building. This allows for very different lighting solutions throughout the space. However, as a lighting designer it is important to not only create individual designs for a space, but to also use light to tie all the spaces together. The lighting can also work together with the architecture of a space to bring out certain atmospheres.

Four spaces in the Newseum are being redesigned for this study. They are the Welcoming Lobby, News History Gallery, Freedom Forum Offices, and Exterior Entry. Design criteria was established for each space in order to meet the different needs of the variety of spaces. With the criteria in mind, a lighting layout was designed for each space that would successfully meet these goals. The IESNA Lighting Handbook helped to come up with design criteria in each space. After the design was established, AGI32 was used to perform calculations and create renderings for each of the four spaces. In order to practice responsible lighting design, the maximum power factor was kept under the maximum value given by the ASHRAE Standard 90.1

Welcoming Lobby

Summary

The welcoming lobby is where a guest begins their journey through the Newseum. It is located in the basement level B-1. After guests enter the Newseum from Pennsylvania Avenue, they buy their tickets and are directed down the stairs to the welcoming lobby. In this space, guests become acquainted with the layout of the building and the different exhibits. It is a very laid back environment with Newsuem workers interacting with guests and telling them all that the Newseum has to offer. They are also there to answer any questions one might have.

On the south wall of the welcoming lobby, which is on the right as guests descend the stairs, is where the entrances to multiple orientation theatres are located. They show short videos about the Freedom Forum, Newseum, and current exhibits. There are three main guest elevators in the building. They are all in a row located at the east side of the lobby. One more important aspect of the welcoming lobby is to lead guests to the main attraction of the B-1 level which is the Berlin Wall exhibit. It contains sections of the Berlin Wall and a guard tower.

Overall, the welcoming lobby is a very open space. It is approximately 5,849 square feet. This provides visitors a great place to meet up with family and friends to enjoy the rest of their visit to the Newsuem.

Materials

Ceiling: painted gypsum wall board – gray
Reflectance: 45 %

Walls: painted gypsum wall board – white
Reflectance: 94 %

Floor: Carpeting – gray
Reflectance: 35 %

There are not many furnishings in the space since it is mainly a quick gathering and information area before continuing on to the rest of the Newsuem. However, there is a podium located out from the bottom of the stairway. This is where the workers are located for guests to ask questions.

Summary of Design Criteria and Concepts

The Welcoming Lobby is the place where guests first experience the Newseum. It should give them an idea of what is to come. Since the Newseum has a very modern look and feel, this should be expressed in the lobby as well.

Illuminance Levels:

A lobby should not be the most illuminated area of a building. There are not any difficult type of tasks being completed in the space. Therefore, a low light level is desired in this space. According to the IESNA Handbook, the desired horizontal illuminance for a lobby is 10 horizontal footcandles. It also recommends 3 vertical footcandles.

Power Allowance:

According to ASHRAE 90.1 standard, the power density allowance for a lobby is 1.1 watts per square foot.

Points of interest:

The welcome area has many points of interest. One is the information area with the podium. The wall should be washed behind this in order to highlight the area and show visitors where to go. The south wall is also a very important part of the space. It should have a higher illuminance than the surrounding area to draw the guest's attention. Structural columns in the space are an architectural element which could also be highlighted.

Modeling of faces:

Make sure there is proper vertical illuminance to be able to see people's faces properly. This space is used as a meeting/gathering space before going off into the Newseum.

Aesthetics:

A modern feeling space should be created to go along with the modern exterior of the building. This can be accomplished with cooler CCT's and using LED's. Kinetic lighting is another possibility to add to a more contemporary design.

Luminaire Schedule

When designing any type of system, it is important to produce a schedule for the products you spec. The following is the luminaire schedule for the Welcoming Lobby. Two types of fixtures were used.

Symbol	Manuf.	Cat. #	Description	Lamp	Lamp Qty.	Watts
W-1	Cooper Lighting	C6042E-6011	Wall Washer	26W TTT	1	26
W-2	Lightolier	8019CCLW	Recessed downlight	32W triple tube	1	32

Symbol	Voltage	Mounting	Ballast	Quantity
W-1	120	Ceiling Recessed	Electronic	25
W-2	120	Ceiling Recessed	Electronic	38

Light Loss Factors

The following table contains light loss factors for the two fixtures specified in the previous schedule. IESNA charts were used to calculate the values.

$$RCR = 5 * h * (l + w) / (l * w)$$

Symbol	Maintenance Category	Room Cleanliness	Cleaning Period	RCR	BF	RSDD	LDD	LLF
W-1	II	“clean”	12 months	1.34	0.98	0.93	0.94	0.86
W-2	II	“clean”	12 months	1.34	0.98	0.93	0.94	0.86

Power Density

According to ASHRAE 90.1 the allowable power factor in an lobby is 1.1 Watts/ ft² . It is very important to follow these standards in order to have a responsible lighting design in terms of energy usage.

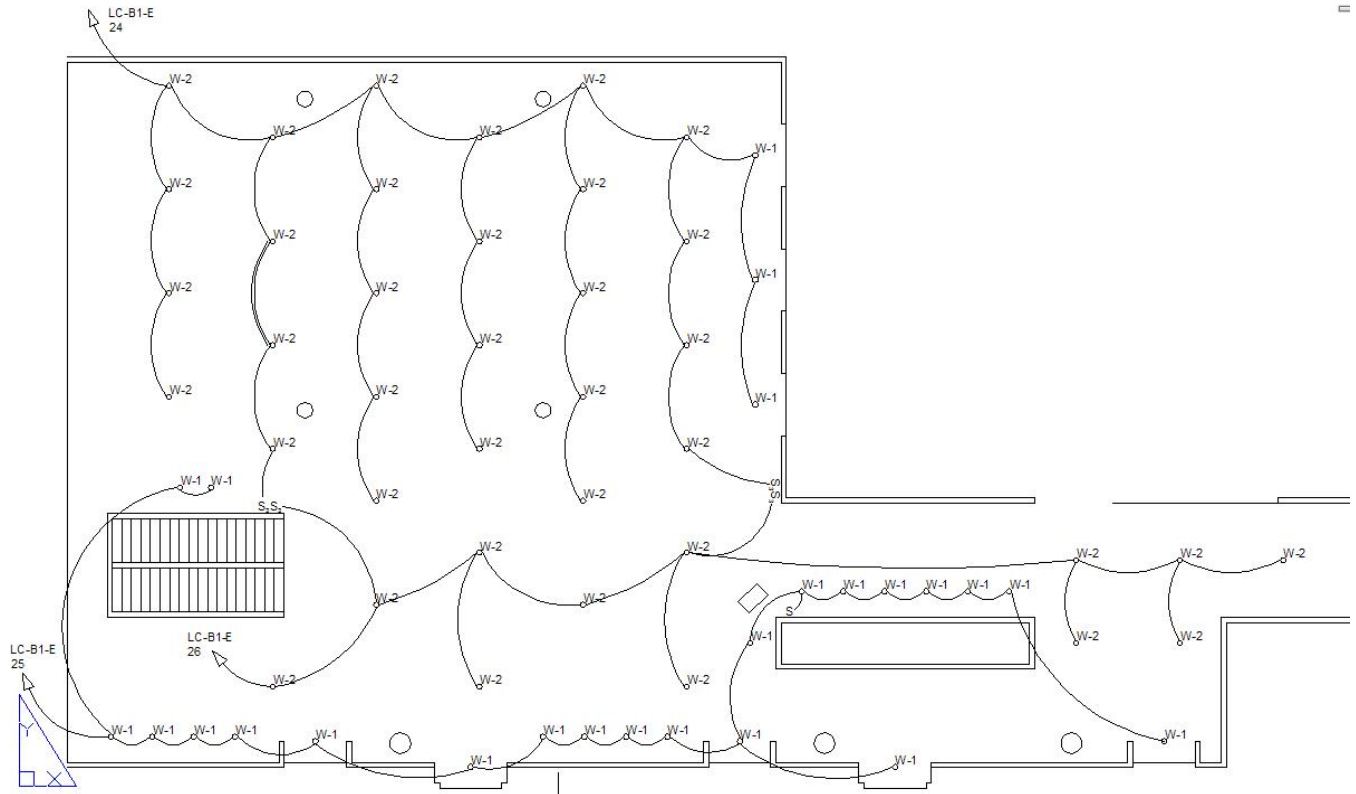
$$\text{Area:} \quad 69' \times 67' + 16' \times 11' + 42' \times 25' = 5,849 \text{ ft}^2$$

$$\text{Total Watts:} \quad (25 \times 26) + (38 \times 32) = 1,486 \text{ watts}$$

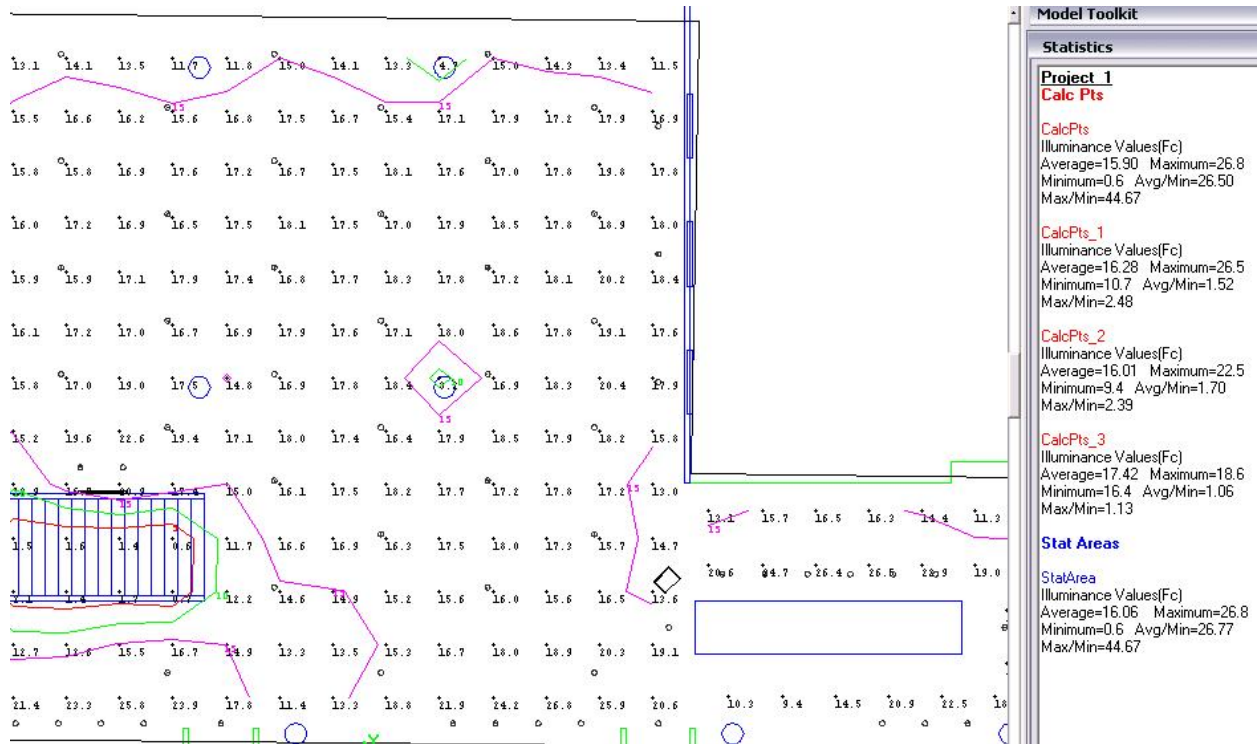
$$\text{Power density:} \quad 1486 \text{ watts} / 5849 \text{ ft}^2 = 0.25 \text{ w/ft}^2$$

This value of 0.25 w/ft² is within the allowable power density of 1.1 Watts/ ft² set by ASHRAE 90.1.

Lighting Layout Plan



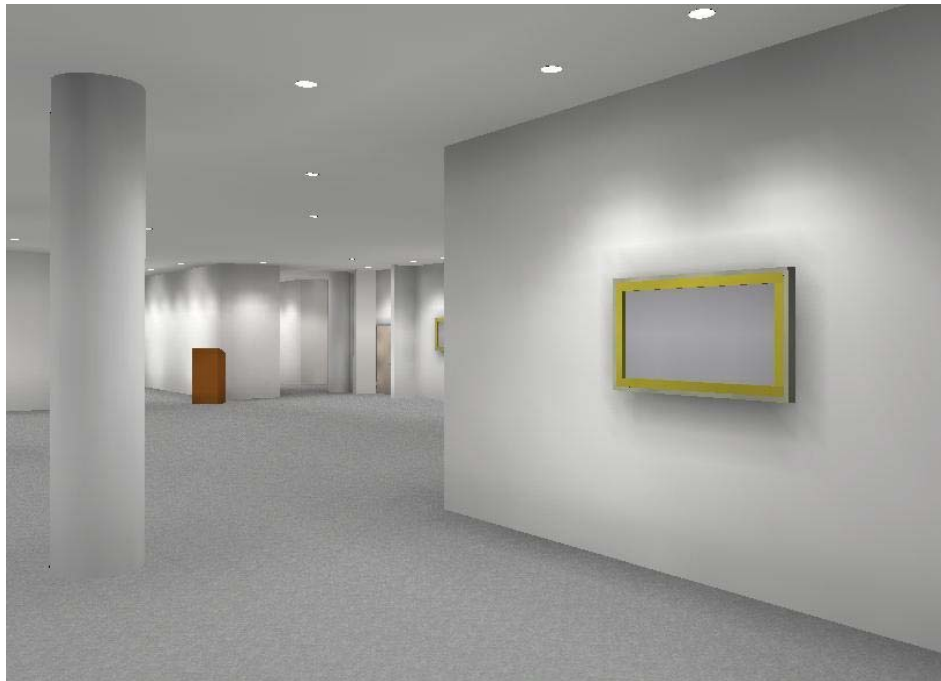
Illuminance Contour



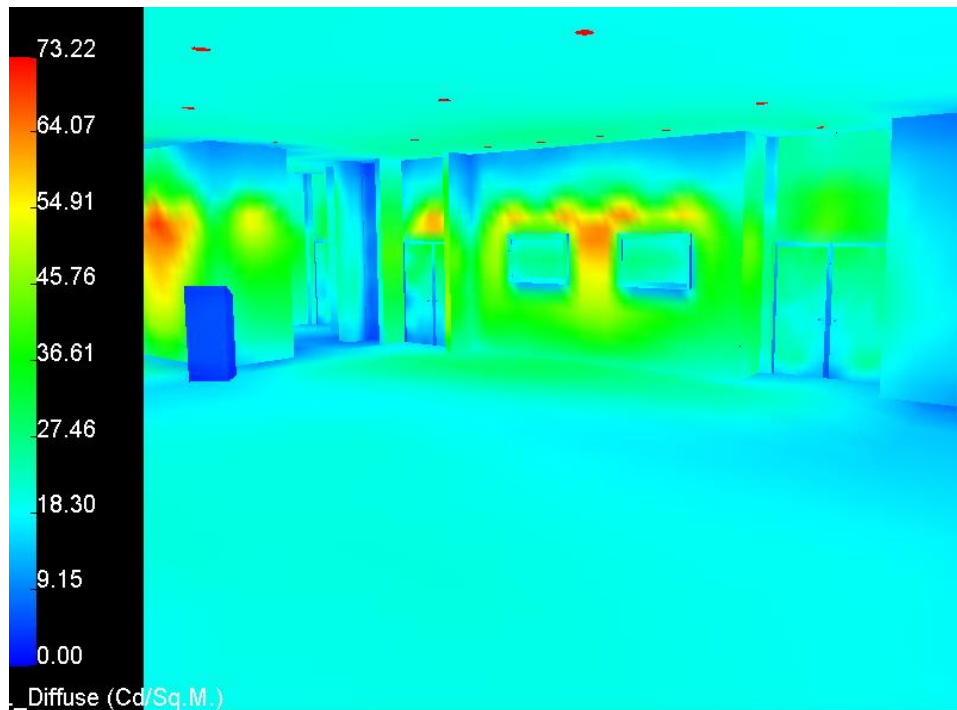
This illuminance contour shows that that an average level of 16 fc was achieved with this design. That meets the recommended level of 10 fc for a lobby space.

Renderings





Pseudo-Color Luminance



Conclusions

The lighting redesign for the Welcoming Lobby does meet the design criteria. The horizontal illuminance is an average of 16 footcandles which meets the minimum of 10. Also, the goal of washing the orientation theatre wall was a success. The accenting of the doorways and displays on the walls create a visual draw, that will direct visitors over to that area of the lobby. The same is true for the podium area.

News History Gallery

Summary

The News History Gallery is a large portion of the 4th level of the Newseum. It is a long space and is approximately 130 feet long by 35 feet wide which gives 4550 square feet in area. The ceilings are 16 feet high. Like the name suggests, this gallery is all about news and media throughout history. It shows off the Newseum's collection of historic news articles ranging back to the 18th century. They come from various newspapers and magazines. Spanning the center of this space is an exhibit called the timeline. It is devoted to showcasing newspaper front pages of important events of the past. Some of these include the start of the Civil War, the sinking of the Titanic, the bombing of Pearl Harbor, the JFK assassination, and the events of 9/11.

Another large focus of this space is to bring attention to journalists and the technology that they used to spread news to the public throughout the years. This section is on the outer walls of the gallery. There are display cases containing these artifacts and memorabilia. Above these display cases are projection screens which span the length of the gallery. These continuously play short video clips of historic news broadcasts.

Materials

Ceiling:	Powder coat paint finish – matte black Reflectance: 7 %
Walls:	Painted gypsum wall board – matte black Reflectance: 7 % (only the two end walls are exposed)
	Quotation bases are painted gypsum wall board – gray Reflectance: 45 %
Floor:	Vinyl Flooring – matte black Reflectance: 8 %
Display Cases:	Black painted bases, single pane glass

Summary of Design Criteria and Concepts

With a gallery space, the lighting can have a profound impact on the way visitors interpret what they are seeing. It can also affect how they feel. The challenge is having historic exhibits in a modern space. The lighting should merge with both of these two extremes and bring the whole space together. Another very important thing to consider for this gallery is the fragility of the artifacts. Light and the heat given off by lamps could have a negative effect on the museum pieces. This is especially true for all of the old newspaper front pages.

Illuminance:

For a museum gallery space, the illuminance values recommended by the IESNA handbook are 10 fc horizontal (on the floors), and 5 fc vertical. However, this particular gallery has fragile artifacts. According to the IESNA handbook, paper documents falls under the category of highly susceptible, and should have a maximum illuminance of 50 lux, or around 5 footcandles. The artifacts in the outer display cases fall under the moderately susceptible category and should have a maximum of 200 lux or around 20 footcandles.

Power Allowance:

According to ASHRAE 90.1 standard, the power density allowance for a museum general exhibition space is 1.0 watts per square foot.

Controls:

The lighting system should be dimmable to allow the visitors to focus their attention to the exhibits instead of the space around them. There should also be separate switching for the different display cases.

Points of Interest:

Each display case should have accent lighting and have more illuminance than the rest of the space. This can be done with track lighting. Another area that should be accented is the entrances to the gallery. Visitors should easily be able to find their way to exits. The quotations at each end wall are another point of interest in this space. Washing the walls would draw attention to them.

Reflected Glare:

Reflected glare could be a problem at the glass surrounding the display cases. To avoid this, make sure accent lighting is coming from the side, or inside the case. Not directly from behind.

Shadows:

It is important to avoid shadows on the items in the cases. These could be very disruptive to the guests. They could be caused by seams in the glass. A way to avoid this is to make sure the accent lighting is placed in a location so the beam will avoid transmitting thorough any seams.

Modeling of objects:

It is very important to have good modeling of objects in this space. The objects in the exhibits should be properly illuminated so visitors can see them well, and see detail well.

Light Color

Since this gallery deals with history, the use of a low CCT (warm light), rather than cool light could make the visitors feel like they are in more of a historic environment.

Luminaire Schedule

When designing any type of system, it is important to produce a schedule for the products you spec. The following is the luminaire schedule for the News History Gallery. Three types of fixtures were used.

Symbol	Manuf.	Cat. #	Description	Lamp	Lamp Qty.	Watts
N-1	Cooper Lighting	HD6-6300C	Recessed downlight	Par 30	1	75
N-2	Cooper Lighting	C6042E-6011	Wall Washer	26W TTT	1	26
N-3	Lightolier	C3MRLCLW	Wall Washer	37W MR16	1	37

Symbol	Voltage	Mounting	Ballast	Quantity
N-1	120	Ceiling Recessed	-	33
N-2	120	Ceiling Recessed	Electronic	10
N-3	120	Display Case	-	22

Light Loss Factors

The following table contains light loss factors for the three fixtures specified in the previous schedule. IESNA charts were used to calculate the values.

$$RCR = 5 * h * (l + w) / (l * w)$$

Symbol	Maintenance Category	Room Cleanliness	Cleaning Period	RCR	BF	RDSS	LDD	LLF
N-1	II	“clean”	6 months	2.9	-	0.98	0.96	0.94
N-2	II	“clean”	6 months	2.9	0.98	0.98	0.96	0.92
N-3	II	“clean”	6 months	2.9	-	0.98	0.96	0.94

Power Density

According to ASHRAE 90.1 the allowable power factor in an gallery is 1.0 Watts/ ft² . It is very important to follow these standards in order to have a responsible lighting design in terms of energy usage.

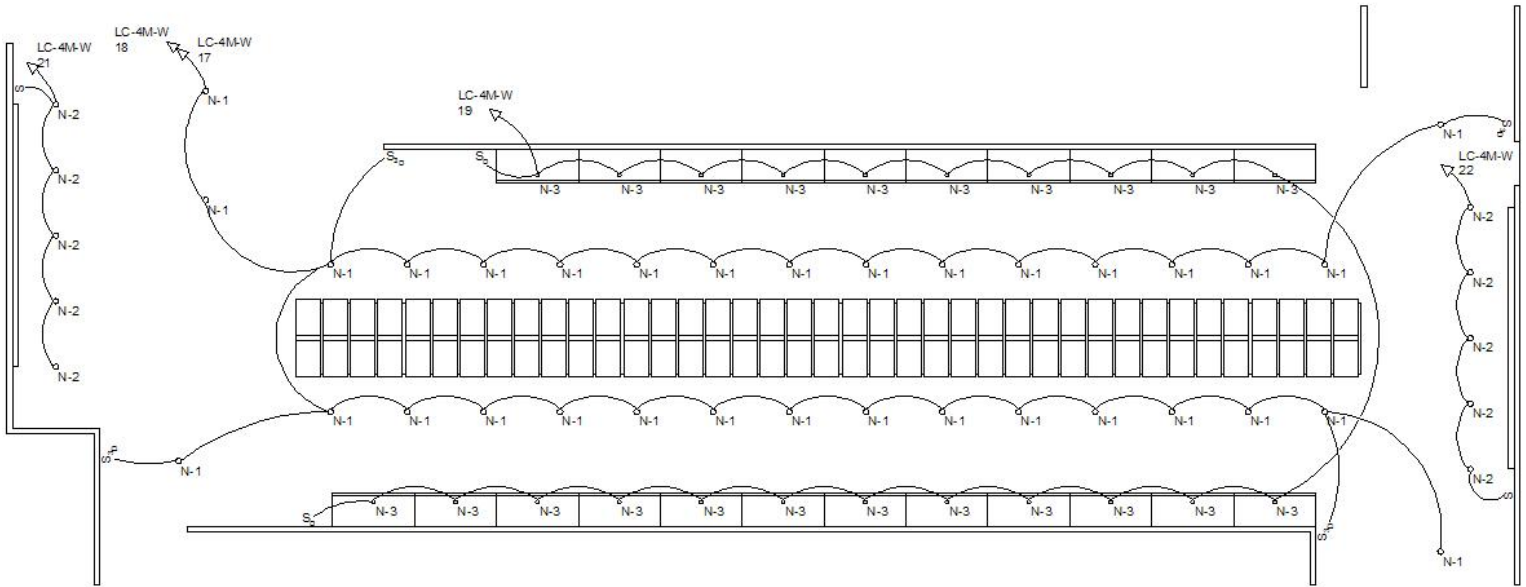
Area: $130' \times 35' = 4550 \text{ ft}^2$

Total Watts: $(33 \times 75) + (10 \times 26) + (22 \times 37) = 3459 \text{ watts}$

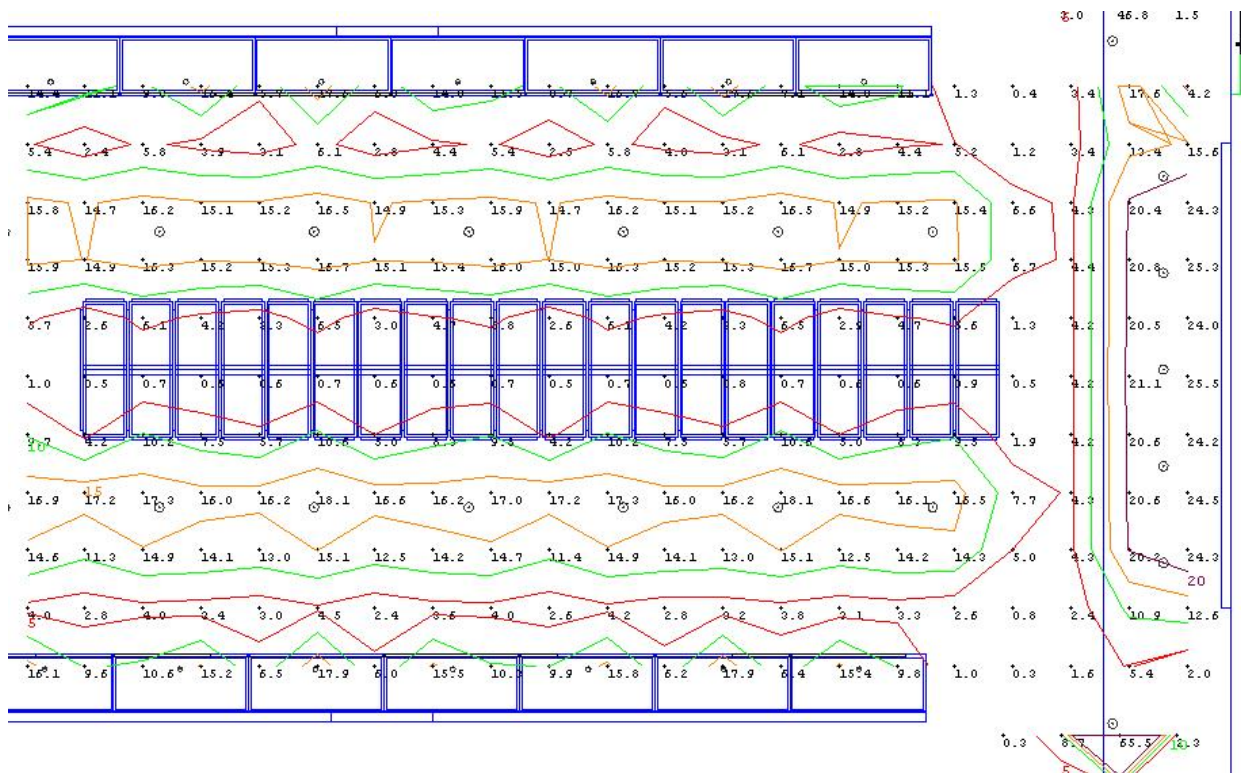
Power density: $3459 \text{ watts} / 4550 \text{ ft}^2 = 0.76 \text{ w/ft}^2$

This value of 0.76 w/ft² is within the allowable power density of 1.0 Watts/ ft² set by ASHRAE 90.1.

Lighting Layout Plan

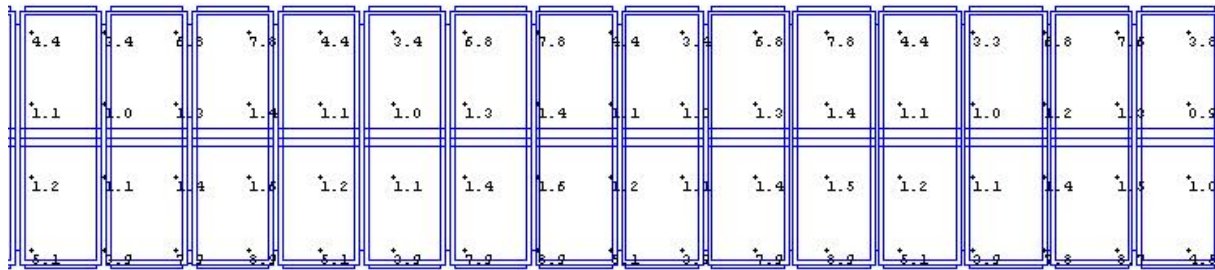
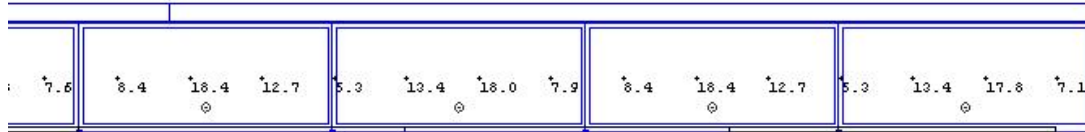


Illuminance Contour



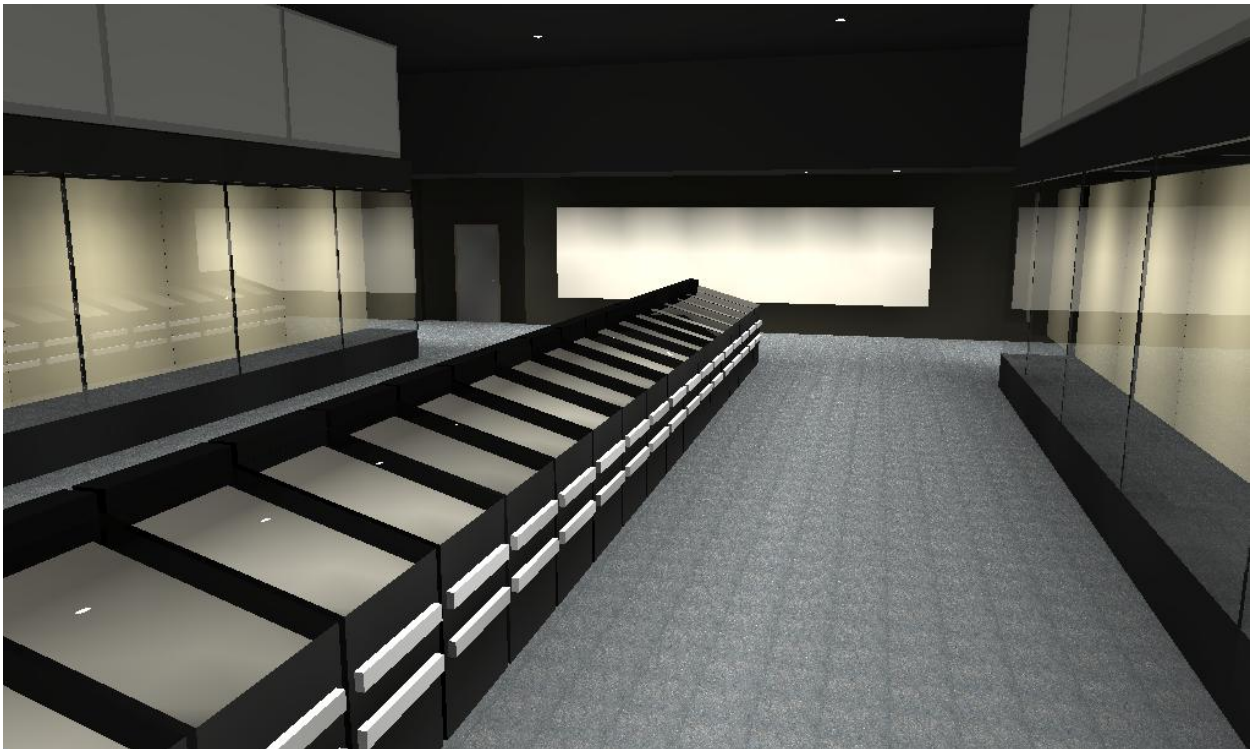
Average illuminance: 9.96 fc

Exhibit Illuminance



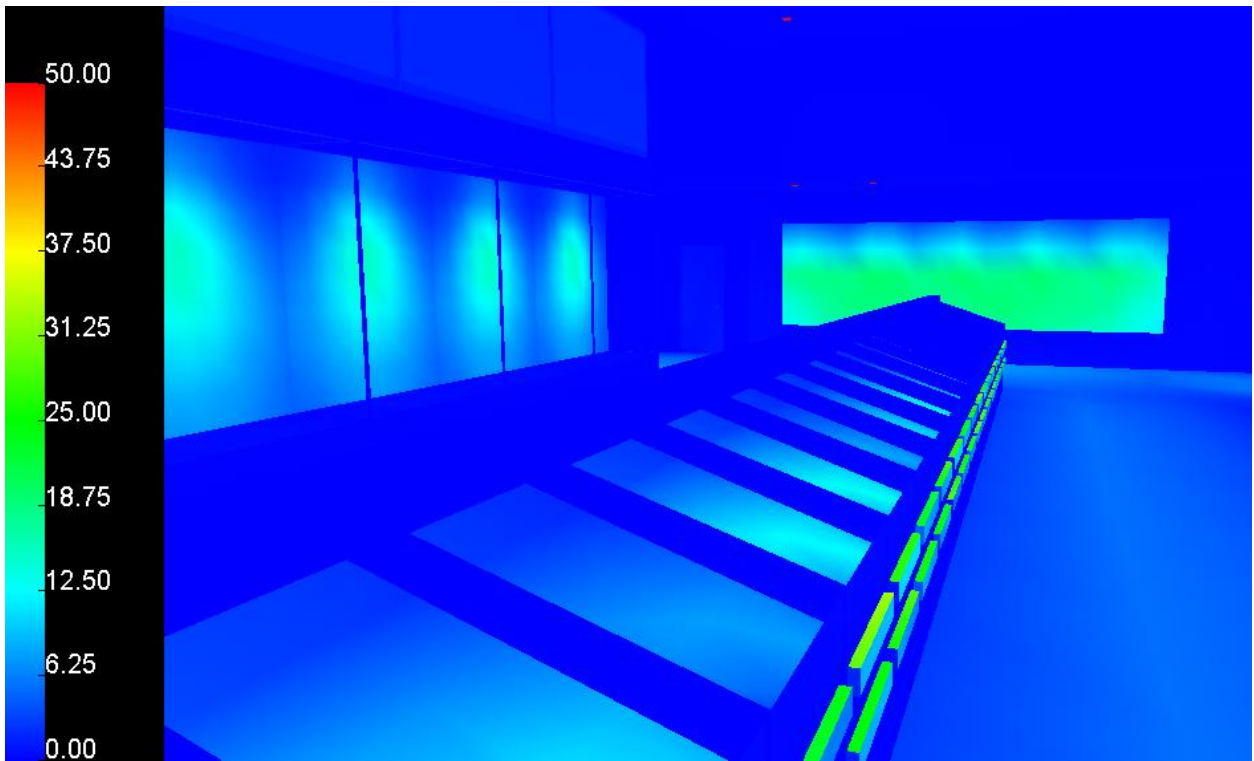
These calculation points show the illuminance values which will be on the displays. The side wall display cases have an average of approximately 13 fc, and they do not exceed 20 fc. The center display has an average of 3.61 fc. There are a few calculation points that are a little over 5 fc, however they are only located at the edge of the display. Most of the actual papers will not extend to the very edge.

Renderings





Pseudo-Color Luminance



Conclusions

The lighting redesign in the News History Gallery is successful in meeting the design criteria. First of all, the most important part is the illuminance levels on the actual artifacts. As seen above in the exhibit calculations, the levels are under the maximum values so the damaging effects of light are avoided. The overall average illuminance is also meeting the recommended values of the IESNA handbook. The recommended value for a gallery space is 10 horizontal fc. The redesign is achieving a value of 9.96 fc.

Reflected glare can also be a major problem in an exhibit that has glass display cases. In this space, this problem is avoided very well. The outer display cases are lit from the inside to avoid this issue altogether. Since the center exhibit is lit from behind and not directly on it, most glare is avoided. The two types of fixtures that light the exhibits, each use incandescent sources. With the low CCT's, the warm light works well with the faded color of the newspapers.

Even though the exhibits are the main part of this space, there are still some other aspects to pay attention to. Each end wall in the gallery contains a quote. By using wall washers at these two areas, the quotations really stand out and draw attention to themselves.

Freedom Forum Offices

Summary:

The Freedom Forum is an organization that works to bring attention to the first amendment. It is also the group who is in charge of the Newseum. Their offices are in an area of the third floor of the Newseum which is not accessible by the public. Members of the Freedom Forum will be using these offices for administrative work to keep the Newseum running smoothly. They will also be conducting research to come up with new exhibits for the ever changing world of news, as well as add to existing exhibits. Most work in this space will be computer based.

This particular space is an open office floor plan which is approximately 28 feet by 36 feet. There is a ceiling height of nine feet. The partitions between the individual cubicles are five feet high. It includes nine computer stations.

Materials:

Ceiling:	White acoustical tile Reflectance: 95%
Walls:	Painted gypsum wallboard – tan Reflectance: 85%
Floor:	Carpeting – gray Reflectance: 25%
Other:	Cubicle partitions – gray Reflectance: 50%

Furnishings include mounted desks, office chairs, and computers

Summary of Design Criteria and Concepts

From the outside, the Newseum and Freedom Forum Headquarters has a very new and modern look. This will be continued in the interior spaces as well. While working in their new headquarters, members of the Freedom Forum will be in a modern office environment. This can be achieved through selection of luminaires and lighting layouts. Visual clarity is another important aspect in office lighting. A uniform lighting layout will help give the impression of visual clarity.

Illuminance Levels:

In an office, light levels are very important in order for the occupants to properly be able to complete their work. According to the IESNA Handbook, the desired horizontal illuminance for an office is 30 footcandles. This should be achieved at the work plane height of 2.5 feet. It also recommends 5 vertical footcandles. In the corridor space beside the cubicles, a horizontal illuminance of no less than 10 footcandles should be achieved.

Glare:

With the extensive use of visual display terminals (VDTs) in this workspace, reflected glare could potentially be a problem in the computer screens. However, with newer flat panel and flat screen monitors, this is no longer as big of an issue. None the less, an indirect lighting system will help ensure that no glare will be able to be seen in any visual display terminal.

Accenting:

Using light to accent certain areas is a great way to draw attention to objects or spaces. In the Freedom Forum Offices, there is one area that this could be used for. The director's office has an entrance located at the end of the corridor along the open office space. Lighting can be used to give this area higher lighting levels than the surrounding ambient light.

Controls:

The lighting in the Freedom Forum Offices should have occupancy sensors incorporated in its switching.

Luminaire Schedule:

When designing any type of system, it is important to produce a schedule for the products you spec. The following is the luminaire schedule for the Freedom Forum Offices. Three types of fixtures were used.

Symbol	Manuf.	Cat. #	Description	Lamp	Lamp Qty.	Watts
O-1	Lightolier	BSL6H01CN	Direct/Indirect lighting	T5 HO	1	54
O-2	Lightolier	FW201	Wall sconce	13W 4pin twin tube	1	13
O-3	Cooper Lighting	C6042E-6011	Wall washer	26W TTT	1	26

Symbol	Voltage	Mounting	Ballast	Quantity
O-1	277	Pendant	Electronic	14
O-2	277	Wall	Electronic	5
O-3	277	Ceiling Recessed	Electronic	1

Light Loss Factors:

The following table contains light loss factors for the three fixtures specified in the previous schedule. IESNA charts were used to calculate the values.

$$RCR = 5 * h * (l + w) / (l * w) = 5 * 9 * (28 + 36) / (28 * 36) = 2.86$$

Symbol	Maintenance Category	Room Cleanliness	Cleaning Period	RCR	BF	RSDD	LDD	LLF
O-1	II	“clean”	12 months	2.86	0.98	0.93	0.94	0.86
O-2	V	“clean”	12 months	2.86	0.98	0.93	0.88	0.80
O-3	II	“clean”	12 months	2.86	0.98	0.93	0.94	0.86

Power Density:

According to ASHRAE 90.1 the allowable power factor in an office is 1.0 Watts/ ft². It is very important to follow these standards in order to have a responsible lighting design in terms of energy usage.

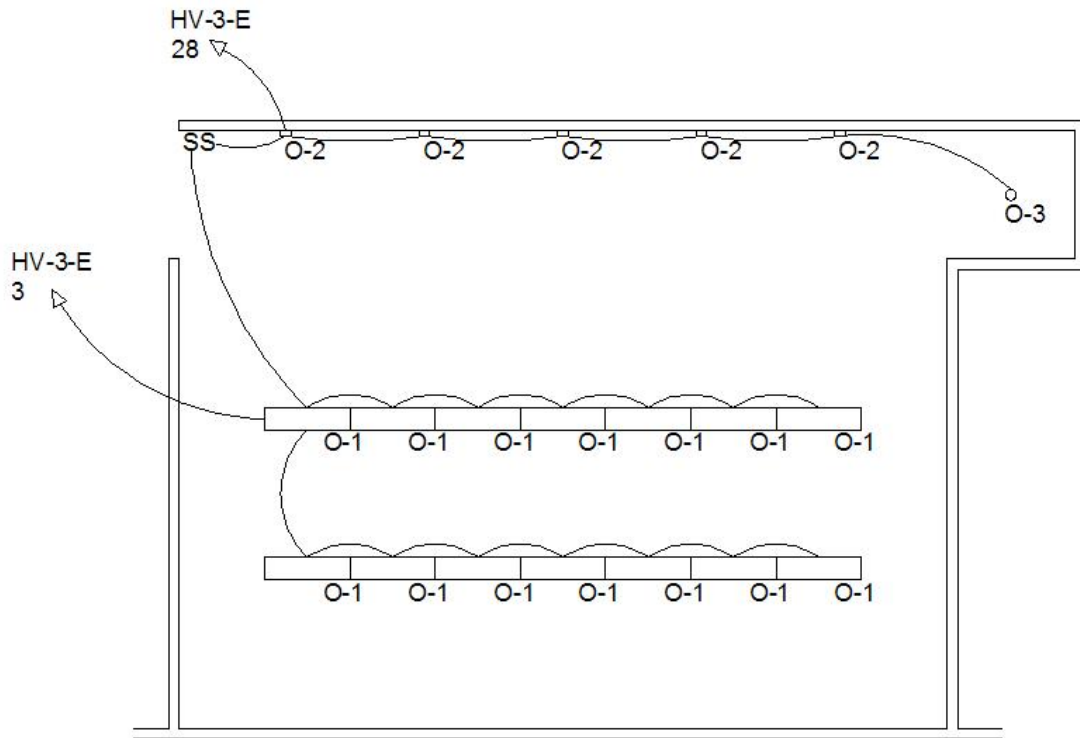
Area: $28' \times 36' = 1008 \text{ ft}^2$

Total Watts: $(14 \times 54) + (5 \times 13) + (1 \times 26) = 901 \text{ watts}$

Power density: $901 \text{ watts} / 1008 \text{ ft}^2 = 0.89 \text{ w/ft}^2$

This value of 0.89 w/ft² is within the allowable power density of 1.0 Watts/ ft² set by ASHRAE 90.1.

Lighting Layout Plan:

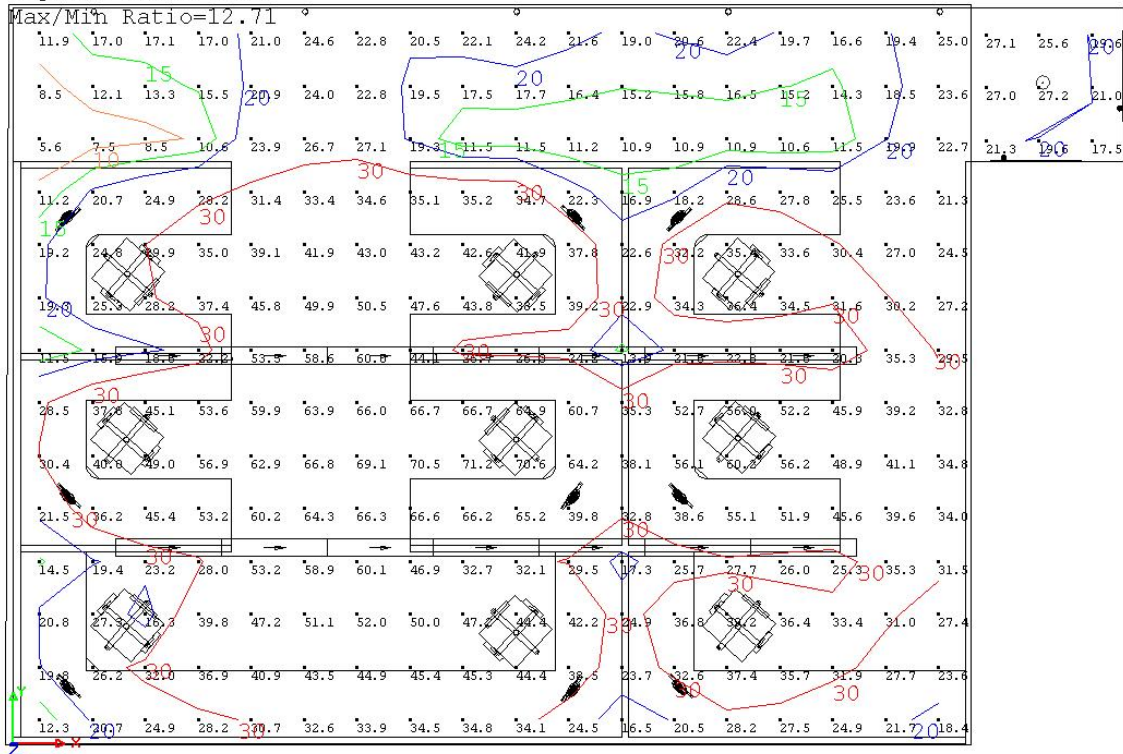


Design

The lighting design for the Freedom Forum Offices creates a great working environment. I used 1x4 indirect fixtures over the cubicle area in order to create a uniformly lit work plane, and a visually clear environment. Wall sconces illuminate the corridor which leads to the director's office. There is also a ceiling recessed wall washer at the end of the corridor in order to highlight the doorway.

Illuminance Contour:

Illuminance Values (Fc)
Average =33.05
Maximum =71.2
Minimum =5.6
Avg/Min Ratio=5.90

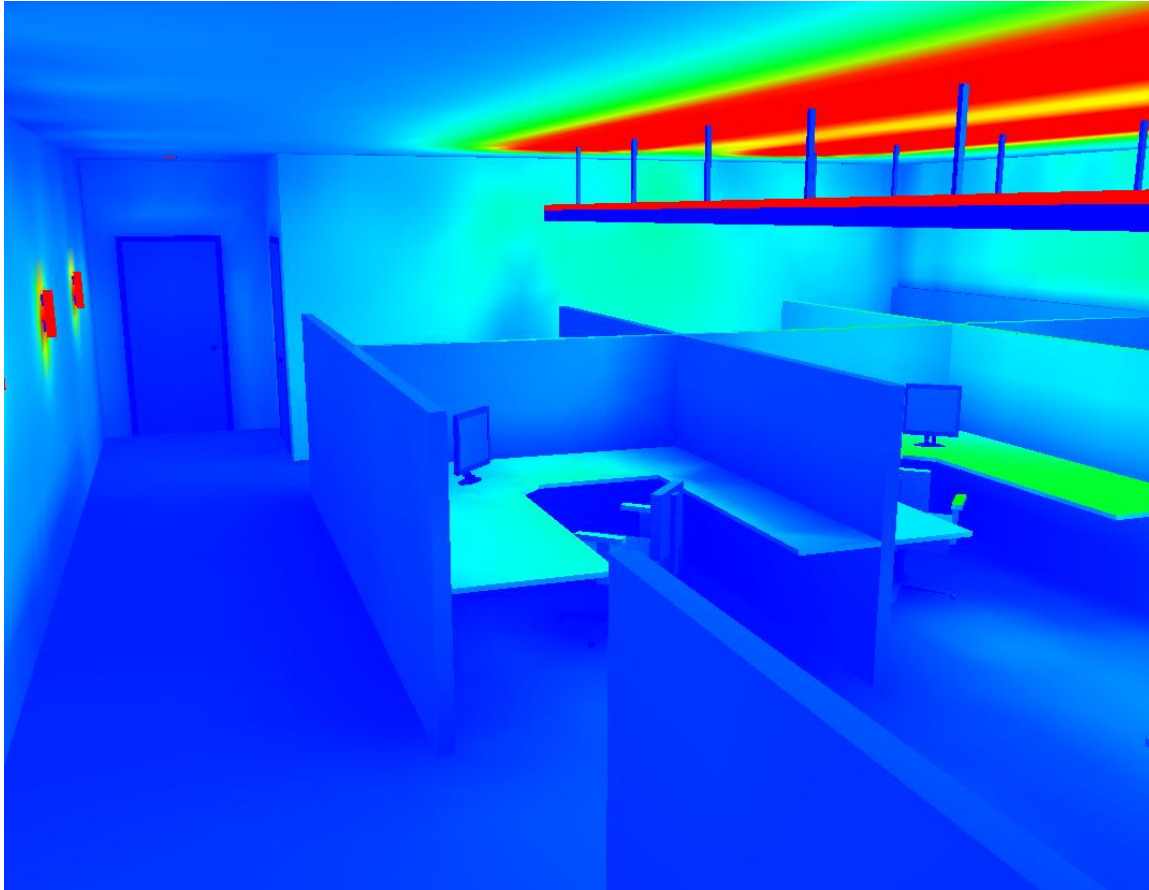


This illuminance contour shows that an average horizontal illuminance level of 30 footcandles was met for the Freedom Forum Offices. It is also easy to see that the corridor area has a lower light level, but still meets the minimum of 10 footcandles.

Renderings:



Pseudo-Color Luminance



Conclusion

The lighting redesign for the Freedom Forum Offices is achieving its desired effects. The main criteria was to create an environment which will allow the employees accomplish their work effectively. The average illuminance levels at the work plane height of 2.5 feet is 33 fc, which is very close the goal of 30 fc. Using the indirect fixtures instead of the existing direct fixtures, eliminates the issue of reflected glare in the computer monitors. In the corridor, the sconces create a different way of lighting the space instead of a typical office where all light comes from above. The modern fixtures in this space go along well with the overall modern architecture and feel of the building.

Exterior Entry

Summary:

The Newseum entry porch is what draws people to the building from off of Pennsylvania Avenue. It is a transition from the sidewalk to the interior of the Newseum. The glass façade walls can allow pedestrians walking by to look in and become interested in what is going on inside. This area should not only appeal to Newseum guests, but also to people walking by. Because it has a roof, it can be a place to take cover in precipitation. It is important that any lighting used doesn't draw attention away from existing monuments along Pennsylvania Avenue. The dimensions are about 40' x 23' and it is approximately 920 square feet.

Materials:

Ceiling:	Steel Metal Mesh Panels Reflectance: 40%
Walls:	Glass curtain walls Polished metal supports the glass Reflectance: 85%
Floor:	Stone pavers Reflectance: 15%

Summary of Design Criteria and Concepts

The entrance is the part of the Newseum that the public sees on a daily basis. It is also the first exposure of the building to the guests. It should have a clean, modern look in order to combine well with the outside architecture. This feel is also continued to the inside of the building.

Illuminance:

The IESNA recommended illuminances for an exterior building entrance is 5 horizontal fc and 3 vertical fc.

Power Allowance:

According to ASHRAE 90.1 standard, the power density allowance for an exterior building entrance is 1.25 watts per square foot.

Light Pollution:

Avoid light pollution into the night sky. This can be done by having all luminaires aiming down, or installing shielding.

Appearance of Space:

The entry porch should be a pleasant space and draw people into the Newseum.

Points of interest:

The one main point of interest of the entry porch is the Newseum's front doors. These can be accented to guide visitors to the entrance.

Modeling of faces:

Make sure there is proper vertical illuminance to be able to see people's faces properly. The entry porch is also used as a meeting/gathering space for visitors before entering the Newseum.

Aesthetics:

Allow the lighting scheme for the entry porch to blend into that of the interior. Use similar fixtures and similar CCT's.

Luminaire Schedule:

When designing any type of system, it is important to produce a schedule for the products you spec. The following is the luminaire schedule for the Exterior Entry. One type of fixture is being used.

Symbol	Manuf.	Cat. #	Description	Lamp	Lamp Qty.	Watts
E-1	Lightolier	1101HCLC	Wet Location downlight	32 watt triple tube	1	32

Symbol	Voltage	Mounting	Ballast	Quantity
E-1	120	Recessed	Electronic	6

Light Loss Factors:

The following table contains light loss factors for the three fixtures specified in the previous schedule. IESNA charts were used to calculate the values.

$$RCR = 5 * h * (l + w) / (l * w)$$

Symbol	Maintenance Category	Room Cleanliness	Cleaning Period	RCR	BF	RSDD	LDD	LLF
E-1	II	“dirty”	12 months	2.9	0.98	0.95	0.86	0.8

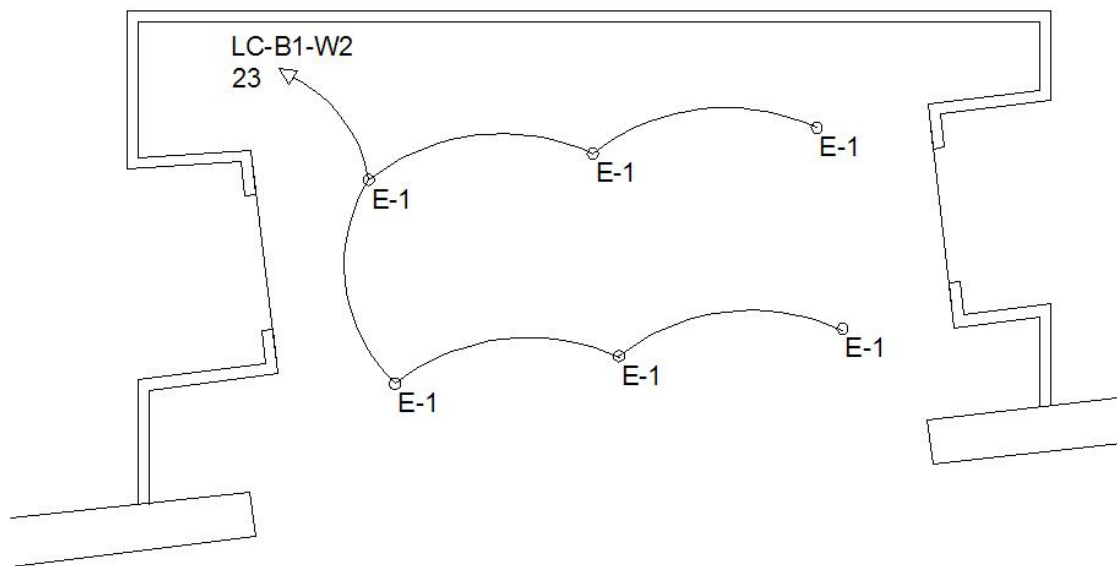
Power Density:

According to ASHRAE 90.1 the allowable power factor an exterior building entry is 1.25 Watts/ ft² . It is very important to follow these standards in order to have a responsible lighting design in terms of energy usage.

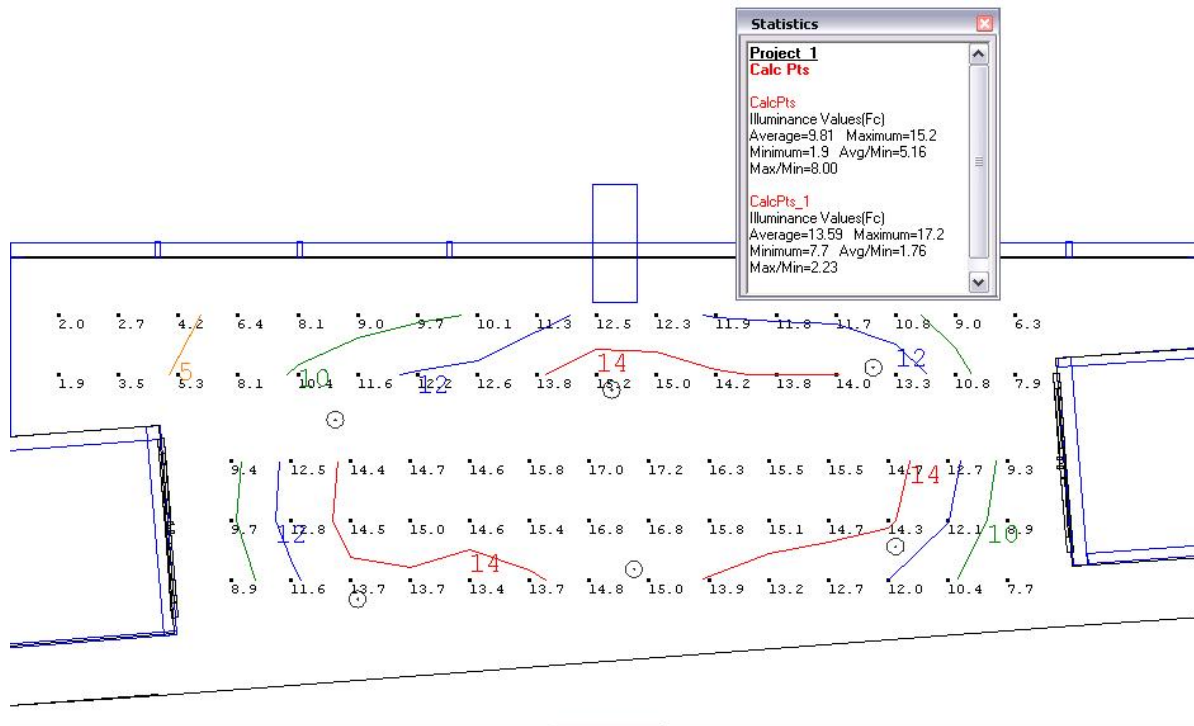
Area:	40' x 30' = 1200 ft ²
Total Watts:	(6 x 32) = 192 watts
Power density:	192 watts / 1200 ft ² = 0.16 w/ft ²

This value of 0.16 w/ft² is within the allowable power density of 1.25 Watts/ ft² set by ASHRAE 90.1.

Lighting Layout Plan:



Illuminance Contour



These calculation points show that an average of about 11.7 footcandles is being achieved in the entry area. This meets the minimum value of 5 horizontal footcandles.

Rendering



Conclusion

The lighting redesign for the exterior entry area does meet the design criteria. A horizontal illuminance of 5 fc is recommended. This design is supplying around 11.7 fc. This gives the entrance a brighter space the other areas surrounding it. Because of this, guests eyes will be drawn to this area. The light acts as a guide in this case. The modern look of the architecture is also emphasized with this lighting scheme because it allows the metals to really come through. This gives the space sparkle, which further adds to the appeal.

Electrical Depth

Summary of distribution system

The power to the Newseum and Freedom Forum Headquarters is supplied by PEPCO in Washinton, D.C. There are three incoming services which are all connected to a totalization meter. The service is at 480Y/277V, 3PH, 4W. Each of the three services then goes to a main switchboard. From here, the power is taken to distribution panels throughout the building. Some of these panels continue to carry the power at 480Y/2277V, 3PH, 4W , while some feeders carry power from the main switchboards to transformers which step the voltage down to a 208Y/120V, 3PH, 4W system, and is taken to low voltage distribution panels.

Depth Topics

First, with the redesign of the lighting system, it will be necessary to redesign the panel boards and circuits which feed the four spaces. Those spaces are the Welcoming Lobby, News History Gallery, Freedom Forum Offices, and Exterior Entry. I will also perform a protective device coordination study. Two other topics will also be examined in the electrical depth. One is the effect of using energy efficient transformers versus standard transformers. The other is looking into the effect of the addition of wind turbines in the Newseum's electrical system.

Welcoming Lobby

The welcoming lobby is where guests are directed after they purchase their tickets. It is located in basement level B-1. The main purpose of the space is to get guests acquainted with the Newseum. The main part is about 69' x 67' and there is also a wing which goes to the Berlin Wall Exhibit.

The redesigned lighting for this space utilizes two fixtures. The first is a recessed downlight used for the general ambient light of the space. There are also wall washers which are used to accent certain areas of the space such as artwork, information podium, and orientation theatre entrances. The general downlighting is switched by three way switching on either side of the lobby. The accent lighting is controlled by a one way switch behind the information area.

New Luminaire Schedules

Symbol	Manuf.	Cat. #	Description	Lamp	Lamp Qty.	Watts
W-1	Cooper Lighting	C6042E-6011	Wall Washer	26W TTT	1	26
W-2	Lightolier	8019CCLW	Recessed downlight	32W triple tube	1	32

Symbol	Voltage	Mounting	Ballast	Quantity
W-1	120	Ceiling Recessed	Electronic	25
W-2	120	Ceiling Recessed	Electronic	38

EXISTING PANEL SCHEDULE												
VOLTAGE: 208Y/120V,3PH,4W			PANEL TAG: LC-B1-E						N. C/B AIC: 10K			
SIZE/TYPE BUS: 225A			PANEL LOCATION: Elec. Closet B1-05A						OPTIONS:			
SIZE/TYPE MAIN: 225A/3P C/B			PANEL MOUNTING: SURFACE									
SIZE/TYPE MAINS: MLO									REMARKS			
LOAD	LOCATION	LOAD	C/B	POS	A	B	C	POS	C/B	LOAD	LOCATION	LOAD
DESCRIPTION		WATTS	SIZE	NO	PH	PH	PH	NO	SIZE	WATTS		DESCRIPTION
track lighting	gallery	1548	20A/1P	1	*			2	20A/1P	1548	gallery	track lighting
spare		0	20A/1P	3			*	4	20A/1P	0		spare
track lighting	gallery	1548	20A/1P	5	*			6	20A/1P	1548	gallery	track lighting
spare		0	20A/1P	7			*	8	20A/1P	0		spare
track lighting	gallery	1548	20A/1P	9	*			10	20A/1P	3600	theatre	downlighting
-		0	-	11			*	12	-	0		-
-		0	-	13	*			14	-	0		-
-		0	-	15			*	16	-	0		-
-		0	-	17	*			18	-	0		-
-		0	-	19			*	20	-	0		-
-		0	-	21	*			22	-	0		-
-		0	-	23			*	24	20A/1P	1548	lobby	track lighting
track lighting	lobby	1548	20A/1P	25	*			26	20A/1P	1548	lobby	track lighting
track lighting	lobby	1548	20A/1P	27			*	28	20A/1P	1548	lobby	track lighting
track lighting	lobby	1548	20A/1P	29	*			30	20A/1P	1548	lobby	track lighting
track lighting	lobby	1548	20A/1P	31			*	32	20A/1P	1548	lobby	track lighting
track lighting	lobby	1548	20A/1P	33	*			34	20A/1P	1548	lobby	track lighting
track lighting	lobby	1548	20A/1P	35			*	36	20A/1P	1548	lobby	track lighting
track lighting	lobby	1548	20A/1P	37	*			38	20A/1P	1500	lobby	track lighting
track lighting	lobby	1500	20A/1P	39			*	40	-	0		-

PANELBOARD SIZING WORKSHEET

PANELBOARD SIZING WORKSHEET										
Panel Tag----->				LC-B1-E	Panel Location:			Elec. Closet B1-05A		
Nominal Phase to Neutral Voltage----->				120	Phase:			3		
Nominal Phase to Phase Voltage----->				208	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	lighting		gallery	1548	w		1548	1935	
2	A	lighting		gallery	1548	w		1548	1935	
3	B	spare		-	0	w		0	0	
4	B	spare		-	0	w		0	0	
5	C	lighting		gallery	1548	w		1548	1935	
6	C	lighting		gallery	1548	w		1548	1935	
7	A	spare		-	0	w		0	0	
8	A	spare		-	0	w		0	0	
9	B	lighting		gallery	1548	w		1548	1935	
10	B	lighting		gallery	3600	w		3600	4500	
11	C	-			0	w		0	0	
12	C	-			0	w		0	0	
13	A	-			0	w		0	0	
14	A	-			0	w		0	0	
15	B	-			0	w		0	0	
16	B	-			0	w		0	0	
17	C	-			0	w		0	0	
18	C	-			0	w		0	0	
19	A	-			0	w		0	0	
20	A	-			0	w		0	0	
21	B	-			0	w		0	0	
22	B	-			0	w		0	0	
23	C	-			0	w		0	0	
24	C	lighting		lobby	910	w		910	1138	
25	A	lighting		lobby	572	w		572	715	
26	A	lighting		lobby	384	w		384	480	
27	B	spare		-	0	w		0	0	
28	B	spare		-	0	w		0	0	
29	C	spare		-	0	w		0	0	
30	C	spare		-	0	w		0	0	
31	A	spare		-	0	w		0	0	
32	A	spare		-	0	w		0	0	
33	B	spare		-	0	w		0	0	
34	B	spare		-	0	w		0	0	
35	C	spare		-	0	w		0	0	
36	C	spare		-	0	w		0	0	
37	A	spare		-	0	w		0	0	
38	A	spare		-	0	w		0	0	
39	B	spare		-	0	w		0	0	
40	B	-			0	w		0	0	
41	C	-			0	w		0	0	
42	C	-			0	w		0	0	
PANEL TOTAL								13.2	16.5	Amps= 45.9

REDESIGN PANEL SCHEDULE												
VOLTAGE: 208Y/120V,3PH,4W			PANEL TAG: LC-B1-E						N. C/B AIC: 10K			
SIZE/TYPER BUS: 50A			PANEL LOCATION: Elec. Closet B1-05A						OPTIONS:			
SIZE/TYPER MAIN: 225A/3P C/B			PANEL MOUNTING: SURFACE									
SIZE/TYPER MAINS MLO									REMARKS			
LOAD DESCRIPTION	LOCATION	LOAD WATTS	C/B SIZE	POS NO	A PH	B PH	C PH	POS NO	C/B SIZE	LOAD WATTS	LOCATION	LOAD DESCRIPTION
track lighting	gallery	1548	20A/1P	1	*			2	20A/1P	1548	gallery	track lighting
spare		0	20A/1P	3			*	4	20A/1P	0		spare
track lighting	gallery	1548	20A/1P	5	*			6	20A/1P	1548	gallery	track lighting
spare		0	20A/1P	7			*	8	20A/1P	0		spare
track lighting	gallery	1548	20A/1P	9	*			10	20A/1P	3600	theatre	downlighting
-		0	-	11			*	12	-	0		-
-		0	-	13	*			14	-	0		-
-		0	-	15			*	16	-	0		-
-		0	-	17	*			18	-	0		-
-		0	-	19			*	20	-	0		-
-		0	-	21	*			22	-	0		-
-		0	-	23			*	24	20A/1P	910	lobby	lighting
lighting	lobby	572	20A/1P	25	*			26	20A/1P	384	lobby	lighting
spare	-	0	-	27			*	28	-	0	-	spare
spare	-	0	-	29	*			30	-	0	-	spare
spare	-	0	-	31			*	32	-	0	-	spare
spare	-	0	-	33	*			34	-	0	-	spare
spare	-	0	-	35			*	36	-	0	-	spare
spare	-	0	-	37	*			38	-	0	-	spare
spare	-	0	-	39			*	40	-	0	-	-
-		0	-	41	*			42	-	0		-

Feeder Sizing

Values for max ampacity in current carrying conductors and maximum number of conductors in conduit is retrieved from NEC 2008.

50 amp panel

(4) #6 AWG & (1) #6 AWG ground in 1" con.

News History Gallery

The News History Gallery is a large portion of the 4th level of the Newseum. It is a long space and is approximately 130 feet long by 35 feet wide which gives 4550 square feet in area. The ceilings are 16 feet high. The gallery contains two exhibits. Throughout the middle of the space is the “Timeline” which has newspaper front pages from important times in history. The outer walls of the space are covered by display cases which house news broadcasting equipment and artifacts from the space.

The lighting redesign consists of display lighting, accent lighting, and ambient lighting. The circuits of panel LC-4M-W that are affected are #'s 17, 18, 19, 21, 22. The accent lighting at the two end walls is controlled by one way switching. Three way switches control the display case lighting on the walls of the gallery. The ambient lighting in the middle of the space is controlled by three way dimming switches.

New Luminaire Schedules

Symbol	Manuf.	Cat. #	Description	Lamp	Lamp Qty.	Watts
N-1	Cooper Lighting	HD6-6300C	Recessed downlight	Par 30	1	75
N-2	Cooper Lighting	C6042E-6011	Wall Washer	26W TTT	1	26
N-3	Lightolier	C3MRLCLW	Wall Washer	37W MR16	1	37

Symbol	Voltage	Mounting	Ballast	Quantity
N-1	120	Ceiling Recessed	-	33
N-2	120	Ceiling Recessed	Electronic	10
N-3	120	Display Case	-	22

EXISTING PANEL SCHEDULE												
VOLTAGE: 208Y/120V,3PH,4W			PANEL TAG: LC-4M-W							N. C/B AIC: 10K		
SIZE/TYPE BUS: 225A			PANEL LOCATION: Elec. Closet 4M-09							OPTIONS:		
SIZE/TYPE MAIN: 225A/3P C/B			PANEL MOUNTING: SURFACE									
SIZE/TYPE MAINS MLO										REMARKS		
LOAD DESCRIPTION	LOCATION	LOAD WATTS	C/B SIZE	POS NO	A PH	B PH	C PH	POS NO	C/B SIZE	LOAD WATTS	LOCATION	LOAD DESCRIPTION
lighting	global thea.	200	20A/1P	1	*			2	20A/1P	200	global thea.	lighting
spare		0	20A/1P	3			*	4	20A/1P	0		spare
lighting	global thea.	312	20A/1P	5	*			6	20A/1P	240	global thea.	lighting
spare		0	20A/1P	7			*	8	20A/1P	1548	global thea.	lighting
lighting	global thea.	1548	20A/1P	9	*			10	20A/1P	0		spare
lighting	corr.	1350	20A/1P	11			*	12	20A/1P	1350	corr.	lighting
lighting	corr.	1350	20A/1P	13	*			14	20A/1P	1350	corr.	lighting
lighting	corr.	1350	20A/1P	15			*	16	20A/1P	0		spare
lighting	new s hist	1548	20A/1P	17	*			18	20A/1P	1548	new s hist	lighting
lighting	new s hist	1548	20A/1P	19			*	20	20A/1P	1548	new s hist	lighting
lighting	new s hist	1548	20A/1P	21	*			22	20A/1P	1548	new s hist	lighting
spare		0	20A/1P	23			*	24	20A/1P	0		spare
spare		0	20A/1P	25	*			26	20A/1P	0		spare
spare		0	20A/1P	27			*	28	20A/1P	1200		lighting
lighting		1200	20A/1P	29	*			30	20A/1P	1200		lighting
lighting		1200	20A/1P	31			*	32	20A/1P	1200		lighting
lighting		1200	20A/1P	33	*			34	20A/1P	1200		lighting
-		0	-	35			*	36	-	0		-
-		0	-	37	*			38	-	0		-
-		0	-	39			*	40	-	0		-
-		0	-	41	*			42	-	0		-
SUB-TOTAL		A PHASE 10144.0		B PHASE					9594.0		C PHASE 8748.0	
TOTAL CONNECTED LOAD (WATT		28486.0									DEMAND LOAD 25637.4	

PANELBOARD SIZING WORKSHEET

Panel Tag----->	LC-4M-W	Panel Location:	Elec. Closet 4M-09	
Nominal Phase to Neutral Voltage----->	120	Phase:	3	
Nominal Phase to Phase Voltage----->	208	Wires:	4	

Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	lighting		global thea.	200	w		200	250		
2	A	lighting		global thea.	200	w		200	250		
3	B	spare		-	0	w		0	0		
4	B	spare		-	0	w		0	0		
5	C	lighting		global thea.	312	w		312	390		
6	C	lighting		global thea.	240	w		240	300		
7	A	spare		-	0	w		0	0		
8	A	lighting		global thea.	1548	w		1548	1935		
9	B	lighting		global thea.	1548	w		1548	1935		
10	B	spare		-	0	w		0	0		
11	C	lighting		corr.	1350	w		1350	1688		
12	C	lighting		corr.	1350	w		1350	1688		
13	A	lighting		corr.	1350	w		1350	1688		
14	A	lighting		corr.	1350	w		1350	1688		
15	B	lighting		corr.	1350	w		1350	1688		
16	B	spare		-	0	w		0	0		
17	C	lighting		news hist	1200	w		1200	1500		
18	C	lighting		news hist	1275	w		1275	1594		
19	A	lighting		news hist	814	w		814	1018		
20	A	spare		-	0	w		0	0		
21	B	lighting		news hist	130	w		130	163		
22	B	lighting		news hist	130	w		130	163		
23	C	spare		-	0	w		0	0		
24	C	spare		-	0	w		0	0		
25	A	spare		-	0	w		0	0		
26	A	spare		-	0	w		0	0		
27	B	spare		-	0	w		0	0		
28	B	lighting			1200	w		1200	1500		
29	C	lighting			1200	w		1200	1500		
30	C	lighting			1200	w		1200	1500		
31	A	lighting			1200	w		1200	1500		
32	A	lighting			1200	w		1200	1500		
33	B	lighting			1200	w		1200	1500		
34	B	lighting			1200	w		1200	1500		
35	C	-		-	0	w		0	0		
36	C	-		-	0	w		0	0		
37	A	-		-	0	w		0	0		
38	A	-		-	0	w		0	0		
39	B	-		-	0	w		0	0		
40	B	-		-	0	w		0	0		
41	C	-		-	0	w		0	0		
42	C	-		-	0	w		0	0		
PANEL TOTAL								22.7	28.4	Amps=	79.0

REDESIGN PANEL SCHEDULE													
VOLTAGE: 208Y/120V,3PH,4W			PANEL TAG: LC-4M-W						N. C/B A IC: 10K				
SIZE/TYPE BUS: 100A			PANEL LOCATION: Elec. Closet 4M-09						OPTIONS:				
SIZE/TYPE MAIN: MLO			PANEL MOUNTING: SURFACE										
SIZE/TYPE MAINS									REMARKS				
LOAD	LOCATION	LOAD	C/B	POS	A	B	C	POS	C/B	LOAD	LOCATION	LOAD	
DESCRIPTION		WATTS	SIZE	NO	PH	PH	PH	NO	SIZE	WATTS		DESCRIPTION	
lighting	global thea.	200	20A/1P	1	*			2	20A/1P	200	global thea.	lighting	
spare		0	20A/1P	3			*	4	20A/1P	0		spare	
lighting	global thea.	312	20A/1P	5	*			6	20A/1P	240	global thea.	lighting	
spare		0	20A/1P	7			*	8	20A/1P	1548	global thea.	lighting	
lighting	global thea.	1548	20A/1P	9	*			10	20A/1P	0		spare	
lighting	corr.	1350	20A/1P	11			*	12	20A/1P	1350	corr.	lighting	
lighting	corr.	1350	20A/1P	13	*			14	20A/1P	1350	corr.	lighting	
lighting	corr.	1350	20A/1P	15			*	16	20A/1P	0		spare	
lighting	new s hist	1200	20A/1P	17	*			18	20A/1P	1275	new s hist	lighting	
lighting	new s hist	814	20A/1P	19			*	20	20A/1P	0	-	spare	
lighting	new s hist	130	20A/1P	21	*			22	20A/1P	130	new s hist	lighting	
spare		0	20A/1P	23			*	24	20A/1P	0		spare	
spare		0	20A/1P	25	*			26	20A/1P	0		spare	
spare		0	20A/1P	27			*	28	20A/1P	1200		lighting	
lighting		1200	20A/1P	29	*			30	20A/1P	1200		lighting	
lighting		1200	20A/1P	31			*	32	20A/1P	1200		lighting	
lighting		1200	20A/1P	33	*			34	20A/1P	1200		lighting	
-		0	-	35			*	36	-	0		-	
-		0	-	37	*			38	-	0		-	
-		0	-	39			*	40	-	0		-	
-		0	-	41	*			42	-	0		-	
SUB-TOTAL	A PHASE	7862.0	B PHASE						6758.0	C PHASE 8127.0			
TOTAL CONNECTED LOAD (WATT 22747.0									DEMAND LOAD 20472.3				

Feeder Sizing

Values for max ampacity in current carrying conductors and maximum number of conductors in conduit is retrieved from NEC 2008.

100 amp panel

(4) #1 AWG & (1) #1 AWG ground in 2" con.

Freedom Forum Offices

The Freedom Forum is an organization that works to bring attention to the first amendment. It is also the group who is in charge of the Newseum. Their offices are in an area of the third floor of the Newseum which is not accessible by the public. Members of the Freedom Forum will be using these offices for administrative work to keep the Newseum running smoothly. They will also be conducting research to come up with new exhibits for the ever changing world of news, as well as add to existing exhibits. Most work in this space will be computer based.

This particular space is an open office floor plan which is approximately 28 feet by 36 feet. There is a ceiling height of nine feet. The partitions between the individual cubicles are five feet high. It includes nine computer stations.

The existing lighting design consists of 2x2 recessed fixtures above the office space, and recessed 6" downlights in the corridor area. These fixtures are wired to circuits on panel HV-3-E. The lighting redesign utilizes 4 foot linear pendent indirect fixtures above the workspaces and compact fluorescent sconces in the corridor area. There is also a 6" recessed compact fluorescent wall wash in the back corner to accent the entrance to the director's office.

Redesign

The existing corridor lighting goes to circuit 28, and the existing office lighting is on circuit 3. For the electrical redesign, I subtracted the load for the 15 2x2 fixtures and 6 downlights. Then the new loads from the linear fluorescent and wall wash were added to circuit 3. The new loads from the wall sconces were added to circuit 28.

New Luminaire Schedule

Symbol	Manuf.	Cat. #	Description	Lamp	Lamp Qty.	Watts
O-1	Lightolier	BSL6H01CN	Direct/Indirect lighting	T5 HO	1	54
O-2	Lightolier	FW201	Wall sconce	13W 4pin twin tube	1	13
O-3	Cooper Lighting	C6042E-6011	Wall washer	26W TTT	1	26

Symbol	Voltage	Mounting	Ballast	Quantity
O-1	277	Pendant	Electronic	14
O-2	277	Wall	Electronic	5
O-3	277	Ceiling Recessed	Electronic	1

EXISTING PANEL SCHEDULE

VOLTAGE		480Y/277V,3PH,4W		TAG						TYPE PANEL		
MOUNTING		Surface		HV-3-E						C/B MIN	AIC	FEED
SIZE/TYPE BUS		60A		LOCATION						OPTIONS/ACCESSRS		
SIZE/TYPE MAINS		MLO		3rd floor elec. Rm 3-45						REMARKS		
LOAD DESCRIPTION	LOCATION	LOAD WATTS	C/B SIZE	POS NO	A PH	B PH	C PH	POS NO	C/B SIZE	LOAD WATTS	LOCATION	LOAD DESCRIPTION
Lighting		1104	20A/1P	1	*			2	20A/1P	0		spare
Lighting		742	20A/1P	3			*	4	20A/1P	900		FTR-F
spare		0	20A/1P	5	*			6	20A/1P	900		FTR-F
FCU-3-6		60	20A/1P	7			*	8	20A/1P	900		FTR-f
spare		0	20A/1P	9	*			10	20A/1P	4500		FTR-J
spare		0	20A/1P	11			*	12	20A/1P	4500		FTR-J
spare		0	20A/1P	13	*			14	20A/1P	4500		FTR-J
spare		0	20A/1P	15			*	16	20A/1P	0		spare
spare		0	20A/1P	17	*			18	20A/1P	0		spare
spare		0	20A/1P	19			*	20	20A/1P	0		spare
	-	0	-	21	*			22	20A/1P	252		Lighting
	-	0	-	23			*	24	20A/1P	408		Lighting
	-	0	-	25	*			26	20A/1P	1238		Lighting
	-	0	-	27			*	28	20A/1P	1484		Lighting
	-	0	-	29	*			30	20A/1P	1562		Lighting
	-	0	-	31			*	32	20A/1P	0		spare
	-	0	-	33	*			34	20A/1P	984		Lighting
	-	0	-	35			*	36	20A/1P	426		Lighting
	-	0	-	37	*			38	-	0		-
	-	0	-	39			*	40	-	0		-
	-	0	-	41	*			42	-	0		-
SUB-TOTAL		A PHASE		7802.0		B PHASE		8862.0		C PHASE		7796.0
TOTAL CONNECTED LOAD (WATT)		24460.0								DEMAND LOAD		22014.0

PANELBOARD SIZING WORKSHEET

PANELBOARD SIZING WORKSHEET											
Panel Tag----->					HV-3-E	Panel Location:			3rd flr. Elec. Rm 3-45		
Nominal Phase to Neutral Voltage----->					277	Phase:			3		
Nominal Phase to Phase Voltage----->					480	Wires:			4		
Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks	
1	A	lighting			1104	w		1104	1380		
2	A	spare			0	w		0	0		
3	B	lighting			756	w		756	945		
4	B	FTR-F			900	w		900	1125		
5	C	spare			0	w		0	0		
6	C	FTR-F			900	w		900	1125		
7	A	FCU-3-6			60	w		60	75		
8	A	FTR-F			900	w		900	1125		
9	B	spare			0	w		0	0		
10	B	FTR-J			4500	w		4500	5625		
11	C	spare			0	w		0	0		
12	C	FTR-J			4500	w		4500	5625		
13	A	spare			0	w		0	0		
14	A	FTR-J			4500	w		4500	5625		
15	B	spare			0	w		0	0		
16	B	spare			0	w		0	0		
17	C	spare			0	w		0	0		
18	C	spare			0	w		0	0		
19	A	spare			0	w		0	0		
20	A	spare			0	w		0	0		
21	B	spare			0	w		0	0		
22	B	lighting			252	w		252	315		
23	C				0	w		0	0		
24	C	lighting			408	w		408	510		
25	A				0	w		0	0		
26	A	lighting			1238	w		1238	1548		
27	B				0	w		0	0		
28	B	lighting			91	w		91	114		
29	C				0	w		0	0		
30	C	lighting			1562	w		1562	1953		
31	A				0	w		0	0		
32	A	spare			0	w		0	0		
33	B				0	w		0	0		
34	B	lighting			984	w		984	1230		
35	C				0	w		0	0		
36	C	lighting			426	w		426	533		
37	A				0	w		0	0		
38	A				0	w		0	0		
39	B				0	w		0	0		
40	B				0	w		0	0		
41	C				0	w		0	0		
42	C				0	w		0	0		
PANEL TOTAL								23.1	28.9	Amps=	34.7

REDESIGN PANEL SCHEDULE

VOLTAGE		480Y/277V, 3PH, 4W		TAG						TYPE PANEL			
MOUNTING		Surface		HV-3-E						C/B MIN	AIC	FEED	
SIZE/TY PE BUS		60A		LOCATION						OPTIONS/ACCESSRS			
SIZE/TY PE MAINS		MLO		3rd floor elec. Rm 3-45						REMARKS			
LOAD	LOCATION	LOAD	C/B	POS	A	B	C	POS	C/B	LOAD	LOCATION	LOAD	
DESCRIPTION		WATTS	SIZE	NO	PH	PH	PH	NO	SIZE	WATTS		DESCRIPTION	
Lighting		1104	20A/1P	1	*			2	20A/1P	0		spare	
Lighting		756	20A/1P	3			*	4	20A/1P	900		FTR-F	
spare		0	20A/1P	5	*			6	20A/1P	900		FTR-F	
FCU-3-6		60	20A/1P	7			*	8	20A/1P	900		FTR-f	
spare		0	20A/1P	9	*			10	20A/1P	4500		FTR-J	
spare		0	20A/1P	11			*	12	20A/1P	4500		FTR-J	
spare		0	20A/1P	13	*			14	20A/1P	4500		FTR-J	
spare		0	20A/1P	15			*	16	20A/1P	0		spare	
spare		0	20A/1P	17	*			18	20A/1P	0		spare	
spare		0	20A/1P	19			*	20	20A/1P	0		spare	
	-	0	-	21	*			22	20A/1P	252		Lighting	
	-	0	-	23			*	24	20A/1P	408		Lighting	
	-	0	-	25	*			26	20A/1P	1238		Lighting	
	-	0	-	27			*	28	20A/1P	91		Lighting	
	-	0	-	29	*			30	20A/1P	1562		Lighting	
	-	0	-	31			*	32	20A/1P	0		spare	
	-	0	-	33	*			34	20A/1P	984		Lighting	
	-	0	-	35			*	36	20A/1P	426		Lighting	
	-	0	-	37	*			38	-	0		-	
	-	0	-	39			*	40	-	0		-	
	-	0	-	41	*			42	-	0		-	
SUB-TOTAL	A PHASE	7802.0	B PHASE			7483.0			C PHASE		7796.0		
TOTAL CONNECTED LOAD (WATT		23081.0							DEMAND LOAD		20772.9		

Feeder Sizing

Values for max ampacity in current carrying conductors and maximum number of conductors in conduit is retrieved from NEC 2008.

60 amp panel

(4) #4 AWG & (1) #4 AWG ground in 1.5" con.

Exterior Entry

The Newseum entry porch is what draws people to the building from off of Pennsylvania Avenue. It is a transition from the sidewalk to the interior of the Newseum. The glass façade walls can allow pedestrians walking by to look in and become interested in what is going on inside. This area should not only appeal to Newseum guests, but also to people walking by. Because it has a roof, it can be a place to take cover in precipitation. It is important that any lighting used doesn't draw attention away from existing monuments along Pennsylvania Avenue. The dimensions are about 40' x 23' and it is approximately 920 square feet. The lighting redesign consists of recessed lighting in the steel mesh porch covering.

New Luminaire Schedule:

Symbol	Manuf.	Cat. #	Description	Lamp	Lamp Qty.	Watts
E-1	Lightolier	1101HCLC	Wet Location downlight	32 watt triple tube	1	32

Symbol	Voltage	Mounting	Ballast	Quantity
E-1	120	Recessed	Electronic	6

EXISTING PANEL SCHEDULE													
VOLTAGE: 208Y/120V,3PH,4W			PANEL TAG: LC-B1-W2						N. C/B AIC: 10K				
SIZE/TYPE BUS: 100A			PANEL LOCATION: Elec. Closet B1-09A						OPTIONS:				
SIZE/TYPE MAIN: -			PANEL MOUNTING: SURFACE										
SIZE/TYPE MAINS MLO									REMARKS				
LOAD DESCRIPTION	LOCATION	LOAD WATTS	C/B SIZE	POS NO	A PH	B PH	C PH	POS NO	C/B SIZE	LOAD WATTS	LOCATION	LOAD DESCRIPTION	
lighting		960	20A/1P	1	*			2	20A/1P	528		lighting	
lighting		1050	20A/1P	3			*	4	20A/1P	600		lighting	
lighting		600	20A/1P	5	*			6	20A/1P	900		lighting	
lighting		288	20A/1P	7			*	8	20A/1P	144		lighting	
spare		0	20A/1P	9	*			10	20A/1P	0		spare	
spare		0	20A/1P	11			*	12	20A/1P	0		spare	
lighting		1008	20A/1P	13	*			14	20A/1P	720		lighting	
spare		0	20A/1P	15			*	16	20A/1P	0		spare	
spare		0	20A/1P	17	*			18	20A/1P	192		lighting	
lighting		432	20A/1P	19			*	20	20A/1P	336		lighting	
lighting		750	20A/1P	21	*			22	20A/1P	2550		lighting	
lighting		208	20A/1P	23			*	24	20A/1P	104		lighting	
lighting		1056	20A/1P	25	*			26	20A/1P	600		lighting	
lighting		384	20A/1P	27			*	28	20A/1P	672		lighting	
lighting		336	20A/1P	29	*			30	20A/1P	750		lighting	
lighting		1116	20A/1P	31			*	32	20A/1P	336		lighting	
spare		0	20A/1P	33	*			34	20A/1P	0		spare	
lighting		816	20A/1P	35			*	36	20A/1P	528		lighting	
-		0	-	37	*			38	20A/1P	1222		lighting	
-		0	-	39			*	40	-	0		-	
-		0	-	41	*			42	-	0		-	
SUB-TOTAL		A PHASE 8746.0		B PHASE				6006.0		C PHASE		4434.0	
TOTAL CONNECTED LOAD (WATT		19186.0								DEMAND LOAD		17267.4	

PANELBOARD SIZING WORKSHEET

Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
Panel Tag----->		LC-B1-W2		Panel Location:		Elec. Closet B1-09A				
Nominal Phase to Neutral Voltage----->		120		Phase:		3				
Nominal Phase to Phase Voltage----->		208		Wires:		4				
1	A	lighting			960	w		960	1200	
2	A	lighting			528	w		528	660	
3	B	lighting			1050	w		1050	1313	
4	B	lighting			600	w		600	750	
5	C	lighting			600	w		600	750	
6	C	lighting			900	w		900	1125	
7	A	lighting			2881	w		2881	3601	
8	A	lighting			144	w		144	180	
9	B	spare			0	w		0	0	
10	B	spare			0	w		0	0	
11	C	spare			0	w		0	0	
12	C	spare			0	w		0	0	
13	A	lighting			1008	w		1008	1260	
14	A	lighting			720	w		720	900	
15	B	spare			0	w		0	0	
16	B	spare			0	w		0	0	
17	C	spare			0	w		0	0	
18	C	lighting			192	w		192	240	
19	A	lighting			432	w		432	540	
20	A	lighting			336	w		336	420	
21	B	lighting			750	w		750	938	
22	B	lighting			2550	w		2550	3188	
23	C	lighting			192	w		192	240	
24	C	spare			0	w		0	0	
25	A	lighting			1056	w		1056	1320	
26	A	lighting			600	w		600	750	
27	B	lighting			384	w		384	480	
28	B	lighting			672	w		672	840	
29	C	lighting			336	w		336	420	
30	C	lighting			750	w		750	938	
31	A	lighting			1116	w		1116	1395	
32	A	lighting			336	w		336	420	
33	B	spare			0	w		0	0	
34	B	spare			0	w		0	0	
35	C	lighting			816	w		816	1020	
36	C	lighting			528	w		528	660	
37	A	-			0	w		0	0	
38	A	lighting			1222	w		1222	1528	
39	B	-			0	w		0	0	
40	B	-			0	w		0	0	
41	C	-			0	w		0	0	
42	C	-			0	w		0	0	
PANEL TOTAL								21.7	27.1	Amps= 75.2

REDESIGN PANEL SCHEDULE													
VOLTAGE: 208Y/120V,3PH,4W			PANEL TAG: LC-B1-W2						N. C/B AIC: 10K				
SIZE/TYPE BUS: 100A			PANEL LOCATION: Elec. Closet B1-09A						OPTIONS:				
SIZE/TYPE MAIN: -			PANEL MOUNTING: SURFACE										
SIZE/TYPE MAINS MLO									REMARKS				
LOAD DESCRIPTION	LOCATION	LOAD WATTS	C/B SIZE	POS NO	A PH	B PH	C PH	POS NO	C/B SIZE	LOAD WATTS	LOCATION	LOAD DESCRIPTION	
lighting		960	20A/1P	1	*			2	20A/1P	528		lighting	
lighting		1050	20A/1P	3			*	4	20A/1P	600		lighting	
lighting		600	20A/1P	5	*			6	20A/1P	900		lighting	
lighting		288	20A/1P	7			*	8	20A/1P	144		lighting	
spare		0	20A/1P	9	*			10	20A/1P	0		spare	
spare		0	20A/1P	11			*	12	20A/1P	0		spare	
lighting		1008	20A/1P	13	*			14	20A/1P	720		lighting	
spare		0	20A/1P	15			*	16	20A/1P	0		spare	
spare		0	20A/1P	17	*			18	20A/1P	192		lighting	
lighting		432	20A/1P	19			*	20	20A/1P	336		lighting	
lighting		750	20A/1P	21	*			22	20A/1P	2550		lighting	
lighting		192	20A/1P	23			*	24	20A/1P	0		spare	
lighting		1056	20A/1P	25	*			26	20A/1P	600		lighting	
lighting		384	20A/1P	27			*	28	20A/1P	672		lighting	
lighting		336	20A/1P	29	*			30	20A/1P	750		lighting	
lighting		1116	20A/1P	31			*	32	20A/1P	336		lighting	
spare		0	20A/1P	33	*			34	20A/1P	0		spare	
lighting		816	20A/1P	35			*	36	20A/1P	528		lighting	
-		0	-	37	*			38	20A/1P	1222		lighting	
-		0	-	39			*	40	-	0		-	
-		0	-	41	*			42	-	0		-	
SUB-TOTAL	A PHASE	8746.0	B PHASE					6006.0	C PHASE		4314.0		
TOTAL CONNECTED LOAD (WATT		19066.0								DEMAND LOAD		17159.4	

Feeder Sizing

Values for max ampacity in current carrying conductors and maximum number of conductors in conduit is retrieved from NEC 2008.

100 amp panel

(4) #1 AWG & (1) #1 AWG ground in 2" con.

Energy Efficient vs Standard Transformer Comparison

This comparison will investigate the cost effectiveness of replacing the Newseum’s existing transformers with energy efficient transformers. Any amount of cost savings would have multiple benefits. It would save the Freedom Forum costs on the electrical bill, which could add up quickly because of the Newseums large demands and three service entrances. It would also require less production from PEPCO, who is the electric service provider. It is important to save energy when possible, especially now with the popularity of “going green.”

Powersmith’s energy savings calculator was used to help perform this analysis. They are a manufacturer of energy efficient transformers. To use the calculator, certain data must first be obtained. The Newsuem is open every day from 9 am to 5 pm. It is only closed on Thanksgiving, Christmas, and New Years Day. Assuming employees are there earlier and later, a daily operation of 10 hours will be used. Load during normal operating hours is assumed to be 35% and outside operating hours is assumed to be 15%.

Existing Transformers

Tag	T4	T5	T6	T7	T8	T9	T10	T11	T13
Size (kVA)	15	30	45	75	112.5	150	225	300	750
Quantity	3	9	7	8	7	3	10	1	1



ESP for LEED Calculator™

Energy Savings Payback Calculator

Toll Free : 1-800-747-9627 or (905) 791-1493

Project Description
Date

Newseum and Freedom Forum Headquarters
7-Apr-09

Data Entry

Transformers on Project

QTY	kVA
3	15
9	30
7	45
8	75
7	112.5
3	150
10	225
5	300
	500
1	750
	1000
	1500
	2000
	7.5

Available Full Load kW	6967.5		
Average kVA (calc)	131		
equipment operating hrs/ day	10		
equipment operating days/yr	362	Calc Load kW	Calc Annual kWh
Load during normal operating hours	35%	2439	8,827,823
Load outside operating hours	15%	1045	5,371,943
		Total Annual Load kWh:	14,199,765
Annual Cost to Operate Load Only			
kWh rate	\$ 0.100	Annual Consumption:	\$ 1,419,977
demand rate (\$/kW/mo) ex. \$10.00	\$6.50	Annual Demand:	\$ 190,213
		Total Cost to run load	\$ 1,610,189

Annual Cost of Status Quo Transformer Losses & Associated Air Conditioning (A/C) burden

Nameplate Linear efficiency (normal op hrs)	96.5%	% electronics or current THD	30.0%
Calculated operating efficiency	95.5%		
Transformer kW Losses (Normal Operation)	116.2 kW		
Status quo Efficiency (Outside op. hrs)	94.0%		
Transformer kW Losses (Outside op. hrs)	66.7 kW		
Annual additional kWh from transformers	763,703 kWh		
Annual Cost of Transformer Losses	\$ 85,438		
A/C System Performance (kW/ton)	1.25		
Additional Tons of Cooling (on peak)	33.02 tons		
Annual additional kWh from A/C	271,201 kWh		
Annual Cost of Associated A/C	\$ 30,340		


Summary with Status Quo Transformer

Annual Cost of feeding Building Load	\$ 1,610,189
Annual Cost of Transformer Losses	\$ 85,438
Annual Cost of Associated A/C	\$ 30,340
Electrical Bill (Status Quo Transformer)	\$ 1,725,967

IMPORTANT: By using the ESP Calculator™, you are agreeing the TERMS OF USE section on page 3

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POWERSMITHS	Page 2		ESP for LEED Calculator™	
Toll Free : 1-800-747-9627 or (905) 791-1493			Energy Savings Payback Calculator	
Using Powersmiths instead of status quo transformers				
Powersmiths Efficiency (Normal Operation)	98.8%			
Powersmiths kW Losses (Normal Operation)	29.6 kW			
Powersmiths Efficiency (Outside op. hrs)	98.4%			
Transformer kW Losses (Outside op. hrs)	17.0 kW			
Annual additional kWh from transformers	194,569 kWh			
Annual Cost of Powersmiths Losses	\$ 21,767			
Additional Tons of Cooling (on peak)	8.41 tons			
Annual additional kWh from A/C	69,094 kWh			
Annual Cost of Associated A/C	\$ 7,730			
Comparing Status Quo & Powersmiths				
	Status Quo		Powersmiths	
Annual Cost of feeding Building Load	\$ 1,610,189	\$ 1,610,189		
Annual Cost of Transformer Losses	\$ 85,438	\$ 21,767		
Annual Cost of Associated A/C	\$ 30,340	\$ 7,730	Reduction	
Annual estimated Electrical Bill	\$ 1,725,967	\$ 1,639,686	5%	
Peak kW reduction (normal op hours)	117.4 kW			
Annual kWh reduction	771,241 kWh			
Reduction in Air Conditioning Load (on peak)	24.61 tons			
Cost Analysis (calc)				
Energy Cost Escalation (above inflation)	3.0%			
Annual Power Quality Benefit	\$ -			
	Annual Operating Cost		Life Cycle Operating Cost & Savings	
			20 years	32 years
Status Quo Transformers	\$115,778		\$4,182,143	\$9,540,377
Powersmiths Transformers	\$29,497		\$1,065,498	\$2,430,633
Savings with Powersmiths	\$86,281		\$3,116,645	\$7,109,745
Cost				
	Cost			
Powersmiths Transformers	\$270,953			
Status Quo Transformers	\$135,476			
Payback on total cost				
	1.57 years		current kWh rate:	
Cost of Energy Savings	\$ 0.005	/kWh	\$0.100	
Cost - Benefit Ratio	18.2		times less to save a kWh than to buy a kWh	
Leasing Option				
	60 Month Term	48 Month Term	36 Month Term	
Total Annual Leasing Payments	\$68,508	\$83,562	\$106,322	
Net Annual Cost with savings	(\$17,773)	(\$2,719)	\$20,041	
Summary of Environmental Benefits				
Annual Reduction in Greenhouse Gases (per EPA)			Equivalence	
569 tons of CO2			106 Acres trees planted	
1,844 tons of Coal			76 Car Emissions	
4,462 kgs of SO2			77 homes heated	
1,921 kgs of NOx				
IMPORTANT: By using the ESP Calculator™, you are agreeing the TERMS OF USE section on page 3				
Powersmiths International Corp. is a licensed user. Content subject to change without notice				
				
Page 2 of 3	© Power Quality Institute 1998-2007. All rights reserved	doc#807-000440-115-A03	17-Jan-09	

	Page 3	ESP for LEED Calculator™
Toll Free : 1-800-747-9627 or (905) 791-1493		Energy Savings Payback Calculator
Status Quo Transformer (Normal Operation)		
Enter the average efficiency of the transformers. While NEMA TP1 is legislated minimum efficiency, it only applies at a single 35% load point, and under ideal linear load profile. Since most transformers are much less loaded than 35%, be sure to use lower efficiency to reflect load level.		
Status Quo Transformer (Outside Op. hours)		
Transformer efficiency is typically lower than normal when lightly loaded (86-89% when 10-15% loaded for most sizes) %electronics or Current THD		
IEEE Std 1100 and other industry references document transformer losses can more than double when feeding electronics when installed compared to ideal linear load in a manufacturer's factory test.		
Transformer Operating Losses		
Transformer Losses = kW load/net efficiency - kW load.		
A/C Performance (kW/ton)		
Varies widely depending on age and technology of cooling system. As low as 0.5 to over 2kW/ton (1.25-1.5 is often tp)		
Unlike most substation transformers that are vented to the exterior, most building distribution transformers are ventilated within the building, and their heat losses therefore add to the cooling load.		
Powersmiths Efficiency (Normal Operation) & (Outside Op. hours)		
Available on Powersmiths product data sheet		
Energy Cost escalation (above inflation)		
It is well recognized that energy rates are increasing much faster than inflation. Enter the % over inflation		
Annual Power Quality Benefit		
Savings attributable to reduced downtime, equipment locks & failures associated with poor power quality		
Cost		
Cost of transformers. Enter dollar figure for transformers under consideration. If the interest is to look at the justification for replacing existing transformers, enter \$0 in the conventional transformer cost field.		
Energy Operating Cost		
Energy OPERATING COST (normal op) = (transformer + cooling) kW losses x kWh rate x hrs/day x days/yr + demand charge		
Demand charge is not included in the calculation of losses outside normal hours to be conservative.		
Return on Investment (ROI)		
ROI on Incremental Cost is based on dividing the Incremental Investment in Powersmiths by the Annual Savings		
ROI on Total Transformer Cost is based on dividing the Total Transformer Cost by the Annual Savings		
Cost of Energy Savings		
In its simplest form, the cost of energy savings represents the cost to save a kWh as opposed to paying for it according to the prevailing kWh rate.		
The equation is: Cost of Energy Savings = (Incremental Product Cost / Lifetime kWh saved)		
Leasing		
Powersmiths Leasing has many benefits, including avoiding the use of capital, offsetting monthly leasing payment with the reduction in monthly energy bill from using Powersmiths		
Environmental Benefits		
Conversion rates from kWh to emission reduction and equivalent benefits are published by the EPA, and reflect environmental benefits derived from reduced emissions associated with reduced power generation.		
TERMS OF USE		
Power Quality Institute has used its best efforts in developing the ESP Calculator™ with the intent of providing an easy to use and useful calculation tool. However, data entered and assumptions made may not accurately reflect all variables that apply in a given facility. The results are therefore estimates only and may differ from actual measurements. The user is responsible for evaluating the suitability and accuracy of the ESP Calculator™. The Power Quality Institute and Powersmiths International Corp. make no representations or warranties with respect to the accuracy or completeness of the estimates generated by the ESP Calculator™ and specifically disclaim any implied warranties of merchantability or fitness for any particular purpose and shall in no event be liable for any loss of profit or any other commercial damage, including, but not limited to special, incidental, consequential or other damages.		
Page 3 of 3	© Power Quality Institute 1998-2007, All rights reserved	doc#807-000440-115-A03



Conclusion

According to the results of the calculations, changing to energy efficient transformers would be very beneficial to the Newseum & Freedom Forum Headquarters building. There will be a 5% decrease in annual electric bill costs. With standard transformers, the annual operating cost came to \$115,778. With the energy efficient transformers this cost is only \$29,497. This is an annual savings of \$86,281.

Like most energy saving equipment, the transformers have a higher initial cost than the standard ones. However, it is important to realize that they will pay for themselves overtime, and after that period the money savings will start adding up. Based on the calculations, the energy efficient transformers will pay for themselves in 1.57 years.

Addition of a Wind Turbine System

With the Newseum's large power consumption through its many galleries, displays, and interactive exhibits, it is important to look at possible forms of alternative energy. It is also important because of the trends of "going green". There is potential for the Newseum to be able to produce some of its own energy, and therefore reduce electric costs.

Since the Newseum is on Pennsylvania Avenue in downtown Washington, D.C., it does not have extensive property for the placement of wind turbines. One solution to this problem would be to go with a roof mounted turbine. One type I found is called the Swift Wind Turbine from Cascade Engineering. (A spec sheet can be found in the appendix) It is a building mountable turbine with a 7 foot blade spinning diameter. It can produce approximately 2000 kWh per year.

In order to determine if this type of system is advantageous for the Newseum, I will at energy production, and perform a cost analysis on potential savings. I am using information from the Newseum's energy provider, PEPCO, for this analysis as well. It too can be found in the appendix.

Analysis

The wind turbine can produce 2000 kWh per year. The rate that PEPCO charges for the first 6000 kWh is \$0.04067 in the summer and \$0.03371 in the winter.

	Summer	Winter
Generation kWh rate	0.12147	0.11736
Distribution kWh rate	0.04067	0.03371
Transmission kWh rate	0.00349	0.00349
Delivery tax kWh rate	0.0077	0.0077
Public space surcharge rate	0.00219	0.00219
Total rate	0.1755	0.16445
x 2000 kWh savings / year	\$351	\$328.9

The website also stated that the average cost to install one unit is around \$10,000. Now I can determine how long it would take for the turbine to pay for itself.

Installation costs	\$10000	\$10000
Yearly savings	\$351	\$328.9
Paid for	28.5 years	30.4 years

Conclusion

After analyzing cost benefits and energy values, it is clear that a wind turbine addition may not be the best solution for the Newseum. By taking the summer values, which are the peak values, the turbine only saves \$351 per year. At that rate, it would take about 28.5 years to pay for itself. This is not good at all considering Cascade Engineering lists the turbine to last approximately 20 years. Since this shows that at least this particular wind turbine is not the best idea, other forms of renewable energy, such as solar, could be looked into.

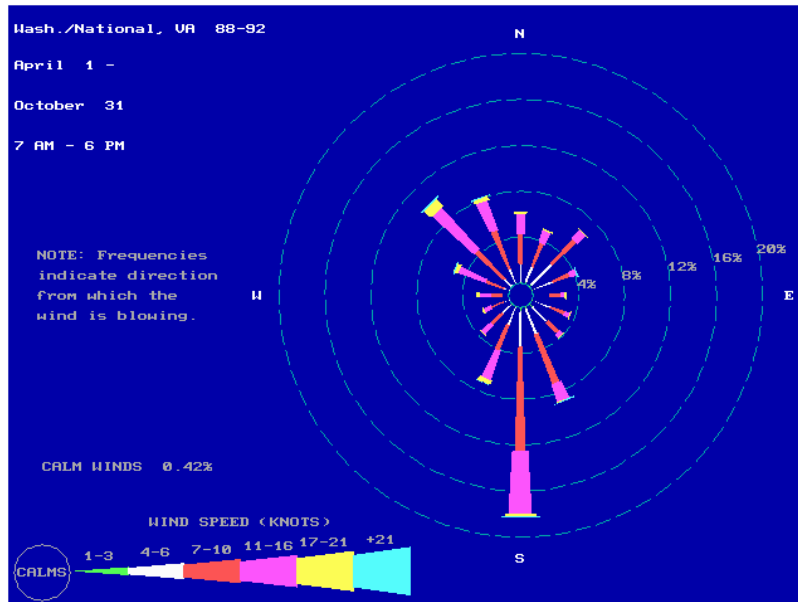
Breadth Work

For my areas of breadth work, I will be conducting an architectural study and a mechanical study. In the electrical depth, I looked into incorporating a wind turbine into the system. Even though I found that it was not the best idea, I am going to say it was for the architectural study. For the architectural breadth I am going to look into the placement and layout of the wind turbines on the Newseum's existing roof.

In the News History Gallery, where a lighting redesign was performed, there exist environmentally susceptible artifacts in the display cases. Because of this, like many other museums, there is humidity control for the displays. I want to analyze the environment inside of the display cases to ensure that any heat produced by the new lighting I placed there in the redesign does not have a profound effect and cause possible damage to the artifacts.

Architecture Breadth

The first step to determine the layout of wind turbines on the roof of the Newseum would be to access a wind rose of the Washington, D.C. area. The following was accessed at <http://home.pes.com/windroses/wrgifs/13743.GIF>.

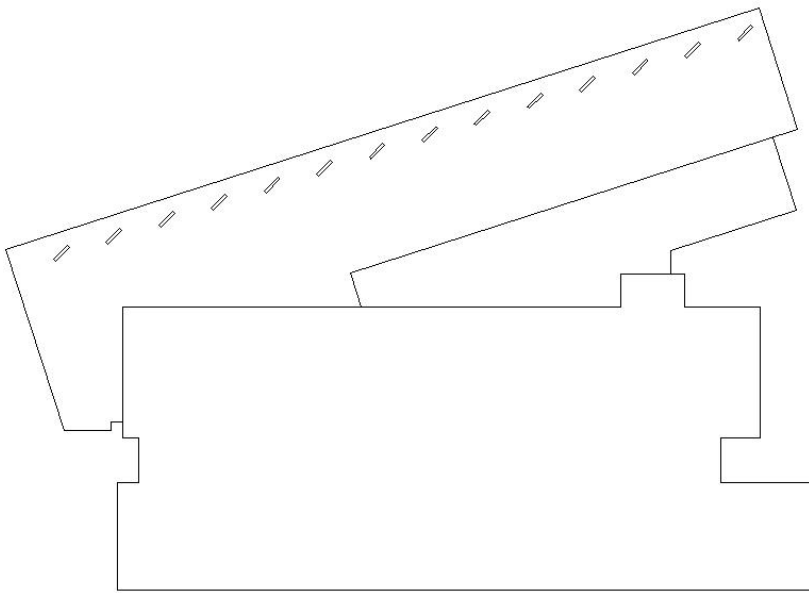


It can be noted the majority of wind comes from the south, or the north west. The south side of the building is the one bordering Pennsylvania Avenue, and the north west corner is where the Newseum apartments are located.

Taking these two options into consideration I have chose the north west side for a few reasons. First the south wind is just one large spike in one certain direction. On the other hand, with wind coming from the north west, there is a cluster of compass directions which all have a decent amount of wind. Another reason to choose the north west side is so that the front building façade along Pennsylvania Avenue is not hindered by the addition of the turbines.

Next a roof plan must be constructed in order to see the turbine placement options. I have designed a layout that consists of an array of 14 turbines spaced 20 feet apart. That is ample spacing since the blade spinning diameter is only 7 feet. The height restriction zoning in Washington, D.C. allows the wind to reach the turbines directly without trouble.

Roof Plan



Mechanical Breadth

The News History Gallery has atmosphere control in the display cases. It keeps track of things like humidity and temperature. During the lighting redesign, I added lighting in the cases. Now I want to analyze the environment and make the lights did not create any changes in the display cases which could damage the artifacts.

The fixture in the cases is a lensed wall washer. It uses MR-16 lamping which is an incandescent source. Therefore I can eliminate the possibility of any radiation or ultra violet contamination. The main changes would be temperature and infrared. There is only one fixture in each case. The cases have dimensions of 6 feet by 3 feet. The amount of heat radiated by the MR-16 is fairly small.

After examining the air handling system that services the cases, it is found that they will have no problem handling the small additional heat loads in a timely manner. Thus no damage to the artifacts will occur.

Overall Conclusions

Overall, each part of this report came to a well analyzed or designed conclusion. All of the lighting spaces met design criteria, illumination levels, and power limits. They also do a good job of tying all of the spaces together even though they each light a completely different environment. They do this by creating similar feelings and using similar fixtures.

In terms of electrical studies, the redesigns use lower rated panels which shows the lighting redesign is also using less power. Good comparisons and analysis were also completed showing that energy efficient transformers would be a good idea for the Newseum, and that wind turbines are not the best solution to save on energy costs.

The breadth studies also did a good job at analyzing what was described. The architectural breadth took into account environmental issues, as well as aesthetic issues when coming up with the best layout of wind turbines. The mechanical breadth also accomplish analyzing the environment of the display cases to determine that the lighting does not present any damaging issues.

Acknowledgements

I would like to thank everyone who has helped me and gave me support all along the way during senior thesis :

Thank you to Turner Construction for allowing me to use the Newseum and Freedom Forum Headquarters as my thesis building and supplying me with drawings.

Mark Miller from Turner Construction

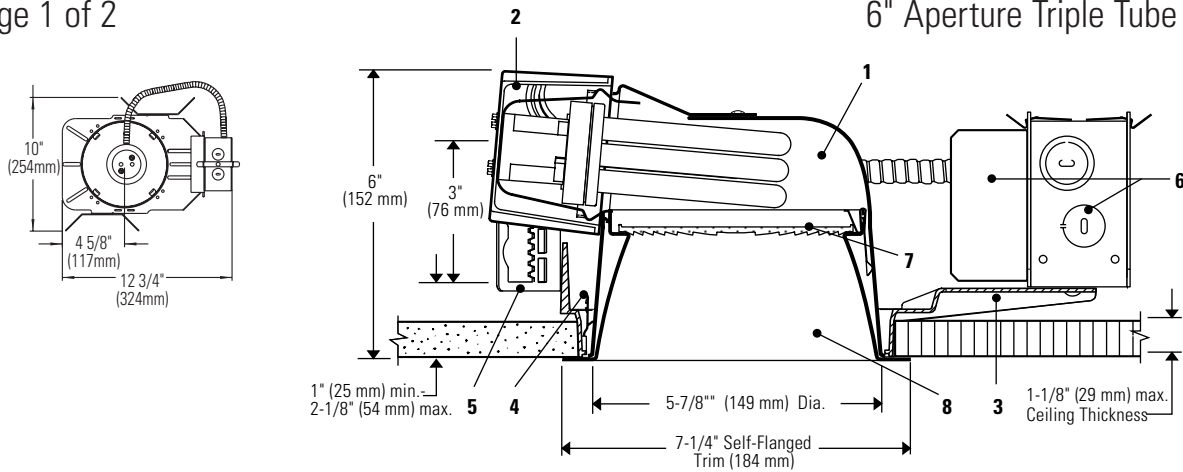
Dr. Mistrick

Professor Dannerth

Professor Parfitt

Professor Holland

All my family and friends who gave me support and encouragement.



Reflector Trim				Frame-In Kit	
(Lens:)	Fresnel	Clear	Prismatic	S6132BU	6" aperture, 1 lamp 26/32W Triple Tube CFL (120/277V) 4-Pin (Amalgam)
Clear Cone, White Flange	8091FCLW	8091CCLW	8091PCLW	Dimming Options:	
Clear Cone, Polished Flange	8091FCLP	8091CCLP	8091PCLP	S6132B	<input type="checkbox"/>
White Cone, White Flange	8091FWHW	8091CWHW	8091PWHW	CU3	Lightolier PowerSpec 3% Dimming (120/277V)
				J1LD3	Lutron 5% Dimming (120V)
				J2LD3	Lutron 5% Dimming (277V)
				J1MX	Mark 10 Dimming (120V)
				J2MX	Mark 10 Dimming (277V)
				Other dimming product available, please consult factory	
Opal Diffuser				Remodeler Frame-In Kits	
Clear Cone, White Flange	8091DCLW			6126BURM	6" aperture, 1 lamp 26W Triple Tube CFL (120/277V) 4-Pin (Amalgam)
Clear Cone, Polish Flange	8091DCLP			6132BURM	6" aperture, 1 lamp 26/32W Triple Tube CFL (120/277V) 4-Pin (Amalgam)
White Cone, White Flange	8091DWHW				

Features

- Reflector:** 16 ga. Die-formed aluminum, Anobrite® finish.
- Socket Cup:** Effectively dissipates heat and positions lamp holder. Snaps onto reflector neck to assure consistently correct optical alignment without tools.
- Mounting Frame:** Galvanized steel for dry or plaster ceilings. Accepts other 6" Triple Tube reflectors (see S6132BU Spec Sheet).
- Retaining Springs:** Precision-tooled steel friction springs secure reflector to mounting frame for quick, tool-less installation.
- Mounting Brackets:** 16 ga. steel. Adjust from inside of fixture. Use 3/4" or 1 1/2" lathing channel, 1/2" EMT, or optional mounting bars.
- Ballast/J-Box:** Electronic 120V-277V. UL listed for through branch circuit wiring with max of (8) No. 12AWG, 90°C supply conductors. Outboard-mounted to reduce heat transfer and maintain lamp efficacy and life. Service from below without tools.
- Shielding Media:** Molded acrylic. Available in fresnel lens, clear lens, or opal diffuser. Secured to aperture cone.
- Cone:** 16 ga. Alzak® aluminum. Clear Iridescence Free finish or Comfort Clear™ low iridescence finish. Retained by friction springs; no loose parts.

Electrical

Note: For ballast electrical data and latest lamp/ballast compatibility refer to "Ballast" specification sheet for complete electrical data.

UL Listed for through branch circuit wiring with max of (8) No 12 AWG, 90 degree C supply conductors.

Options and Accessories

Comfort Clear™ Finishes¹		Other Finishes	
Clear	CCL	White	WH
Diffuse	CCD	Champagne Bronze	CCZ

¹Specify desired flange. **W** White, **P** Polished

Options and Accessories (continued)

Emergency	Add suffix EM*
Chicago Plenum	Use 6132BULC
Existing/Thk. Ceiling	FA EC6*
Emergency Ltg. Kit	FA EM3E*
	FA EM4E*

Fuse (Slow Blow) Add suffix **F**
 *See Spec. Sheets: FAEC, FAEM

Mounting Bars & Accessories; see Specification Sheet MBA. Sloped Ceiling Adapters; see Specification Sheet SCA.
 IC Frame available; see **C6CFL32** specification sheet.

Labels

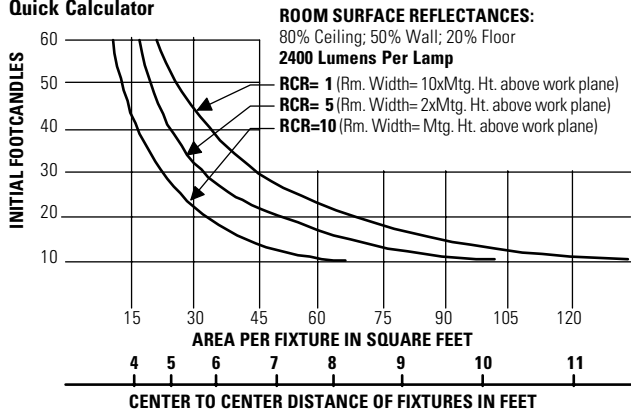
All units are UL listed for wet locations; Opal Diffuser is UL listed for damp locations.

Alzak® is a registered trademark of ALCOA. **US Patent Pending.**

Job Information	Type:
Job Name:	
Cat. No.:	
Lamp(s):	
Notes:	

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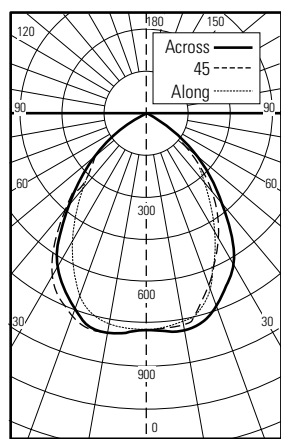
32W Clear Cone (CL) Quick Calculator



This quick calculator chart determines the number and spacing of 1 Lt. - 32W PL-T units with fresnel lens and clear reflector, for any level of illumination. Conversion factors: Opal diffuser, fc x 0.8; Clear lens, fc x 1.0. 1 Lt. - 26W PLT : Fresnel Lens, fc x 0.8; Opal Diffuser, fc x 0.65; Clear lens fc x 0.8.

Spacing Ratio = 1.2

CERTIFIED TEST REPORT NO. 0075FR
COMPUTED BY LSI PROGRAM **TEST-LITE**
CALCULITE 6" DIAMETER RECESSED FLUORESCENT LENSED DOWNLIGHT
SEMI-SPECULAR REFLECTOR WITH CLEAR CONE AND FRESNEL LENS
LUMEN RATING = 2400 LMS.
1-32W PL-T LAMP,



ANGLE	CANDLEPOWER				
	ALONG 22.5	45	67.5	ACROSS	LUMENS
0	780	780	780	780	780
5	773	778	779	782	785 37
10	758	768	774	781	790
15	736	732	738	753	776 104
20	680	647	664	699	739
25	589	552	591	633	688 140
30	499	489	530	572	630
35	413	425	446	481	536 143
40	334	358	364	386	425
45	268	286	288	304	323 115
50	210	232	232	239	244
55	87	105	109	116	119 55
60	32	38	42	45	47
65	6	8	9	9	11 7
70	1	1	1	2	2
75	1	1	1	1	1 0
80	1	1	1	1	1
85	0	1	1	0	1 0
90	0	1	1	0	1

ZONE	ZONAL LUMENS AND PERCENTAGES			
	LUMENS	% LAMP	% LUMINAIRE	
0-30	585	24.40	47.62	
0-40	886	36.92	72.06	
0-60	1216	50.67	98.90	
0-90	1229	51.24	100.00	
40-90	343	14.32	27.94	
60-90	13	.57	1.10	
90-180	0	.00	.00	
0-180	1229	51.24	100.00	

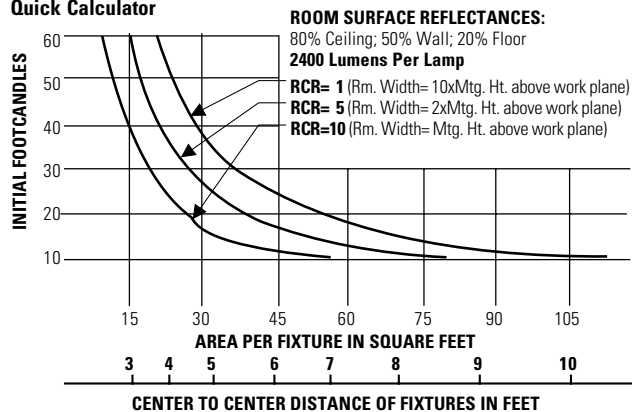
** EFFICIENCY = 51.2% **

Coefficients Of Utilization

ROOM CAVITY RATIO	% EFFECTIVE CEILING CAVITY REFLECTANCE																							
	80				70				50				30				10				0			
	% WALL REFLECTANCE																							
	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10
1	.56	.55	.54	.56	.54	.53	.53	.52	.51	.51	.51	.50	.50	.49	.48	.48	.48	.48	.48	.48	.48	.48	.48	
2	.52	.50	.48	.51	.49	.48	.50	.48	.47	.48	.47	.46	.47	.46	.45	.44	.44	.44	.44	.44	.44	.44	.44	
3	.48	.46	.44	.48	.45	.43	.46	.44	.43	.45	.43	.42	.44	.43	.41	.40	.40	.40	.40	.40	.40	.40	.40	
4	.45	.42	.40	.44	.42	.39	.43	.41	.39	.42	.40	.38	.41	.39	.38	.37	.37	.37	.37	.37	.37	.37	.37	
5	.42	.38	.36	.41	.38	.36	.40	.37	.35	.39	.37	.35	.38	.36	.35	.34	.34	.34	.34	.34	.34	.34	.34	
6	.38	.35	.33	.38	.35	.32	.37	.34	.32	.36	.34	.32	.36	.33	.32	.31	.31	.31	.31	.31	.31	.31	.31	
7	.35	.32	.30	.35	.32	.29	.34	.31	.29	.33	.31	.29	.33	.31	.29	.28	.28	.28	.28	.28	.28	.28	.28	
8	.32	.29	.27	.32	.29	.27	.32	.29	.27	.31	.28	.26	.30	.28	.26	.25	.25	.25	.25	.25	.25	.25	.25	
9	.30	.27	.24	.30	.26	.24	.29	.26	.24	.29	.26	.24	.28	.26	.24	.23	.23	.23	.23	.23	.23	.23	.23	
10	.28	.24	.22	.27	.24	.22	.27	.24	.22	.26	.24	.22	.26	.23	.22	.21	.21	.21	.21	.21	.21	.21	.21	

20% FLOOR CAVITY REFLECTANCE
Conversion Factors: 1 Lt-32W PLT: Opal Diffuser, CU x 0.8; Clear Lens, CU x 1.0.
1 Lt-26W PLT: Fresnel Lens, CU x 1.1; Opal Diffuser, CU x 0.9; Clear Lens, CU x 1.1.

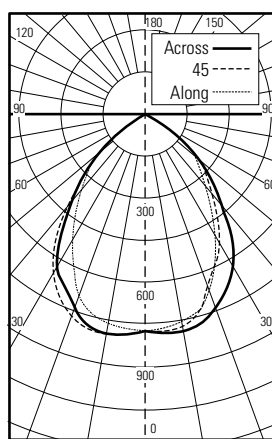
32W White Cone (WH) Quick Calculator



This quick calculator chart determines the number and spacing of 1 Lt. - 32W PL-T units with fresnel lens and white cone, for any level of illumination. Conversion factors: Opal diffuser, fc x 0.8; Clear lens, fc x 1.0. 1 Lt. - 26W PLT : Fresnel Lens, fc x 0.8; Opal Diffuser, fc x 0.65; Clear lens fc x 0.8.

Spacing Ratio = 1.1

CERTIFIED TEST REPORT NO. 0072FR
COMPUTED BY LSI PROGRAM **TEST-LITE**
CALCULITE 6" DIAMETER RECESSED FLUORESCENT LENSED DOWNLIGHT
SEMI-SPECULAR REFLECTOR WITH WHITE CONE AND FRESNEL LENS
LUMEN RATING = 2400 LMS.
1-32W PL-T LAMP,



ANGLE	CANDLEPOWER				
	ALONG 22.5	45	67.5	ACROSS	LUMENS
0	656	656	656	656	656
5	649	654	657	660	662 31
10	626	639	650	660	669
15	588	605	622	639	654 87
20	525	546	567	592	617
25	452	479	501	526	563 116
30	378	419	432	450	490
35	312	363	361	370	405 114
40	256	303	290	297	322
45	200	233	225	231	244 89
50	144	156	165	171	180
55	99	115	115	117	120 53
60	66	74	76	77	79
65	46	48	49	50	52 26
70	35	36	37	38	39
75	26	27	27	27	29 14
80	16	17	17	19	19
85	7	9	9	9	9 5
90	1	1	1	1	1

ZONE	ZONAL LUMENS AND PERCENTAGES			
	LUMENS	% LAMP	% LUMINAIRE	
0-30	468	19.51	44.30	
0-40	697	29.07	66.29	
0-60	956	40.28	91.86	
0-90	1052	43.86	100.00	
40-90	354	14.76	33.71	
60-90	85	3.57	8.14	
90-180	0	.00	.00	
0-180	1052	43.86	100.00	

** EFFICIENCY = 43.9% **

Coefficients Of Utilization

ROOM CAVITY RATIO	% EFFECTIVE CEILING CAVITY REFLECTANCE																							
	80				70				50				30				10				0			
	% WALL REFLECTANCE																							
	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10
1	.48	.46	.45	.47	.46	.44	.45	.44	.43	.43	.43	.42	.42	.41	.41	.41	.41	.41	.41	.41	.41	.41	.41	
2	.44	.42	.40	.42	.41	.39	.41	.40	.38	.40	.39	.38	.39	.38	.37	.37	.37	.37	.37	.37	.37	.37	.37	
3	.40	.37	.35	.39	.37	.35	.38	.38	.34	.37	.35	.34	.36	.33	.33	.33	.33	.33	.33	.33	.33	.33	.33	
4	.37	.34	.32	.36	.34	.32	.35	.33	.31	.34	.32	.31	.34	.32	.30	.30	.30	.30	.30	.30	.30	.30	.30	
5	.34	.31	.29	.33	.31	.28	.33	.30	.28	.32	.30	.28	.31	.29	.28	.27	.27	.27	.27	.27	.27	.27	.27	
6	.31	.28	.26	.31	.28	.26	.30	.28	.26	.29	.27	.25	.29	.27	.25	.25	.25	.25	.25	.25	.25	.25	.25	
7	.29	.26	.23	.28	.25	.23	.25	.25	.23	.27	.25	.23	.27	.25	.23	.23	.23	.23	.23	.23	.23	.23	.23	
8	.26	.23	.21	.26	.23	.21	.26	.23	.21	.25	.23	.21	.25	.23	.21	.21	.21	.21	.21	.21	.21	.21	.21	
9	.24	.21	.19	.24	.21	.19	.24	.21	.19	.23	.21	.19	.23	.21	.19	.19	.19	.19	.19	.19	.19	.19	.19	
10	.23	.20	.18	.22	.20	.18	.22	.20	.18	.22	.20	.18	.22	.20	.18	.18	.18	.18	.18	.18	.18	.18	.18	

20% FLOOR CAVITY REFLECTANCE
Conversion Factors: 1 Lt-32W PLT: Opal Diffuser, CU x 0.8; Clear Lens, CU x 1.0.
1 Lt-26W PLT: Fresnel Lens, CU x 1.1; Opal Diffuser, CU x 0.9; Clear Lens, CU x 1.1.

Job Information Type:

631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710
We reserve the right to change details of design, materials and finish.
www.lightolier.com © 2009 Philips Group • B0209

DESCRIPTION

Low brightness 6" aperture open wall wash reflector for use with 26W or 32W Triple Twin Tube 4-pin lamps. Available in single, double and corner wall wash versions. Standard features include low iridescent finish on all reflectors, electronic ballasts and venting to ensure maximum lamp life and lumen output. Optics offer unparalleled performance with uniform illuminance on wall, no flashback, and glare-free downlighting. Medium beam, wide beam, lensed and open wall wash trims are interchangeable within the same housing.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

A ... Reflector

Full spinning Gradient Kicker provides high levels of vertical illumination, protects reflector integrity and achieves superior sealed design. Airflow travels through downlight cone neck for optimum lamp cooling. One piece spun Quiet Cone downlight reflector of .050 thick aluminum, available in a variety of Alzak® finishes. Positive reflector mounting pulls self-flanged trim tight to ceiling.

B ... Trim Ring Options

Self flanged reflector is standard. Painted white flange (WF) option is available.

C ... Socket Cap

One piece vented and finned die cast aluminum cap for maximum thermal performance.

D ... Housing Mounting Frame

One piece precision die cast aluminum 1-1/2" deep collar accommodates varying dimensions of ceiling materials.

E ... Universal Mounting Bracket

Accepts 1/2" EMT, C Channel, T bar fasteners, and bar hangers. Adjusts 5" vertically from above or below ceiling.

F ... Conduit Fitting

Die cast screw tight connectors.

G ... Junction Box

Listed for eight #12AWG (four in, four out) 90°C conductors feed through branch wiring. 1/2" and two 3/4" pry outs. Positioned to allow straight conduit runs. Access to junction box by removing reflector.

H ... Socket

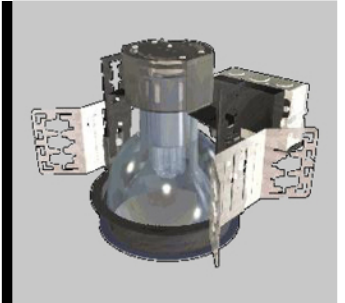
4 pin GX24q-3 base with fatigue free stainless steel lamp spring ensures positive lamp retention.

I ... Electronic Ballast

Electronic ballast provides full light output and rated lamp life. Provides flicker free and noise free operation and starting. End of lamp life protection is standard.

Labels

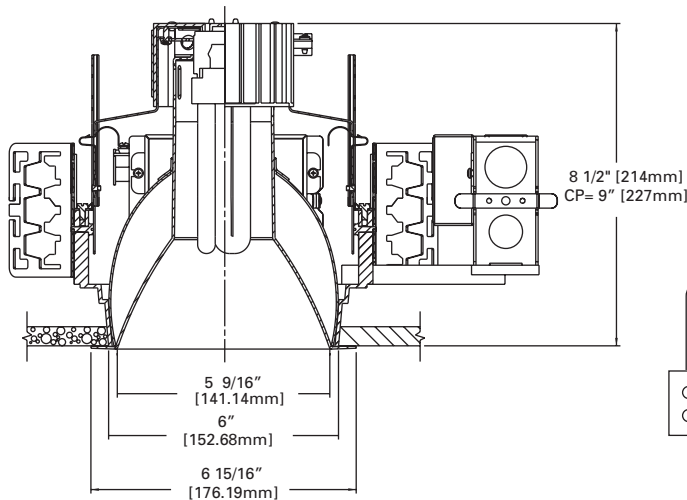
cULus listed, standard damp label.



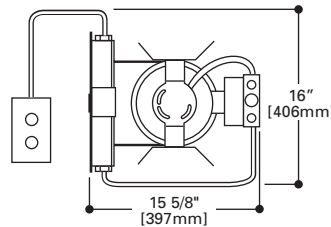
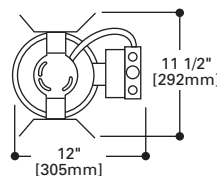
C6042
60111
60121
60131

26W, 32W TTT
Compact Fluorescent

6" OPEN
WALL WASH



Top View



(with EM Option)

ORDERING INFORMATION

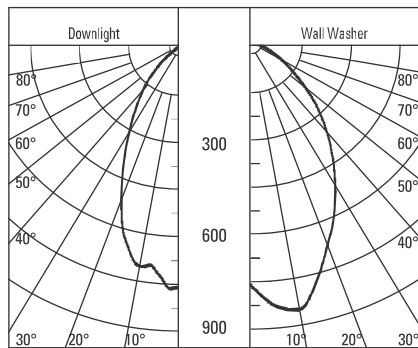
Sample Number: Complete unit consists of housing, ballast and trim.

<p>Housing C60= 6" CF Vertical</p> <p>Wattage 42= (1) 26W or 32W TTT Lamp</p>	<p>Ballast E= 120/277V 50/60 Hz Electronic 3E= 347V 50/60 Hz Electronic 1D26= 26W 120V Dimming, Lutron Compact SE 2D26= 26W 277V Dimming, Lutron Compact SE 1D32= 32W 120V Dimming, Lutron Compact SE 2D32= 32W 277V Dimming, Lutron Compact SE EDR26= DeRated Wattage Label, 26W EDR32= DeRated Wattage Label, 32W</p>	<p>Options CP= Chicago Plenum EM= Emergency Module with remote test switch</p>	<p>Trims Trims 60111: Single Wall Wash, Self Flanged 60121: Double Wall Wash, Self Flanged 60131: Corner Wall Wash, Self Flanged</p>	<p>Finish LI= Low Irdescent Clear H= Haze WMH= Warm Haze G= Gold WH= Wheat W= Gloss White GP= Graphite GPH= Graphite Haze K= Cognac KH= Cognac Haze</p>	<p>Option WF= White Painted Flanged (Self Flanged only)</p>	<p>Accessories HB26= C Channel Bar Hangers, 26" Long, Pair HB50= C Channel Bar Hangers, 50" Long, Pair FK5= 5 Amp Field Installable Fuse Kit 300V Max RMB-22= Wood Joist Bar Hanger, 22" Long, Pair</p>
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Specifications and Dimensions subject to change without notice.

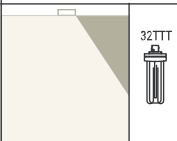
Consult your representative for additional options and finishes.

Candlepower Distribution



Spacing Criterion = 1.1
Efficiency = 41.8%

Test No. 247P124
C6042E-60111
Lamp = 32W TTT



Single Unit Foot-candles

Multiple Unit Foot-candles

DD	Distance from wall (single fixture)						2'6" from wall (spacing between fixtures)			3' from wall (spacing between fixtures)								
	1'	2'	3'	4'	5'	6'	3'	4'	6'	4'	6'	6'						
1	12	8	3	1	1	0	14	11	14	12	7	12	9	8	9	7	5	7
2	19	14	7	3	1	1	25	22	25	21	15	21	18	17	18	14	12	14
3	16	13	8	4	2	1	25	24	25	20	17	21	21	21	21	17	15	17
4	11	10	7	4	2	1	20	20	20	16	15	16	19	19	19	15	14	15
5	8	7	5	4	2	1	15	15	15	12	12	12	16	16	16	12	12	12
6	5	5	4	3	2	1	12	12	12	9	9	9	13	13	13	10	10	10
7	4	3	3	2	2	1	9	9	9	7	7	7	10	10	10	8	8	8
8	3	2	2	2	1	1	7	7	7	6	6	6	8	8	8	6	6	6
9	2	2	2	1	1	1	5	5	5	4	4	4	6	6	6	5	5	5
0	1	1	1	1	1	1	4	4	4	3	3	3	5	5	5	4	4	4

Candlepower

180° Downlight	Degree	0° Wall Washer
749	0	749
723	5	815
644	15	781
426	25	614
250	35	453
128	45	307
12	55	176
1	65	91
0	75	39
0	85	6
0	90	0

Average Luminance CD/SQ.M

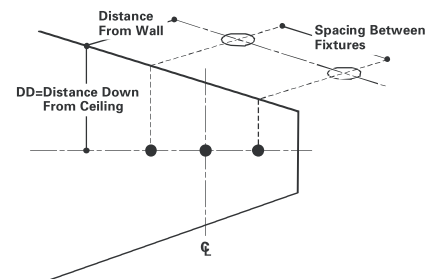
Degree	0° Wall Washer	180° Downlight
45	28315	11806
55	20012	1364
65	14043	154
75	9827	0
85	4490	0

Notes:

- Illuminance values for multiple fixtures are based upon the center two units of a four unit array. Footcandle values are centerline of fixtures and centered between fixtures.
- Illuminance values are cosine corrected initial values with no contribution from inter reflections from other room surfaces. Total illumination may increase from contributions from other surfaces.
- Changing fixture spacing will affect illuminance level.

$$\text{New Fc} = \frac{\text{Existing Spacing}}{\text{New Spacing}} \times \text{Average Table Fc Level}$$

- When selecting colored cones option, only downlight cone is colored; the wallwash reflector is specular clear. This allows the color (CRI, °K) of the light source to be unaffected and maximizes lumen output.



DESCRIPTION

A very low brightness 6" diameter downlight for use with PAR30 short neck lamps (75W max). The precisely formed non-imaging reflector ensures 45° cutoff to lamp and lamp image. The modular housing system supports various downlight, wallwash, and lens reflectors.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

A ... Reflector/Baffle

Positive reflector mounting pulls trim tight to ceiling. 0.050" spun aluminum reflector. Available in a variety of Alzak® finishes. Painted white finish as well as white or black baffles.

B ... Trim Ring

Self flanged or molded white trim ring. Metal trim ring and rimless trim ring accessories available (see Options and Accessories).

C ... Socket Cap

One piece heat dissipating die-cast aluminum.

D ... Housing

Precision die-cast aluminum 1-1/2" (38mm) deep collar.

Optical assembly adjusts within the housing to accommodate ceilings up to 4 1/4" (108mm) thick.

E ... Universal Mounting Bracket

Accepts 1/2" EMT, C Channel, T bar fasteners and hanger bars. Provides 5" total adjustment.

F ... Conduit Fittings

Die-cast screw tight connectors.

G ... Junction Box

U.L. listed for four in, four out #12 at 90°C pull through branch wiring. Pry-outs for four 1/2" and two 3/4" conduits. Access to junction box by removing reflector.

H ... Socket

Medium base porcelain socket with nickel plated screw shell.

Insulation Detector

Self-resetting insulation detector opens circuit if insulation is improperly installed.

Labels

cULus listed, C.S.A. certified, damp location, IBEW union made.

Options & Accessories

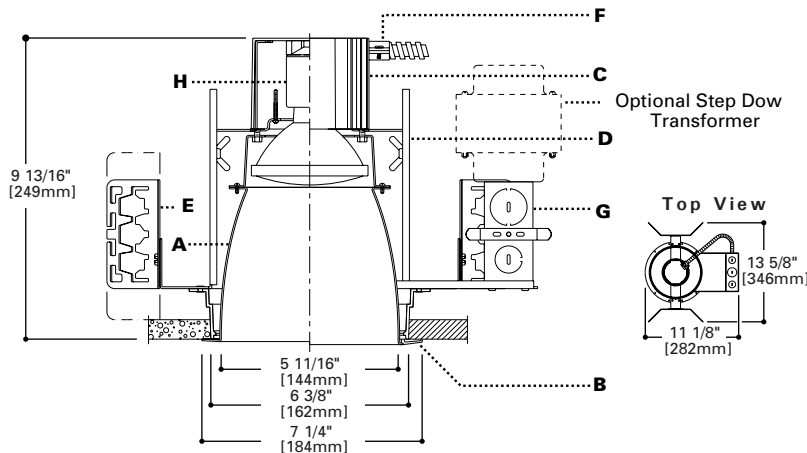
TRM=Metal Trim Rings to replace molded trim ring.
TRR=Rimless Trim Rings for minimal flange appearance in plaster ceilings.



HD6
6301/6300

75W MAX
PAR30

6" DOWNLIGHT



NOTES:

Accessories should be ordered separately. For additional options, please consult your Cooper Lighting Representative. Alzak is a registered trademark of Aluminum Company of America.

ORDERING INFORMATION

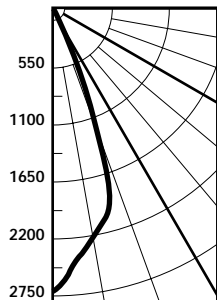
Sample Number: Complete unit consists of housing, ballast and trim.

Housing HD6 - 6" Incandescent	Options CP - Chicago Plenum	Trims Trims 6301 - Self Flanged Reflector 6300 - Molded Trim Ring	Finish LI - Low Iridescent Clear H - Haze WMH - Warm Haze G - Gold WH - Wheat B - Spectral Black W - Gloss White GP - Graphite GPH - Graphite Haze K - Cognac KH - Cognac Haze BB - Black Baffle (6300 only) WB - White Baffle (6300 only)	Option WF - White Painted Flanged (Self Flanged only)	Derated Wattage Label DR* - DeRated, Specify Wattage	Accessories H277 - Step Down Transformer, 300VA Max HB26 - C Channel Bar Hangers, 26" Long, Pair HB50 - C Channel Bar Hangers, 50" Long, Pair TRM 6 - Metal Trim Ring, Specify Finish TRR6 - Rimless Trim Ring, White FK5 - 5 Amp Field Installable Fuse Kit 300V Max RM B-22 - Wood Joist Bar Hanger, 22" Long, Pair HSA6 - Slope Adapter for 6" Aperture Housings, Specify Slope
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Specifications and Dimensions subject to change without notice.

Consult your representative for additional options and finishes.

Candlepower Distribution



Test No. H22245
HD6-6300C
 Lamp = 75W
 PAR30
 Halogen
 Flood
 Lumens = 1100
 Spacing Criteria = 0.6
 Efficiency = 89.2%

Candlepower

Deg.	CD
0	2732
5	2454
15	2035
25	341
35	43
45	10
55	0
65	0
75	0
85	0
90	0

Average Luminance

Deg.	CD/SQ M
45	862
55	0
65	0
75	0
85	0

Cone of Light

Distance to Illuminated Plane	Initial Nadir Footcandles	Beam Diameter
5'6"	90	3'6"
6'6"	65	4'0"
8'0"	43	5'0"
10'0"	27	6'6"
12'0"	19	8'0"
14'0"	14	9'0"

Beam diameter is to 50% of maximum footcandles, rounded to the nearest half-foot.

Footcandle values are initial, apply appropriate light loss factors where necessary.

Zonal Lumen Summary

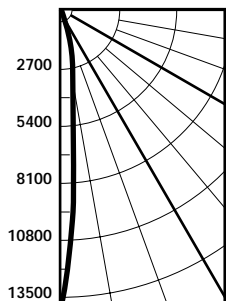
Zone	Lumens	%Lamp	%Luminaire
0-30	948	86.2	96.6
0-40	976	88.8	99.5
0-60	982	89.2	100.0
0-90	982	89.2	100.0
90-180	0	0.0	0.0
0-180	982	89.2	100.0

Coefficient of Utilization

rc	80%				70%				50%		30%		10%		0%
	rw	70	50	30	10	50	30	10	50	10	50	10	50	10	0
RCR															
0	106	106	106	106	104	104	104	99	99	95	95	91	91	89	
1	103	102	100	99	100	98	97	96	94	93	91	90	89	87	
2	101	98	95	93	96	94	92	94	91	91	89	89	87	86	
3	98	95	92	90	94	91	89	92	88	90	87	88	85	84	
4	96	92	89	87	91	88	86	89	85	88	84	86	84	83	
5	94	89	86	84	88	86	84	87	83	86	82	85	82	81	
6	92	87	84	82	87	84	82	85	81	84	81	83	80	79	
7	90	85	82	80	84	81	79	83	79	83	79	82	78	78	
8	88	83	80	78	82	79	77	82	77	81	77	80	77	76	
9	86	81	78	76	80	78	76	80	75	79	75	79	75	74	
10	84	79	76	74	79	76	74	78	74	78	74	77	73	73	

rc = Ceiling reflectance, rw = Wall reflectance, RCR = Room cavity ratio
 CU Data Based on 20% Effective Floor Cavity Reflectance.

Candlepower Distribution



Test No. H22246
HD6-6300C
 Lamp = 75W
 PAR30
 Halogen
 Narrow
 Spot
 Lumens = 1100
 Spacing Criteria = 0.2
 Efficiency = 96.5%

Candlepower

Deg.	CD
0	13561
5	6260
15	1534
25	128
35	13
45	4
55	0
65	0
75	0
85	0
90	0

Average Luminance

Deg.	CD/SQ M
45	604
55	0
65	0
75	0
85	0

Cone of Light

Distance to Illuminated Plane	Initial Nadir Footcandles	Beam Diameter
5'6"	448	1'0"
6'6"	321	1'6"
8'0"	212	1'6"
10'0"	136	2'0"
12'0"	94	2'6"
14'0"	69	3'0"

Beam diameter is to 50% of maximum footcandles, rounded to the nearest half-foot.

Footcandle values are initial, apply appropriate light loss factors where necessary.

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Luminaire
0-30	1051	95.5	99.0
0-40	1058	96.2	99.7
0-60	1062	96.5	100.0
0-90	1062	96.5	100.0
90-180	0	0.0	0.0
0-180	1062	96.5	100.0

Coefficient of Utilization

rc	80%				70%				50%		30%		10%		0%
	rw	70	50	30	10	50	30	10	50	10	50	10	50	10	0
RCR															
0	115	115	115	115	112	112	112	107	107	103	103	99	99	97	
1	112	110	109	108	108	107	106	105	103	101	100	98	97	95	
2	110	107	105	103	105	103	102	102	100	100	98	97	96	94	
3	108	104	102	100	103	101	99	101	97	99	96	97	95	94	
4	106	102	99	97	101	98	96	99	95	97	94	96	93	92	
5	104	100	97	95	99	96	94	97	94	96	93	95	92	91	
6	102	96	94	92	97	95	93	96	92	95	92	94	91	91	
7	101	96	94	92	96	93	91	95	91	94	91	93	90	89	
8	99	95	92	90	94	92	90	94	90	93	89	92	89	88	
9	98	93	91	89	93	91	89	92	89	92	88	91	88	88	
10	96	92	90	88	92	89	88	91	88	91	87	90	87	87	

rc = Ceiling reflectance, rw = Wall reflectance, RCR = Room cavity ratio
 CU Data Based on 20% Effective Floor Cavity Reflectance.



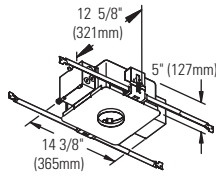
Calculite® Evolution Lensed Wall Washer **C3MRL**

Page 1 of 2

3" Aperture, MR16 (12V)

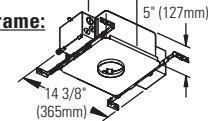
Non-IC Frame:

- C3LV
- C3LVE1
- C3LVE2



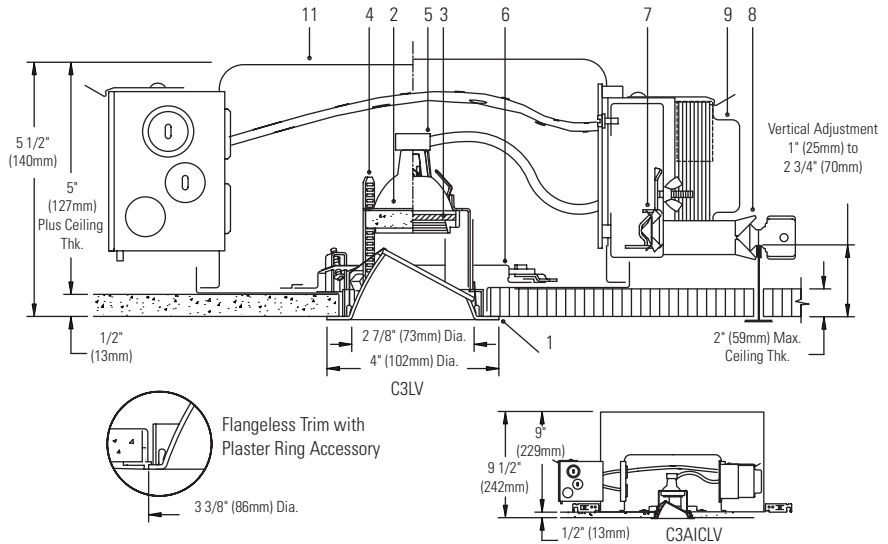
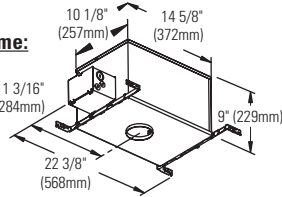
Non-IC AirSeal Frame:

- C3ALV
- C3ALVE1
- C3ALVE2



IC AirSeal Frame:

- C3AICLV
- C3ALCLVE1



Ceiling Cutout: 3 1/2" (130mm) Dia.

For Complete Fixture Order: Trim Kit + Frame-In Kit. Each Sold Separately.

Trim Kit

Cone Finish	White Flange	Polished Flange	Flangeless
Clear	C3MRL CLW	C3MRL CLP	C3MRL CLFT
Comfort Clear Diffuse	C3MRL CCDW	C3MRL CCDP	C3MRL CCDFT
Champagne Bronze	C3MRL CCZW	C3MRL CCZP	C3MRL CCZFT
Gold	C3MRL GDW	C3MRL GDP	C3MRL GDFT
Matte White	C3MRL WHW	NA	C3MRL WHFT
Specular Black	C3MRL BKW	C3MRL BKP	C3MRL BKFT

Frame-In Kit

Model	Frame Type	Lamp*
C3LV	Non-IC	Magnetic 120/277V 42W-65W MR16 (12V)
C3LVE1	Non-IC	Electronic 120V 20W-65W MR16 (12V)
C3LVE2	Non-IC	Electronic 277V 20W-65W MR16 (12V)
C3ALV	Non-IC AirSeal®	Magnetic 120/277V 42W-65W MR16 (12V)
C3ALVE1	Non-IC AirSeal®	Electronic 120V 20W-65W MR16 (12V)
C3ALVE2	Non-IC AirSeal®	Electronic 277V 20W-65W MR16 (12V)
C3AICLV	IC AirSeal®	Magnetic 120 20W-50W MR16 (12V)
C3AICLVE1	IC AirSeal®	Electronic 120V 20W-50W MR16 (12V)

Note: Magnetic not recommended for residential or noise sensitive areas.

Features

- Trim Kit:** Low brightness aperture cone; 0.040" aluminum, anodized; 50° visual cut-off to lamp and lamp image. Cone keyed to kick reflector with direction spread lens distribute light smoothly for vertical surface wall washing. Captive lens during relamping. Hinged, and snaps on for easy tool-less installation. Self-flange in painted white or aperture matching polished flange. Flangeless trim used with Plaster Trim Ring accessory. Interchangeable with other 3" Evolution trims.
- Lamp Support:** Die-form aluminum with knurled surface for easy gripping during relamping. Spring tension clips hold lamp and lens and allow fast snap-in, snap-out relamping. Matte black finish. Accepts up to two 1" diameter accessories.
- Cover Glass:** High temperature, soft focus lens.
- Thick Ceiling Ready Brackets:** Die-form steel, matte black finish. Adjust trim kit vertically to accommodate up to 2" thick ceiling, lockable.
- Lampholder:** Procelain bi-pin socket. Pre-wired with No.18 AWG Teflon leads.
- Horizontal Adjustment Mechanism:** Built-in ready for adjustable trim, matte black finish.
- Frame Vertical Adjustment Mechanism (C3LV):** Accommodates mounting to virtually any ceiling system using pre-installed mounting bars, or 1/2" EMT tubing (by others). Single locking features secures all adjustments. Alignment holes and markings allow fixture to be pre-set prior to installation. Final adjustment can be made from below inside fixture.
- Mounting Bars (C3LV):** Galvanized steel, 0.048"; pre-installed telescoping bars extend from 20" to 30" long and lock securely into position. Built-in locking tabs provide positive attachment to common T-bar systems. Self-centering feature simplified installation in 24" O.C. grid systems. Attaches to steel or wood joists without accessories.
- Transformer:** Replaceable from below. Magnetic: 120V/277V 60 Hz. dual-voltage, core & coil. Electronic: 120V or 277V 50/60 Hz., regulated lamp voltage, HPF, EMI and circuit protections, thermal auto-reset, quiet operation.

Features (continued)

- Frame-In Kit:** See Frame-In Kit specification sheets for more information. Non-IC and Non-IC AirSeal® - Insulation must be kept 3" away from any parts of the luminaire and must not be placed above luminaire in a manner which will entrap heat. IC AirSeal® - Luminaire may be in direct contact with thermal insulation.

Labels

U.L. (Suitable For Wet Locations), I.B.E.W.; U.S. & Foreign Patents Pending
 *Lamp wattage restriction for Non-IC: 65W for up to 1" thick ceiling, 50W for ceiling thickness greater than 1" (up to 2").

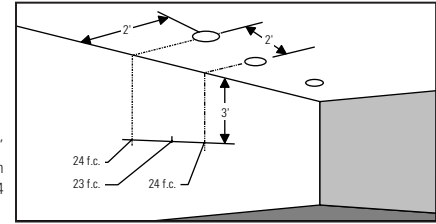
Options and Accessories

- 2" dia. Color Filters/Specialty filters:** See ADF2/AF2 specification sheets
- 2" Dia. Louver:** AL2HC
- Plaster Trim Ring (use with flangeless trim):** CA3FMR
- Chicago Plenum:** Consult Factory

Job Information	Type:
Job Name:	
Cat. No.:	
Lamp(s):	
Notes:	

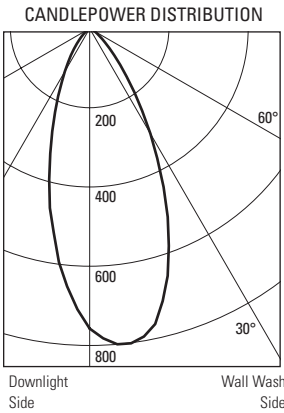
Lightolier a Genlyte company www.lightolier.com
 631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710
 We reserve the right to change details of design, materials and finish.
 © 2007 Genlyte Group LLC • E1107

LIGHTOLIER®



Example: With multiple units located 2' from wall and 2' on center, the illumination on the wall 3'-down from the ceiling is 24 f.c. beneath and 23 f.c. between fixtures.

37W MR16 IR - 40° FLOOD SYLVANIA HALOGEN LAMP, LUMEN RATING = 840 LMS., 120V ELECTRONIC TRANSFORMER CL FINISH REFLECTOR, REPORT NO. 2774FR

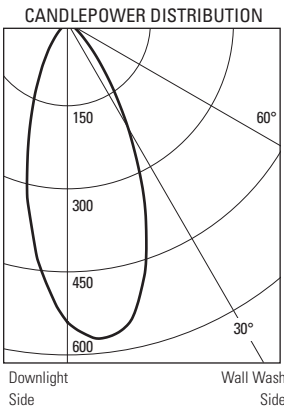


Distance From Ceiling in Feet	Multiple Units - Footcandles On Wall 2' from Wall - 2' On Center		
	2'	2'	2'
1	2.8	2.5	2.8
2	7.3	6.7	7.3
3	11.9	11.3	11.9
4	13.1	12.8	13.1
5	11.8	11.6	11.8
6	10.3	10.2	10.3
7	8.5	8.4	8.5
8	7.2	7.1	7.2
9	6.1	6.1	6.1
10	5.4	5.3	5.4
11	4.8	4.8	4.8
12	4.5	4.5	4.5
13	4.2	4.2	4.2
14	4.2	4.1	4.2

Distance From Ceiling in Feet	Multiple Units - Footcandles On Wall 2' from Wall - 3' On Center		
	3'	3'	3'
1	2.2	1.4	2.2
2	6.0	3.6	6.0
3	8.9	6.8	8.9
4	9.3	8.2	9.3
5	8.2	7.6	8.2
6	7.1	6.8	7.1
7	5.8	5.6	5.8
8	4.9	4.8	4.9
9	4.2	4.1	4.2
10	3.6	3.6	3.6
11	3.3	3.3	3.3
12	3.0	3.0	3.0
13	2.9	2.9	2.9
14	2.8	2.8	2.8

Distance From Ceiling in Feet	Multiple Units - Footcandles On Wall 3' from Wall - 3' On Center		
	3'	3'	3'
1	1.2	1.1	1.2
2	2.0	1.7	2.0
3	3.4	3.1	3.4
4	5.1	4.7	5.1
5	6.0	5.8	6.0
6	6.2	6.0	6.2
7	5.9	5.8	5.9
8	5.5	5.4	5.5
9	5.0	4.9	5.0
10	4.5	4.5	4.5
11	4.1	4.1	4.1
12	3.8	3.7	3.8
13	3.5	3.5	3.5
14	3.4	3.4	3.4

50W MR16 - 40° FLOOD GE HALOGEN LAMP, LUMEN RATING = 800 LMS., 120V ELECTRONIC TRANSFORMER CL FINISH REFLECTOR, REPORT NO. 2816FR

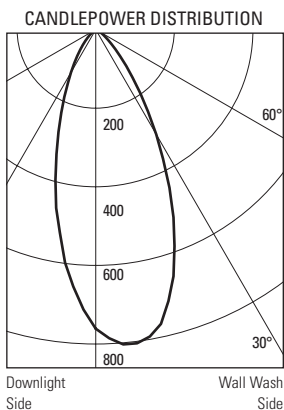


Distance From Ceiling in Feet	Multiple Units - Footcandles On Wall 2' from Wall - 2' On Center		
	2'	2'	2'
1	3.8	3.4	3.8
2	9.8	8.9	9.8
3	16.0	15.1	16.0
4	17.6	17.1	17.6
5	15.8	15.5	15.8
6	13.8	13.6	13.8
7	11.4	11.3	11.4
8	9.6	9.5	9.6
9	8.2	8.2	8.2
10	7.2	7.2	7.2
11	6.5	6.5	6.5
12	6.0	6.0	6.0
13	5.7	5.7	5.7
14	5.6	5.6	5.6

Distance From Ceiling in Feet	Multiple Units - Footcandles On Wall 2' from Wall - 3' On Center		
	3'	3'	3'
1	3.0	2.0	3.0
2	8.1	4.8	8.1
3	11.9	9.1	11.9
4	12.5	10.9	12.5
5	10.9	10.2	10.9
6	9.5	9.1	9.5
7	7.8	7.5	7.8
8	6.5	6.4	6.5
9	5.6	5.5	5.6
10	4.9	4.8	4.9
11	4.4	4.4	4.4
12	4.1	4.0	4.1
13	3.8	3.8	3.8
14	3.8	3.8	3.8

Distance From Ceiling in Feet	Multiple Units - Footcandles On Wall 3' from Wall - 3' On Center		
	3'	3'	3'
1	1.6	1.5	1.6
2	2.7	2.3	2.7
3	4.6	4.2	4.6
4	6.8	6.4	6.8
5	8.1	7.8	8.1
6	8.3	8.0	8.3
7	7.9	7.7	7.9
8	7.3	7.2	7.3
9	6.7	6.6	6.7
10	6.0	6.0	6.0
11	5.5	5.4	5.5
12	5.0	5.0	5.0
13	4.7	4.7	4.7
14	4.5	4.5	4.5

50W MR16 - 40° FLOOD SYLVANIA HALOGEN LAMP, LUMEN RATING = 1125 LMS., 120V ELECTRONIC TRANSFORMER CL FINISH REFLECTOR, REPORT NO. 2700FR



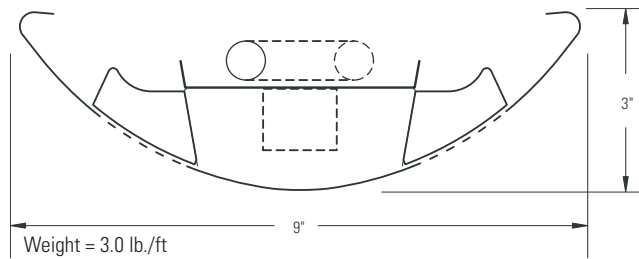
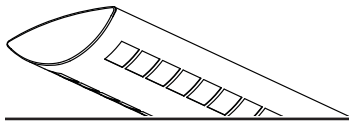
Distance From Ceiling in Feet	Multiple Units - Footcandles On Wall 2' from Wall - 2' On Center		
	2'	2'	2'
1	3.7	3.3	3.7
2	9.8	8.9	9.8
3	15.9	15.1	15.9
4	17.5	17.1	17.5
5	15.8	15.5	15.8
6	13.8	13.6	13.8
7	11.3	11.2	11.3
8	9.6	9.5	9.6
9	8.2	8.1	8.2
10	7.2	7.1	7.2
11	6.4	6.4	6.4
12	5.9	5.9	5.9
13	5.6	5.6	5.6
14	5.6	5.5	5.6

Distance From Ceiling in Feet	Multiple Units - Footcandles On Wall 2' from Wall - 3' On Center		
	3'	3'	3'
1	3.0	1.9	3.0
2	8.0	4.8	8.0
3	11.9	9.1	11.9
4	12.5	10.9	12.5
5	10.9	10.1	10.9
6	9.4	9.0	9.4
7	7.7	7.5	7.7
8	6.5	6.4	6.5
9	5.5	5.5	5.5
10	4.8	4.8	4.8
11	4.3	4.3	4.3
12	4.0	4.0	4.0
13	3.8	3.8	3.8
14	3.7	3.7	3.7

Distance From Ceiling in Feet	Multiple Units - Footcandles On Wall 3' from Wall - 3' On Center		
	3'	3'	3'
1	1.6	1.4	1.6
2	2.7	2.3	2.7
3	4.6	4.2	4.6
4	6.8	6.3	6.8
5	8.0	7.7	8.0
6	8.2	8.0	8.2
7	7.8	7.7	7.8
8	7.3	7.1	7.3
9	6.6	6.5	6.6
10	6.0	5.9	6.0
11	5.4	5.4	5.4
12	5.0	4.9	5.0
13	4.7	4.6	4.7
14	4.5	4.4	4.5

Job Information **Type:**

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Ordering Information

Family	Distribution	Lamp Type	No. of Lamps	Housing	Module Length	Wiring	Voltage	Ballast	Finish
BSL	6 6 = Direct/ Indirect	H H = T5 HO	01 01 = 1 Light	CN CN = Cutout w/baffles	04 = 4' 08 = 8' 12 = 12'	1 = 1cct. 3 = 1cct. w/EC/NL 5 = 1cct. w/EM Battery 7 = 1cct. w/Dimming 8 = 1cct. w/1cct. Thru wire Note: Please consult wiring section of spec sheets for more wiring options.	D = Dual 120V & 277V 1 = 120V 2 = 277V Note: Option 'D' is standard. Voltage options 1 and 2 are only available with EM Battery and Dimming wiring options.	E = Standard <10% THD F = Standard <10% THD w/fusing	C = Custom Color W = Standard White

Specifications

Features

1. Housing: die-formed 20ga. cold rolled steel
2. End Set: die-cast metal with baked powder coat finish
3. Lamping: one T5 HO lamp
4. Configuration: 4', 8' and 12' module lengths or continuous rows
5. Ballasts: electronic 120V or 277V

Finish

High-quality white powder coat with textured matte finish. Custom colors available. Consult factory.

Mounting

Aircraft cable gripper is tamper-resistant and provides infinite vertical adjustment capability. Aircraft cable, crimp and cable gripper independently tested to meet stringent safety requirements.

Electrical

All luminaires are factory pre-wired to module ends with quick-wire connectors.

Joints & Intersections

Self-aligning joining system with hands-free pre-joining wire access.

Labels

UL, CSA standards.

Ordering Instructions

Individual Fixtures

1. Determine the number of individual modules required
2. Order one end set per module
3. Order one non-power mount per module
4. Order one power mount per module

Continuous Rows*

1. Determine run length
2. Order the appropriate number and length of modules for complete run
3. Order one end set for each run
4. Order one non-power mount for each module
5. Order one power mount per run
6. Order one joiner per module minus one (e.g. 3 modules requires 2 joiners)

***Note:** Some runs may require additional power mounts. Please see the 'Run Configuration' table on the next page for more details.

Job Information

Type:

Job Name:

Cat. No.:

Lamp(s):

Notes:

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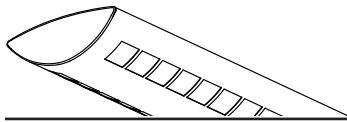
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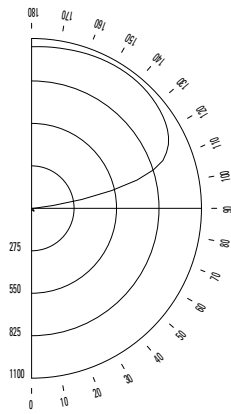
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LIGHTOLIER



Performance

Candlepower Curve



Report No: 2101633
Lamps: F54T5
Lumens per Lamp: 4650
Efficiency: 93.5%
Up: 98.5% **Down:** 1.5%

Candlepower Summary

ZONE DEG.	CANDLEPOWER				
	0	22.5	45	67.5	90
180	1047	1047	1047	1047	1047
175	1042	1042	1047	1049	1050
165	1002	1011	1034	1051	1058
155	930	951	1007	1051	1067
145	826	867	965	1043	1070
135	694	766	912	1025	1062
125	541	651	850	993	1038
115	375	535	777	925	978
105	203	421	640	693	707
95	55	137	99	35	34
90	3	6	8	8	7
85	5	5	6	7	6
75	7	6	7	8	8
65	6	10	10	10	10
55	7	11	16	12	12
45	8	9	17	23	23
35	9	9	13	19	21
25	9	10	10	13	13
15	9	10	11	11	11
5	9	9	10	10	10
0	9	9	9	9	9

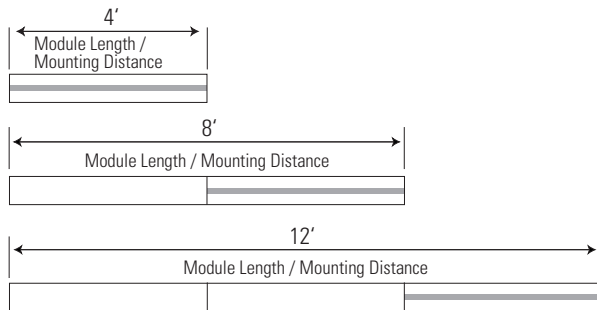
Coefficients of Utilization

	% EFFECTIVE CEILING CAVITY REFLECTANCE								
	80			70			50		
	% WALL REFLECTANCE								
	50	30	10	50	30	10	50	30	10
0	89	89	89	76	76	76	52	52	52
1	77	73	70	66	63	61	45	44	42
2	67	62	57	57	53	50	39	37	35
3	59	52	47	50	45	41	35	31	29
4	52	45	40	44	39	34	30	27	24
5	46	39	33	39	33	29	27	23	21
6	40	34	29	35	29	25	24	20	18
7	36	29	25	31	25	21	22	18	15
8	32	26	21	28	22	19	19	16	13
9	29	23	19	25	20	16	17	14	11
10	27	20	16	23	18	14	16	12	10

Zonal Lumen Summary

ZONE	LUMENS	% BARE LAMP	% LUMINAIRE
0-90	65	1.4	1.5
90-180	4286	92.2	98.5
0-180	4351	93.6	100.0

Module Lengths & Mounting Distances



Note: Shaded area indicates locations of emergency sections (emergency wiring controls all lamps or optional battery pack controls one or two lamps).

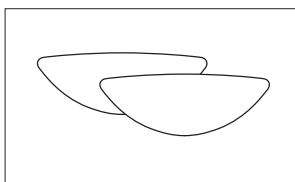
Run Configuration

Run Length	4' Module	8' Module	12' Module	Joiner	End Set	Mount	Power Mount*
4' run	1				1	1	1
8' run		1			1	1	1
12' run			1		1	1	1
16' run		2		1	1	2	1
20' run		1	1	1	1	2	1
24' run			2	1	1	2	1
28' run		2	1	2	1	3	1
32' run		1	2	2	1	3	1

***Note:** Additional power mounts may be required for some runs with T5 HO lamping options, longer runs, and runs with wiring options that are more complex. Please consult factory for assistance.

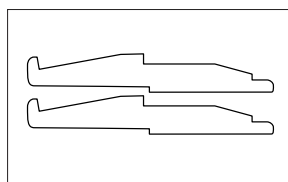
System Components & Accessories

End Set



BSLESW = suspended standard white

Joiner



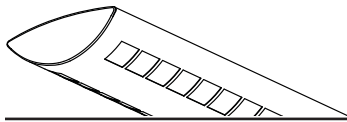
BSLJS = suspended joiner

Job Information

Type:

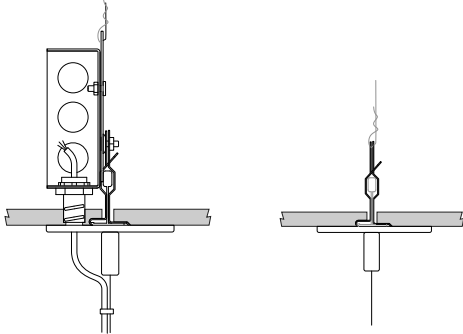
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Mounting Options

Mount Type: T-Bar 15/16" (On-Grid)*



- 65 lbs maximum load
- Canopy: Diameter of 3 3/4" x 7/32"
- Cable: 7x7 stranded aircraft cable
- Supported by T-bar and secured to structure
- J-Box: 4" square (supplied by others)
- Fully adjustable vertically at fixture

1-Power Mount

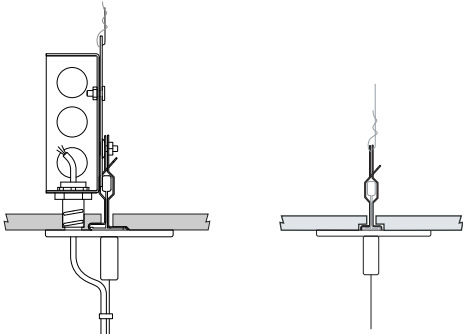
Non-Power Mount



Supension Length

	2'	4'	8'	12'
1-Power Mount				
3 Conductor	BSLM6102P13	BSLM6104P13	BSLM6108P13	BSLM6112P13
4 Conductor	BSLM6102P14	BSLM6104P14	BSLM6108P14	BSLM6112P14
7 Conductor	BSLM6102P17	BSLM6104P17	BSLM6108P17	BSLM6112P17
Non-Power Mount	BSLM6102N	BSLM6104N	BSLM6108N	BSLM6112N

Mount Type: T-Bar 9/16" (On-Grid)*



- 65 lbs maximum load
- Canopy: Diameter of 3 3/4" x 7/32"
- Cable: 7x7 stranded aircraft cable
- Supported by T-bar and secured to structure
- J-Box: 4" square (supplied by others)
- Fully adjustable vertically at fixture

1-Power Mount

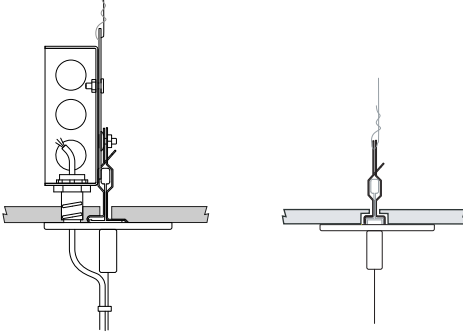
Non-Power Mount



Supension Length

	2'	4'	8'	12'
1-Power Mount				
3 Conductor	BSLM6202P13	BSLM6204P13	BSLM6208P13	BSLM6212P13
4 Conductor	BSLM6202P14	BSLM6204P14	BSLM6208P14	BSLM6212P14
7 Conductor	BSLM6202P17	BSLM6204P17	BSLM6208P17	BSLM6212P17
Non-Power Mount	BSLM6202N	BSLM6204N	BSLM6208N	BSLM6212N

Mount Type: T-Bar 9/16" by 5/16" Slot Grid (On-Grid)*



- 65 lbs maximum load
- Canopy: Diameter of 3 3/4" x 7/32"
- Cable: 7x7 stranded aircraft cable
- Supported by T-bar and secured to structure
- J-Box: 4" square (supplied by others)
- Fully adjustable vertically at fixture

1-Power Mount

Non-Power Mount



Supension Length

	2'	4'	8'	12'
1-Power Mount				
3 Conductor	BSLM6302P13	BSLM6304P13	BSLM6308P13	BSLM6312P13
4 Conductor	BSLM6302P14	BSLM6304P14	BSLM6308P14	BSLM6312P14
7 Conductor	BSLM6302P17	BSLM6304P17	BSLM6308P17	BSLM6312P17
Non-Power Mount	BSLM6302N	BSLM6304N	BSLM6308N	BSLM6312N

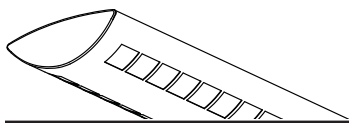
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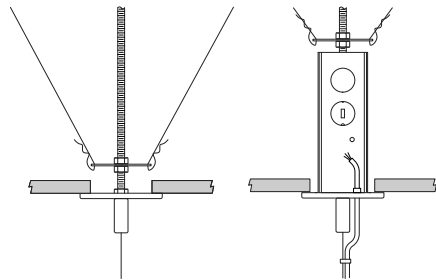
*Note: Standard T-bar mounts are currently not available for tegular tile ceilings, however certain tegular tile / T-bar combinations may be supported by the use of the slot-grid mount. For more information, please consult factory.

LIGHTOLIER



Lighting Systems **Baselyte-BSL4**

Mount Type: T-Bar Fixed Position (1/4-20 Threaded Rod)



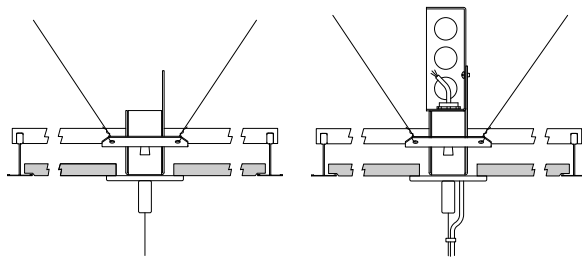
- Meets UBC, OSHPD and DSA seismic requirements
- Canopy: Diameter of 5 1/4" x 3/4" (power)
- Cable: 7x7 stranded aircraft cable
- Tile cut-out hole: Diameter of 2 1/2" (power) or 3/4" (non-power)
- J-Box: Integral J-Box supplied
- 1/4 - 20 all thread rod (supplied by others)
- Fully vertically adjustable at fixture



Supension Length

	2'	4'	8'	12'
1-Power Mount				
3 Conductor	BSLM2102P13	BSLM2104P13	BSLM2108P13	BSLM2112P13
4 Conductor	BSLM2102P14	BSLM2104P14	BSLM2108P14	BSLM2112P14
2-Power Mount				
3 Conductor	BSLM2102P23	BSLM2104P23	BSLM2108P23	BSLM2112P23
Non-Power Mount	BSLM2102N	BSLM2104N	BSLM2108N	BSLM2112N

Mount Type: T-Bar Variable Position



- Meets UBC, OSHPD and DSA seismic requirements
- Canopy: Diameter of 3" x 7/32"
- Cable: 7x7 stranded aircraft cable
- Tile cut-out hole: Diameter of 2 1/4"
- Aligned by T-bar and secured to structure
- J-Box 4" square (supplied by others)
- Fully vertically adjustable at fixture
- Adjusts to both 1" and 1 1/2" high T-bar systems

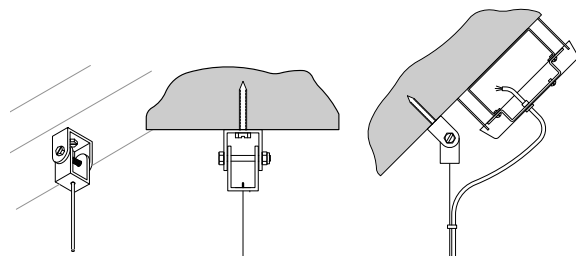


Supension Length

	2'	4'	8'	12'
1-Power Mount				
3 Conductor	BSLM5102P13	BSLM5104P13	BSLM5108P13	BSLM5112P13
4 Conductor	BSLM5102P14	BSLM5104P14	BSLM5108P14	BSLM5112P14
7 Conductor	BSLM5102P17	BSLM5104P17	BSLM5108P17	BSLM5112P17
2-Power Mount				
3 Conductor	BSLM5102P23	BSLM5104P23	BSLM5108P23	BSLM5112P23
Non-Power Mount	BSLM5102N	BSLM5104N	BSLM5108N	BSLM5112N

***Note:** Supports 15/16", 9/16" and slot grid ceiling types.

Mount Type: Support or Open-Joist Ceiling



- Meets UBC, OSHPD and DSA seismic requirements
- Canopy: Diameter of 5 1/4" x 3/4" (power)
- Cable: 7x7 stranded aircraft cable
- Versatile mount, fully adjustable to accommodate open sloped ceilings
- J-Box: 4" octagonal box (supplied by others)
- Fully vertically adjustable at fixture



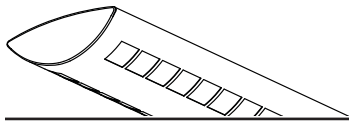
Supension Length

	2'	4'	8'	12'
1-Power Mount				
3 Conductor	BSLM3102P13	BSLM3104P13	BSLM3108P13	BSLM3112P13
4 Conductor	BSLM3102P14	BSLM3104P14	BSLM3108P14	BSLM3112P14
7 Conductor	BSLM3102P17	BSLM3104P17	BSLM3108P17	BSLM3112P17
2-Power Mount				
3 Conductor	BSLM3102P23	BSLM3104P23	BSLM3108P23	BSLM3112P23
Non-Power Mount	BSLM3102N	BSLM3104N	BSLM3108N	BSLM3112N

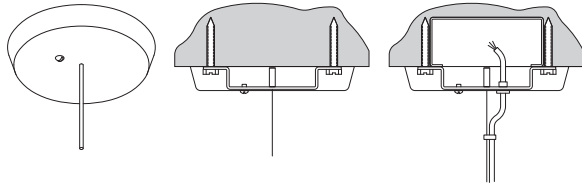
Job Information **Type:**

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Mount Type: Non-Accessible Ceilings (concrete, gypsum etc.)



- Meets UBC, OSHPD and DSA seismic requirements
- Canopy: Diameter of 5 1/4" x 3/4" (power)
- Cable: 7x7 stranded aircraft cable
- Mountable on 0° - 15° sloped ceiling
- Optional Chicago Plenum approved version available (A4)
- J-Box: 4" octagonal box (supplied by others)
- Fully vertically adjustable at fixture

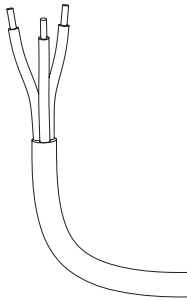


Supension Length

	2'	4'	8'	12'
1-Power Mount				
3 Conductor	BSLM1102P13	BSLM1104P13	BSLM1108P13	BSLM1112P13
4 Conductor	BSLM1102P14	BSLM1104P14	BSLM1108P14	BSLM1112P14
7 Conductor	BSLM1102P17	BSLM1104P17	BSLM1108P17	BSLM1112P17
2-Power Mount				
3 Conductor	BSLM1102P23	BSLM1104P23	BSLM1108P23	BSLM1112P23
Non-Power Mount	BSLM1102N	BSLM1104N	BSLM1108N	BSLM1112N

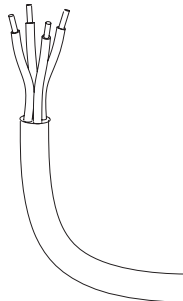
Cord Types

3 Conductor



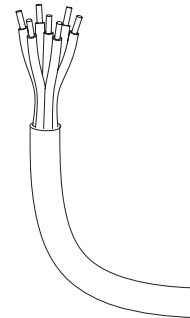
- Max. 10 amps
- Max. 300V

4 Conductor



- Max. 10 amps in a 1 circuit application
- Max. 5 amps per circuit in a 2 circuit application
- Max. 300V
- Good for 2 circuit feeds or a 1 circuit feed with a battery pack hot lead
- 120V or 277V applications

7 Conductor



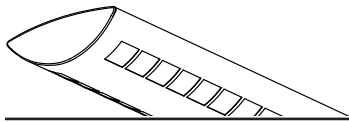
- Max. 10 amps in a 1 circuit application
- Max. 5 amps per circuit in a multi-circuit application
- Good for 3 circuit feeds or 2 circuit feeds with a battery pack hot lead
- 120V or 277V applications

Job Information

Type:

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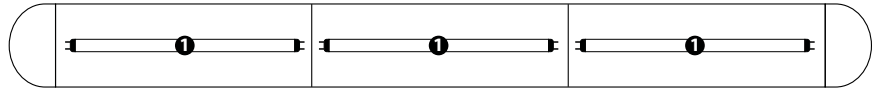
LIGHTOLIER[®]



Wiring Options: 1 Circuit

1 Circuit

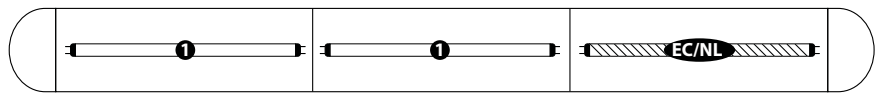
- Type 1:** 1cct.
- Type 8:** 1cct. w/1cct. thru wire
- Type H:** 1cct. w/2cct. thru wire
- Type 7:** 1cct. w/dimming



All lamps wired on one circuit.

1 Circuit with Emergency Circuit/Night Light (EC/NL)

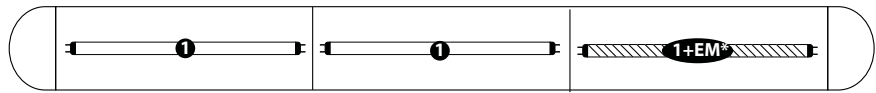
- Type 3:** 1cct. w/EC/NL



One 4' section in a one circuit fixture to be wired on a separate thru circuit. Leads for both normal circuit and EC/NL circuit wired to fixture ends. All lamps in EC/NL section to be wired together.

1 Circuit with Emergency Battery Pack (EM)

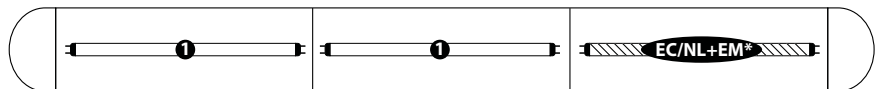
- Type 5:** Chloride standard
CTP700
- Type M:** Bodine standard
LP550
- Type E:** Chloride high performance
CTP1300
- Type P:** Bodine high performance
LP600



All lamps wired on one circuit, plus a battery pack is wired to one lamp. A hot lead is connected to the battery pack and would function as a 'trigger' wire when connected to a constant hot by installer. Leads for both normal circuit and battery pack are wired to fixture ends.

1 Circuit with Emergency Circuit/Night Light and Emergency Battery Pack

- Type J:** Chloride standard
CTP700



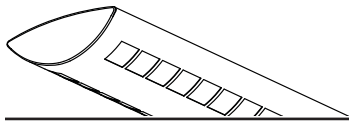
One 4' section in a one circuit fixture to be wired on a separate thru circuit, in addition, a battery pack is wired to one lamp. Installer can connect 'trigger' wire to EC hot lead if controlled together or wire separately if controlled independently. Leads for normal circuit, EC/NL circuit and EM wired to fixture ends. All lamps in EC/NL section to be wired together.

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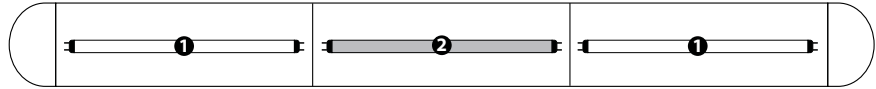
LIGHTOLIER®



Wiring Options: 2 Circuit A/B Switching (alternate 4' sections)

2 Circuit A/B Switching (alternate 4' sections)

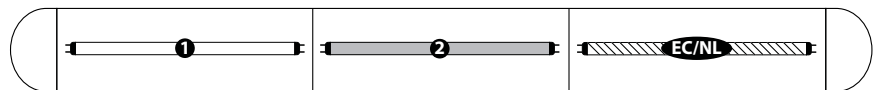
- Type B:** 2cct.
- Type A:** 2cct. w/1cct. thru wire
- Type S:** 2cct. w/2cct. thru wire



Fixture wired for two circuit. Lamps wired for A/B switching in alternate 4' sections.

2 Circuit A/B Switching (alternate 4' sections) with Emergency Circuit/Night Light (EC/NL)

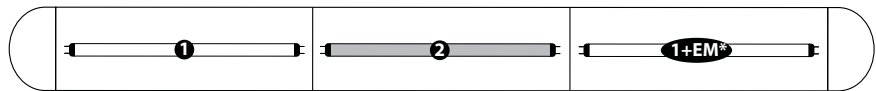
- Type C:** 2cct. w/EC/NL



One 4' section in a two circuit fixture (A/B switching) to be wired on a separate thru circuit. Leads for both normal circuit and EC/NL circuit wired to fixture ends.

2 Circuit A/B Switching (alternate 4' sections) with Emergency Battery Pack (EM)

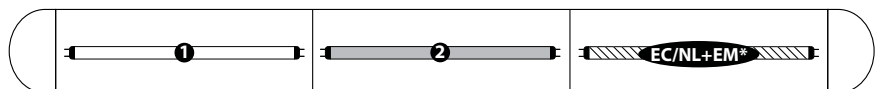
- Type D:** Chloride standard
CTP700
- Type O:** Bodine standard
LP550
- Type G:** Chloride high performance
CTP1300
- Type R:** Bodine high performance
LP600



Fixture wired for two circuits (A/B switching), plus a battery pack is wired to one lamp. A hot lead is connected to the battery pack and would act as a 'trigger' wire when connected to a constant hot by installer. Leads for both normal circuit and battery pack are wired to fixture ends.

2 Circuit A/B Switching (alternate 4' sections) with Emergency Circuit/Night Light and Emergency Battery Pack

- Type L:** Chloride standard
CTP700

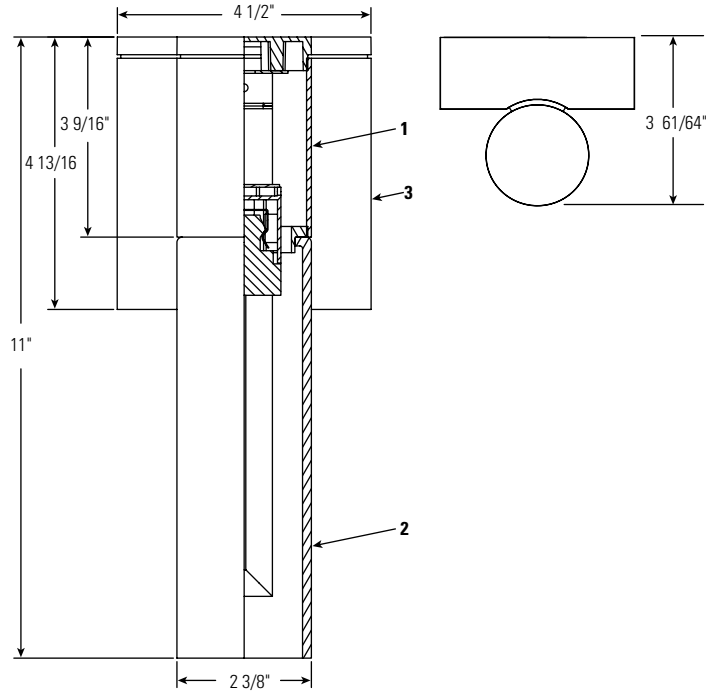


One 4' section in a two circuit fixture (A/B switching) to be wired on a separate thru circuit, in addition, a battery pack is wired to one lamp. Installer can connect 'trigger' wire to EC hot lead if controlled together or wired separately if controlled independently. Leads for normal circuit, EC/NL circuit and battery pack are wired to fixture ends. All lamps in EC/NL module to be wired together.

Job Information

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Ordering Information:

Spec ID	Powerhead	Inner Glass	Outer Glass	Lamp	Volts
FW01	PW13SA	SG02	NA	4-Pin Elect. Twin Tube 13W	120V
FW201	PW132SA	SG02	NA	4-Pin Elect. Twin Tube 13W	277V
FW01Q	PW13QSA	SG02	NA	4-Pin Quad Tube 13W	120V
FW201Q	PW132QSA	SG02	NA	4-Pin Twin Tube 13W	277V
IW01	PW50SA	SG02	NA	T-4 Mini-Can 50W	120V

***All suspension kits can be shortened to length in field with the exception of SMK and CTC. Must order wall chassis and glass separately. Spec ID is for reference only.**

Features

- 1. Power Compartment:** Die Cast and Machined Aluminum Components. Brushed and Clear Lacquer Finish.
- 2. Primary Glass:** Triplex Hand Blown Glass.
- 3. Backplate:** Die Cast Aluminum, Brushed and Clear Lacquer Finish.

Lamping (by others)

Incandescent: 50W Max. T-4 Mini Candelabra

Compact Fluorescent:

General Electric	Osram/Sylvania	Philips
(1) 13W Twin Tube 4-Pin Compact Fluorescent Lamp		
N/A	CF13DS/E/*	N/A
(1) 13W Quad Tube 4-Pin Compact Fluorescent Lamp		
F13DBX/SPX*/4P	CF13DD/E/*	PL-CL3W/*/4P/ALTO

*Manufacturers Color Temperature Designation

Electrical

Lampholders

Incandescent: E11 Base, Porcelain, Plated Copper Alloy Screw Shell

Compact Fluorescent: 13W Twin: 2GX7 Base, High Impact Thermoset Polymer with Brass Contacts.

13W Quad: GX24Q-1 Base, High Impact Thermoset Polymer with Brass Contacts.

Ballasts: Fluorescent: Electronic	13 Watts	
Voltage	120	277
Total Input Watts	35	28
Max. Line Current (Amps)	.33	.18

Labels

cULus Listed. Suitable for Damp Locations.

Job Information

Type:

Job Name:

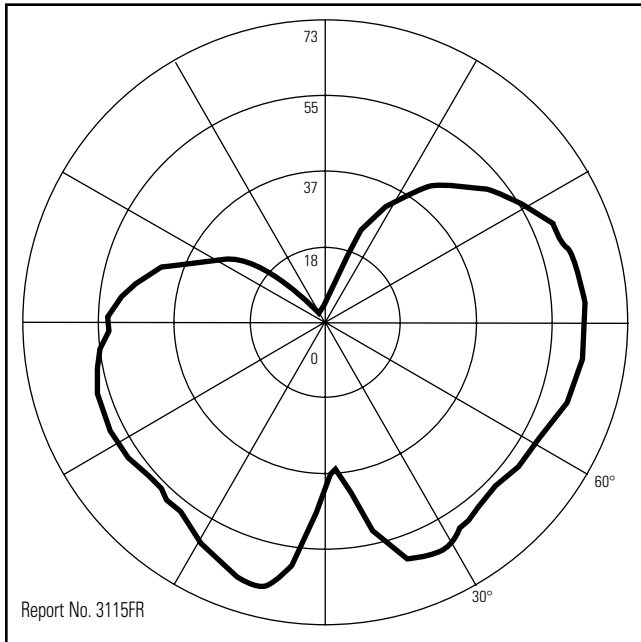
Cat. No.:

Lamp(s):

Notes:

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Catalog No. FW01, 13W 4 Pin Twin Tube, 800 Lumens.



CANDLEPOWER SUMMARY

Angle	0°	45°	90°
0	42	42	42
5	35	37	50
10	43	47	62
15	53	60	68
20	60	65	69
25	61	66	67
30	61	64	65
35	59	62	63
40	58	61	61
45	57	60	60
50	57	60	60
55	58	60	61
60	59	61	61
65	60	62	62
70	61	63	63
75	62	64	63
80	63	65	64
85	63	65	62
90	63	65	63
95	63	65	62
100	63	65	62
105	62	64	60
110	61	63	59
115	60	62	56
120	57	59	53
125	55	56	50
130	51	53	46
135	47	49	41
140	43	45	36
145	39	40	30
150	33	34	22
155	27	26	14
160	19	17	8
165	10	8	3
170	3	3	1
175	1	1	1
180	1	1	1

ZONAL LUMENS AND PERCENTAGES

Zone	Lumens	%Lamp	%Fixt
0-30	53.06	6.6	8.2
0-40	97.48	11.4	14.1
0-60	190.3	23.8	29.4
0-90	381.35	47.7	58.9
90-120	174.62	21.8	27
90-130	214.22	26.8	33.1
90-150	257.49	32.2	33.1
90-180	265.77	33.2	41.1
0-180	647.03	80.9	100

** Efficiency = 80.9% **

COEFFICIENTS OF UTILIZATION

Ceiling	80%		70%		50%		30%		0			
	70	50	30	10	50	10	50	10				
Wall	70	50	30	10	50	10	50	10	0			
RCR	Zonal Cavity Method - Effective Floor Reflectance = 20%											
Room Cavity Ratio	0	88	88	88	88	82	82	71	71	61	61	48
	1	77	71	67	62	66	58	57	50	48	43	32
	2	68	60	54	48	56	45	48	39	40	33	24
	3	62	52	44	38	48	36	41	31	34	26	19
	4	56	45	37	32	42	30	36	26	30	22	15
	5	51	40	32	26	37	25	31	21	26	18	12
	6	47	36	28	23	33	21	28	18	24	16	11
	7	43	32	25	19	30	18	25	16	21	14	9
	8	40	29	22	17	27	16	23	14	19	12	8
	9	37	26	19	15	24	14	21	12	18	11	7
10	35	24	18	13	22	13	19	11	16	9	6	

Determined In Accordance With Current IES Published Procedures
Luminaire Input Watts = 18

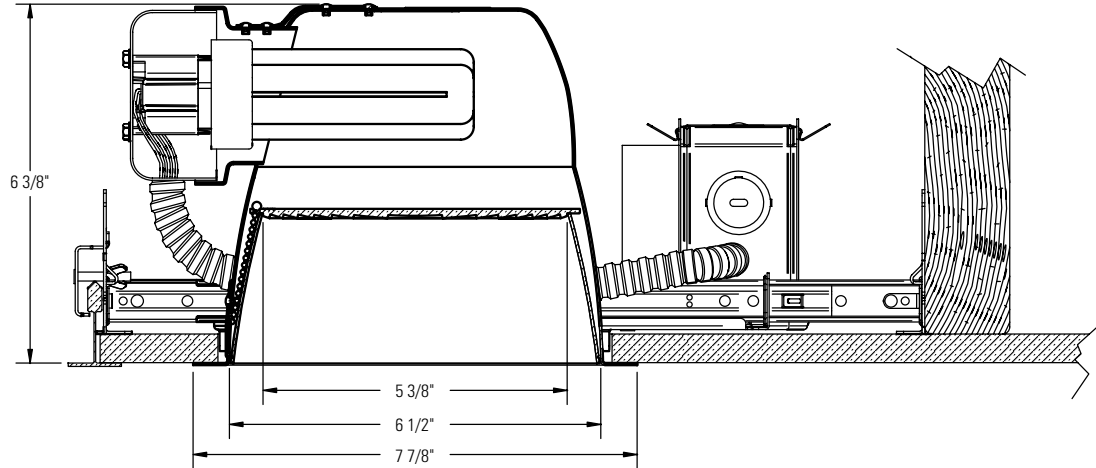
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Lytecaster® Performance Recessed CFL Downlighting **1101HL**

Page 1 of 1

6 3/4" Aperture Horizontal Wet Location, Compact Fluorescent, Performance Series, Reflector Trim



Complete Fixture consists of Frame-In Kit and Reflector Trim. Select each separately.

Uniframe™ Compact Fluorescent Performance Series Reflector Trims		Compatible Frame-In Kits (See Individual Frame-In Kit Specification Sheets)		
Catalog No.	Description	Catalog No.	Installation Type	Lamping
1101HCLF	6-3/4" Horizontal Wet Location Fresnel – Specular Clear	1101F18U	Uniframe™ Non-IC 120/277v	18w Quad/Triple
1101HCDF	6-3/4" Horizontal Wet Location Fresnel – Clear Diffuse	1101FR18U	Uniframe™ Non-IC Remodeler 120/277v	
1101HWHF	6-3/4" Horizontal Wet Location Fresnel – Matte White	1101FD26L1	Uniframe™ Non-IC Lutron Dimming 120v	26w Quad/Triple
1101HCLC	6-3/4" Horizontal Wet Location Clear – Specular Clear	1101FD26L2	Uniframe™ Non-IC Lutron Dimming 277v	
1101HCDC	6-3/4" Horizontal Wet Location Clear – Clear Diffuse	1101FD32L1	Uniframe™ Non-IC Lutron Dimming 120v	32w Triple
1101HWHC	6-3/4" Horizontal Wet Location Clear – Matte White	1101FD32L2	Uniframe™ Non-IC Lutron Dimming 277v	
1101HCLO	6-3/4" Horizontal Wet Location Opal – Specular Clear	1101F2642U	Uniframe™ Non-IC 120/277v	26w Quad/Triple
1101HCDO	6-3/4" Horizontal Wet Location Opal – Clear Diffuse	1101FR2642U	Uniframe™ Non-IC Remodeler 120/277v	32w Triple
1101HWHO	6-3/4" Horizontal Wet Location Opal – Matte White	1101F2642UEM	Uniframe™ Non-IC Emergency 120/277v	42w Triple
		1101FD2642MX1	Uniframe™ Non-IC Advance Mark10 Dimming 120v	
		1101FD2642MX2	Uniframe™ Non-IC Advance Mark10 Dimming 277v	
		1101FD2642M7U	Uniframe™ Non-IC Advance Mark7 Dimming 120/277v	
		1101F18ICU/N	Performance IC 120/277v	18w Quad/Triple
		1101F2642ICU	Performance IC 120/277v	26w Quad/Triple
		1101F2642IUN		32w Triple
				42w Triple
		1101FDICMX1/N	Performance IC Advance Mark10 Dimming 120v	26w Quad/Triple
				32w Triple
		1101FDICMX2/N	Performance IC Advance Mark10 Dimming 277v	26w Quad/Triple
				32w Triple

Features

- Reflector:** Formed aluminum. Matte White flange.
- Finishes:** CL = Specular Clear (Iridescent Free coating)
CD = Clear Diffuse
WH = Matte White Paint
- Lenses:** Clear Acrylic, Textured Acrylic Fresnel, Opal Acrylic
- Performance Data:** 60° Cutoff angle.
See attached photometric reports for distribution and efficiency data.
Go to www.lightolier.com for .IES files.

Labels

cULus Listed. Suitable for Wet Locations. I.B.E.W.

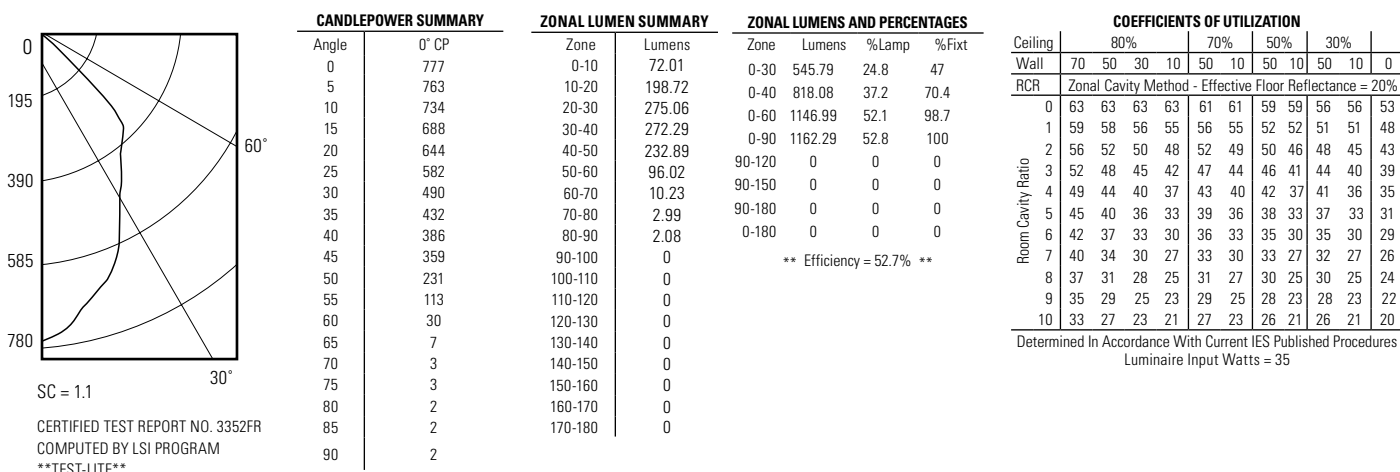
Job Information	Type:
Job Name:	
Cat. No.:	
Lamp(s):	
Notes:	

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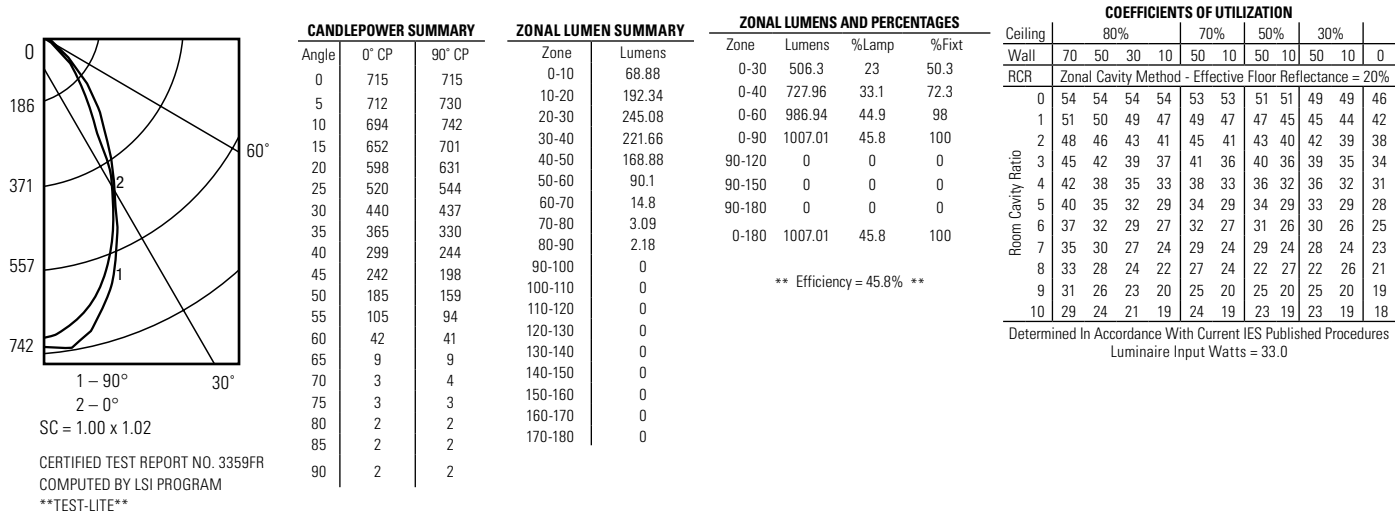
LIGHTOLIER®

Lytecaster® Performance Recessed CFL Downlighting **1101HL**

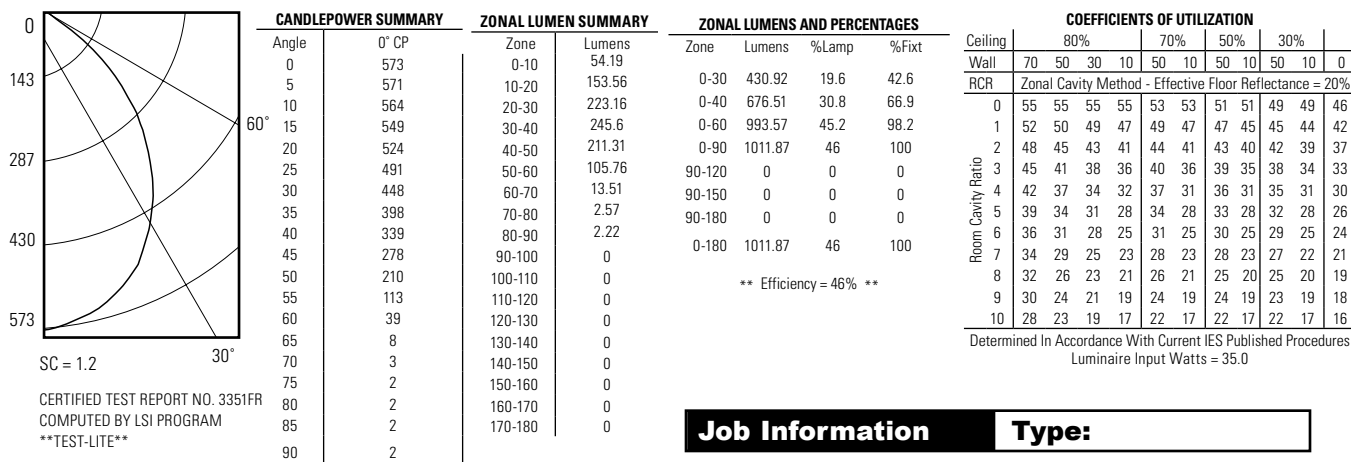
32W TRIPLE TUBE LAMP, LUMEN RATING = 2200 LMS, ELECTRONIC BALLAST, CL FINISH TRIM WITH CLEAR LENS



32W TRIPLE TUBE LAMP, LUMEN RATING = 2200 LMS, ELECTRONIC BALLAST, CL FINISH TRIM WITH FRESNEL LENS



32W TRIPLE TUBE LAMP, LUMEN RATING = 2200 LMS, ELECTRONIC BALLAST, CL FINISH TRIM WITH OPAL LENS



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LIGHTOLIER®

T1000-C3 Transformer

APPLICATIONS

Powersmiths T1000-C3 transformers are selected to improve power quality and reduce electricity waste. Optimized for lowest life cycle cost, the T1000-C3 reduces waste by as much as 74% while treating power system harmonics in the electrical current that can disrupt equipment operation. The T1000-C3 enhances equipment reliability, lowers operating costs and facilitates compliance with IEEE-519 in commercial and industrial facilities.

DESCRIPTION AND CHARACTERISTICS

The T1000-C3 treats the 3rd harmonic through secondary flux cancellation and reduces fundamental current imbalance. Unlike delta-wye transformers, 3rd and other zero sequence currents in the T1000-C3 do not couple into the primary winding. 5th and 7th harmonics are treated on a system basis by alternating phase shifted models within the facility.

QUIET OPERATION

Workplace productivity can be compromised when noisy transformers are located close to people. To meet this challenge, Powersmiths transformers embed structural and acoustic treatments that combine to ensure quiet-operation. Powersmiths incorporates noise tests into our ISO 9001 production procedures for every transformer.

OPTIONAL INTEGRATED METERING

To facilitate on-site commissioning and monitoring, Powersmiths' SMART meter can be integrated into the transformer. SMART is an energy and power meter that serves as a data acquisition system, providing on-going energy and power quality data for the building's energy management systems and education for sustainability software such as Powersmiths Interactive Learning System. An optional port is available to provide safe external access to live transformer primary and secondary voltages and currents; operating temperature and TVSS status, without opening the transformer enclosure.



ENVIRONMENTAL BENEFIT

The T1000-C3 is built in an ISO 9001 (quality management) and ISO 14001 (environmental management) certified facility. Throughout the manufacturing process Powersmiths takes steps to ensure that waste is eliminated and hazardous materials are avoided. Because Powersmiths transformers generate lower losses, they reduce power drawn from generating stations resulting in less smog and lower greenhouse gas emissions.

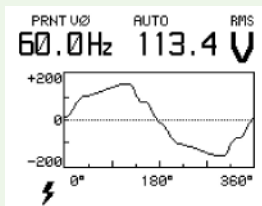
TESTING AND WARRANTY

During manufacturing and assembly the T1000-C3 is subjected to rigorous testing to ensure: efficiency under various load profiles and loading conditions; quiet operation; and insulation integrity. Powersmiths is the only manufacturer to production-test transformers with actual computer-power loading in an ISO 9001 environment. Data can be provided for individual units by selecting the NLT option with your order.

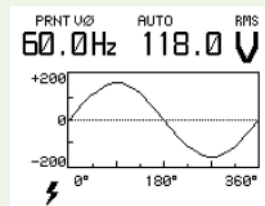
The T1000-C3's long life and dependable performance is backed up by Powersmiths' industry leading 25 year pro-rated warranty. The warranty is automatically extended to 40 years when Powersmiths Cyberhawk MPC monitor, protection and control system is installed at the building entrance.

KEY FEATURES

- Provides Class 3* level energy efficiency to reduce electricity waste
- Improves power quality to facilitate system wide compliance with IEEE-519
- Significantly exceeds NEMA TP-1 efficiency for low operating cost over life of transformer
- Produced in an ISO 9001 and ISO 14001 certified facility assuring high quality and low environmental impact
- Optimized for lowest life cycle cost



Voltage Waveform Before



Voltage Waveform with T1000

* US Department of Energy Candidate Standard Level 3

STANDARD CONFIGURATION

Powersmiths T1000-C3 is a 3-phase common-core copper-wound dry type transformer, built in an ISO 9001 and ISO14001 certified facility to NEMA ST-20 and other applicable ANSI and IEEE standards. Secondary windings have less than 0.3% zero sequence reactance and low zero sequence impedance.

The T1000-C3 has 220°C class insulation and 115°C operating temperature rise, a single electrostatic shield, 60Hz rating and comes standard in a NEMA 2 ventilated indoor enclosure. The standard configuration of the T1000-C3 meets the efficiency requirements of Candidate Standard Level 3 (CSL-3*). These levels significantly exceed NEMA TP -1 efficiency requirements.

SELECT

KVA: Rating of unit (15-1000 kVA, up to 5000 kVA)

DEG: 0 or 30 degrees phase shift

PV: Primary voltage, (600, 480, 415, 400, 380, 208, up to 15kV)

SV: Secondary voltage (208/120V, 480/277V, 600/347V, others available)

SAMPLE PART NUMBER

T1000-C3-75-0-480-208

* FEDERAL REGISTER – US Department of Energy, Office of Energy Efficiency and Renewable Energy. 10 CFR Part 430, July 29, 2004. Energy Conservation Program for Commercial and Industrial Equipment: Energy Conservation Standards for Distribution Transformers; Proposed Rule

TECHNICAL DATA

kVA	Impedance (+/- SEQ.)	Weight (lbs)	Case Size (Inches)
15	3.5 - 5.5%	220 - 260	A (18W x 17D x 27H)
30	3.0 - 5.0%	350 - 420	B (26W x 18D x 30H)
45	3.0 - 5.0%	450 - 550	B (26W x 18D x 30H)
75	3.0 - 5.0%	700 - 800	C (32W x 22D x 40H)
112.5	3.0 - 5.0%	900 - 1100	C (32W x 22D x 40H)
150	3.0 - 5.0%	1100 - 1300	D (38W x 27D x 48H)
225	3.0 - 5.0%	1550 - 1850	D+ (38W x 32D x 52H)
300	3.0 - 5.0%	1800 - 2000	D+ (38W x 32D x 52H)
500	3.0 - 6.0%	3000 - 3300	E+ (52W x 38D x 61H)
750	3.0 - 6.0%	3800 - 4800	F (64W x 47D x 67H)

The above data applies to configurations up to 600V, with NEMA 2 enclosure and standard temperature rise. Selection of some options may change enclosure size and weight. Consult factory for detailed product data sheet for these and other configurations.

*Specific case used determined by factory unless specified. Up to 5000kVA, 15kV class available.

AVAILABLE OPTIONS

SMART1: Integrated metering port

SMART2: Integrated Power & Energy Meter

SMART3: Integrated Meter with Web access

CYBERHAWK-TX: Efficiency & Power Meter

N3R: NEMA 3R, ventilated enclosure

T80: 80 deg. C operating Temp. rise

F50: 50Hz design

2S: Dual electrostatic shields

3S: Triple electrostatic shields

ECO: ECOLOGO certified

SPD: (120/208V OR 277/480V)

PRO80: 80kA, 7 mode, Filter

PRO120: 120kA, 7 mode, Filter

PRO160: 160kA, 7 mode, Filter

PRO200: 200kA, 7 mode, Filter

PRO240: 240kA, 7 mode, Filter

PROXX: Where xx is custom ID

LK: Lug kit, screw-type

COL: Color other than the factory standard

TSB: Terminal Safety Barrier

TS: Thermal Sensors at 170 °C and 200 °C

NLT: Nonlinear load test

SE: Sensitive Environment, extra low noise

C2AL: DOE class 2 efficiency, with aluminum windings



Warranty: Our Commitment to lasting performance is spelled out in the longest transformer warranty in the business – 25 years pro-rated. 40 year pro-rated warranty with the installation of the Cyberhawk MPC at the building entrance. T1000 is a trademark of Powersmiths International Corp.

Technical specification subject to change without notice.

POWERSMITHS

POWERSMITHS INTERNATIONAL CORP.

10 Devon Road, Brampton, Ontario L6T 5B5 Canada

Phone: (905) 791-1493

Toll-free: (800) 747-9627

Fax: (905) 791-8870

Email: info@powersmiths.com

www.powersmiths.com

SWIFT WIND TURBINE

The UK-based company, Renewable Devices, has developed the SWIFT Wind Turbine- a quiet, building-mountable wind turbine capable of providing a cost-effective renewable energy source for domestic, community, and industrial use. Cascade Engineering, Inc. is proud to be the importer and manufacturer of the SWIFT Wind Turbine for North America.

The SWIFT is a grid-connected form of embedded power generation. The emphasis of the design process has focused on safety, reliability, and ease of operation, alongside the high-performance of this innovative system. Unique technologies have been developed, leading to the filing of five international patents, which allow the SWIFT Wind Turbine to offer:

- Universal application
- Quiet, minimal vibration rooftop operation
- Simple installation
- Safe, efficient & autonomous operation
- Visually appealing design, which is zoning compliant
- Sustainable, harm neutral design—allowing the SWIFT to become carbon and energy positive within four years

The SWIFT Wind Turbine is mounted on an aluminum mast with a minimum blade-roof clearance of approximately two feet. It is optimally mounted at the highest point of a roof, in a position which benefits from maximum prevailing wind, but it will work effectively in almost any location. The SWIFT Wind Turbine is designed to be both aesthetically pleasing and zoning compliant.

To ensure minimal transmission of oscillations from turbine to building, the SWIFT mounting brackets incorporate damping systems specifically designed to absorb a wide range of frequencies. The patented ring diffuser minimizes turbine noise by preventing the creation of turbulent vortices at the blade tip. In addition, the five bladed design allows for a slower speed of rotation to further reduce noise, making the SWIFT Wind Turbine one of the quietest wind systems.

For more information, visit www.swiftwindturbine.com.

Installations



Features

Power Output - 1.0 kW @ 11 m/s

Power Supplied - approximately 2,000 kWh per year¹

Electric Power - 240VAC, 60Hz output voltage

Design enables use of turbine in turbulent air flows

Quiet mast mounting technology reduces unwanted vibration to building/home

Warranty - 5 year parts

Application

Universal rooftop-mountable wind energy system

Simple installation & autonomous operation

Mounting Methods - Flat rooftop mount, pole mount to side of building, stand alone pole mount

Safety

The SWIFT Wind Turbine incorporates safety features which meet or exceed all the British, European, and North American safety standards for wind energy systems of this class. Renewable Devices Swift Turbines Ltd. leads the market in passive safety and fail-safe technologies.

Environment

The SWIFT Wind Turbine has been designed to be environmentally sustainable. The product produces more energy in its lifetime than is incorporated in the materials and processes used to manufacture it—it is therefore “harm neutral.”

Technical Specifications

Turbine	Upwind horizontal axis wind turbine
Power Output	1.0 kW @ 11 m/s
Power Supplied	Approximately 2,000 kWh per year ¹
Product Design Life	20 years
Inverter	Custom designed brushless PMG
Rotor	7 foot diameter
Mast	Aluminum (to BS1387, ISO65)
Mounting brackets	Specifically designed mounting system
Cut-in Speed	8 mph
Maximum Designed Wind Speed	145 mph
Acoustic emissions	<35 dB (A) (for all wind speeds @ hub)
EMI (electromagnet emissions)	CE certified, BS EN 6100
Grid connection	G83 certified
Safety, electrical & reliability standards	Certified to UL 1741, IEEE 1547 & 1547.1, and CSA C22.2 NO 107.1-01

¹ Rated wind speed: 6 m/s, Dependant on siting of turbine

Cascade Engineering, Inc.
North American Importer and Manufacturer
4855 37th Street SE
Grand Rapids, MI 49512

Contact: SWIFT Wind Turbine Customer Service
Phone: 877.544.5520
Fax: 616.975.4717
Email: info@swiftwindturbine.com

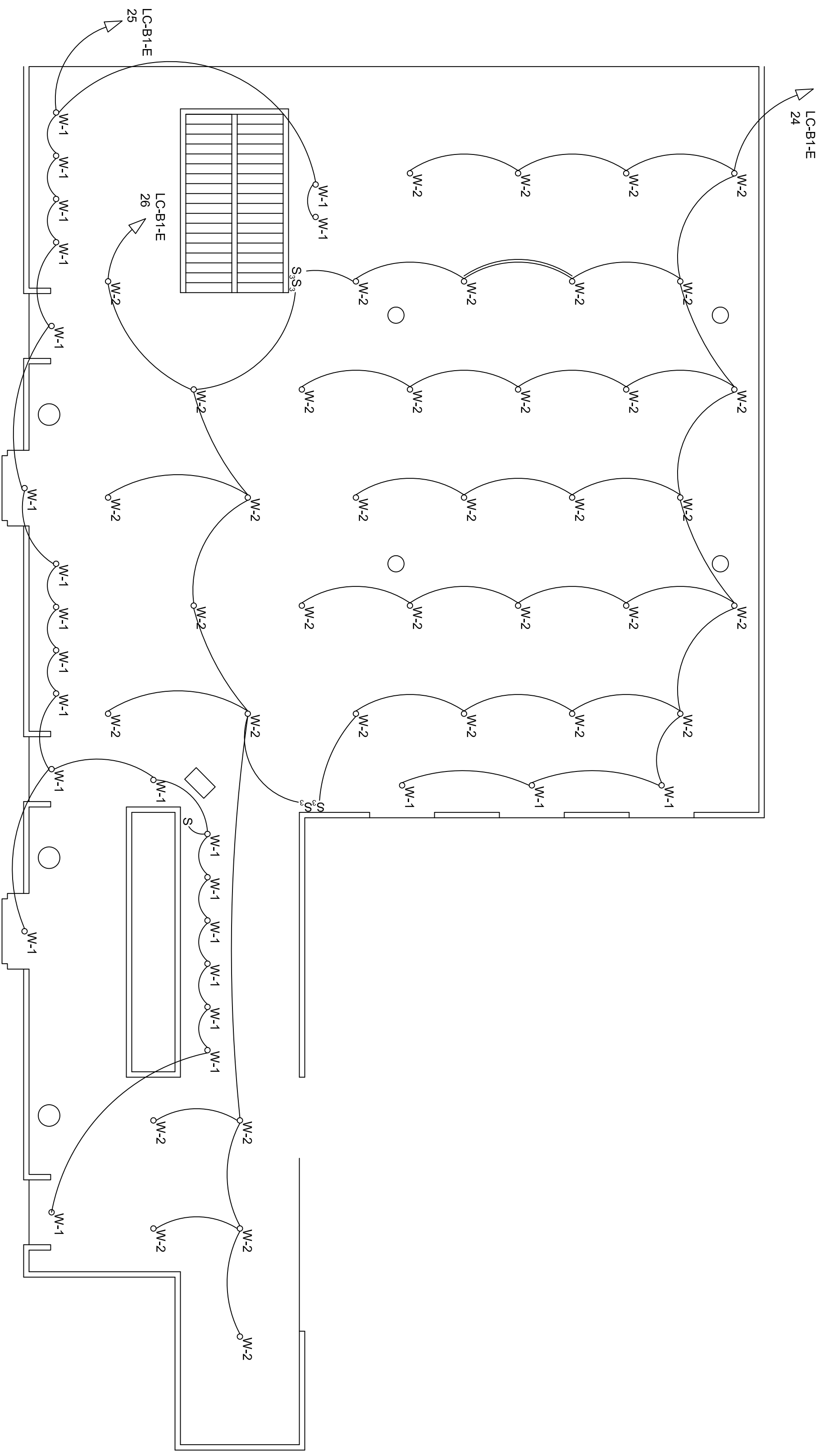


A PHI Company

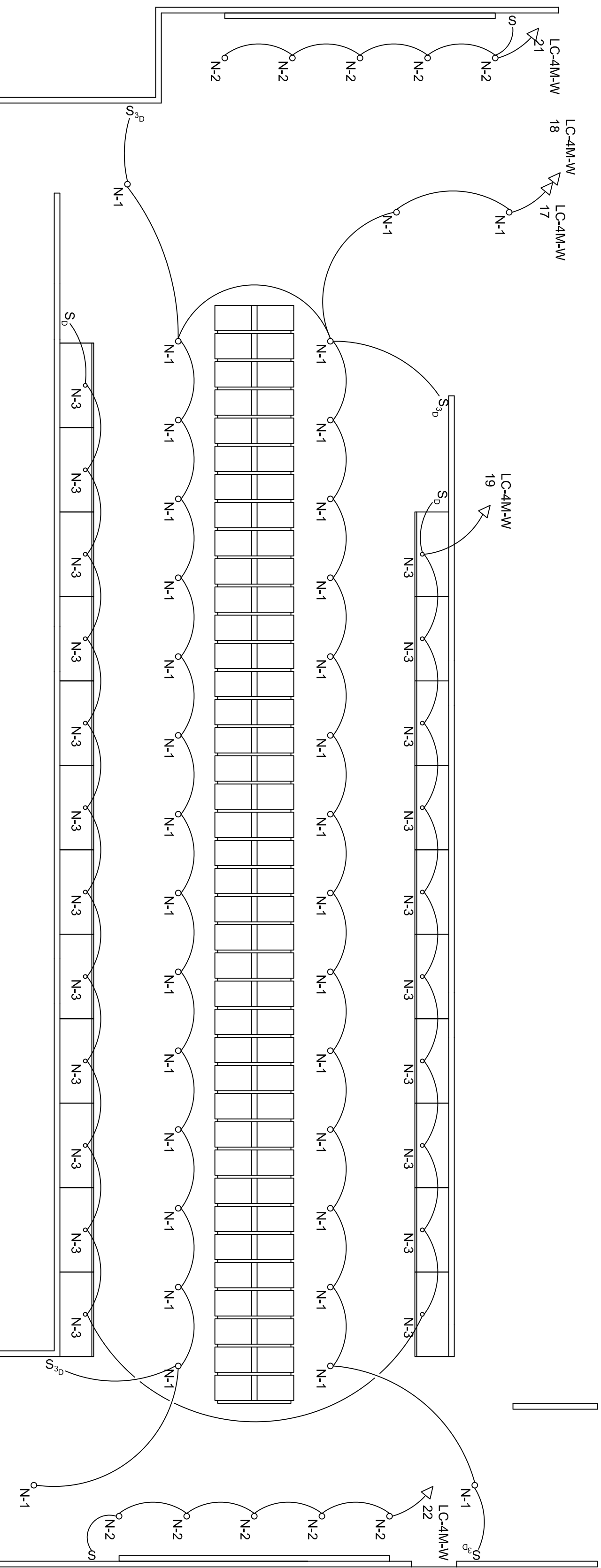
**DISTRICT OF COLUMBIA
GENERAL SERVICE PRIMARY SERVICE
SCHEDULE GS3A
UPDATED AUGUST 22, 2007**

	Billing Months of June – October (Summer)	Billing Months of November – May (Winter)
Generation¹		
First 6,000 kwh	\$ 0.12147 per kwh	\$ 0.11736 per kwh
Additional kwh	\$ 0.12147 per kwh	\$ 0.11736 per kwh
First 25 kw	No charge	No charge
Additional kw	\$ 0.17955 per kw	\$ 0.14956 per kw
Procurement Cost Adjustment	www.pepco.com for monthly rate	
Transmission²		
All kwh	\$ 0.00349 per kwh	\$ 0.00349 per kwh
Distribution³		
Customer Charge	\$ 6.48 per month	\$ 6.48 per month
First 6,000 kwh	\$ 0.04067 per kwh	\$ 0.03371 per kwh
Additional kwh	\$ 0.02558 per kwh	\$ 0.01654 per kwh
First 25 kw	No charge	No charge
Additional kw	\$ 4.69 per kw	\$ 4.09 per kw
Delivery Tax⁴	\$ 0.0077 per kwh	\$ 0.0077 per kwh
Public Space Occupancy Surcharge⁵	\$ 0.00219 per kwh	\$ 0.00219 per kwh
Administrative Credit	www.pepco.com for monthly rate	
Reliable Energy Trust Fund⁶	\$ 0.00111 per kwh	\$ 0.00111 per kwh
Generation Procurement Credit⁷	\$ 0.000000 per kwh	\$ 0.000000 per kwh

¹ Effective June 1, 2007
² Effective February 8, 2005
³ Effective February 8, 2005
⁴ Effective January 1, 2005
⁵ Effective March 1, 2007
⁶ Effective August 22, 2007
⁷ Effective Billing Month of July, 2007

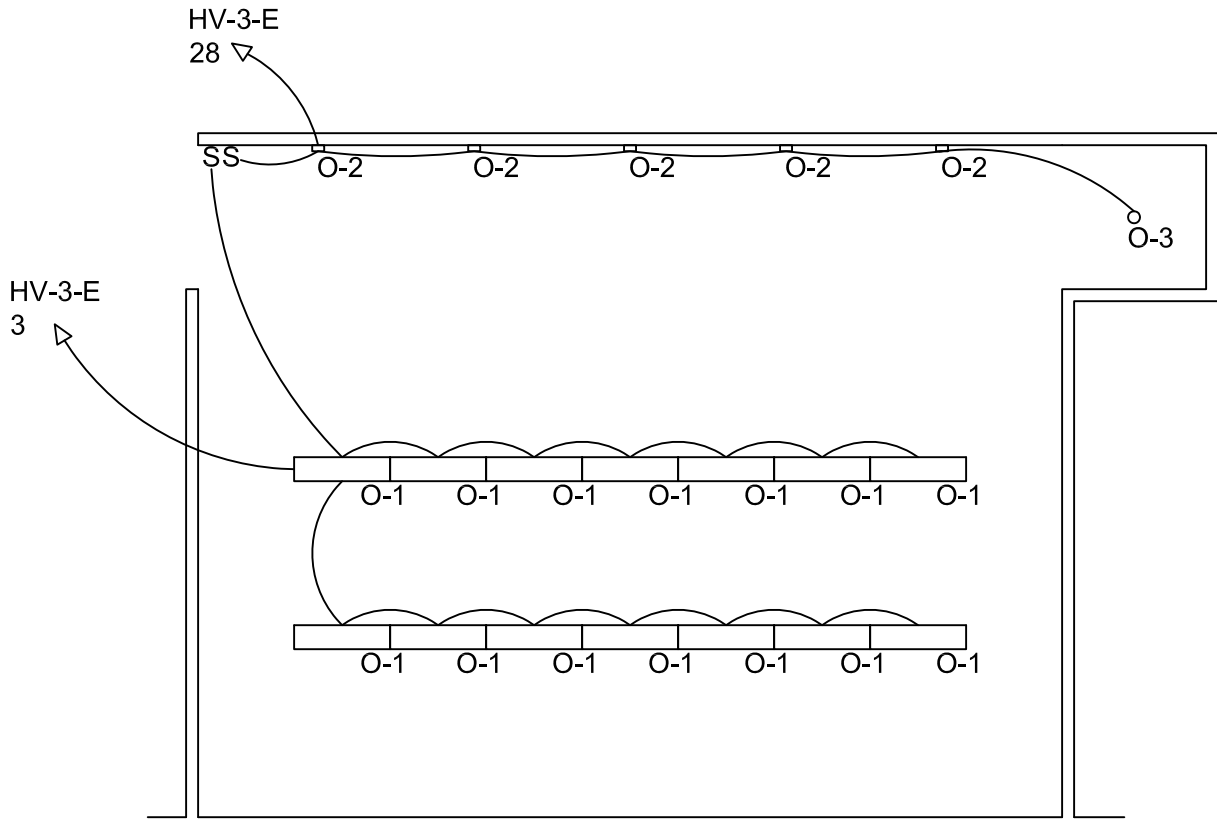


Welcoming Lobby - Lighting Plan
 Scale: 1/8" = 1'



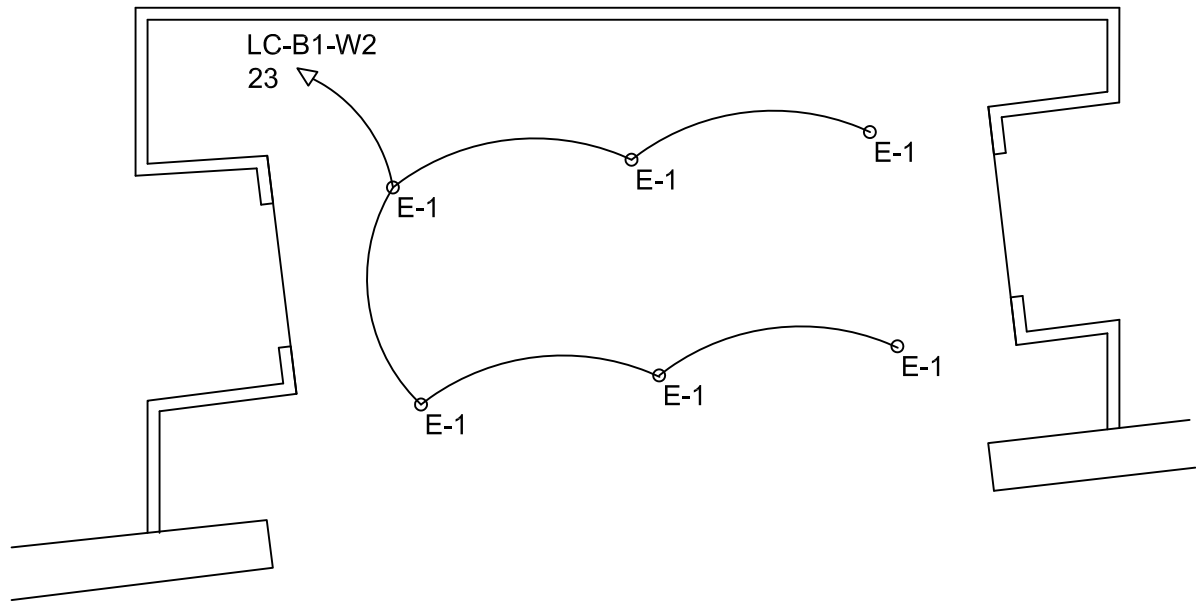
News History Gallery - Lighting Plan

Scale: 1/8" = 1'



Freedom Forum Offices - Lighting Plan

Scale: $\frac{1}{8}" = 1'$



Exterior Entry - Lighting Plan

Scale: $\frac{1}{8}'' = 1'$