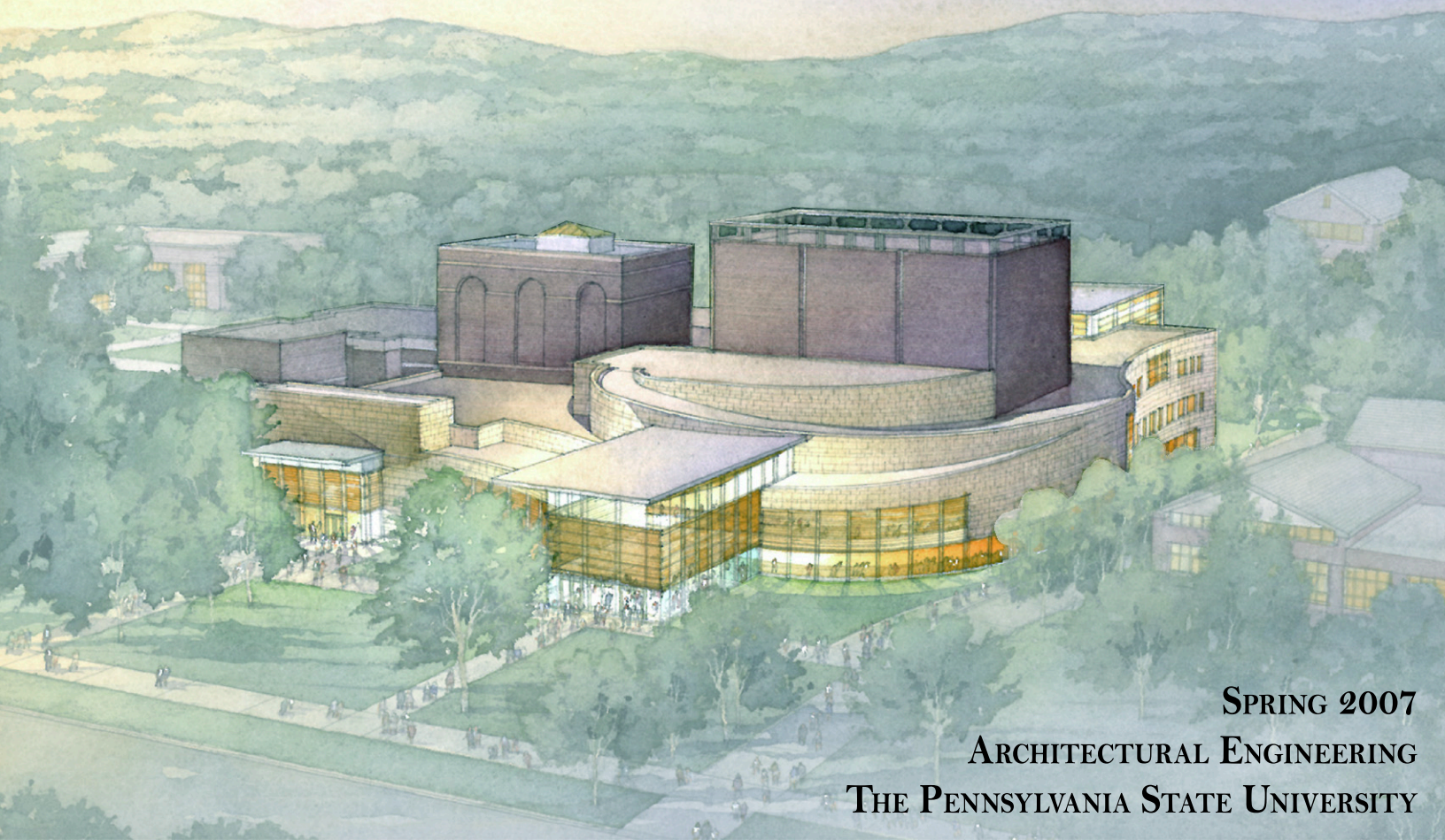
Devin Maurizio
Lighting/Electrical Option
R. Mistrick

Williams College

'62 Center for Theatre & Dance



Spring 2007
Architectural Engineering
The Pennsylvania State University

Williams College

'62 Center For Theater & Dance

Williamstown, MA

Architect: William Rawn Associates

Size: 126,000 sq.ft. on 8.21 acre site
Height: 5 stories (above grade) + basement
Cost: $50 million
Facade: Limestone veneer, Wood paneling, Brick

Program: 550 seat Mainstage
150 seat flexible Centerstage
220 seat Adams Memorial Theater
3000 sq.ft. dance studio

Structural: LeMessurier Consultants
MEP/FP: TMP Consulting Engineers
Lighting: Horton Lees Brogden
CM: Barr & Barr, Inc.

Structural: Composite steel beam & girlder floor framing
Concrete slab on metal deck
Braced frame lateral resisting frame
Conventional concrete spread footings

Mechanical: 35 ton air cooled liquid chiller
cv & vav forced air system
Hydronic radiant floor heating
Finned-tube radiant heaters at curtain walls

Electrical: 2-1500Kva 480/277v main transformers
480/277v & 208y/120v systems throughout
100Kw diesel emergency backup generator

Lighting: Halogen in lobbies & theatrical spaces
Linear & compact fluorescent fill in
Heavy daylight infiltration

Devin Maurizio
Lighting/Electrical Option

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Acknowledgements

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- Randy Wilmot & William Rawn Associates, for providing me with drawings and specifications when I was somewhat desperate and in need of a helping hand.
- Robert Benson, for allowing me to use his photos of the building. Note: all pictures that are really impressive, © Robert Benson Photography
- Kristen Mathias at Theatre Projects Consultants, Inc.
- Bruce J. Decoteau, Head of Building & Grounds, for giving me a tour and unlocking all the doors for me when I know he really wanted to go home and enjoy his thanksgiving break
- Don Clark, Utilities Program Manager of the Facilities Department, for his help in obtaining utility information
- Dr. Mistrick
- Ted Dannerth
- Spongebob

Executive Summary

As the culminating proof of the development of knowledge in the architectural engineering field, this analytical document provides an in-depth research study on the existing conditions in the Williams College Center for Theatre & Dance's lighting and electrical systems and suggests possible alternative design solutions to create an overall successful project, whether that success be measured in dollars or beauty. The Williams College Center for Theatre & Dance is a 126,000 sq.ft., $50 million theatre & performing arts building, boasting two large professional theatres (shared by students and the community), a state of the art black box theatre, a dance rehearsal studio, and many classrooms and support spaces. Located in Williamstown, Massachusetts, Williams College is a small liberal arts campus in the middle of the rolling Berkshire hills. Also covered in this report are topics on sustainable design and the feasibility of the installation of a green roof onto the Center, taking into account both cost and structural feasibility.

My designs for the lighting in the building, paramount to the visual impact of architecture, have centered around the impression of a single person having control over the inanimate natural environment that surrounds them. Metaphorically, this speaks of the immense power we have to conserve energy and natural resources and to preserve the world we live in. As people walk in and through the building, little hints of this idea are subtly expressed. Although compact fluorescents have had trouble becoming a standard in lighting, due to issues with color temperature, the technology for compact fluorescent lamps has become much better and rivals the very need for incandescent lamps at all. Almost all lighting throughout the building has been specified in my design as compact fluorescent or LED.

Electrical support for the building was designed with safety in mind. With two transformers, rated at double the necessary capacity and a tie-breaker in the main switchgear, any emergency power losses from a single transformer can be picked up by the other and, as they say in the theatre, the show can go on. Energy efficiency and economic utilitarianism was in mind during the design of the systems for this building, making the lighting systems only a small fraction of the total necessary power. Mechanical systems to combat the harsh Massachusetts climates take almost 65% of the total power in the building with a 35ton air cooled liquid chiller and radiant heating in floors and windows. Several coordination studies have been performed, verifying the safety of the system.

Sustainable design, although a buzz word right now, is the future of the building industry. With an earth unable to support the exponential human growth, energy is becoming a delicate commodity. With building using 70% of the total energy produced in the U.S., an enormous potential exists for building engineers to make a fight against energy depletion. The green roof study performed in this analysis is only one aspect of sustainable design, but with a 7 year payback and over $1 million saved over the lifecycle of the building, 'only one aspect' sounds pretty good. We can just image the possibilities as technology and methods improve.

General Building Overview

The Williams College ’62 Center for Theater & Dance is a 126,000 sq.ft. building which consists of two professional stage theatres, a state-of-the-art black box theatre, a dance rehearsal studio, a directors studio, and multiple classrooms, offices, and support rooms. The building is located on Main St. in Williamstown, Massachusetts, in the heart of a college campus that sits in a very rural area. Being covered in a skin of limestone veneer, brick, and glass and aluminum curtain walls, the Center for Theater & Dance was recently completed in June ’06 and cost nearly fifty-four million dollars. The building uses approximately 5% of Williams College’s overall energy consumption and has not attempted LEED certification. Much of the theatrical spaces are illuminated with incandescent 130v lamps and are kept dimmed when in use to prolong life. The remainder of the building is typically linear and compact fluorescent, and was designed in a very utilitarian way to save costs in the building.

Building Statistics:

Building Name:	Williams College '62 Center For Theater & Dance
Location:	Williams College, Williamstown, MA
Building Occupant:	Department of Theater & Dance, Williams College
Type of Building:	Theatrical Performance Space, Offices, and Dance Studios
Size:	126,000 sq.ft.
Stories:	5/6 (including sub-grade)

Project Team:

Owner
Williams College
http://www.williams.edu/go/62center/

Architect
William Rawn Associates
http://www.rawnarch.com/

Construction Manager
Barr & Barr, Inc.
http://www.barrandbarr.com/

Structural Engineer
LeMessurier Consultants
http://www.lemessurier.com/

Civil Engineer
Guntlow & Associates
http://www.guntlowassociates.com/

MEP Engineer
TMP Consulting Engineers
http://www.tmpeng.com/

Lighting Consultant
Horton Lees Brogden
http://www.hlblighting.com/

Landscape Architect
The Halvorson Company, Inc.
http://www.halvorsondesign.com/

Theatre Consultant
Theatre Projects Consultants, Inc.
http://www.tpcworld.com/index.asp

Acoustical Consultant
Acoustic Dimensions
http://www.acousticdimensions.com/

Williams College Project Manager
Bruce J. Decoteau, Buildings & Grounds
http://www.williams.edu

Construction Dates:	April 2003 – June 2005
Cost Information:	Total Project Cost = $54.5 Million
	Building Contract = ~$38 Million
Project Delivery:	Design-Bid-Build

Architecture:

Design & Function:

- The Main Stage Lobby, a glass cube with strong overhanging roof and dense wood shutters, brings strength of form, warmth of materials, and warmth of natural light to the face of the building on Main Street. If offers an architectural counterpoint to the semi-circular stone walls and the 80' tall fly tower of the Main Stage.

- The publicly accessible passageway from front-of-house to back-of-house is marked by a strong change in character and materials. Beginning with the glass and warm wood of the front lobby, the passage evolves into the glass, metal and steel industrial aesthetic of the Center Stage and its lobby. That aesthetic is continued in the monumental stair that moves one up to the major dance space and in the gradual ramp that moves one down to the rear entrance.

- The interior for the building is everywhere infused with daylight, either through large glass walls modulated by wood shutters in the front Lobby or by skylights creating ever changing patterns of light along circulation routes. Extraordinary views of the campus and surrounding Berkshire Hills are found throughout, particularly from the Lobby and the large Dance Studio.

National Codes Used:

- Massachusetts Energy Code - Chapter 13, Sec.1307 & Sec.1308
- NEC 2005

Zoning Requirements: Zoning requirements are defined by the Williams College master planning committee and is exempt from the Williamstown zoning ordinances.

Building Envelope: Structural CMU block walls with decorative façades. Limestone veneer on the majority of the building, brick on the fly tower and the northwest corner under the dance studio, and glass and aluminum curtain walls at the main theatre lobby and circulation corridor. Though the changes in roof heights are quite dynamic around various parts of the building, they are all flat.

System Descriptions:

Construction: The Williams College '62 Center for Theatre & Dance was a design-bid-build project that topped out at $54.5 million dollars and took just over 2 years to build. It's 5 stories above grade in most locations and has a basement. The building is built on a sloped site and requires a grand staircase along the length of the center of the building to maintain appropriate flow through it.

Electrical: The electrical distribution system for the Williams College '62 Center for Theatre & Dance is a radial system powered by two 1500 kva transformers provided by the college. Emergency lighting panels are housed in separate emergency electrical rooms and are backed up by a 100kw diesel emergency generator. Automatic transfer switches control the power transfer in the event of a power loss. Both 480/277v and 208Y/120v systems run throughout the building. Most large mechanical equipment have been provided fused disconnect switches for easy maintenance and flexibility. Lighting control panels have been linked to relay panels for integration into the building automation system.

Lighting: The lighting system consists of halogen/incandescent lamps in theatrical and lobby spaces, as well as fluorescent strip and compact fluorescent lighting for other general areas. There is site lighting enough for egress requirements along the walkways to the building, but façade lighting only exists by the deep orange and yellow glow of the main theatre entrance lobby.

Mechanical: The building utilizes a hybrid constant volume and variable air volume forced air system for the majority of space conditioning needs. A 35 ton air cooled liquid chiller services the buildings chilled water needs. An incoming steam line from the campus steam distribution system provides the means for hot water. The main theatre lobby on the south end of the building has a hydronic radiant floor that dissipates heat through its slate surface. The corridor are just inside the lobby is heated by a finned-tube radiant heating curtain wall.

Structural: The structural system consists of composite steel beams and girders for the floor framing system, topped with concrete slabs on metal decking. The walls throughout the building are braced, lateral resisting frames and the building is supported by conventional concrete spread footings.

Fire Protection: The Center for Theatre & Dance utilizes two levels of fire protection. The first is a wet system with sprinkler heads throughout the building. In theatrical spaces where efforts were taken to preserve the beauty of the space, concealed sprinkler heads were used. The second system is a fire department hookup, which is controlled by three separate automatic control valves in the main mechanical room in the basement of the west side of the building. The fire department inlet is located by the north entrance to the building and ceiling mounted smoke detectors are located throughout.

Transportation: The building is serviced by multiple hydraulic elevators and pit lifts used for moving scenery, chair racks, and equipment throughout the theatrical service areas of the building. Pedestrian elevators exist at the Main Stage lobby near the directing studio on the ground floor for easy access to handicapped individuals.

Telecommunications: Ethernet/Phone/AV: All Data/Voice/Coax conduits in the building are fed from room 052, Tel/Data, located in the basement of the 550 seat main theatre. Two data racks house the input/output data streams and are backed up by a UPS. Data and voice inputs are primarily located in offices and the theatrical control room in the 550 seat main theatre. Other inputs are placed at intervals throughout the rest of the building for a flexible data communication system. Most lines are run through conduit and cable trays that run throughout the circulation spaces in the building.

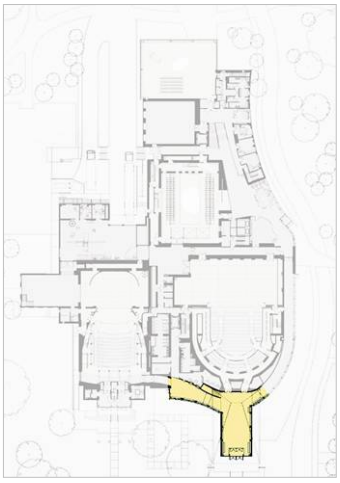
Figure 0.1 - '62 Center for Theatre & Dance Site Plan (During Construction)

Lighting Depth

The following pages outline the performance characteristics of the existing lighting system and detail a new design based on personal concepts and design criteria

Space 1: Main Stage Lobby (A circulation space)

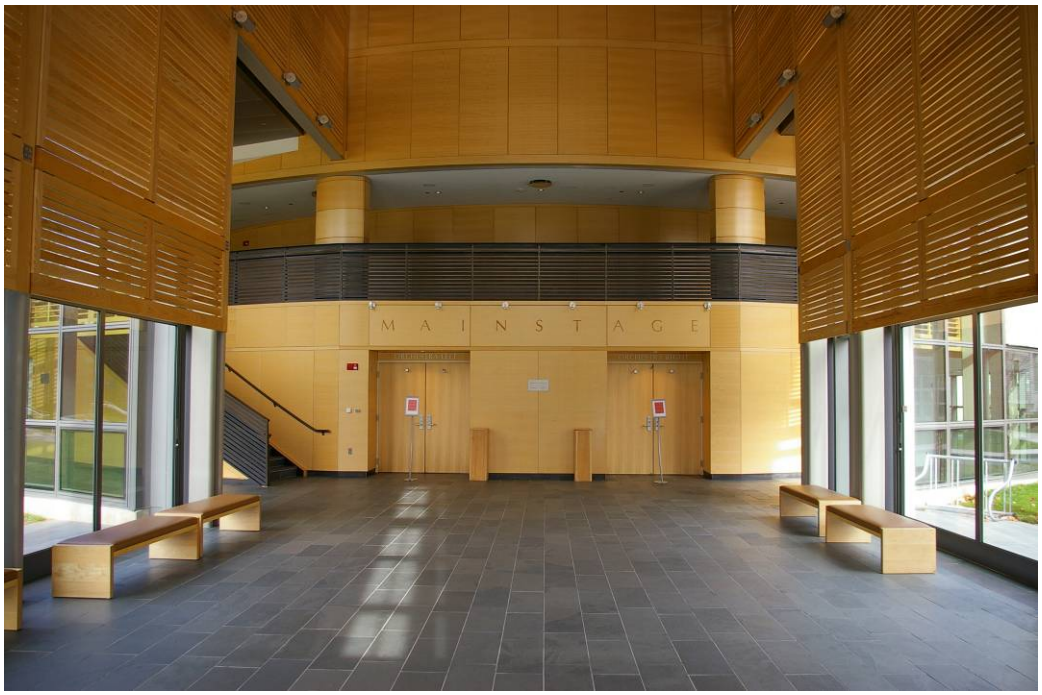
General Summary:

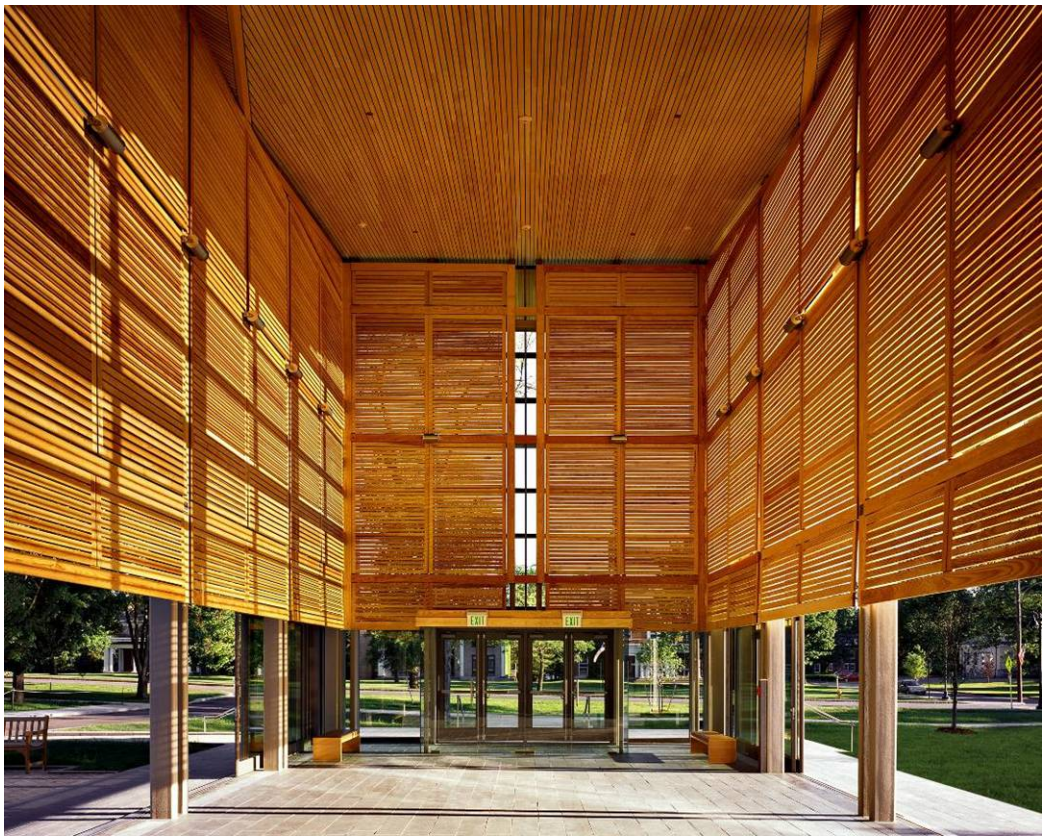


The circulation of the building is made up of 3 defined entry locations and 332 feet of linear serpentine hallway that runs from the south side to the north side that totals 5576 sq.ft. The 1450 sq.ft. southern entry lobby is the signiature entrance of the building, created as a luminous box of aluminum and glass curtainwall. This is the entry for the main theatre space in the building, the 550 seat Main Stage, that is home to both community and college theatre productions. On the inside face of the curtainwall, wood slats were designed as permenant louvers to filter daylight into the lobby and warm up the atmosphere of the materials. A second lobby exists in the middle of the corridor: a 1120 sq.ft. breakout lounge that marks the entrance to the Center Stage theatrical laboratory. A grand staircase moves occupants from this breakout lounge to the entrance at the north side of the building, which is one story higher than the southern entrance.

Tasks that will occur in this space are walking (flat and up steps), minimal reading (for tickets purchase transactions), and face-to-face conversation. It will be important to maintain the emotional connotation of the space as is defined by the architecture and creating the glow of the southern lobby.

Williams College ’62 Center For Theater & Dance
Williamstown, MA



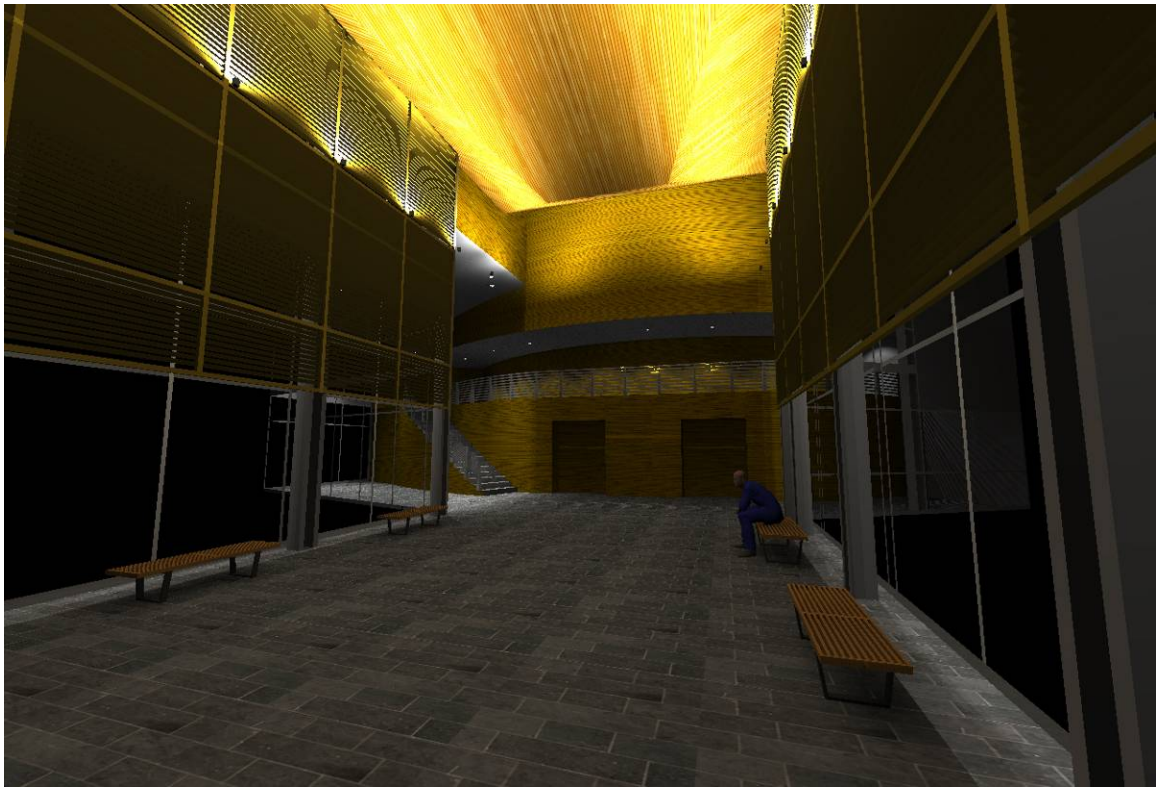


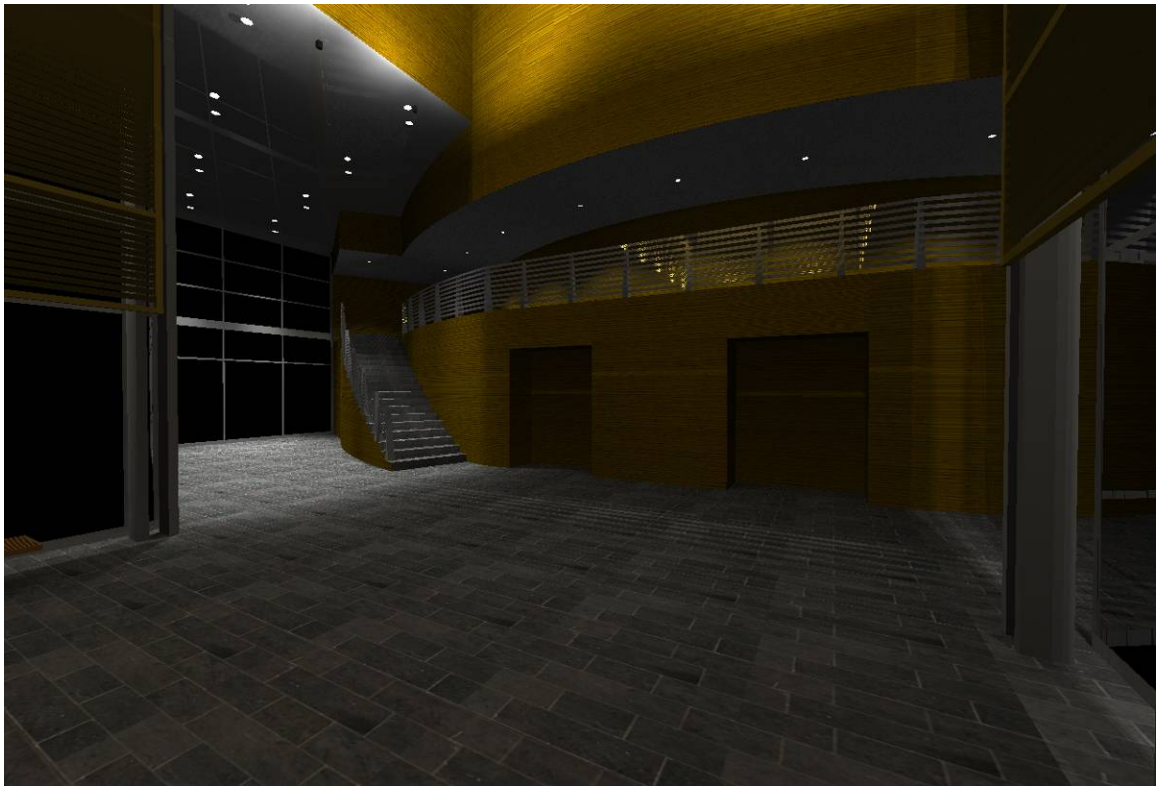
Existing Conditions:

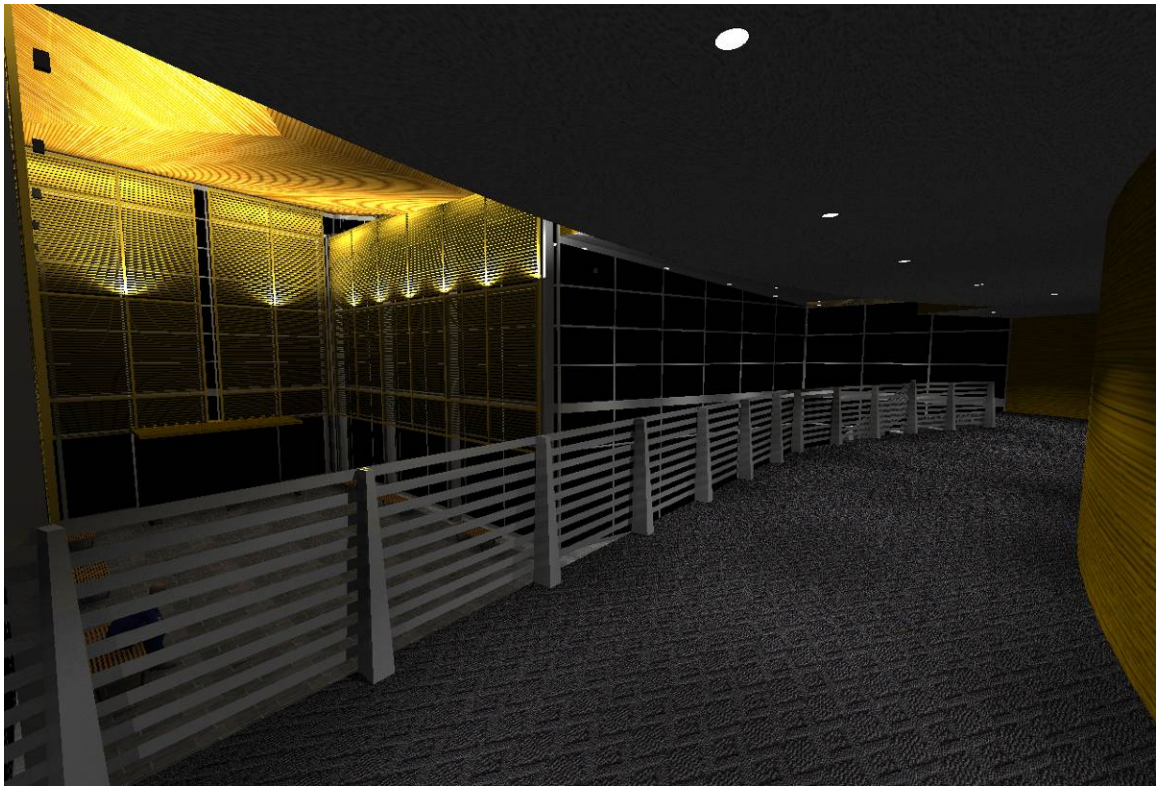
Lighting - The main lobby has two lighting systems: a series of ceramic metal halide downlights for illuminating the vertical façade of the "glass box" and a second series of halogen uplights for general ambient illumination in the space. The balcony and passageway to the left both have halogen par downlights.

Controls - All of the lighting in the main lobby is connected to the building management system through dimmer panels connected to a Lutron Grafik Eye system, located on the ground floor of the lobby just inside the theatre entrance. The system consists of a Lutron dimming panel, DPA, and two programming interfaces. Corridor lighting is connected to two keyed switches located on the wall to the left of the 550 seat theatre back of house service corridor.

Space Properties – The lobbies and hallway are infused with constant spans of glass. Glass transmittance values throughout the buildings circulation spaces are approximately 62% and were hand measured with an illuminance meter. When the wooden slats are included in this calculation, the transmittance value decreases to approximately 20%. The main lobby is primarily wood paneling with an approximate reflectance value of 45%.







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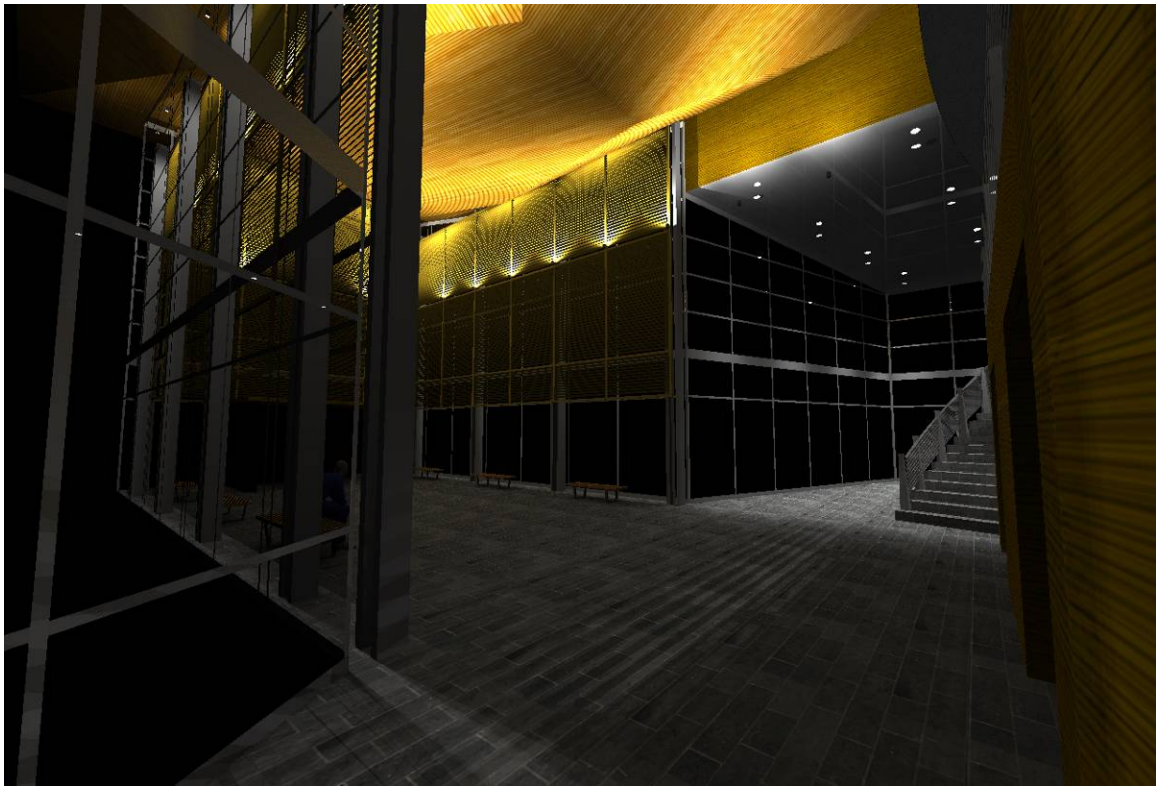
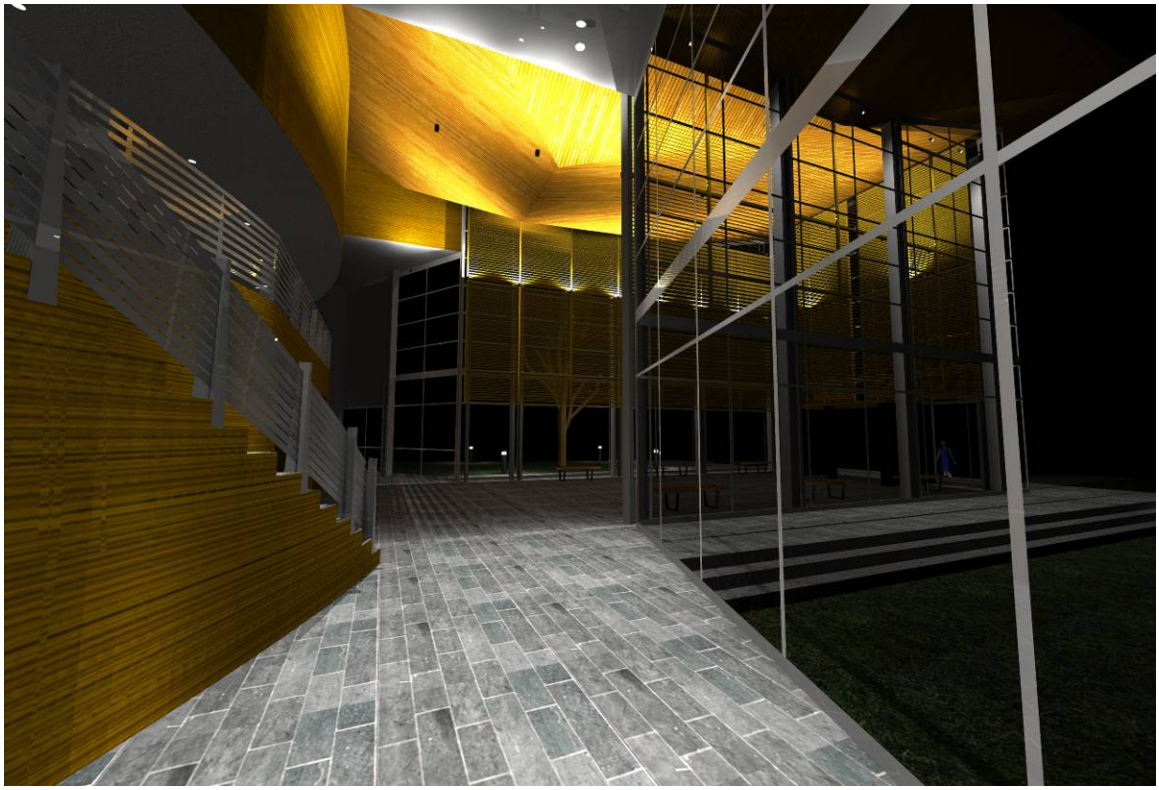




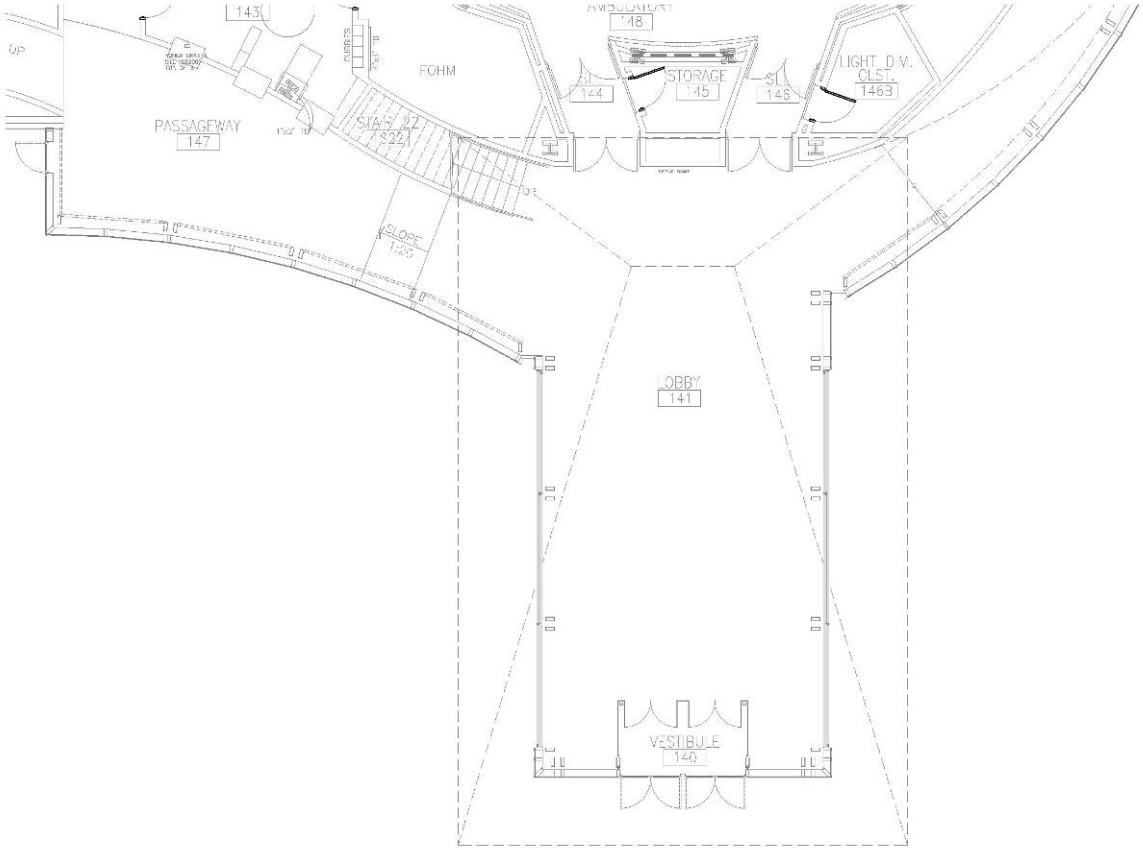


Figure 1.1 – Floorplan

Space Characteristics:

- Ceiling Height: 24' – 31' (pitched ceiling slopes up to exterior)
- Area: 1500 sq. ft. (Lobby, including vestibule)
- Area: 766 sq. ft. (Adjoining Passageway)
- Area: 650 sq. ft. (Balcony)
- Materials: aluminum, glass, wood shutters, slate tile flooring & stairs

Assumptions about the Space:

- 18 month cleaning cycle
- Very clean
- RCR: ~8
- Horizontal illuminance measured at floor level

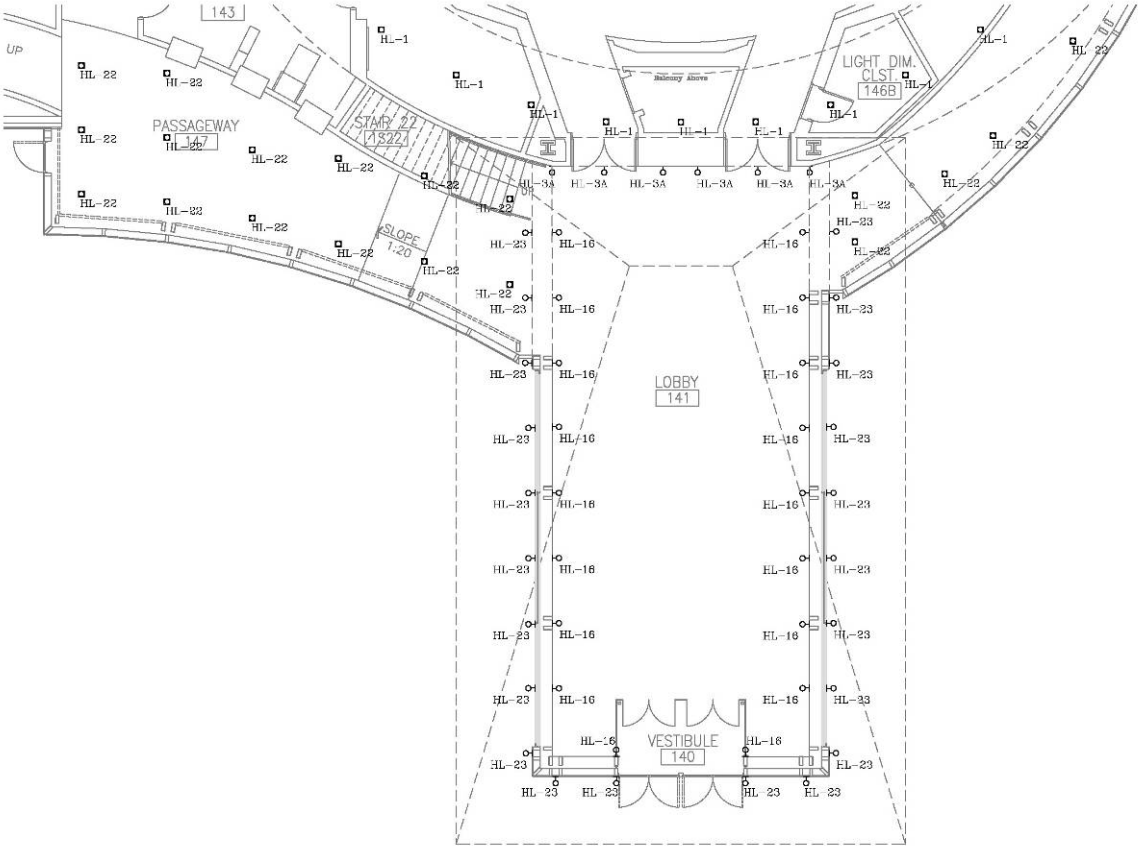


Figure 1.2 – Reflected Ceiling Plan (Existing Layout)

Light Loss Factors						
Fixture Type	Maintenance Category	LLD	LDD	BF	RSDD	Total LLF
HL-3A	V	1.00	0.90	1.00	0.96	0.86
HL-16	VI	1.00	0.89	1.00	0.88	0.78
HL-22	IV	1.00	0.92	1.00	0.96	0.88
HL-23	V	0.79	0.90	1.00	0.96	0.68

Table 1.1 – Light Loss Factors (Existing Layout)

Energy Modeling				
Fixture Type	Lamp Type	Count	Watts/Fixt	Total Watts
HL-3A	LV Halogen MR16	6	50	300
HL-16	Halogen Bi-Pin	18	350	6300
HL-22	Halogen Par Lamp	14	90	1260
HL-23 (ext)	CMH	22	48	1056
	Area=	2266	System=	7860
			LPD (w/sq.ft.) =	3.5

Table 1.2 – Energy Modeling Analysis (Existing Layout) - Note that the CMH fixtures are shown here, but are not counted against the lighting power density

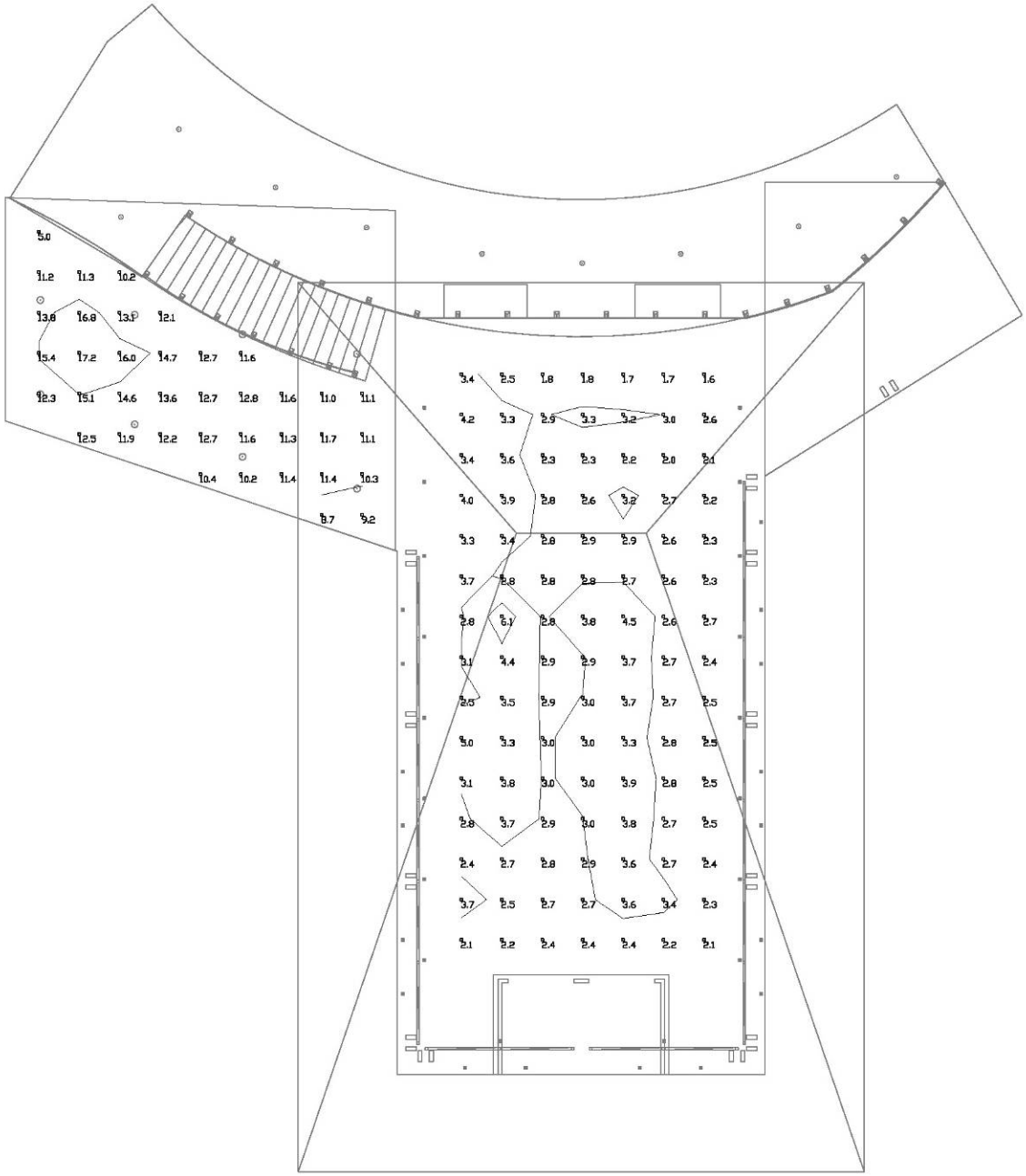


Figure 1.3 – Horizontal Illuminance Values & Isocontours

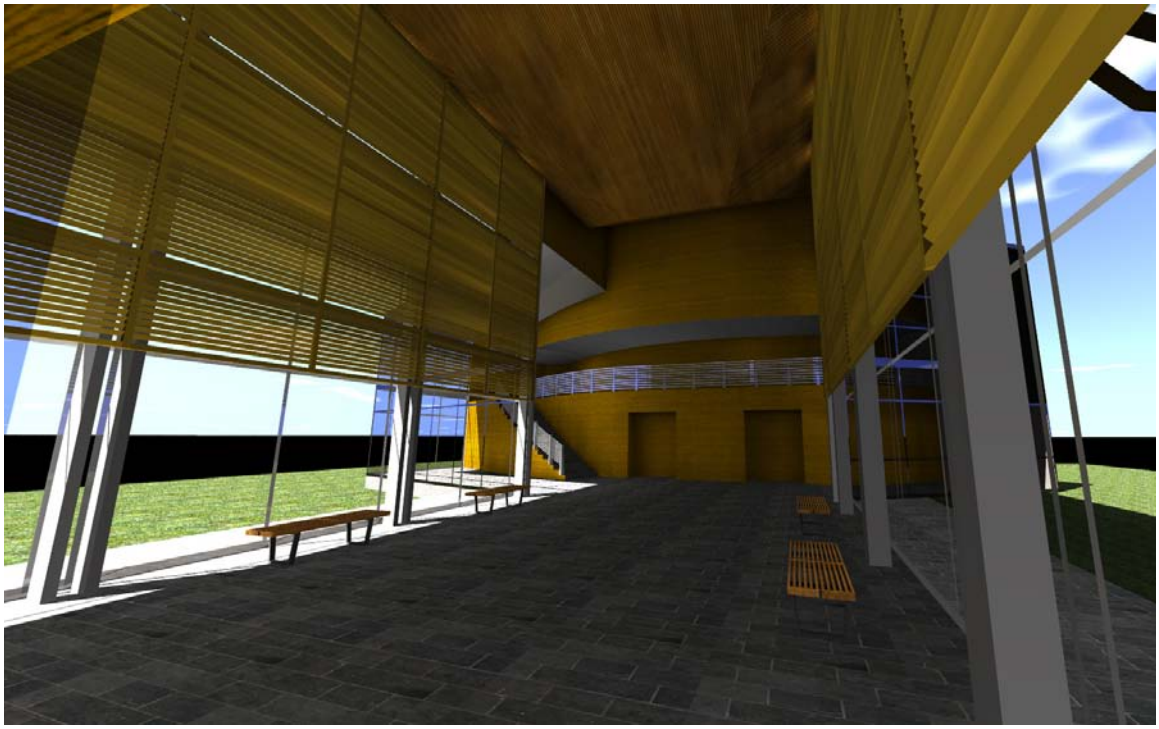
Illuminance Summary:

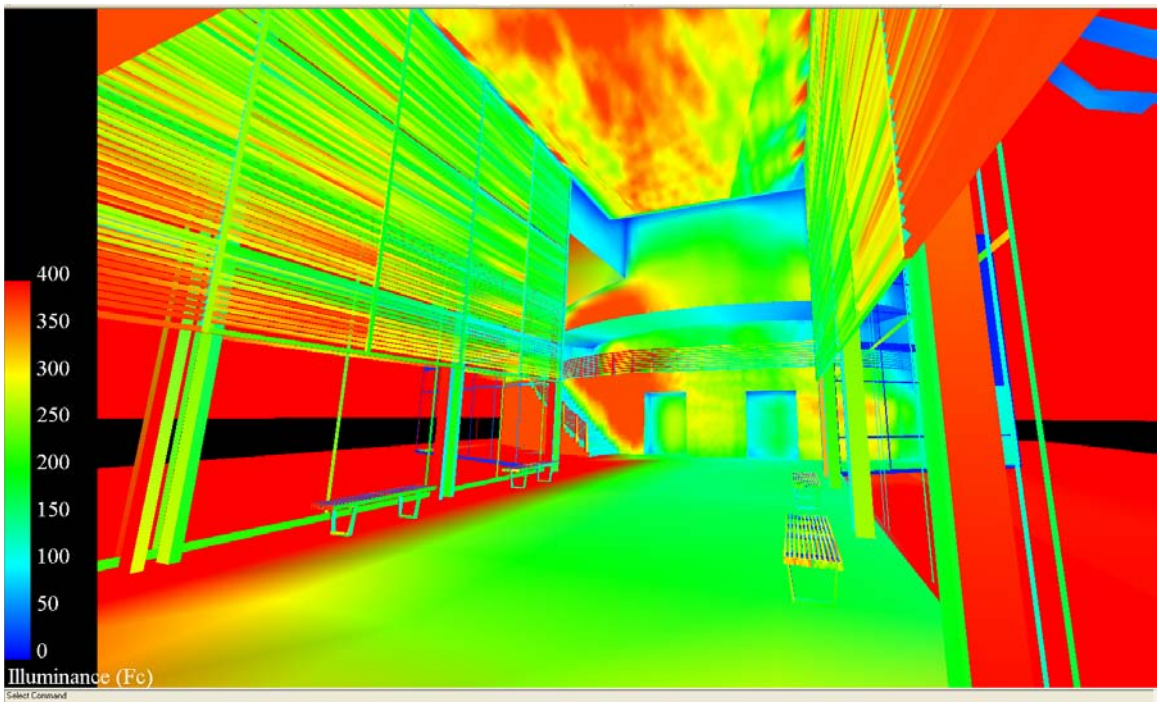
(Lobby)
Average Horizontal Illuminance: 2.92fc
Max/Min Ratio: 3.81

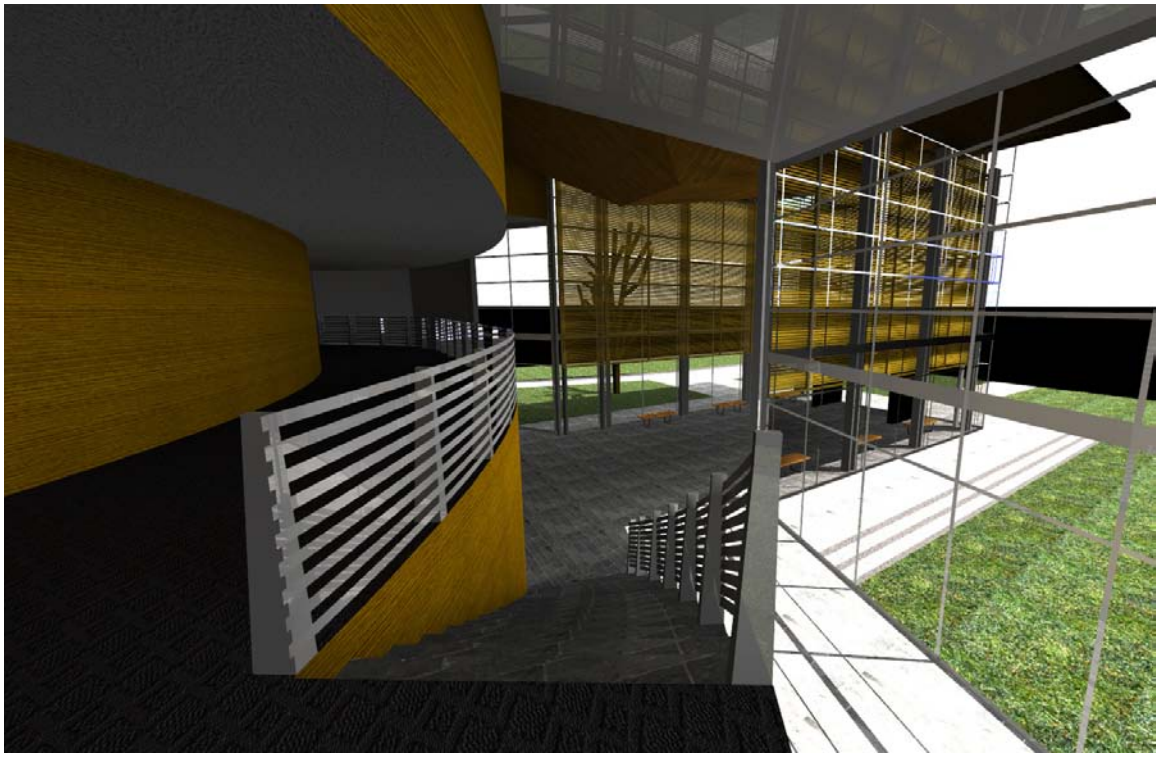
(Passageway)
Average Horizontal Illuminance: 12.2fc
Max/Min Ratio: 3.44

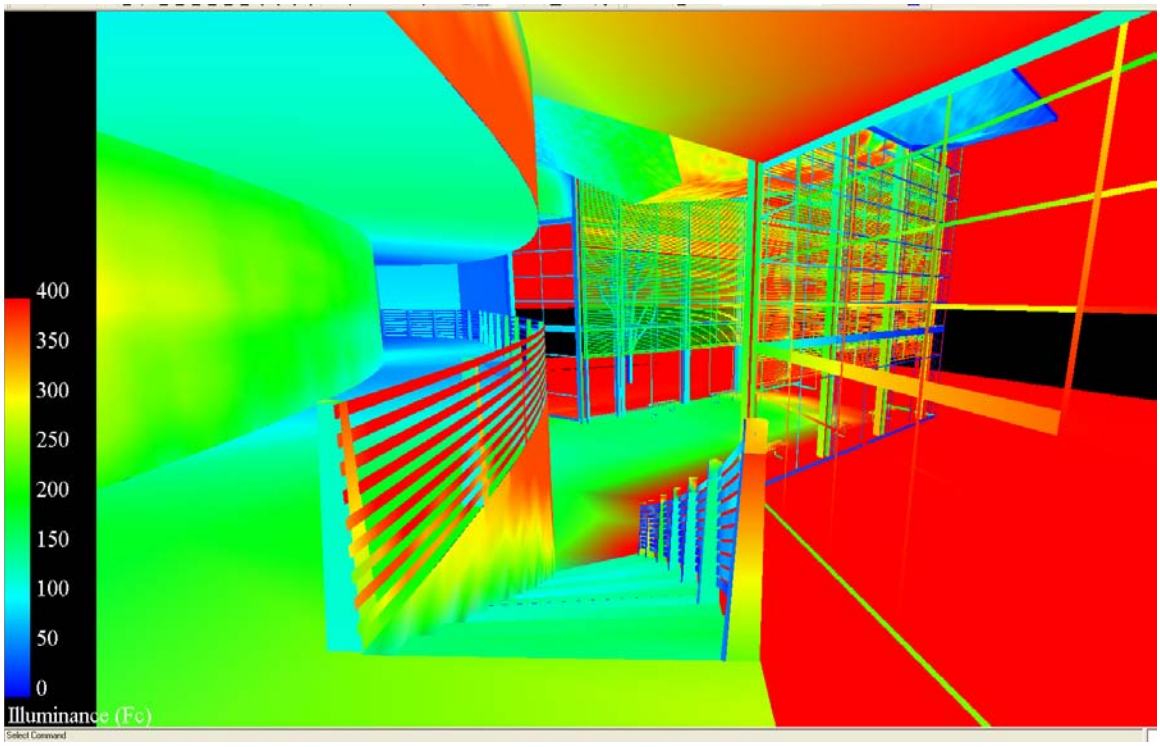
Daylighting Conditions:

(June 21st, 1pm, clear sky conditions)








400
350
300
250
200
150
100
50
0
Illuminance (Fc)

Design Criteria:

Illuminance Criteria - Illuminance requirements for the space are 10fc horizontal and 10fc vertical, according to IESNA Lighting Handbook illuminance criteria for lobby spaces.

Power Allowance - According to the Massachusetts Energy Code 780.CMR.Chapter13, which is compliant and in excess of ASHRAE Standard 90.1-2001, using the space-by-space method, the maximum allowable power allowance is 1.8w/ft^2 for the lobbies and 0.7w/ft^2 for the transition corridors, totaling 3236w.

Aesthetic Quality - The appearance of the space and its luminaires are the first impression a patron has when coming to a performance and is therefore very necessary to consider. Also necessary to consider is the extensive use of wood throughout the space. Warm tones should be used to bring out the warmth of the material.

Uniformity - Uniformity helps to maintain a smooth journey along the corridor. A break in this uniformity at the two lobbies and the grand staircase can help to build a hierarchy of spaces.

Modeling of Faces - Facial modeling will be important in the lobby so that patrons will look good to each other while they are waiting for performances to start or during intermission.

System Control & Flexibility - Flexibility might be nice in the southern lobby to match performance mood or time of day. Since this is the main entrance to the large 550 seat theatre, this entrance can have very dynamic lighting to impress the patrons as they walk in. During normal daytime use, the space would only really need appropriate task lighting to make up for overcast days.

Daylight Integration & Control - There's a significant amount of daylight that penetrates into the space from the east side of the corridor from a continuous strip of windows and a skylight above the central section of the corridor. The southern entrance lobby, in particular, has all three sides made of glass. Energy savings are quite possible all throughout these spaces, as is seen from the previous daylight modeling simulation, showing extremely high illuminance values during the day.

New Design:

Design Concept Narrative:

The design concept, which was paramount to this entry lobby, was the idea of a glowing glass box, which would attract attention from the cars and pedestrians as they passed along the main street of Williamstown. To increase the phenomenological impact of the space, my design seeks to maintain the architectural concept for the outside of the space, a glowing glass box that can be seen from the street, and then create an interior space that's drastically darker than expected. The decrease in lighting levels and the use of blue and purple color tones will set the tone for the audience members as they enter the space, calming them and putting them in a mindset of thoughtful introspection.

To achieve this concept in the space and to attempt to achieve allowable lighting power density values, I intend to implement the following:

1. *Install LED strip light projectors between wood shutters and glass facade*. The current ceramic metal halide downlights that are being used to illuminate the wood shades, visible from the exterior of the building, can be replaced by linear LED projectors that have a much longer lifespan and provide a more even wash of light, without sacrificing vertical luminance values.

2. *Provide very minimal ambient lighting in the main area of the lobby*. With the main purpose of the space to be an entry portal to the theatre inside, it seemed to be counter-productive to draw the attention of the occupants of the space up to the ceiling or the floor. The focus of the space can be on the entry doors of the theatre and elsewhere, where necessary.

3. *Add a system of fiberoptics in the ceiling to mimic a night sky.* The night sky is added as a metaphor to the building's environmentally conscious architecture, while providing just enough light necessary for the occupants in the space. The application of fiberoptics in this capacity significantly reduces the lighting levels in this area of the space, matching the desired effects of the space and maintaining the phenomenological impact.

4. *Add low voltage spots at 45 degrees above and to the sides of the entry doors.* In the theatre, the best location to light a speaker from is at 45 degrees horizontal and 45 degrees vertical. Whether there are attendants taking tickets from occupants or not, these spots will mimic the theatrical experience awaiting inside, creating either an evenly lit attendant or an emphasized aura around the doors.

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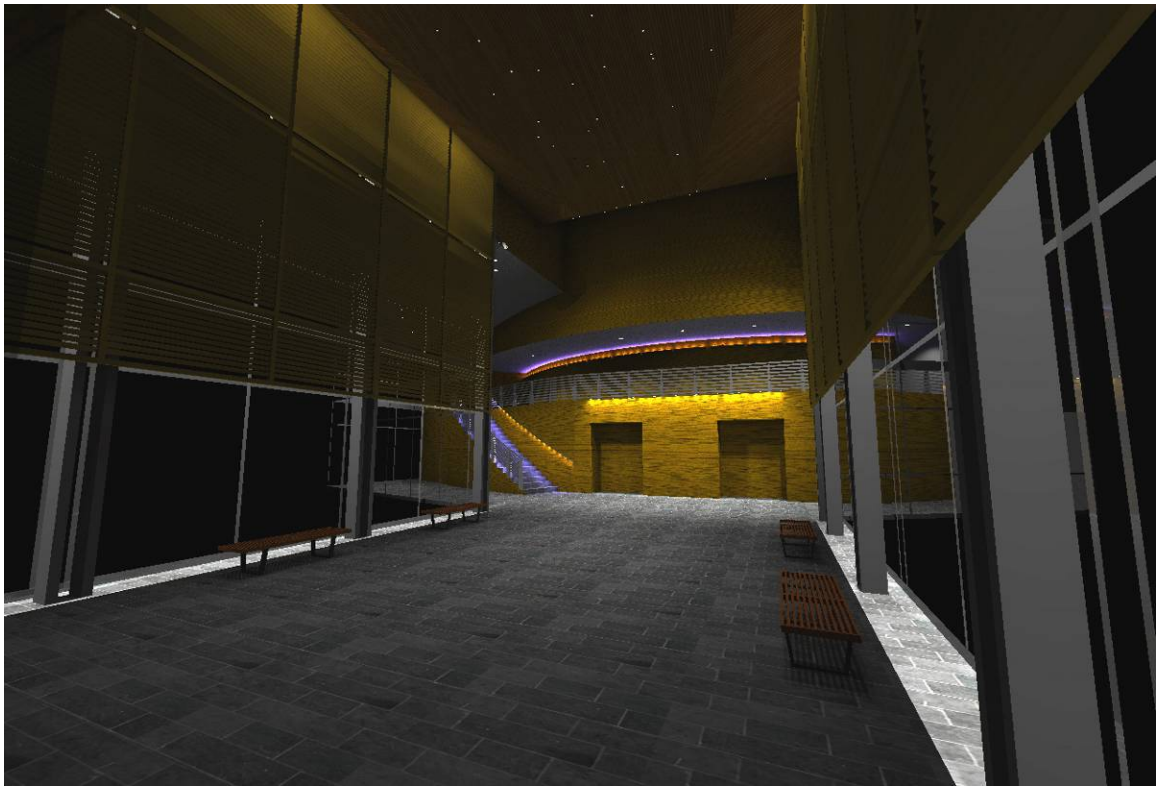
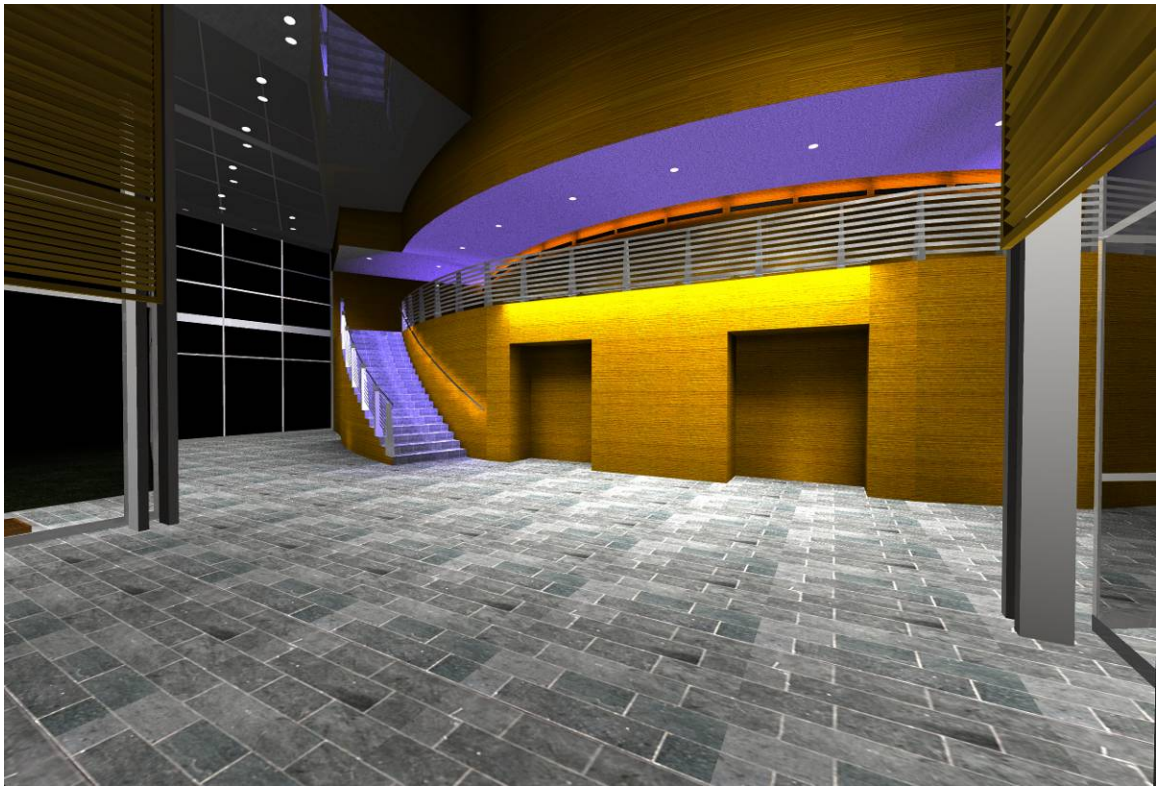
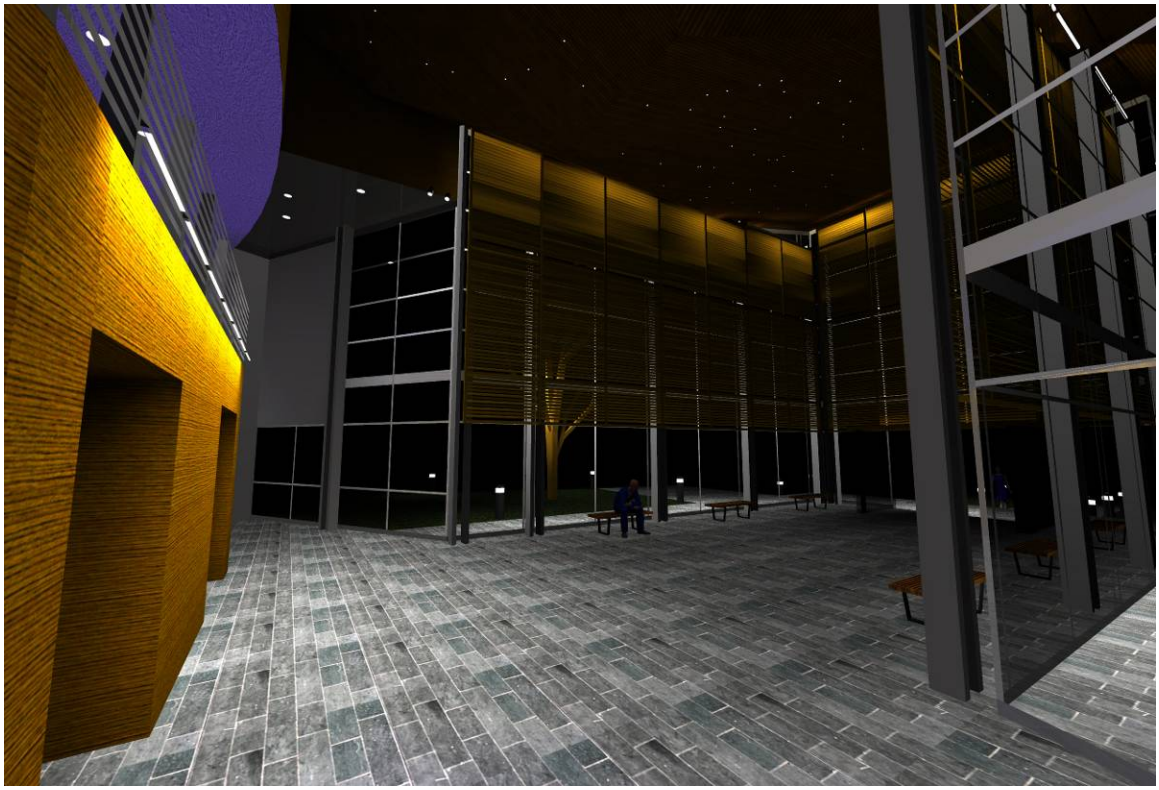
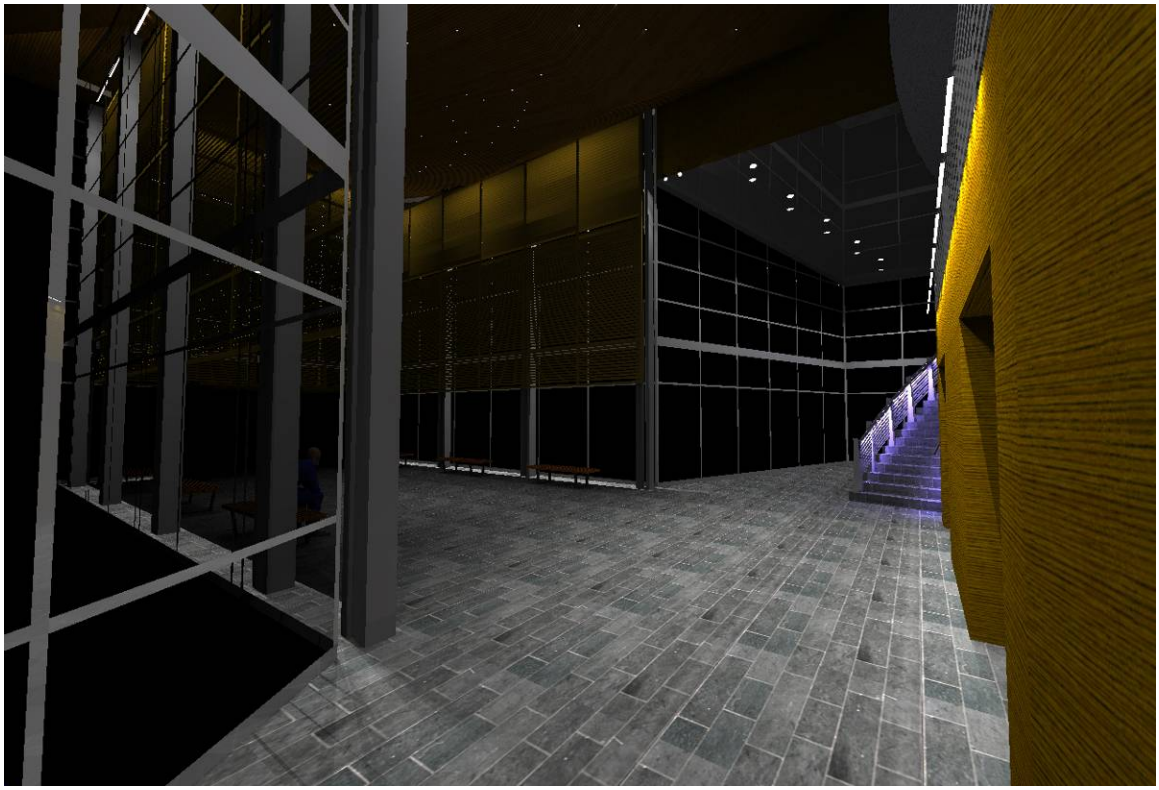
Williamstown, MA









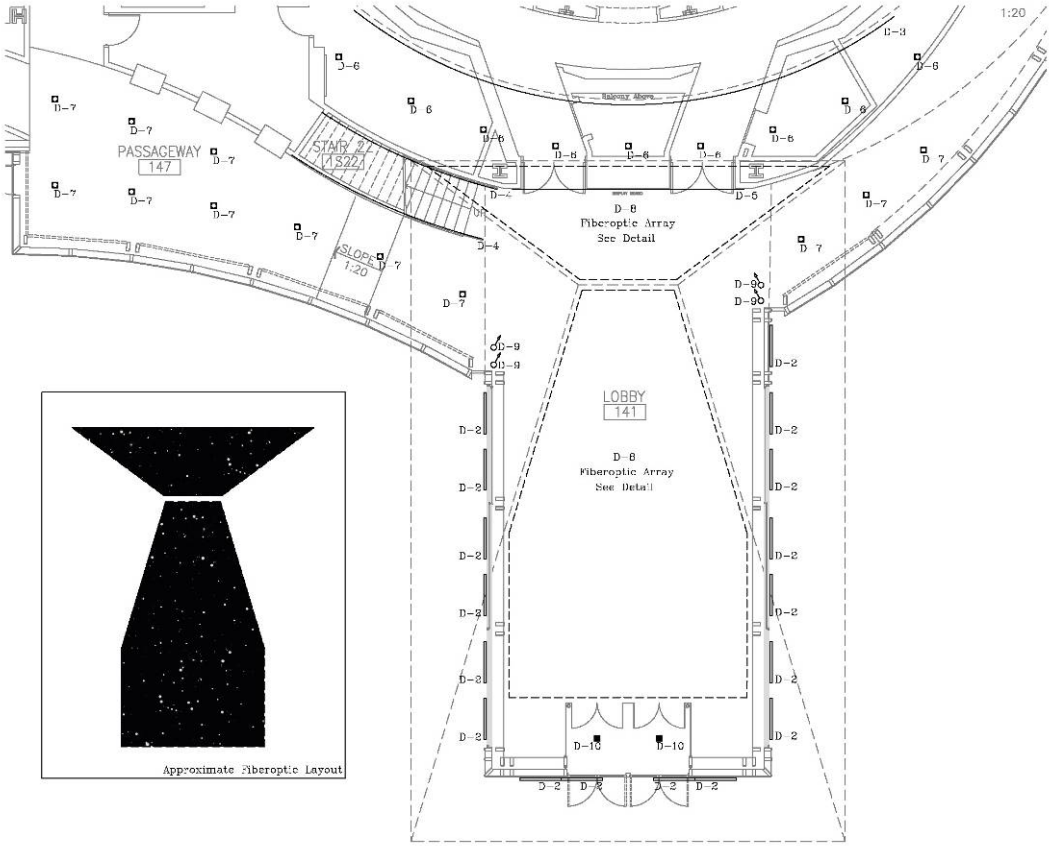


Figure 1.4 – Reflected Ceiling Plan (New Layout)

Light Loss Factors						
Fixture Type	Maintenance Category	LLD	LDD	BF	RSDD	Total LLF
D-2	V	1.00	0.90	1.00	0.96	0.86
D-3	VI	1.00	0.89	1.00	0.96	0.85
D-4	V	1.00	0.90	1.00	0.96	0.86
D-5	V	1.00	0.90	1.00	0.96	0.86
D-6	IV	0.85	0.91	1.00	0.96	0.74
D-7	IV	0.85	0.91	1.00	0.96	0.74
D-8	I	0.90	0.96	1.00	0.96	0.83
D-9	IV	0.95	0.91	1.00	0.96	0.83
D-10	IV	0.85	0.91	1.00	0.96	0.74

Table 1.3 – Light Loss Factors (New Layout)

Energy Modeling				
Fixture Type	Lamp Type	Count	Watts/Fixt	Total Watts
D-2	LED (ext)	17	48	816
D-3	LED	56	1.15	64.4
D-4	LED	40	8	320
D-5	LED	23	8	184
D-6	CFL	9	28	252
D-7	CFL	12	28	336
D-8	Halogen	3	71	213
D-9	LV MR16	4	50	200
D-10	CFL	2	22	44
	Area=	2916	System=	1613.4
			LPD (w/sq.ft.) =	0.6

Table 1.4 – Energy Modeling Analysis (New Layout)

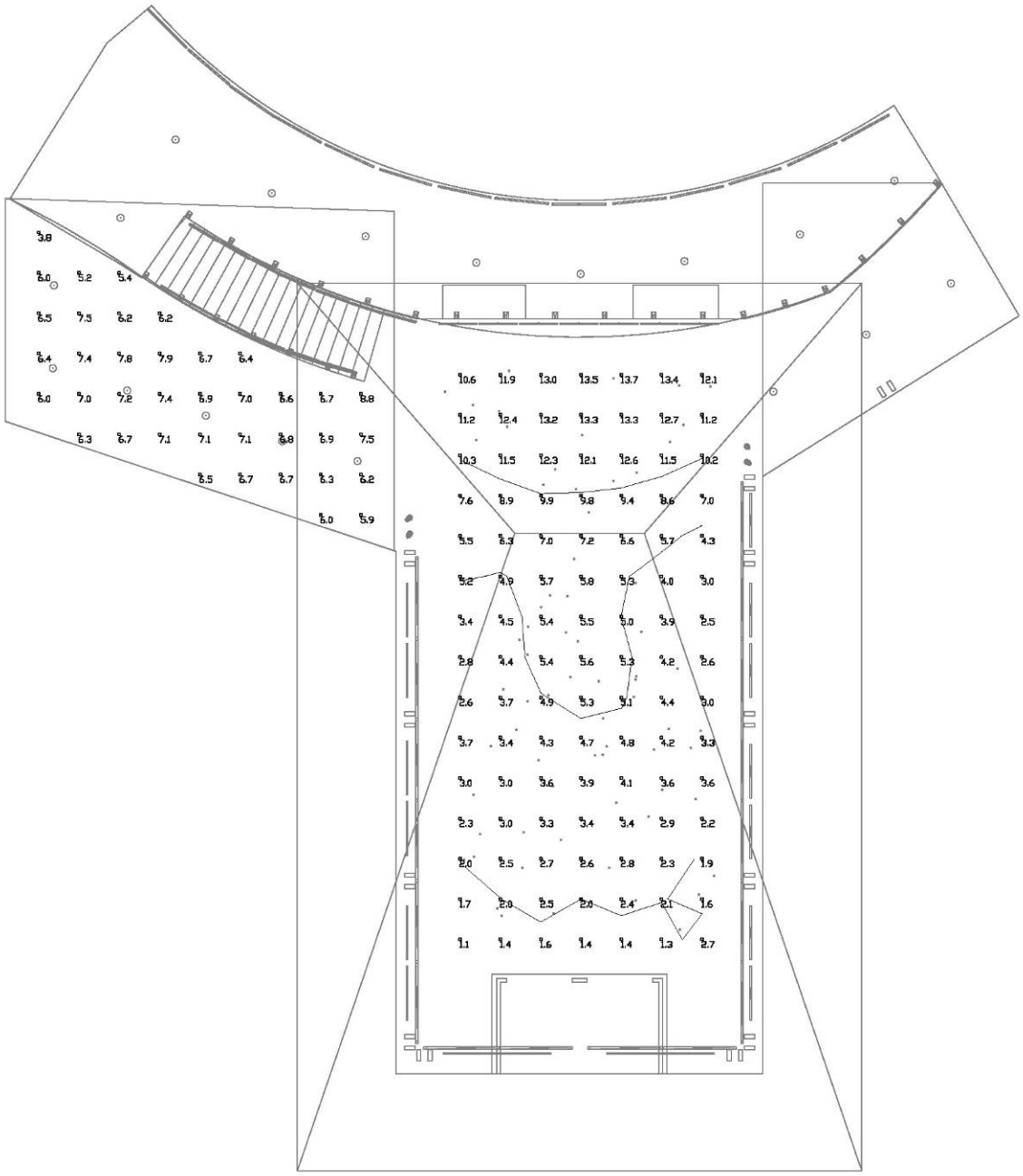


Figure 1.5 – Horizontal Illuminance Values & Isocontours

Illuminance Summary:

(Lobby)
Average Horizontal Illuminance: 5.6fc
Max/Min Ratio: 9.8

(Passageway)
Average Horizontal Illuminance: 6.7fc
Max/Min Ratio: 2.3

Summary of Design:

The design in this space provided illumination that ranged from 3 to 13 fc, from the entrance to the theatre doors at the other end of the lobby. This increase in light, coupled with the MR16 spotlights illuminating the vertical surfaces of the theatre doors, creates a path of light that draws the occupants towards their destination. Visual hierarchy of the space was defined, keeping the illuminance levels in other paths, such as the passageway to the left and the corridor to the right, at a level lower than that of the theatre doors.

The phenomenological aspects of the design were realized with the addition of the star field sky and the purple wash on the ceiling of the balcony and from the staircase leading to the upper balcony seating area. The purple illumination on the stairs provides visual interest and links the image of these stairs with the idea of the upstairs balcony, providing psychological direction.

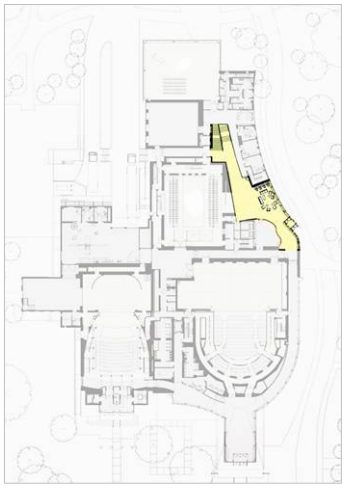
Although not shown, illuminance levels on the stairs ranged between 5 and 10 fc, adequate illuminance for safety code.

Including the fact that much of the lighting in the space has been provided with compact fluorescent and LED sources, I believe the overall system has a very available efficiency. The actual LPD of the space is 0.6, well below the allowable $1.8w/ft^2$. Expanding this concept of energy efficiency to the entire building could help in achieving valuable points on the LEED rating scale, should such an endeavor been warranted.

It should be noted that the downlights in the entry, on both the interior and exterior faces of the building façade have been left out of the analysis, as they are not direct components to the design. In a complete design of the space, these compact fluorescent downlights would need to be included for fire safety compliance. 9 or 18w CFL downlights would be sufficient and are negligible in the LPD calculation.

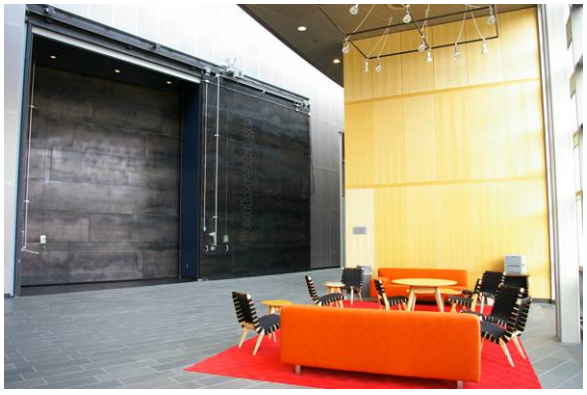
Space 2: Center Stage Lobby (A special purpose space)

General Summary:



Located just outside the Center Stage black box theatre and in the middle of a long hallway that winds through the entire length of the building, the Center Stage lobby marks the point at which the architect has chosen to change the use of materials from a warm wood glow to a more harsh and technical steel and aluminum. This change was characterized as personifying the learning experience as you travel to the "back of the house" of the theatrical world, where things aren't quite as warm and beautiful as the end result on stage. This breakout space also serves as one of the three entrances to the new construction portion of the building and has quite and extensive square footage of glass, both along the perimeter wall and at the skylight in the ajoining corridor to the north west.

The activities that occur in this space are primarily walking, viewing of artwork, reading, and writing. Careful attention will need to be taken when determining fixture choices in this space to appropriately change the mood of the corridor with the change in material.



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Existing Conditions:

Lighting - The center stage lobby, located in the center of the hallway that runs throughout the building, has a series of MR16 accent lights suspended above the tables and lounge chairs. General lighting is provided by compact fluorescent downlights, coming out of the adjoining corridor, and by multi-head halogen PAR lamps, through the area with the skylight. There is a series of compact fluorescent wallwashers that light the wall at the entrance to the emergency exit stairwell.

Controls - All luminaires in the Center Stage breakout lobby are connected to dimming rack DR4 through the building management system. Scene control and zoning are also controlled through the central building management system and integrates a time clock and open loop photosensor control.

Space Properties – The Center Stage lobby has wood paneling on the exterior walls, with a reflectance value of approximately 45%, and light grey punched metal paneling on the interior walls and ceiling, with a reflectance value of approximately 60%. In the corridor to the north of the Center Stage lobby, there's a skylight above made of fritted glass, with an estimated transmittance value of 0.70. The floor is made of slate tile with an approximate reflectance value of 33%. Furniture within the space can be seen in the previous photos, but most likely does not have a very long lifespan in the building, so designing to these colors and fabrics is probably not ideal.

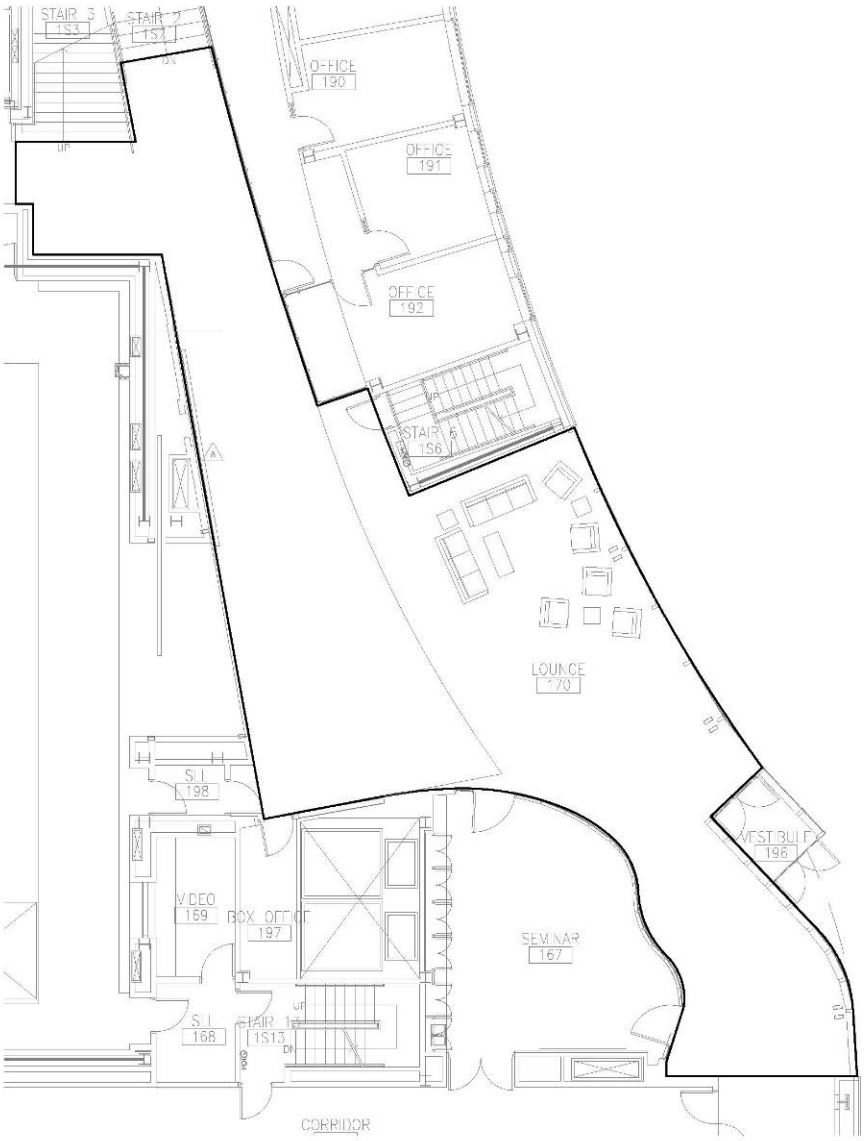

Figure 2.1 – Floorplan

Space Characteristics:

- Ceiling Height: 31' (at skylight), 25' (at ceiling)
- Area: 2220 sq.ft.
- Materials: aluminum, glass, aluminum paneling, fritted skylight glazing

Assumptions about the Space:

- 18 month cleaning cycle
- Very clean
- RCR: ~ 7.5
- Horizontal illuminance measured at floor level

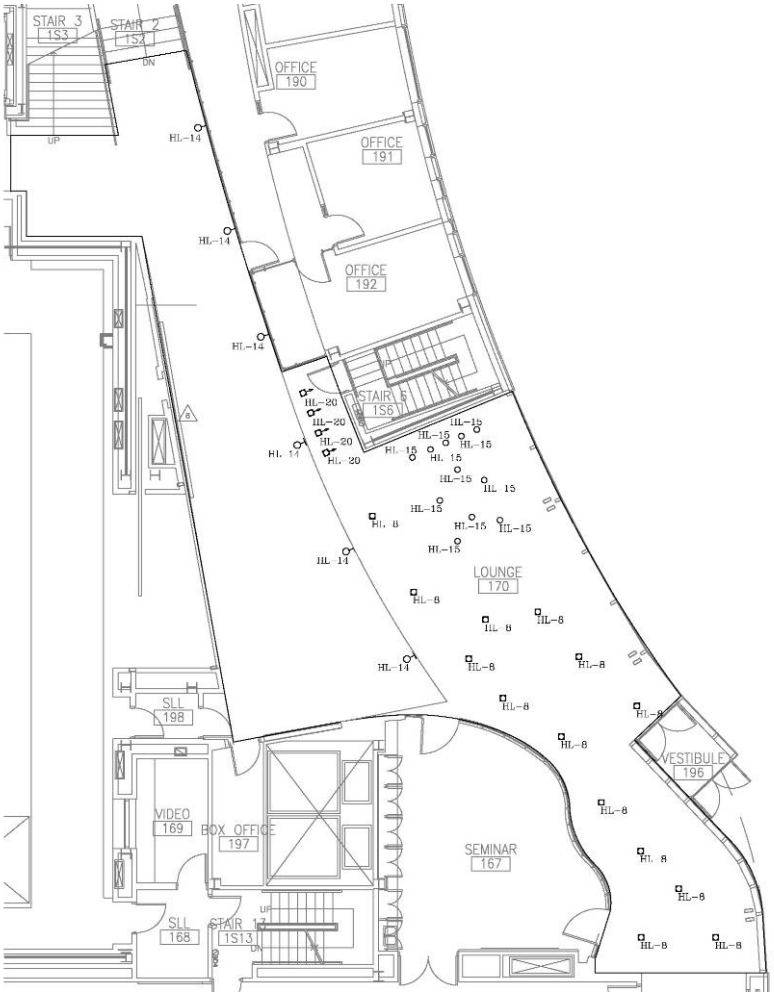

Figure 2.2 – Reflected Ceiling Plan (reference appendix for luminaire types)

Light Loss Factors						
Fixture Type	Maintenance Category	LLD	LDD	BF	RSDD	Total LLF
HL-8	IV	0.85	0.92	1.00	0.97	0.76
HL-14	I	0.97	0.95	1.00	0.97	0.89
HL-15	I	0.97	0.95	1.00	0.97	0.89
HL-20	IV	0.85	0.92	1.00	0.97	0.76

Table 2.1 – Light Loss Factors (Existing Layout)

Energy Modeling				
Fixture Type	Lamp Type	Count	Watts/Fixt	Total Watts
HL-8	42w CFL	14	46	644
HL-14	Halogen Par	7	90	630
HL-15	Halogen Par	11	90	990
HL-20	42w CFL	4	46	184
	Area=	2220	System=	2448
			LPD (w/sq.ft.) =	1.1

Table 2.2 – Energy Modeling Analysis (Existing Layout)

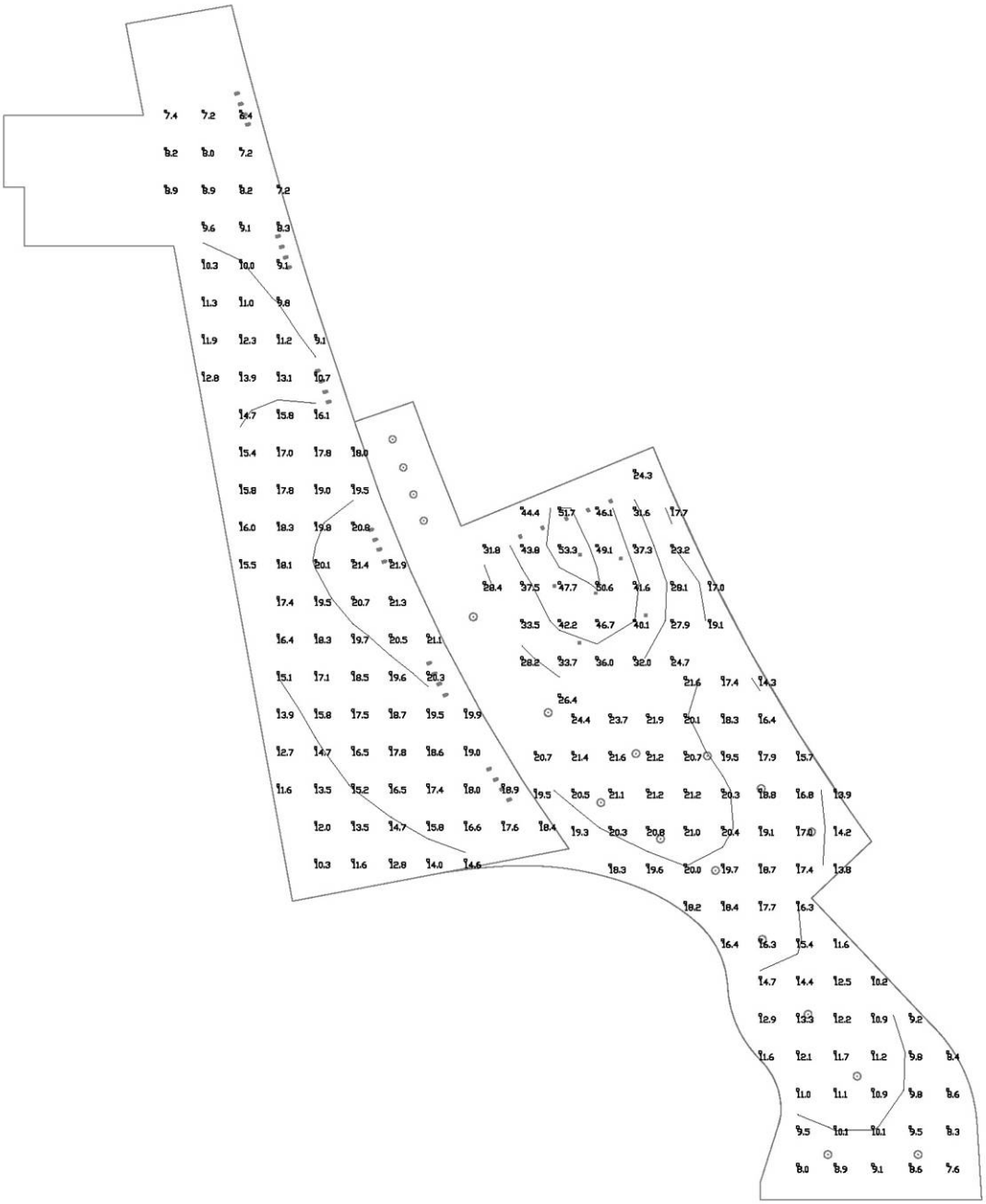

Figure 2.3 – Illuminance Levels and Isocontours

Illuminance Summary:

- Average Horizontal Illuminance: 15fc (below skylight)
- Average Horizontal Illuminance: 36fc (lounge/breakout space)
- Average Horizontal Illuminance: 17fc (corridor)

Design Criteria:

Illuminance Criteria - Illuminance requirements for the space are 10fc horizontal and 10fc vertical according to IESNA Lighting Handbook illuminance criteria for lobby spaces. Because it is likely that there may be reading and writing tasks, as students take advantage of the available tables and chairs, horizontal illuminance levels in this are should be increased to at least 30fc.

Power Allowance - According to the Massachusetts Energy Code 780.CMR.Chapter13, which is compliant and in excess of ASHRAE Standard 90.1-2001, using the space-by-space method, the maximum allowable power allowance for this space is 1.8w/ft^2 (w), considering the space to be a general lobby, with an additional 1.0w/ft^2 for accent lighting on artwork.

Aesthetic Quality - The architecture of the building is very respectful of the ideals of the environment, highly infused with wood and slate floors, naturally occurring environmental material. To preserve this original intent, the light fixtures should either meet this requirement or be hidden so the light emanates from the architecture itself. Visual aesthetics can still be obtained, which is definitely an important characteristic of the space, through dynamic lighting and contrasting vertical surfaces.

Uniformity - The space will have a significant amount of daylight during the day, which may or may not be very uniform, due to the glazing being clear. Non-uniformity may actually help to increase the aesthetic appeal of the space.

Modeling of Faces - It is important in a space like this, where people are expected to meet and speak with one another on a very regular basis, to have good facial modeling.

System Control & Flexibility - Flexibility in this space is very important, as the range of uses changes drastically. At different times, the space may be used as a study lounge, a mere corridor, or a main entrance for theatrical performances.

Daylight Integration & Control - The infusion of daylight into the space requires some type of control in order to maximize the efficiency of these systems in the building. With an expansive skylight that fills the entire ceiling of the north-west corridor and the clear glazing curtain walls on the east side of the space, significant amounts of daylight will penetrate this space during the day. For most of the year, the lights can probably be kept off due to the large amount of daylight in the space. Also an issue, during the nighttime, the skylight well will be very dark unless somehow lit to open up the space again.

New Design:

Design Concept Narrative:

The design of this space is important, as this is where the architect has chosen to change the use of materials in the corridor. The space is also unique in that it is both a corridor and a lounge, requiring two layers of lighting. There needs to be higher illuminance levels around the lounge chairs and tables to give people the opportunity to do their homework or read. The two tall empty walls behind the lounge area are great locations for paintings or posters about upcoming shows. An important consideration for illumination in this space is the large skylight. By illuminating this during the evening, it will open up the space and give it a much lighter atmosphere; more conducive to the naturalist quality of the architecture. Since the mounting height for any luminaires in this are is extremely high, a source with a long lifespan would be necessary.

To meet this concept and requirements, the following design will:

1. *Install compact fluorescent lighting throughout the corridor.* Compact fluorescents are highly energy efficient and provide adequate light in high ceiling applications.

2. *Add a warmer source lamp above the lounge area*. MR16 lamps will provide a little more sparkle and a warmer glow to this area, setting it apart from the rest of the transition space. The stronger cutoff of these sources will also help to delineate between lounge and corridor, hopefully helping to direct traffic through the space.

3. *Provide wallwashers for both walls where hanging is available*. The wallwashers allow for artwork to be hung and adds illuminance to the area around the lounge.

4. *Install LED linear projectors to illuminate the skylight well*. By illuminating this skylight well, the space opens up at night and feels much larger than if they skylight well were dark. An LED source wont need to be relamped like a halogen source would and thus reduces maintenance requirements in such a difficult space.

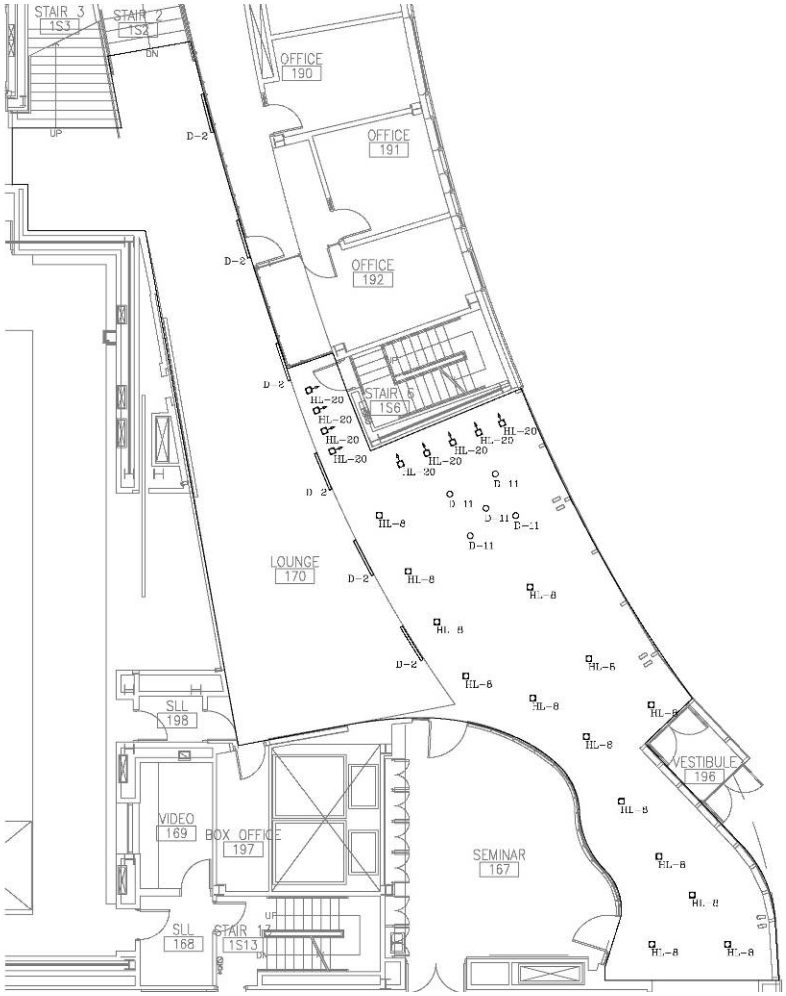

Figure 2.4 – Reflected Ceiling Plan (reference appendix for luminaire types)

Light Loss Factors						
Fixture Type	Maintenance Category	LLD	LDD	BF	RSDD	Total LLF
HL-8	IV	0.85	0.92	1.00	0.97	0.76
HL-20	IV	0.85	0.92	1.00	0.97	0.76
D-2	V	1.00	0.90	1.00	0.97	0.87
D-11	IV	0.85	0.91	1.00	0.97	0.75

Table 2.3 – Light Loss Factors (New Layout)

Energy Modeling				
Fixture Type	Lamp Type	Count	Watts/Fixt	Total Watts
HL-8	42w CFL	13	46	598
HL-20	42w CFL	9	46	414
D-2	LED	6	48	288
D-11	50w MR16	5	50	250
	Area=	2220	System=	1550
			LPD (w/sq.ft.) =	0.7

Table 2.4 – Energy Modeling Analysis (New Layout)

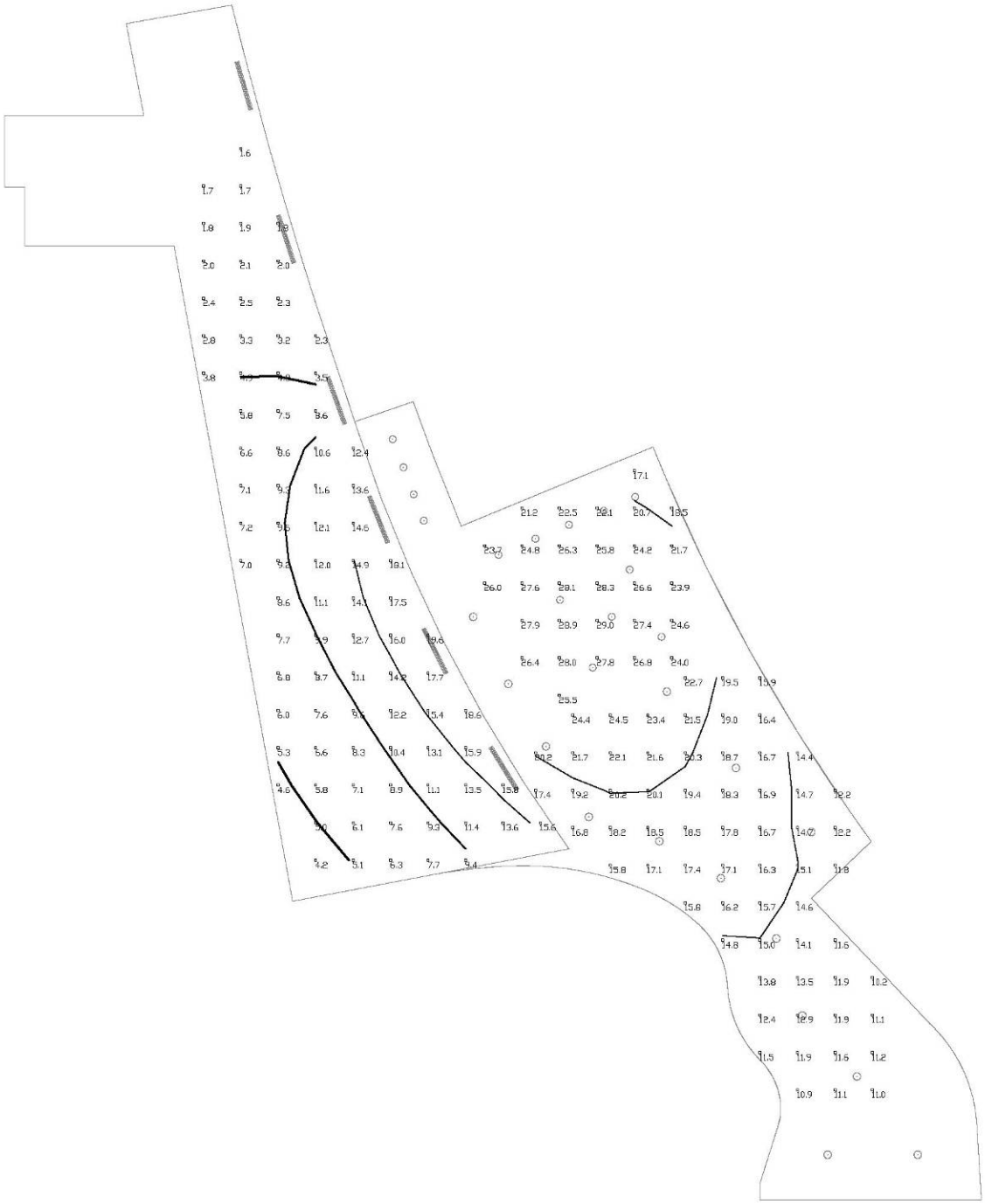

Figure 2.5 – Illuminance Levels and Isocontours

Illuminance Summary:

- Average Horizontal Illuminance: 8.6fc (below skylight)
- Average Horizontal Illuminance: 27fc (lounge/breakout space)
- Average Horizontal Illuminance: 16fc (corridor)

Summary of Design:

The Center Stage lobby and breakout space provided me the opportunity to maintain the concept of the building as a natural expression. All fixtures are recessed, either downlights or wallwashers, and the LED projects that illuminate the skylight well are made from round extruded aluminum and provide good contrast to the sharp edges where the ceiling height changes. Illuminance levels meet the desired requirements for each area, increasing around the lounge chairs and tables to provide more light for reading and writing.

Conceptually, the lighting levels help to provide the originally intended variation of spaces. There was a significant need for visual hierarchy in the space to define it different from just chairs in a corridor. Adjustable downlights could have been specified to provide flexibility, but the dimensions of the space don't provide very much movement away from the initial location of the furniture, making the adjustable portion somewhat unnecessary.

Space 3: Dance Rehearsal Studio (A large work space)

General Summary:

Located on the second floor of the North West corner of the building is a 3200 sq.ft. (65'x50') dance rehearsal studio that is surrounded on three sides by soaring glass curtain walls with an impressive view of the rolling landscape. There's 27 feet from floor to ceiling, which takes the room straight to the underside of the roof, leaving the mechanical and lighting systems exposed overheard, while maximizing the volume of the space. The fourth wall of the space, which isn't made of glass, is covered with eight foot tall mirrors and acoustical panels.

Tasks that will most likely occur in this space are very active, including dancing, aerobics, physical presentations, and theatrical rehearsal. These tasks require an amount of light to comfortably see and perform, similar to a gymnasium or other athletic facility, but can be reduced because the primary equipment being used in the space is the human body. Consideration needs to be placed on the need for theatrical performance lighting in the space to mimic an actual stage for rehearsal purposes. Also, including this second layer of lighting creates a much more dynamic space and could be used for informal performances should the need arise from other performance spaces being in use. Since most of the walls in the room are glass or mirrors, both the view from the exterior and the direction and spill of light within the space need to be carefully considered, as they will have a serious impact on the overall composition of the space.

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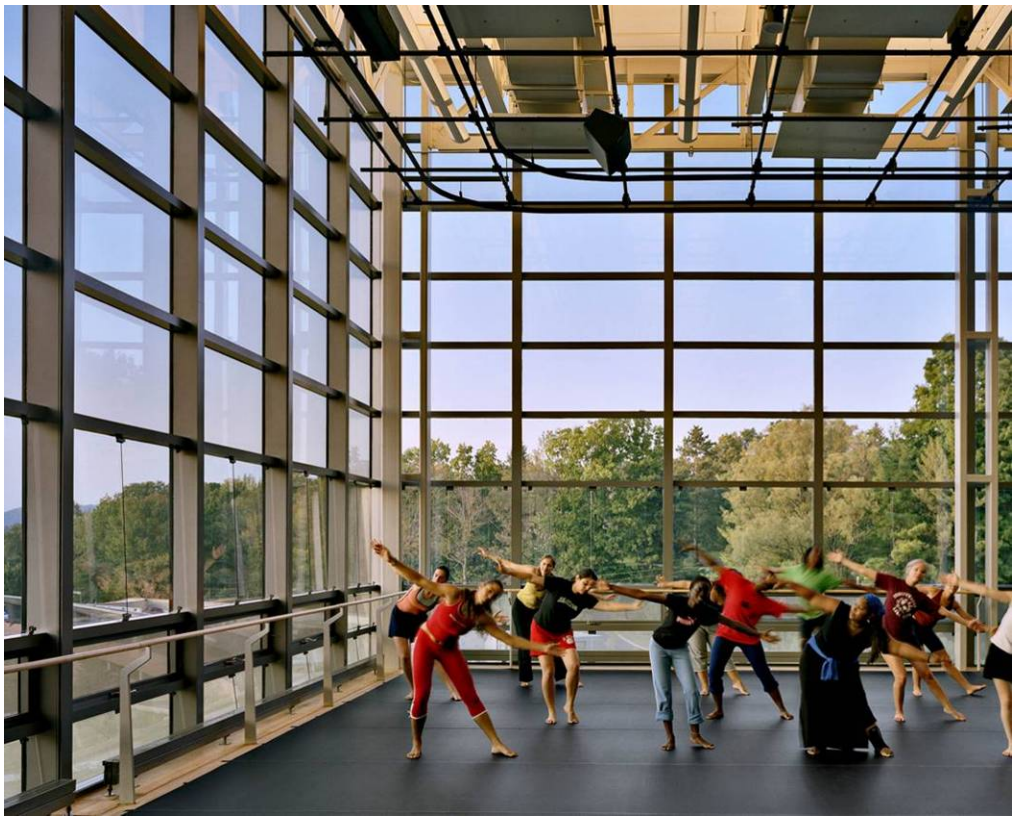


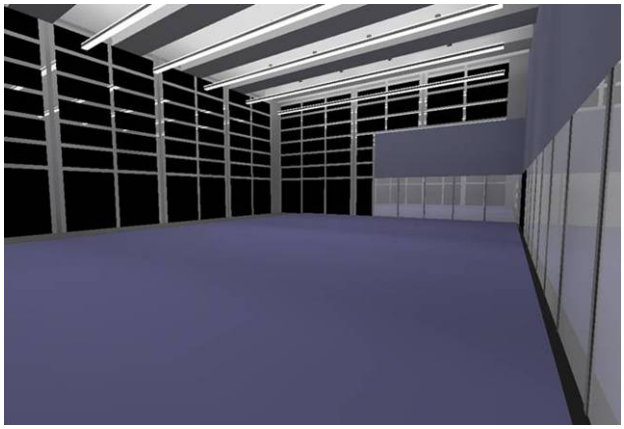
Existing Conditions:

Lighting - In the dance rehearsal studio, there are two major permanent lighting systems and one variable pipe-mounted theatrical lighting system. The two permanent lighting systems consist of an indirect linear fluorescent system and a Halogen canister downlight system. Cut sheets for the luminaires and ballasts in these systems are provided at the end of this space's section.

Controls - These systems are controlled on two separate systems within the room. The linear fluorescent pendants are switched along the east wall after the mirrors by five keyed switches and are separated into bi-level switching on two zones: a west zone and an east zone, each consisting of 3 rows of luminaires. The second control system in the space is for the halogen downlights. These are controlled by a dimmer switch on the wall directly to the right of the entry doors that is connected to a dimmer rack located in room 090. The downlights are controlled separately through the dimmer rack in rows for a total of five separate dimmers, allowing for a high level of flexibility in the space. There is also a manually-controlled blackout-shade system on all three curtain walls, allowing the space to be used for performance practice at any time of the day.

Space Properties - The vertical surfaces of the space are primarily made of glass and mirrors. The glass in the space, made of clear glazing, has a transmittance value that was calculated using an illuminance meter to be approximately 0.62. The mirrors in the space are eight foot tall continuous mirrors. All other walls within the space are made of acoustical panels that are light blue in color, with an approximate reflectance of 36%. The floor is made of sprung wood paneling and is usually covered with a medium blue exercise mat that is approximately two inches thick and approximately 15% reflective. The structural trusses and overhead mechanical system are both visible above the unfinished ceiling. Ductwork is a matte brushed aluminum, assumed approximately 50% reflectance and has some specularity to it.

Rendering (West)



Rendering (East)

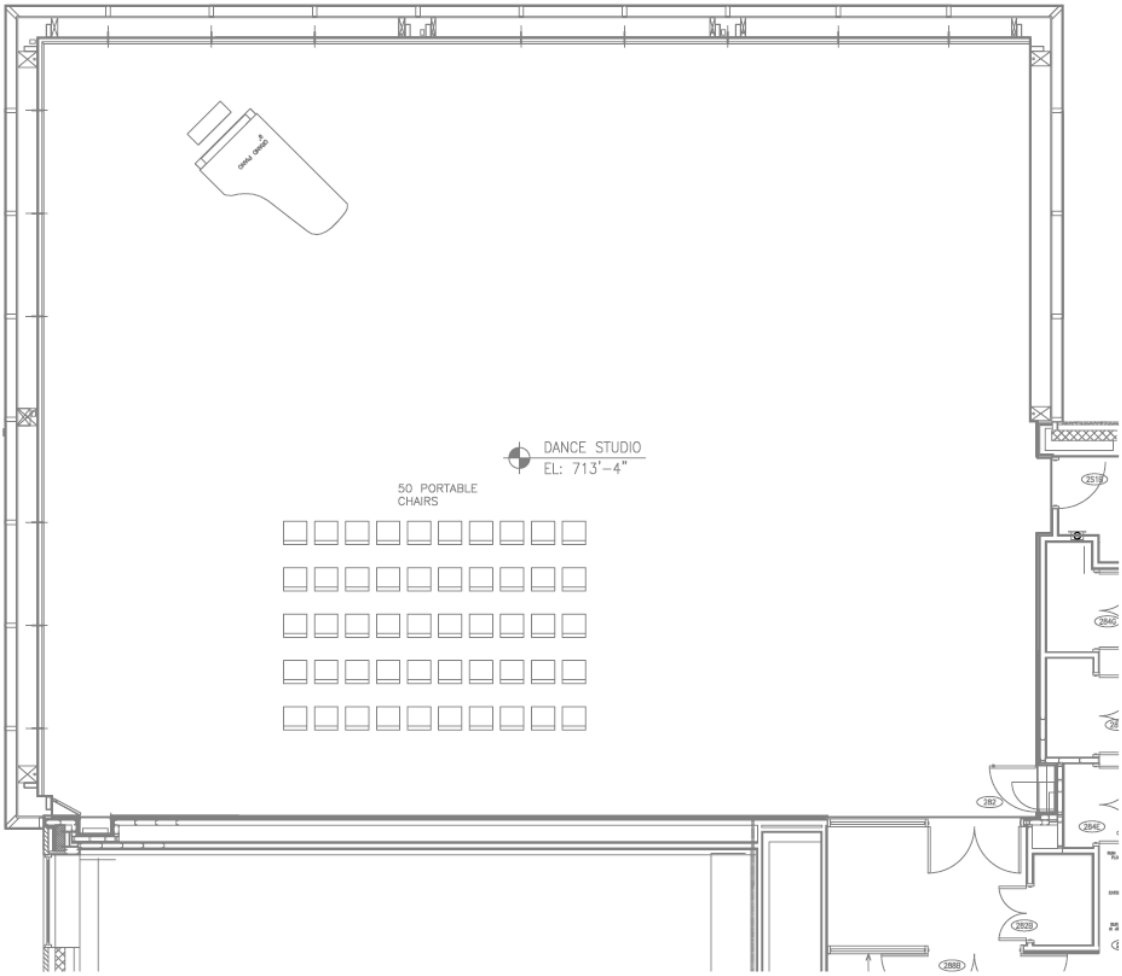


Figure 3.1 – Floorplan

Space Characteristics:

- Ceiling Height: 27'
- Area: 3250 sq. ft.
- Materials: Aluminum, Glass, Wood, Acoustical Wallboard

Assumptions about the Space:

- 18 month cleaning cycle
- Very clean
- RCR: ~5
- Horizontal illuminance measured at floor level

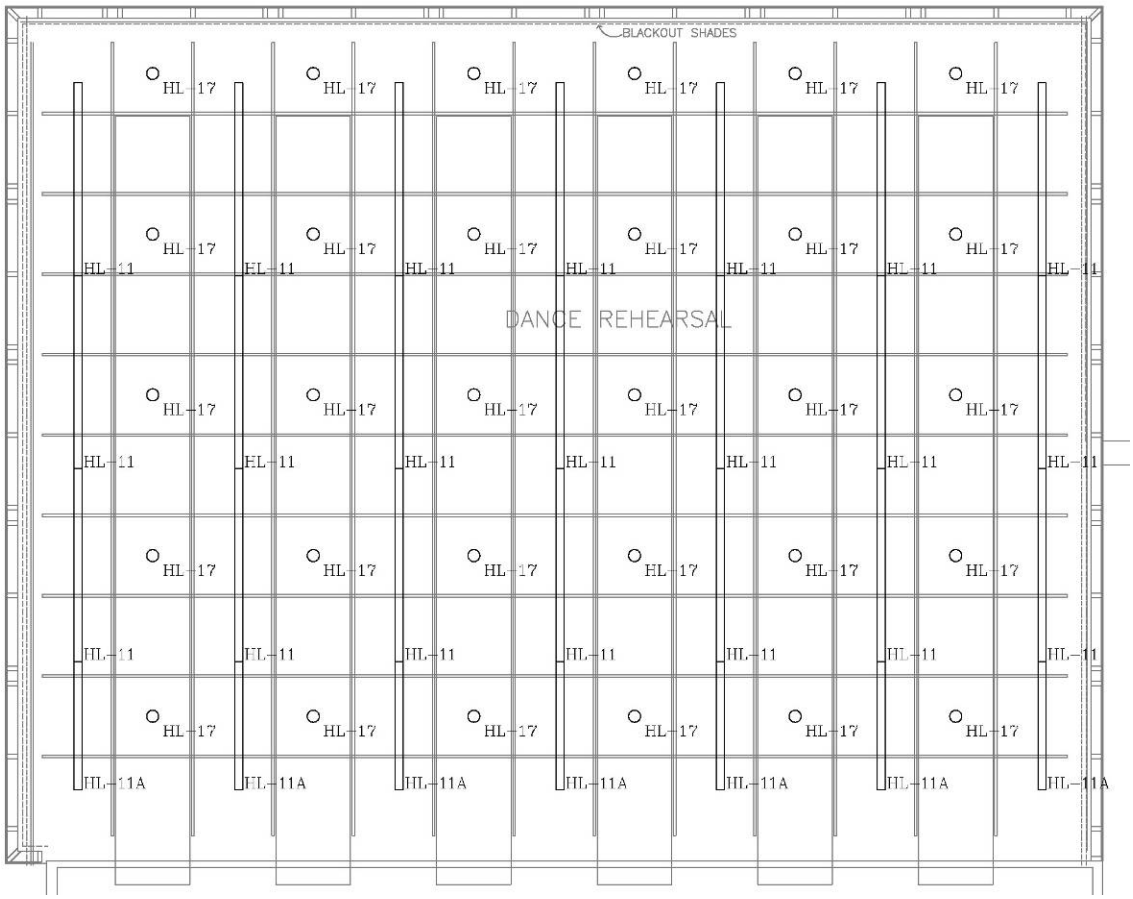


Figure 3.2 – Reflected Ceiling Plan (reference Appendix for luminaire types)

Light Loss Factors						
Fixture Type	Maintenance Category	LLD	LDD	BF	RSDD	Total LLF
HL-11	II	0.95	0.96	0.88	0.89	0.71
HL-17	IV	0.95	0.92	1.00	0.89	0.78

Table 3.1 – Light Loss Factors (Existing Layout)

Energy Modeling				
Fixture Type	Lamp Type	Count	Watts/Fixt	Total Watts
HL-11	Linear Fluorescent	21	276	5796
HL-11A	Linear Fluorescent	7	184	1288
HL-17	Halogen Par Lamp	30	90	2700
	Area=	3250	System=	9784
			LPD (w/sq.ft.) =	3.0

Table 3.2 - Energy Modeling Analysis (Existing Layout)

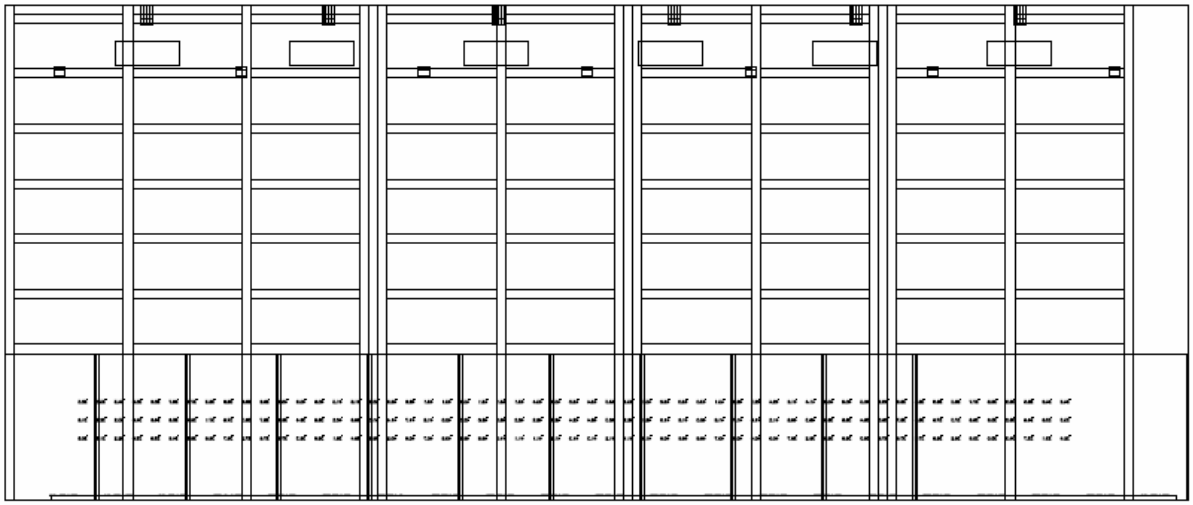


Figure 3.3 – Horizontal Cross Section

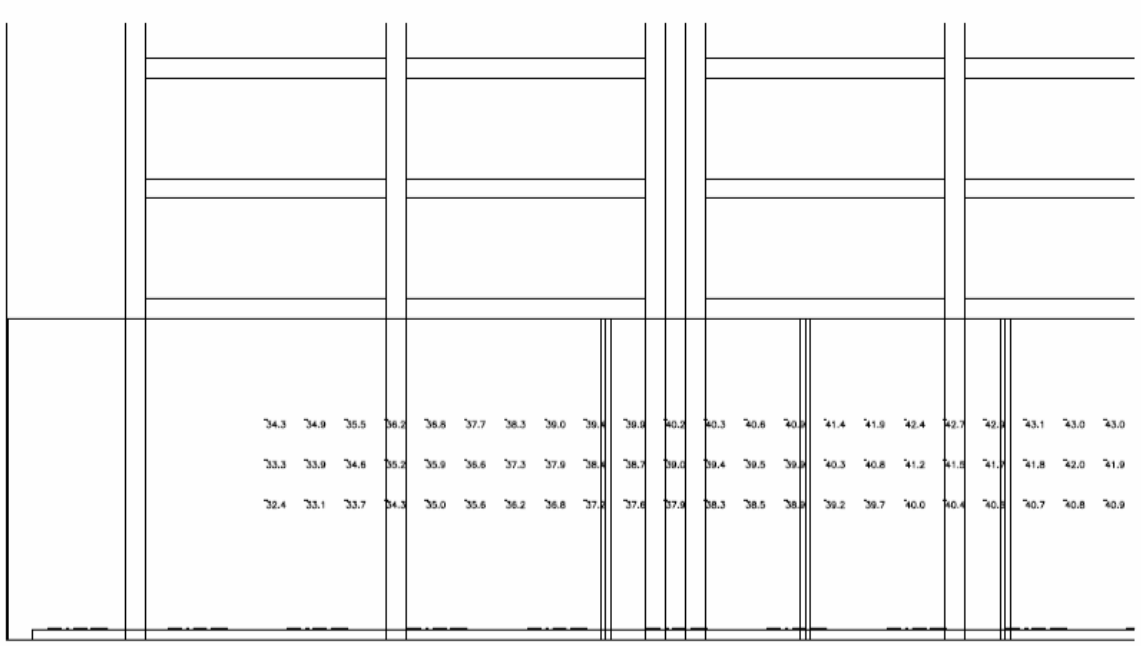


Figure 3.4 – Vertical Illuminance Grid

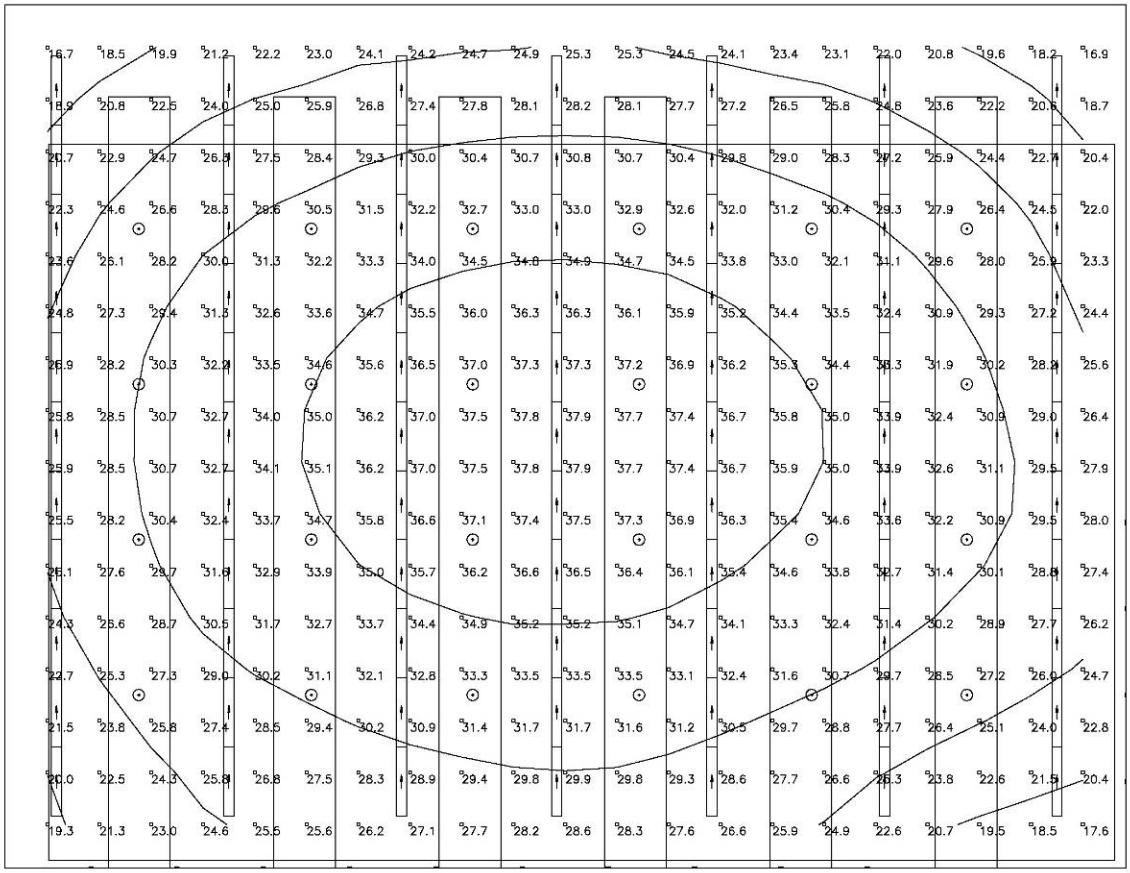


Figure 3.5 – Horizontal Illuminance Values & Isocontours

Illuminance Summary:

- Average Horizontal Illuminance: 30fc
- Max/Min Ratio: 2.3:1
- Average Vertical Illuminance: 39fc
- Max/Min Ratio: 1.4:1

Existing Conditions Summary:

Current lighting conditions meet the requirements for the illuminance levels and uniformity in the space. The lighting power density, at 3.0w/ft2, is nearly twice the allowable power density, following ASHRAE 90.1-2004. There seems to be some issues with the use of the space and the available switching controls. An overhead projector faces the north wall of the space that projects onto blackout shades. However, there are no options to switch those rows of lights off during the use of this projector.

Daylighting Conditions:

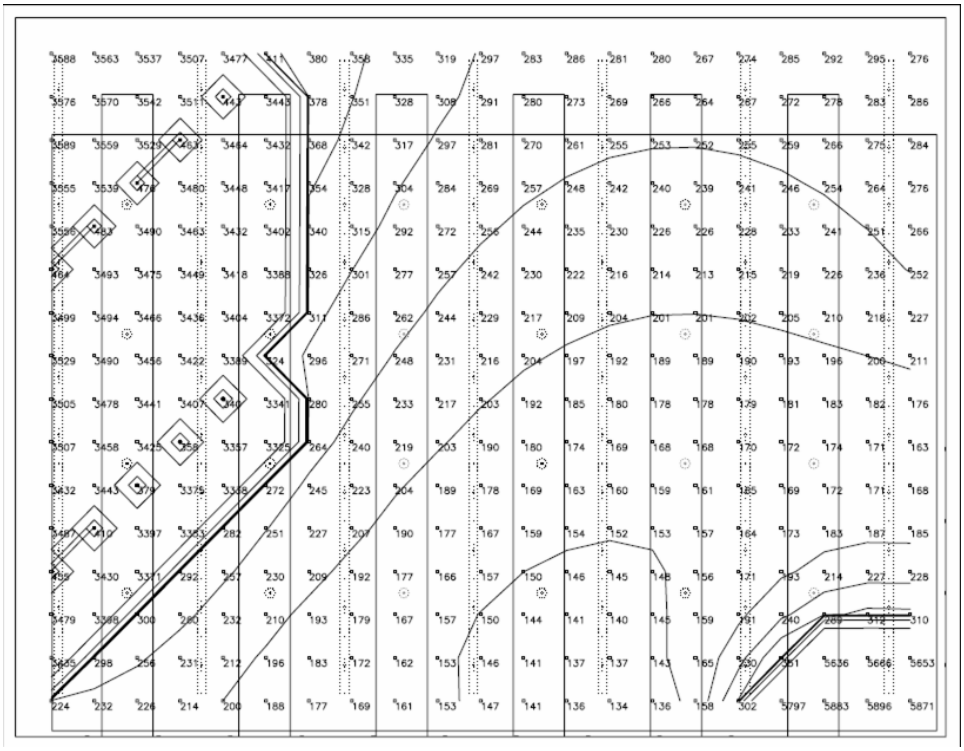
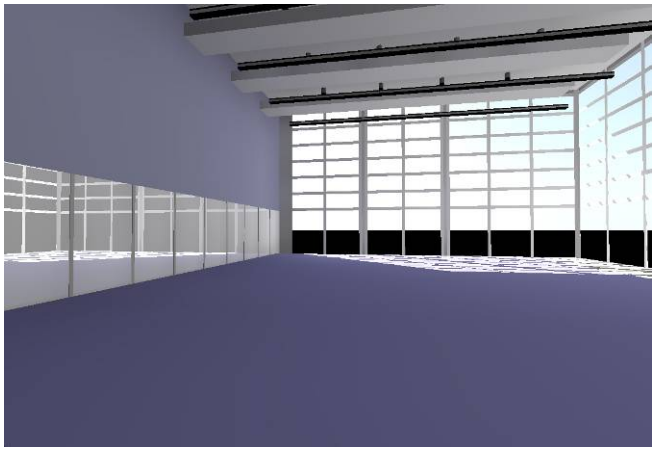


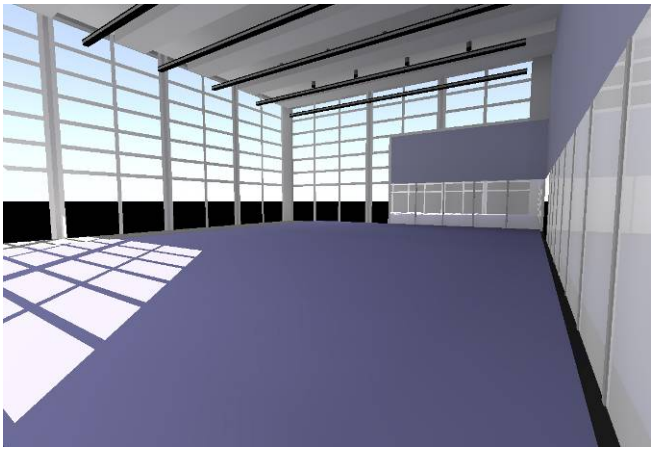
Figure 3.6 – Illuminance Values & Isocontours

Illuminance Summary:

- Average Horizontal Illuminance: 950fc
- Max/Min Ratio: 44:1



Rendering (West)



Rendering (East)

Design Criteria:

Illuminance Criteria - Illuminance requirements for the space are 30fc horizontal and 30fc vertical. Horizontal illuminance is higher than typically recommended, but the space is also a part of an educational facility and may have reading and/or writing tasks within the space. Please note that these criteria can only be applied to general space use. Specialized illuminance levels vary upon necessity of theatrical performance and may vary severely in both directions.

Power Allowance - According to the Massachusetts Energy Code 780.CMR.Chapter13, which is compliant and in excess of ASHRAE Standard 90.1-2001, using the space-by-space method, the maximum allowable power allowance for this space is 1.6w/ft^2 (5120w), considering the space to be an academic classroom/lecture area. Actual power allowance could probably be higher for the space since it has significant theatrical performing arts activities. However, the code does not specifically cover lighting power densities for theatrical performance spaces.

Aesthetic Quality - Visual interest in the space should be kept at a minimum since the focus should be on the dancers, not the space. However, a high end feel should be maintained, as the culture of dance draws in crowds with a more exquisite taste. In this respect, it may be necessary to provide light from hidden luminaires or to choose luminaires that are very attractive yet unobtrusive.

Direct & Reflected Glare - As dancers are required to be in specific locations throughout a performance, it is imperative for them to be able to see clearly. Direct and reflected glare could cause serious issues by masking certain locations on the floor or by blinding the dance through the reflected component.

Uniformity - Since dance often is performed by multiple dancers all in unison, it is important to have a high level of uniformity across the space. This will help to enhance the idea of fluid motion throughout the entire body of dancers. In some instances, it may be necessary or beneficial to have varying levels of light across the space for different performances. This introduces the need for a second, variable lighting system. Also, being able to have the center of the space illuminated for performances, while the perimeter hides the viewers will create a much more relaxing environment for the spectators.

Modeling of Faces - Dancers go through arduous makeup processes when getting ready for performances to enhance their facial features. Creating a lighting system that creates beautiful faces throughout the spaces, in any direction, is very important for this system to be effective. Energy and mood are often times direct outputs from the faces and motions of the bodies of the dancers within the performance.

Psychological Aspects - Dance is generally designed to invoke emotion, whether it is a direct emotion such as anger or sorrow, or a passive emotion such as awe or excitement. While the dance itself may be capable of invoking these emotions, a well-designed lighting scheme within the space can dramatically increase these effects. Theatrical lighting concepts should probably be used in this space to provide a system that is dynamic enough for the vast differences in performances that may occur.

System Control & Flexibility - Dynamic lighting is imperative to creating an effective space for dance performance. Character, emotional attitude, and energy change for every piece of dance that is performed and a lighting system should be available to contribute to and accentuate these differences.

Daylight Integration & Control - Although a part of system control, the importance of daylighting integration and control in this space warrants its own category. Two and a half of the four walls in the space are all glass, floor to ceiling, introducing an incredible amount of daylight into the space. Direct glare from sunlight isn't as much an issue in the space, since the main glass wall is north facing. However, morning and early evening sun may cause some issues during certain parts of the year. For most of the year, the lights can probably be kept off due to the large amount of daylight in the space.

New Design:

Design Concept Narrative:

The dance studio is a very utilitarian space with a need for uniform diffuse lighting. The best way to reduce unwanted shadows in the space is to employ indirect lighting. This, however, makes it very difficult to maintain the Massachusetts Energy Code allowable power density of $1.6w/ft^2$. The following two designs represent the most efficient indirect system possible (to provide the necessary lighting levels and maintain shadowless lighting) and a direct system (which will seek to provide lighting within the limits of the Massachusetts Energy Code).

My plans to achieve this concept are to:

1. *Install energy efficient indirect linear fixtures*. 4' T5 lamps have the highest efficiency of the linear fluorescent sources, at 103.6 lumens/watt, higher than T8 lamps, at 92.2 lumens/watt, and T5HO lamps, at 92.6 lumens/watt. Also, the luminaire chosen for the space has an efficiency of 93.0%.

2. *Add wedge-shaped reflectors above the linear fluorescent luminaire rows*. This keeps the light from being lost in the mechanical system and increases the amount of useable diffuse light that reaches the floor.

3. *Switch zones to provide flexibility and necessary switching for projections.* I propose to switch the north-most luminaires as a separate zone to allow for better control of the lighting when presentations are being given on that wall.

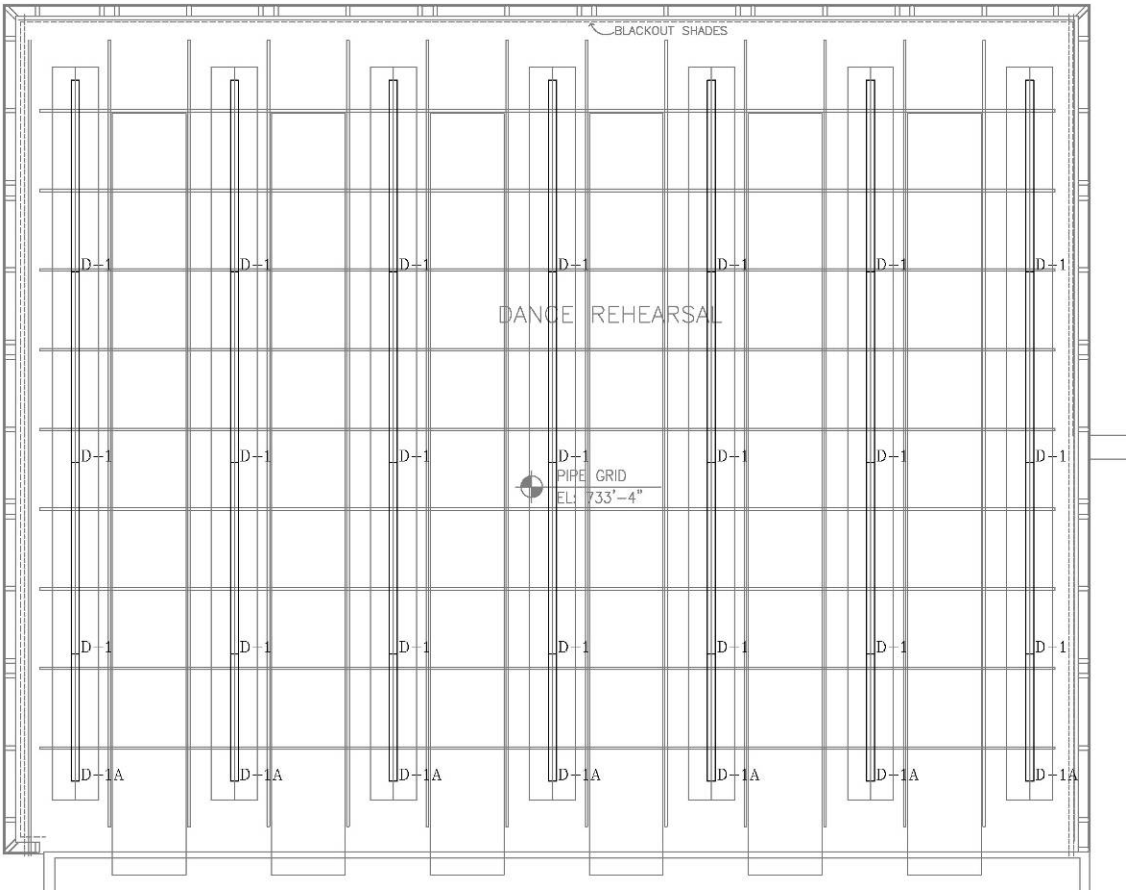


Figure 3.7 – Reflected ceiling Plan (reference Appendix for luminaire types)

Light Loss Factors						
Fixture Type	Maintenance Category	LLD	LDD	BF	RSDD	Total LLF
D-1	II	0.95	0.96	0.98	0.89	0.80
D-1A	II	0.95	0.96	0.98	0.89	0.80

Table 3.3 – Light Loss Factors (New Layout)

Energy Modeling				
Fixture Type	Lamp Type	Count	Watts/Fixt	Total Watts
D-1	Linear Fluorescent	21	270	5670
D-1A	Linear Fluorescent	7	180	1260
		Area= 3250	System=	6930
			LPD (w/sq.ft.) =	2.1

Table 3.4 – Energy Modeling Analysis (New Layout)

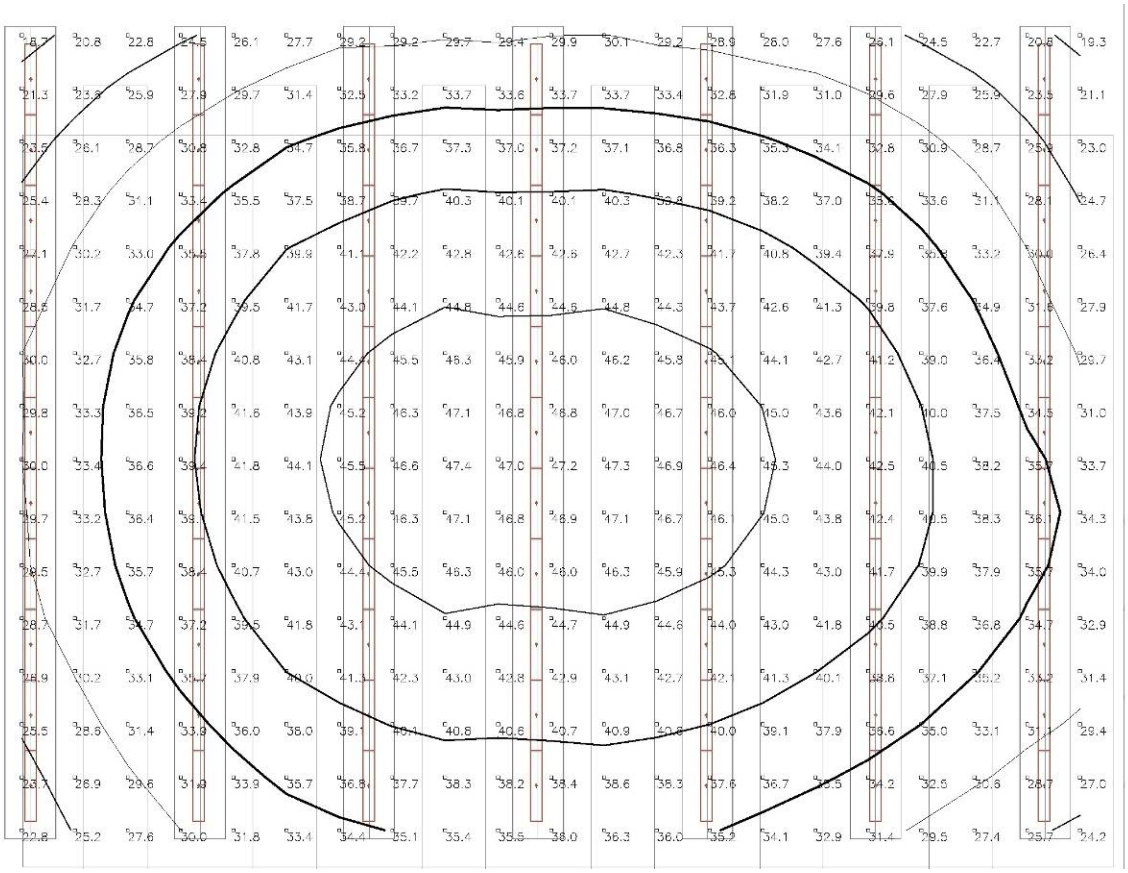
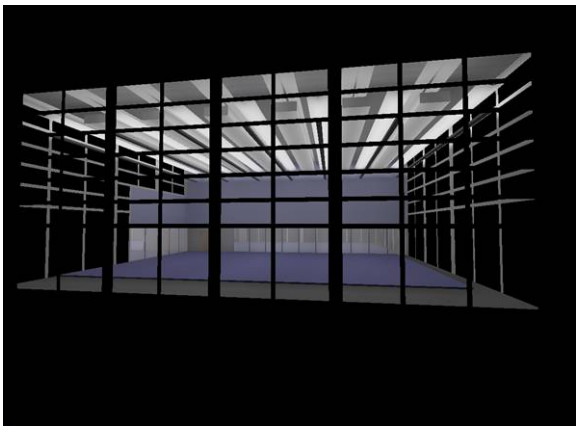


Figure 3.8 – Horizontal Illuminance Values & Isocontours

Illuminance Summary:

- Average Horizontal Illuminance: 37fc
- Max/Min Ratio: 2.5:1



Rendering from exterior

Rendering (North East)

Secondary Design:

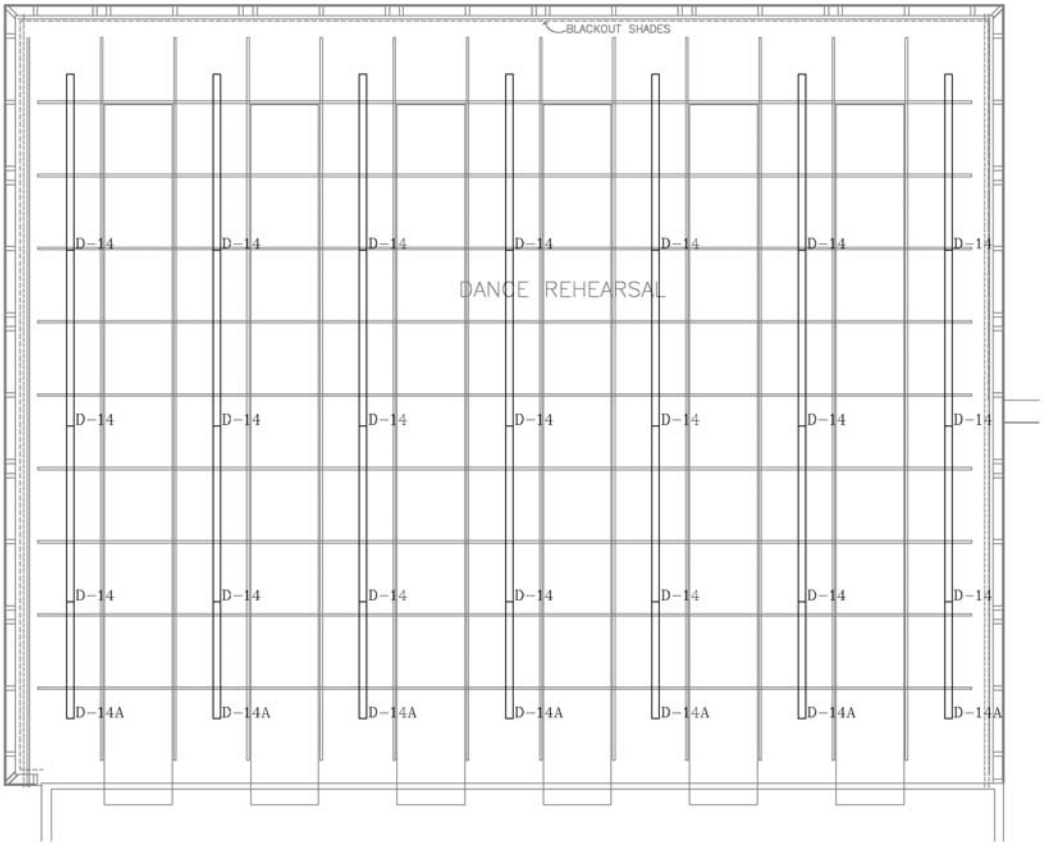


Figure 3.9 – Reflected ceiling Plan (reference Appendix for luminaire types)

Energy Modeling				
Fixture Type	Lamp Type	Count	Watts/Fixt	Total Watts
D-14	Linear Fluorescent	21	186	3906
D-14A	Linear Fluorescent	7	124	868
	Area=	3250	System=	4774
				1.47

Table 3.5 – Energy Modeling Analysis (Secondary Layout)

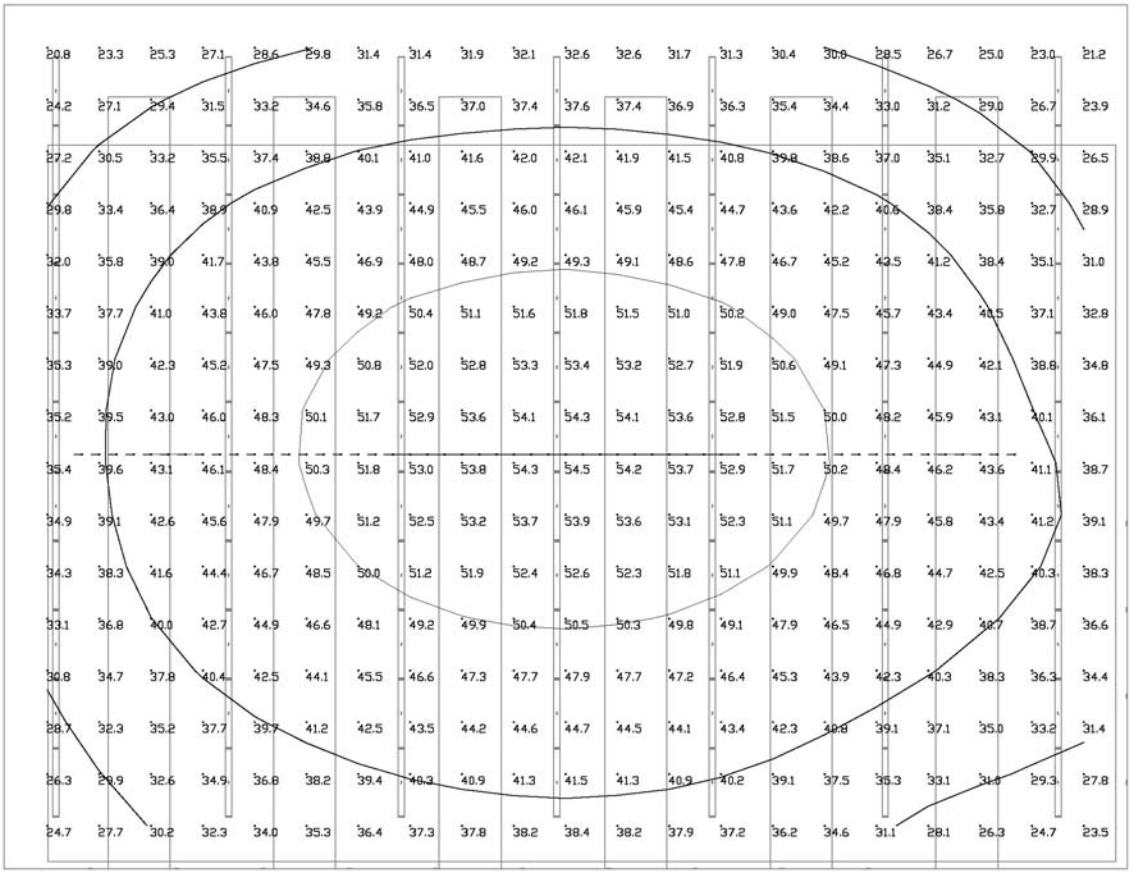


Figure 3.10 – Horizontal Illuminance Values & Isocontours

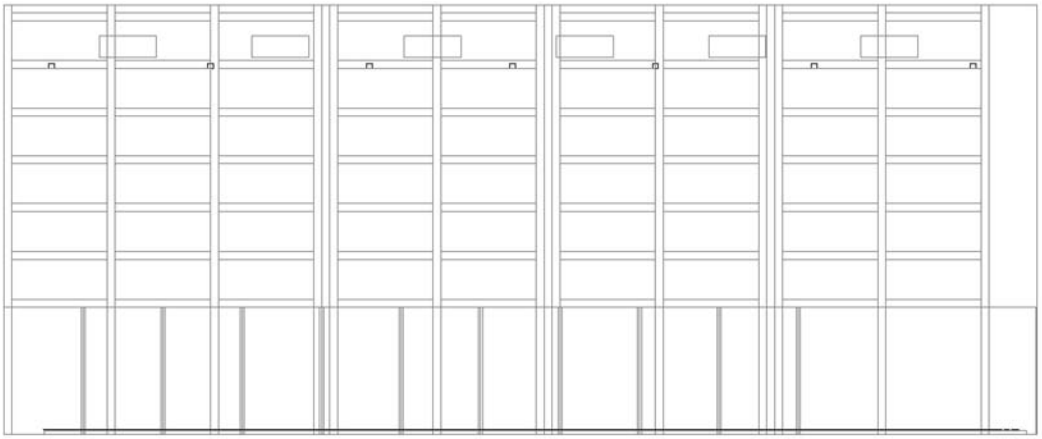


Figure 3.11 – Horizontal Cross Section

Illuminance Summary:

- Average Horizontal Illuminance: 45fc
- Max/Min Ratio: 2.6

Summary of Design:

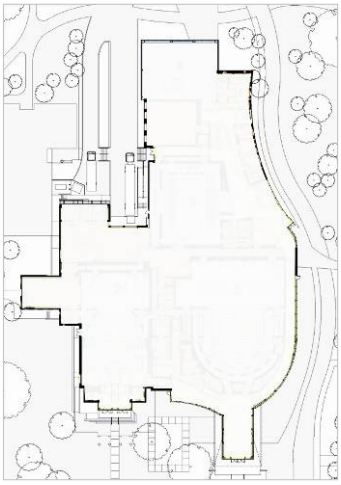
The two new designs for the space each both have positive and negative effects on the system, but the indirect lighting system appears to be the best option. The indirect lighting system has a higher power density than the direct system, but with shadows behind a huge distraction to the dancers, it seems imperative to diffuse the light as much as possible through the space. Consecutively, the power densities for the space were calculated using the space-by-space method and some allowances could be made by adjusting power densities of other spaces to provide this space with the amount necessary.

Since supplementary lighting is provided from a pipe grid with theatrical fixtures outside the scope of this project, this lighting systems appears to be adequate for all their needs.

My original intentions had been to investigate photosensor dimming for the space. However, after studying the uses of the space and the daylighting conditions, it seems that it would be beneficial to leave the control of the lighting to the occupants in the space. All the windows have mechanized blackout shades for presentations. There's also the curtain that runs on a track that can be pulled in during the morning and late afternoon when the rising and setting sun shine directly into the space.

Space 4: Building Facade (An outdoor space or building facade)

General Summary:



The façade of the building is currently unlit other than the glowing effects of the interior lighting. There's path lighting at the entry drive for safety, but the rest of the site is relatively unlit as well. The façade heights range from 24 to 80 feet and combine a combination of limestone veneer, glass and aluminum curtainwall, and brick. Most of the façade is surrouned by grass and is not meant to be walked along. However, there are focal points in the façade at defined entrances at the south and north ends of the building, and at a small paved courtyard on the east side. These entrances, especially the southern end, will need to be address in the lighting solution to make sure they stand out as prominent pieces of the architectural language. There's a significant number of trees on the sight which may block the view of building façade lighting and should be incorporated into the analysis to make sure lighting isn't being used in places it wont be seen.

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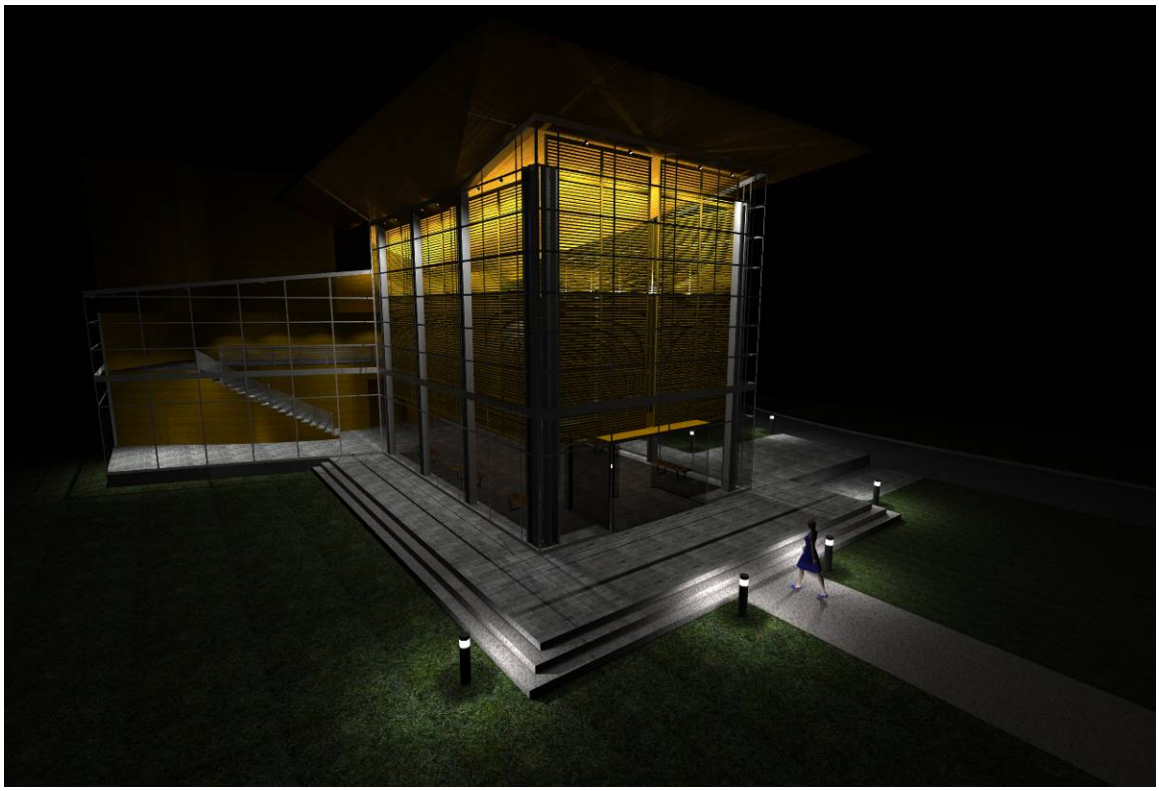
Existing Conditions:

Lighting - The exterior façade is not lit by electric lighting except in areas required by code for egress, such as the entry driveway, emergency lighting for the two main building entrances, and the small exterior patio on the east side of the main lobby. Pathway bollards have been placed around the Main Stage lobby front steps, but must have been a contracted ad-service or change order during the construction process because no bollards have been specified in the construction documents set. Landscape lighting in the small exterior patio, which was specified with tree straps, were in actuality ground mounted and point up towards the tree canopies.

Controls - All exterior lighting is controlled through the building automation system and photocells with low voltage control lines.

Space Properties - The exterior building façade is made up of 3 distinct types of materials: limestone veneer (~65%), which covers the majority of the building, glass & aluminum framed windows, and brick (~26%), which is used for the fly towers of the two main performance theatres. The one exception to this material use is the underside of the thrust roof overhang of the main lobby, which is made of wood paneling (~45%).



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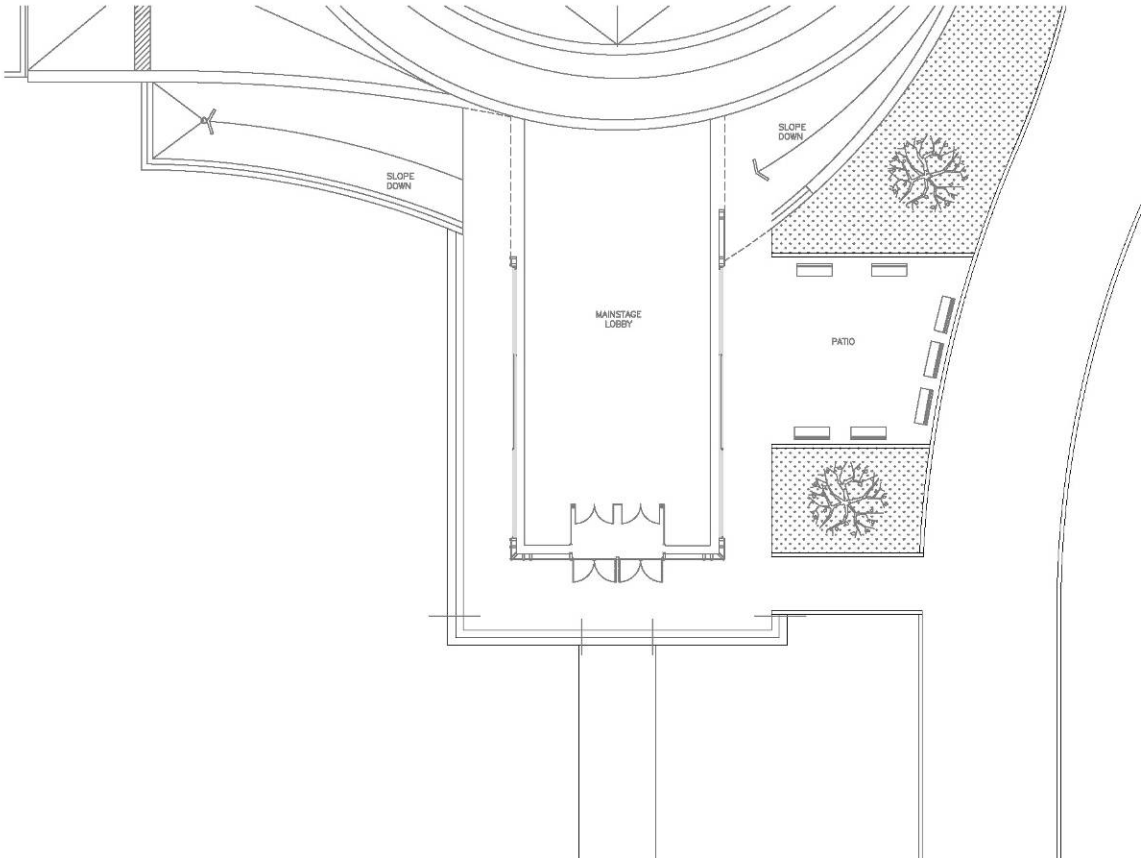


Figure 4.1 - Site Plan

Space Characteristics:

- Area (Patio): 700 sq.ft.
- Materials: slate tile, concrete, granite curbs, grass
- Relevant Furniture: wooden benches, deciduous trees

Assumptions about the space:

- LLF's for outdoor conditions ~0.65
- Horizontal illuminance measure at ground level

Pathway luminaires existed when I visited the site, but no exterior bollards are listed anywhere in the construction documents. (Please note that I have labeled these luminaires on the plans as luminaire type A and can be referenced in the cut sheet appendix as such.)

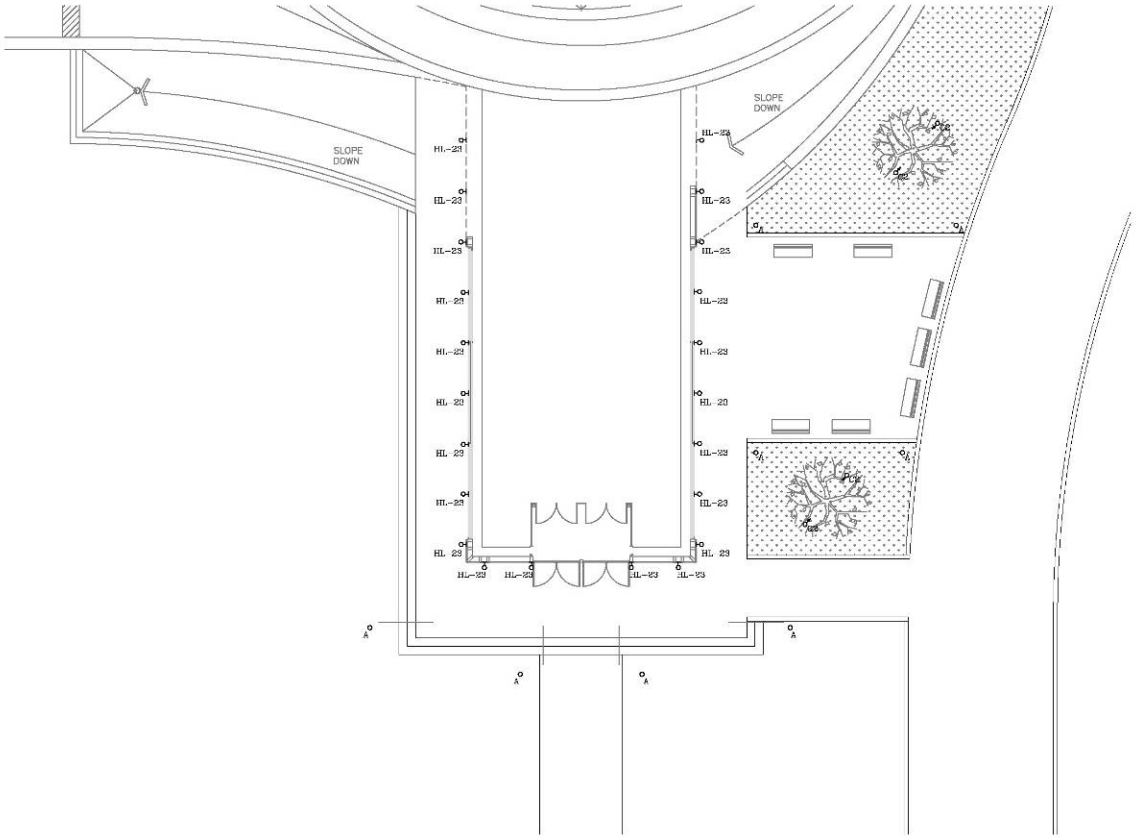


Figure 4.2 – Reflected ceiling Plan (reference Appendix for luminaire types)

Light Loss Factors						
Fixture Type	Maintenance Category	LLD	LDD	BF	RSDD	Total LLF
HL-23	V	0.79	0.90	1.00	0.96	0.68
A	IV	---	---	---	---	0.65
C2	V	---	---	---	---	0.65

Table 4.1 - Light Loss Factors (Existing Layout)

Energy Modeling				
Fixture Type	Lamp Type	Count	Watts/Fixt	Total Watts
HL-23	CMH	22	48	1056
A	CMH	8	62	496
C2	LV MR16	4	50	200
			System=	1752

Table 4.2 - Energy Modeling Analysis (Existing Layout)

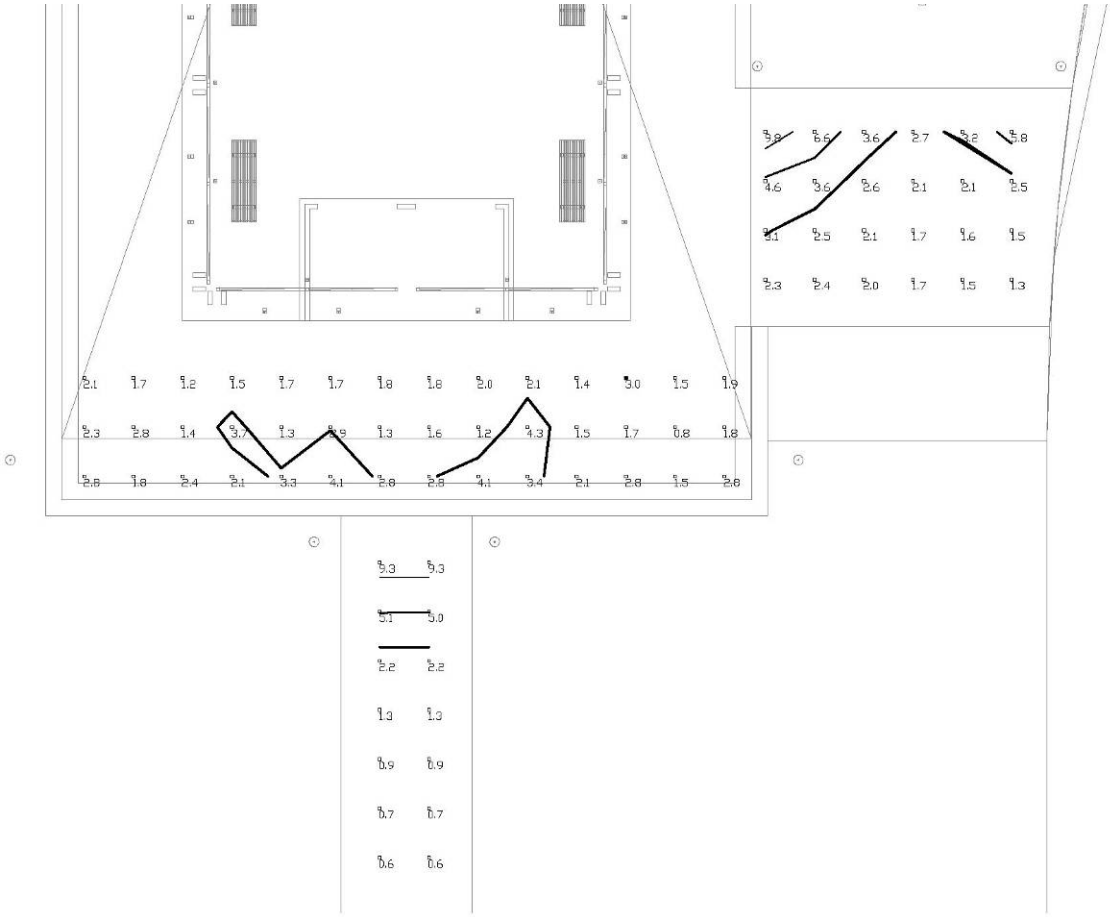


Figure 4.3 – Horizontal Illuminance Values & Isocontours

Illuminance Summary:

- Average Horizontal Illuminance: 3.3fc (Steps)
- Average Horizontal Illuminance: 2.8fc (Sidewalk)
- Average Horizontal Illuminance: 3.3fc (Patio)

Design Criteria:

Illuminance Criteria - Illuminance suggestions for building entrances is 5fc horizontal and 3fc vertical. Since the building has dark surroundings and light colored materials, illuminance suggestions for building façade are 3fc vertical and must not interfere with pedestrian and vehicular visibility.

Power Allowance - According to the Massachusetts Energy Code 780.CMR.Chapter13, which is compliant and in excess of ASHRAE Standard 90.1-2001, building entrances with canopies can have a maximum power density of $3w/ft^2$, building entrances without canopies can have a maximum power density of 33w/lf of door, and the façade can have $0.25w/ft^2$ of illuminated façade. Also noted here, the code requires that all exterior lights above 100w must have an efficacy of not less than 60lm/w.

Aesthetic Quality - The first thing a person sees when either walking or driving by is the building exterior. To draw them into the building, interesting lighting must catch their attention.

Light Pollution/Trespass - Williamstown, MA is in a somewhat small town rural area. Dark sky compliance in this area seems very important for maintaining the natural beauty of the night.

New Design:

Design Concept Narrative:

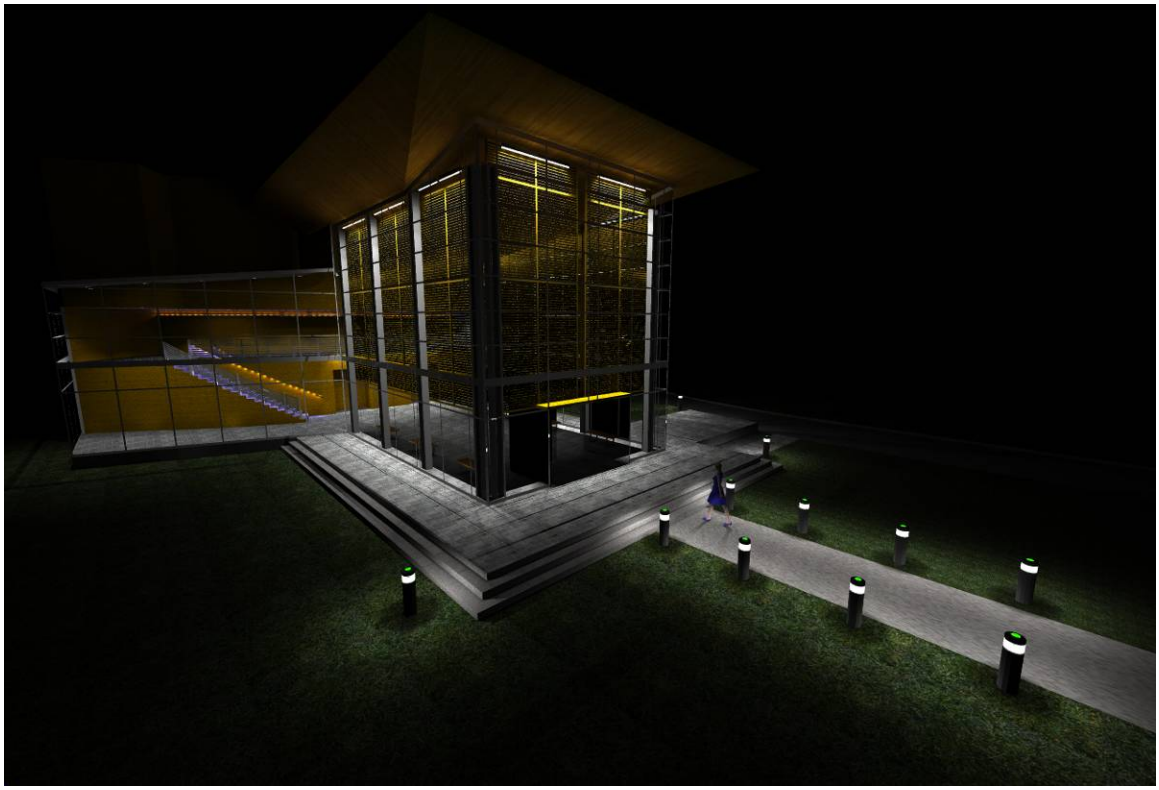
The cube that's the entrance to the Main Stage lobby was designed by the architect to be a glowing beacon that caught the attention of the main traffic through Williamstown. If the cube glows evenly and brightly, this will mimic that uniform glass cube the architect was looking for. Also, one major change that I have proposed to the architecture of the space is to rotate the wooden slats against the windows to a 45 degree angle, thus blocking a significant amount of light from entering the space.

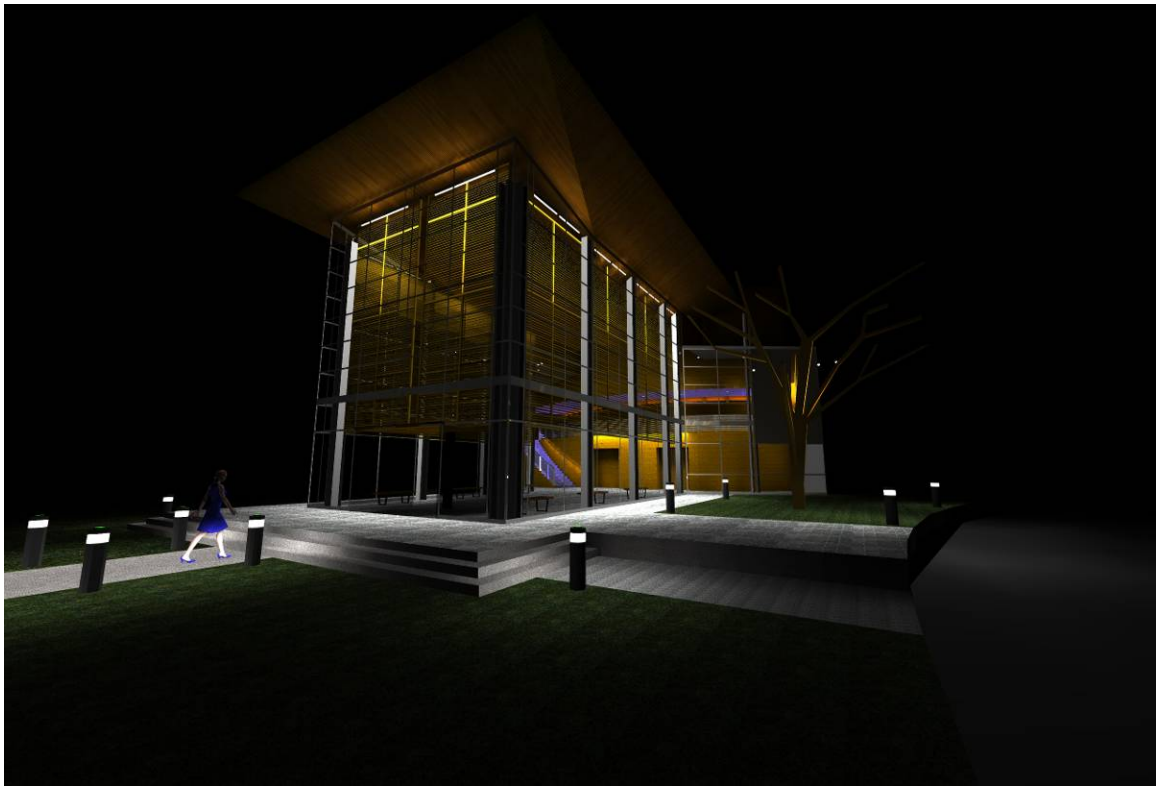
A major component of this space connects back to my design concept for the building; integrating a perception of evoked emotion into the static environment of a building. By allowing the occupants of this space to see feedback from their actions, I feel it unifies the living and the non in a symbiotic natural way. In order to produce these concepts, I am proposing the following:

1. *Install linear LED projectors between the window mullions and wooden shades.* Using LED will require less maintenance for lamp replacement 31 feet above grade. The optics of a linear fixture allow for an even wash against the exterior surfaces of the entry lobby and creates the uniform "glow" effect the architect originally had in mind.

2. *Install LED bollards that contain color-changing decorative cap.* By adding the decorative LED color-changing cap, the bollards bring life and energy to the entrance walkway, as well as meeting the requirements of the concept of evoked emotion in the building. The luminaires will be customized to include a set of motion sensitive beams. When these beams are broken, it was trigger the following set of bollards to change color slightly. While this change will be very slight, I feel even the smallest amount of influence a person has over their environment has a huge personal psychological impact.

3. *Mount landscape lighting in trees and aim down through canopy onto patio.* By allowing the light to filter through the canopy of the tree, the light becomes much more diffuse and calming than a bright tree trunk, which is a bright, distracting, vertical surface. The diffuse overhead light is meant to mimic moonlight filtering through the trees, even on the darkest of cloudy nights, to create a place that always feels peaceful and safe.





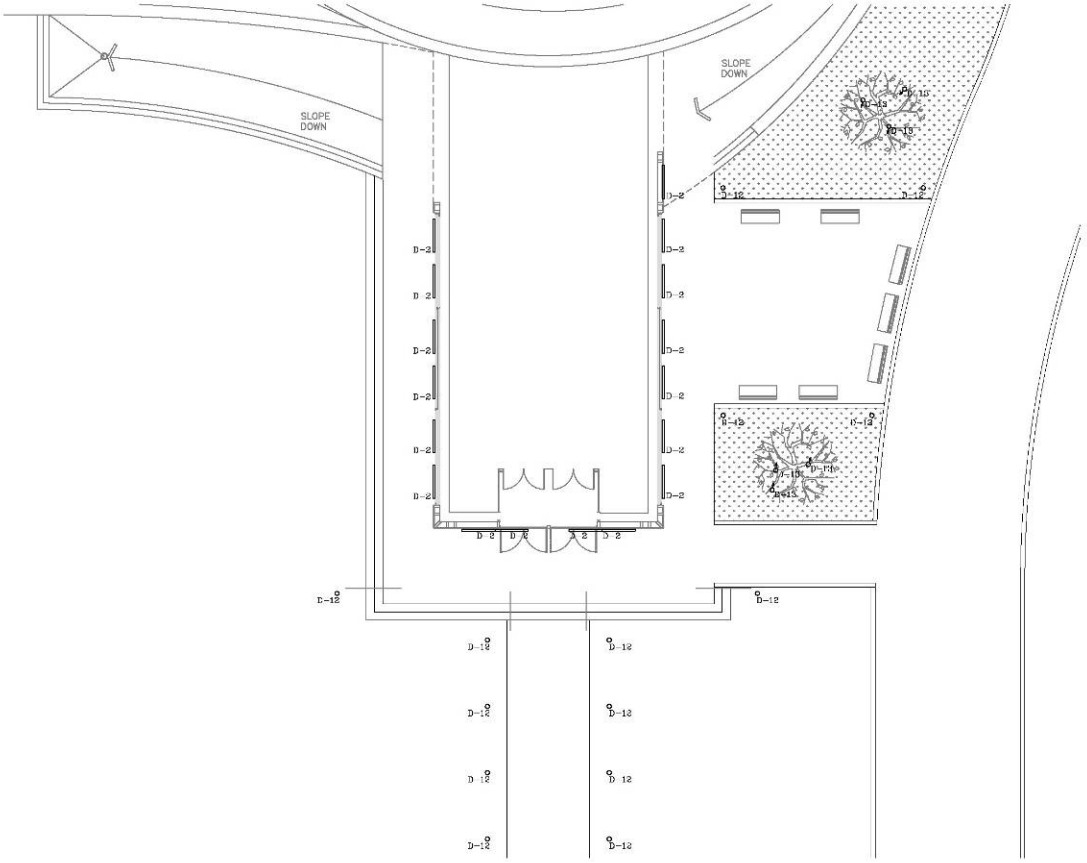


Figure 4.4 – Reflected ceiling Plan (reference Appendix for luminaire types)

Light Loss Factors						
Fixture Type	Maintenance Category	LLD	LDD	BF	RSDD	Total LLF
D-2	V	1.00	0.92	1.00	0.96	0.88
D-12	IV	---	---	---	---	0.65
D-13	V	---	---	---	---	0.65

Table 4.3 - Light Loss Factors (New Design)

Energy Modeling				
Fixture Type	Lamp Type	Count	Watts/Fixt	Total Watts
D-2	LED	17	48	816
D-12	CMH	14	24	336
D-13	LV MR16	6	50	300
			System=	1452

Table 4.4 - Energy Modeling Analysis (New Design)

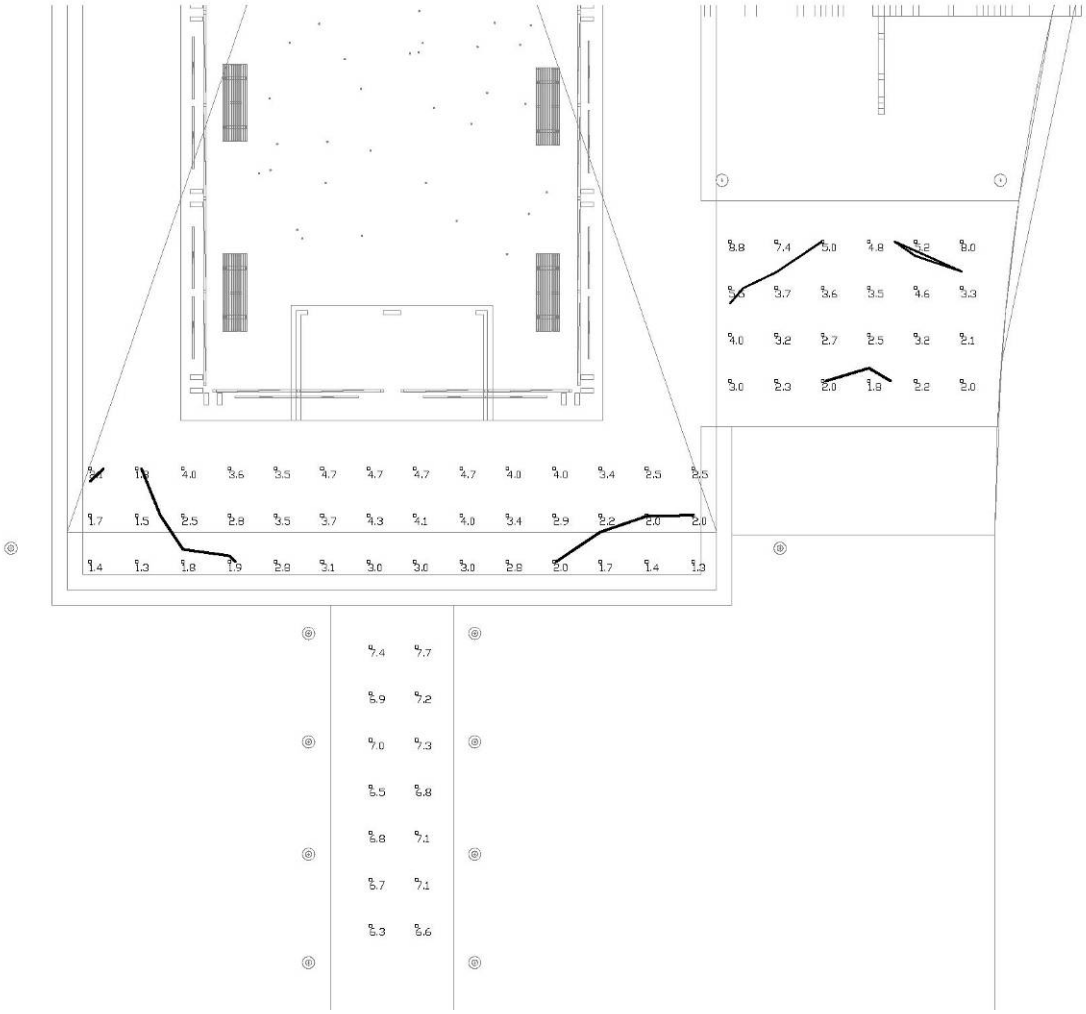


Figure 4.5 – Horizontal Illuminance Values & Isocontours

Illuminance Summary:

- Average Horizontal Illuminance: 2.9fc (Steps)
- Average Horizontal Illuminance: 7.0fc (Sidewalk)
- Average Horizontal Illuminance: 3.9fc (Patio)

Summary of Design:

The above-detailed design has met my expectations for the lighting concept and performance. The linear LED projectors seems not bright enough in renderings, but real-life mockups have shown that this product is a great candidate for this type of application and is meant for illuminating building facades. I was very please with the Thorn lighting bollards that I specified, as they combined the normal pathway lighting and an integral LED luminous top. This playful luminous top was integral to my design and saves a significant amount of money on the project not having to have them custom built. Illuminance levels are adequate to my desired levels for safety, but if field tests proved the LEDs less bright than in the simulation, the manufacturer provides alternate lamping options for the pathway lighting lamp while maintaining the luminous LED top.

Illuminance and uniformity are acceptable at the patio area. More leafy shadows would be apparent from a deciduous tree with leaves and is the major driving force behind the concept for the canopy mounted landscape lights. This diffuse, textured light will create the effects I had envisioned in this intimate patio seating area.

All power allowances are within the allowable Massachusetts Energy Code values and no lamp was specified outside over 100w.

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Electrical Depth

The following pages detail an in-depth analysis of the electrical systems in the Williams College Center for Theatre & Dance, including a lighting and distribution panel feeder and branch circuit design, a feasibility study on the application of PV arrays for on-grid building power, and a protective device coordination study.

Electrical Systems Overview

I. Power Distribution Systems

The electrical distribution system for the Williams College '62 Center for Theater & Dance is a radial system that is powered by two 1500A pad-mounted transformers, located on the west side of the building. These transformers are the access point from the campus-wide distribution system. Once in the building, the system goes through two main distribution panels, with a manual tie breaker linking them. Since this project consists of both a renovation portion (The Adams Memorial Theatre) and a new construction portion (The Center for Theatre & Dance, built around The Adams Memorial Theatre), it will be necessary to describe the interaction between these two spaces. The existing 600A feeder service for the existing Adams Memorial Theatre was removed and new 480Y/277v and 208Y/120v systems were brought into the theatre. The 480Y/277v line feeds a single lighting control panel that services the 277v main and ground floor lighting. The 208Y/120v line feeds a 1200A distribution panel that sends power to multiple lighting control panels for the house and theatrical stage lights, as well as a 225kva rooftop AC unit. There's also both 480Y/277v and 208Y/120v systems in the new Center for Theater & Dance, which are used for similar applications. See Table 1 in Appendix C for a schedule of transformers.

II. Emergency Power System

The building is serviced by a 100kw diesel sound attenuated vibration-reducing pad-mounted emergency generator, located in the main emergency electrical room on the ground floor. The generator is connected to four automatic transfer switches, which control the overall emergency lighting system in both the Center for Dance & Theatre and the Adam's Memorial Theatre renovation. Two of the automatic transfer switches control power transfer for the emergency lighting panels and elevators, and the other two switch emergency power for the fire alarm system's "full-bright" panic signal.

III. Overcurrent Protection

The electrical distribution system relies on circuit breakers and fused disconnect switches to provide the overcurrent protection. Most panelboards and switchgear are located within dedicated electrical rooms or closets. Motor control centers are generally located in dedicated mechanical rooms. Large units such as switchgear and motor control centers are in the basement, while smaller panelboards are located in the closets on upper floors. The third floor contains all the dimmer racks for the main theatre and the studio theatre in a shared dimmer room. The dedicated main lighting electrical closets and emergency lighting electrical closets have been separated from each other in all instances.

IV. Lighting Systems

The entry vestibule on the south side of the building uses halogen sources for both interior and exterior lighting. The interior lobby space also uses halogen, but switches to incandescent with quartz accents as the space transitions into the theatre. Most other general lighting away from the main entry to the theatre is either compact fluorescent or linear fluorescent. A detailed list of lamps in the building and their operating characteristics can be found in appendix C.

V. ASHRAE 90.1 Shutoff Requirements

The building is monitored by an energy management control system (EMCS) that optimizes energy consumption while maintaining occupant comfort. This EMCS is connected to relay panels at each lighting panel and maintains a time-clock control device for shutting off electrical lighting within the building and the control of exterior site lighting. This system also has the capability to reduce and shut off motors once the peak demand load has been reached for a month to conserve energy and electricity costs.

Small offices and other rooms throughout the building that are not performance spaces or spaces intended for 24-hour occupancy have been equipped with occupancy sensors for savings in energy consumption.

VI. Power Factor Correction

There are no power factor correction devices used in the electrical system for this building.

VII. Design Considerations

The building does not have an overly large footprint, so there don't seem to be too many concerns about voltage drop from long runs. A consideration that will need to be made is the temperature differential between the basement feeder and any lines run to the top of the 80 ft fly tower of the main stage. It will need to be considered that ballasts will be running at 35c or above and will affect the output of most fluorescent lamps.

The control for the tie breaker between the two main incoming feeders in the main switchgear may be beneficial to be automatic in the event of significant voltage drop so that if it were to occur during a performance, the performance could still go on with just a slight interruption. Currently, the tie breaker is manual and would require someone to go down in the mechanical room and switch the breaker, increasing the amount of time the building is without primary power.

A lot of consideration needs to be placed on the design of the communications systems throughout the building. The buildings occupancy as an educational facility and as a theatrical performance building increases the need for wired and wireless data transfer for laptops, inter-system controls for a/v integration into overall building and stage performance, and technological expansion. Upgrading a system of this magnitude would be incredibly costly for the college, so looking towards expansion capabilities during construction can save a lot of money in the future.

VIII. NEC Design Load

The total calculated NEC design load was approximately 1400kw. Two 1500kw transformers feed the main distribution panels for the building. I'm assuming that this discrepancy, the amount of available power being twice the design load, has to do with the manual tie breaker between the two sides of the main switchgear. This would allow for one transformer to temporarily carry the load for the entire building until the second transformer could be repaired. The main transformers are rated at 1500kva, which equates to maximum output amperage of 1805A. This value is less than the rated value of the wire, which is 80% of the ampacity of seven sets of 500MCM wire, or 2128A. The wire is adequately sized for the size of the transformers. The two main distribution panels that are fed by the main switchgear both sized appropriately as well. Distribution panel DHB has an 800A trip and is fed by 2 sets of 600MCM wire rated at 840A. Distribution panel DHBB has a 1200A trip and is fed by 4 sets of 500MCM wire rated at 1520A. Detailed calculations for the NEC design load can be found in Appendix D.

IX. Electric Utility Rates

Electric utility is provided by Williams College through their campus-wide distribution system. According to the Utilities Program Director of the Williams College Facilities Department, the Center for Theatre & Dance is a part of the medium voltage campus-wide distribution system and they do not track peak demand charges for each individual building on this system. The total usage of the building over the past 12 month period (July05-June06), was 1,219,964 kwh at a rate of $0.084/kwh, including transmission and distribution charges.

X. Communication Systems

Ethernet/Phone/AV: All Data/Voice/Coax conduits in the building are fed from room 052, Tel/Data, located in the basement of the 550 seat main theatre. Two data racks house the input/output data streams and are backed up by a UPS. Data and voice inputs are primarily located in offices and the theatrical control room in the 550 seat main theatre. Other inputs are placed at intervals throughout the rest of the building for a flexible data communication system. Most lines are run through conduit and cable trays that run throughout the circulation spaces in the building.

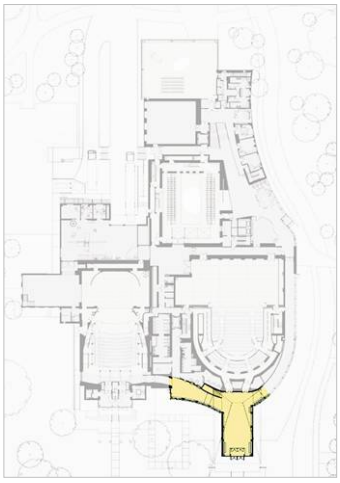
Fire Protection: The Center for Theatre & Dance utilizes two levels of fire protection. The first is a wet system with sprinkler heads throughout the building. In theatrical spaces where efforts were taken to preserve the beauty of the space, concealed sprinkler heads were used. The second system is a fire department hookup that is controlled by three separate automatic control valves in the main mechanical room in the basement of the west side of the building. The fire department inlet is located by the north entrance to the building. Ceiling mounted smoke detectors are located throughout the building.

XI. Documentation Inconsistencies

Note: The MEP consultant on the job has refused to release the panelboard schedules and final electrical drawings. Panelboard schedules are also not included in the construction documents set. Unknown circuits are listed as such and have been assumed fully loaded with a "good practice" loading assumption of 80% of the allowable ampacity of the C/B. It is understood that this will result in an oversized feeder for these panels and in some instances, on existing panels, the design load (A) will not match the circuit breaker or feeder size. Coordination of this sizing was updated for the new design panelboards.

Space 1: Main Stage Lobby (A circulation space)

General Summary:



The circulation of the building is made up of 3 defined entry locations and 332 feet of linear serpentine hallway that runs from the south side to the north side that totals 5576 sq.ft. The 1450 sq.ft. southern entry lobby is the signiature entrance of the building, created as a luminous box of aluminum and glass curtainwall. This is the entry for the main theatre space in the building, the 550 seat Main Stage, that is home to both community and college theatre productions. On the inside face of the curtainwall, wood slats were designed as permenant louvers to filter daylight into the lobby and warm up the atmosphere of the materials. A second lobby exists in the middle of the corridor: a 1120 sq.ft. breakout lounge that marks the entrance to the Center Stage theatrical laboratory. A grand staircase moves occupants from this breakout lounge to the entrance at the north side of the building, which is one story higher than the southern entrance.

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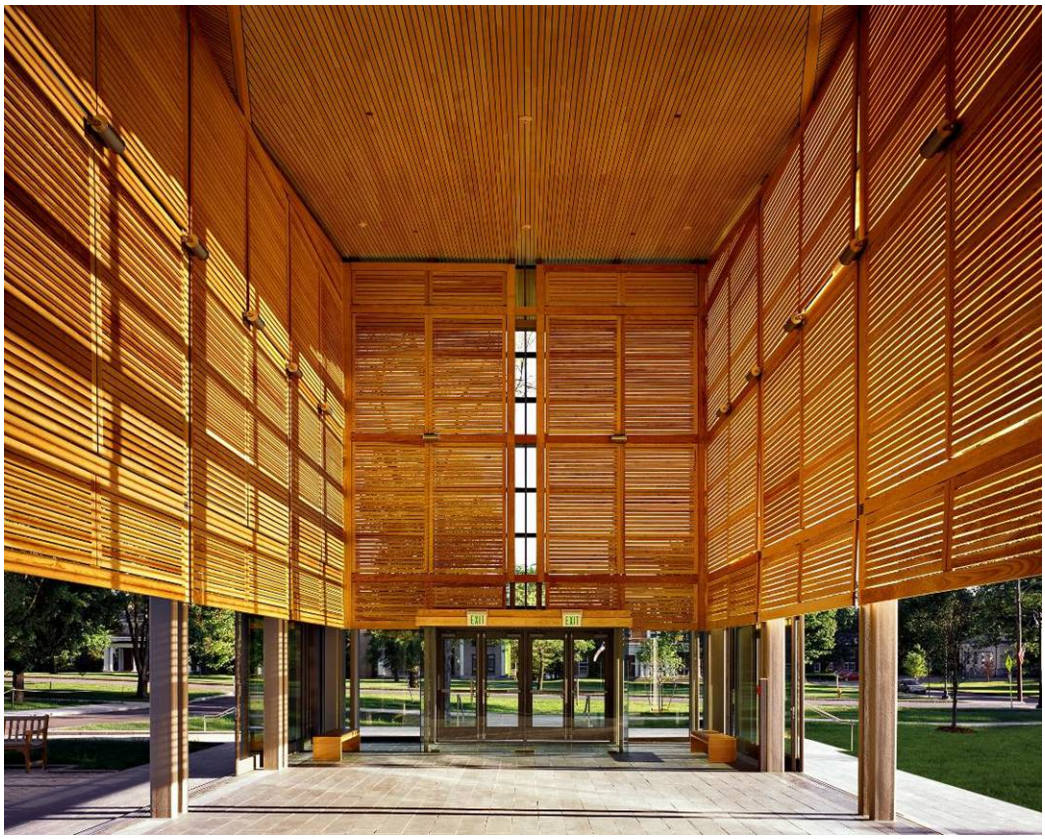


Existing Conditions:

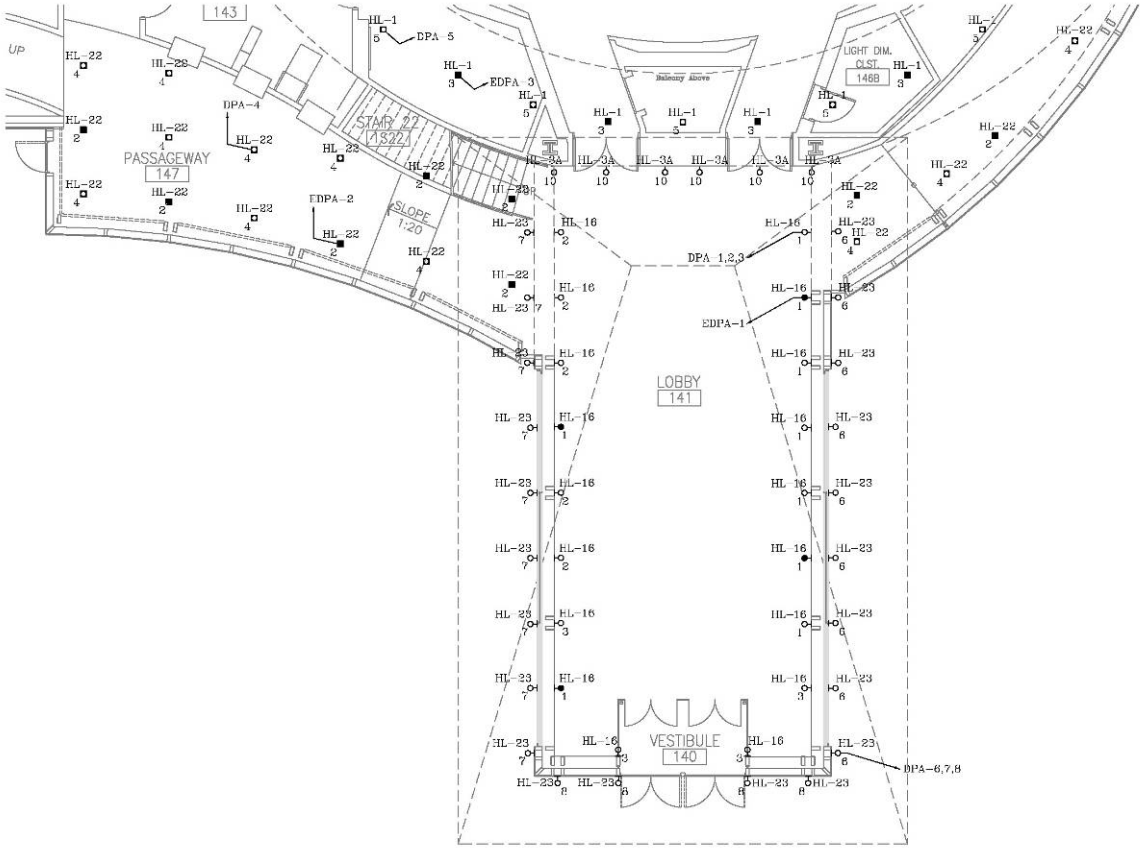


Figure 5.1 – Circuiting Plan (Existing Layout)

Existing Conditions Summary:

The lobby currently has two Lutron dimming panels that address all the lighting loads in the space, one for lighting and one for emergency. Luminaires that are shaded are wired for emergency transfer. The Lutron dimming panel has a 12 scene user interface. Both dimmer panels are main lugs only and are protected by the C/B of the panel that serves them. Feeder and C/B information for the feeding panel are provided in the following charts, along with detailed circuiting and zoning information for each. Note that there is a discrepancy between the calculated values for the feeder and C/B size and the information that was listed on the drawings, displayed at the top of the panel schedule. Without more information it is difficult to justify these differences.

Panelboard Schedules & Feeders

Dimmer Panel - DPA									
208Y/120V 3 Phase 4 Wire, 80A Feed, M.L.O.							Serviced By Panel: DLB, C/B 9		
Fixture Type	Ckt	Zone	Load (W)	Qt	Load Type	Total Load	Max Load	Bkr Size	Phase
Uplight	1	4	350	5	INC/LV	1750	1920	20A - 1P	A
Uplight	2	4	350	5	INC/LV	1750	1920	20A - 1P	B
Uplight	3	4	350	4	INC/LV	1400	1920	20A - 1P	C
Par Down	4	5	90	11	INC/LV	990	1920	20A - 1P	A
Balcony Down	5	6	100	6	INC/LV	600	1920	20A - 1P	B
Exterior Up	6	7	250	6	INC/LV	1500	1920	20A - 1P	C
Exterior Up	7	7	250	6	INC/LV	1500	1920	20A - 1P	A
Exterior Down	8	8	90	4	INC/LV	360	1920	20A - 1P	B
Par Down-AMT	9	9	90	4	INC/LV	360	1920	20A - 1P	C
Lobby Balcony	10	11	50	6	INC/LV	300	1920	20A - 1P	A
Calculation of Design Load Ampacity:									
					Connected Load:	10510			
					(x 1.25) growth:	13138	---------->	36.5 A	
					(/ 0.80) code:	---------->		45.6 A	
Wire Size			**Conduit Size**				**Circuit Breaker**		
(4) #8 AWG + (1) #10 AWG g			3/4" EMT				50A		

Table 5.1 – Dimmer Panel DPA Schedule (Existing Layout)

Dimmer Panel - EDPA									
120V 1 Phase 2 Wire, 20A Feed, M.L.O.							Serviced By Panel: EPLGS, C/B 2,4,6,8		
Fixture Type	Ckt	Zone	Load (W)	Qt	Load Type	Total Load	Max Load	Bkr Size	Phase
Uplight	1	1	350	4	INC/LV	1400	1920	20A - 1P	
Par Down-AMT	2	2	90	8	INC/LV	720	1920	20A - 1P	
Balcony Down	3	3	100	5	INC/LV	500	1920	20A - 1P	
Par Down-AMT	4	10	90	4	INC/LV	360	1920	20A - 1P	
Calculation of Design Load Ampacity:									
					Connected Load:	2980			
					(x 1.25) growth:	3725	---------->	10.3 A	
					(/ 0.80) code:	---------->		12.9 A	
Wire Size			**Conduit Size**				**Circuit Breaker**		
(2) #14 AWG + (1) #14 AWG g			1/2" EMT				15A		

Table 5.2 – Emergency Dimmer Panel EDPA Schedule (Existing Layout)

Distribution Panel - DLB				
208Y120V, 3P 4W			SURFACE MOUNTED	
800A M.L.O.			MIN. AIC. = 65K	
Item No.	Item Served	Frame	Breaker	
			Trip	Poles
1	D-2	100	100	3
2	D-5	100	100	3
3	AUDIO COMPANY SWITCH	100	100	3
4	D-A1	100	60	3
5	D-D2	225	200	3
6	D-DR1	100	60	3
7	D-DR2	225	200	3
8	D-D1	100	100	3
9	LUTRON PANEL DPA	225	80	3
10	SPARE	225	200	3
11	SPARE	100	100	3
12	SPACE & HARDWARE	225		3
13	SPACE & HARDWARE	100		3

Table 5.3 – Distribution Panelboard DLB Schedule (Existing Layout)

New Design:

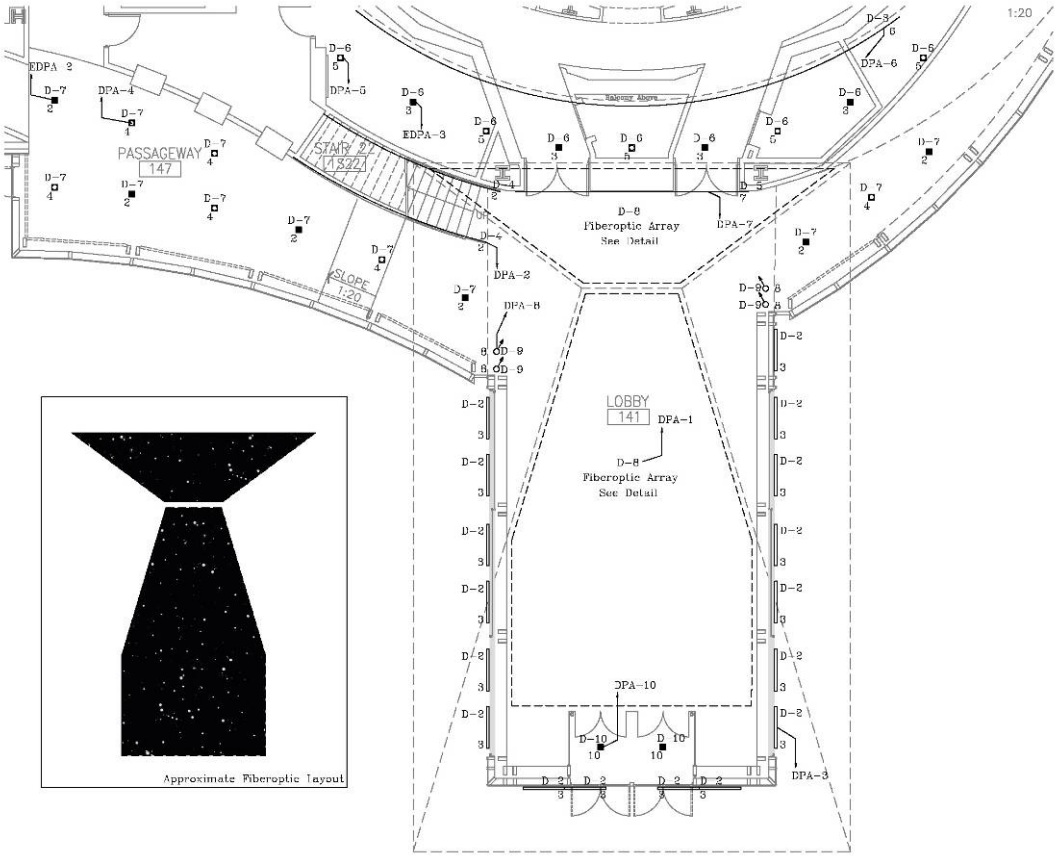


Figure 5.2 – Circuiting Plan (New Layout)

New Electrical Conditions Summary:

The new circuiting layout uses almost the same number of dimmer zones and circuits, but the individual loads have been significantly reduced and can be seen on the tables below. I was able to reduce the C/B protecting dimmer panel DPA from 50A to 15A, due to lower wattage lamps such as LEDs and CFLs. All ballasts and drivers have been specified as dimmable. Note the panelboard schedule has been provided for a piece of switchgear, lighting distribution panelboard DLB, as this breaker size changed due to reduced loading on the Lutron dimming panel.

Panelboard Schedules & Feeders

Dimmer Panel - DPA									
208Y/120V 3 Phase 4 Wire, 20A Feed, M.L.O.							Serviced By Panel: DLB, C/B 9		
Fixture Type	Ckt	Zone	Load (W)	Qt	Load Type	Total Load	Max Load	Bkr Size	Phase
Fiberoptics	1	1	75	3	Fiberoptic	225	1920	20A - 1P	A
Lobby Stairs	2	2	8.00/ft	40	LED	320	1920	20A - 1P	B
Exterior Down	3	3	48	17	LED	816	1920	20A - 1P	C
Passage Down	4	4	28	6	CFL	168	1920	20A - 1P	A
Balcony Down	5	6	28	5	CFL	140	1920	20A - 1P	B
Balcony Cove	6	8	1.15/ft	56	LED	65	1920	20A - 1P	C
Lobby Signage	7	9	8.00/ft	23	LED	184	1920	20A - 1P	A
Lobby Spots	8	10	50	4	INC/LV	200	1920	20A - 1P	B
Par Down-AMT	9	11	90	4	INC/LV	360	1920	20A - 1P	C
Lobby Vestibule	10	13	22	2	CFL	44	1920	20A - 1P	A
Calculation of Design Load Ampacity:									
					Connected Load:	2522			
					(x 1.25) growth:	3153	---------->	8.8 A	
					(/ 0.80) code:	---------->		10.9 A	
Wire Size			**Conduit Size**				**Circuit Breaker**		
(4) #14 AWG + (1) #14 AWG g			1/2" EMT				15A		

Table 5.4 – Dimmer Panel DPA Schedule (New Layout)

Dimmer Panel - EDPA									
120V 1 Phase 2 Wire, 20A Feed, M.L.O.							Serviced By Panel: EPLGS, C/B 2,4,6		
Fixture Type	Ckt	Zone	Load (W)	Qt	Load Type	Total Load	Max Load	Bkr Size	Phase
Passage Down	1	5	28	6	CFL	168	1920	20A - 1P	
Balcony Down	2	7	100	6	INC/LV	600	1920	20A - 1P	
Par Down-AMT	3	12	90	4	INC/LV	360	1920	20A - 1P	
Calculation of Design Load Ampacity:									
					Connected Load:	1128			
					(x 1.25) growth:	1410	---------->	3.9 A	
					(/ 0.80) code:	---------->		4.9 A	
Wire Size			**Conduit Size**				**Circuit Breaker**		
(2) #14 AWG + (1) #14 AWG g			1/2" EMT				15A		

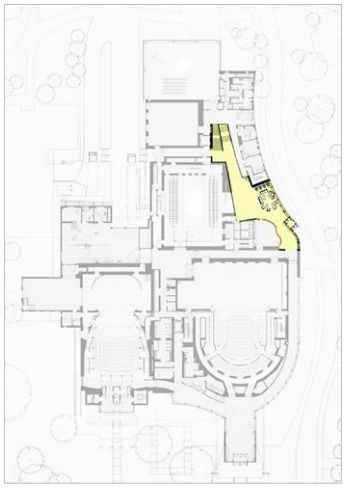
Table 5.5 – Emergency Dimmer Panel EDPA Schedule (New Layout)

Distribution Panel - DLB				
208Y120V, 3P 4W			SURFACE MOUNTED	
800A M.L.O.			MIN. AIC. = 65K	
Item No.	Item Served	Frame	Breaker	
			Trip	Poles
1	D-2	100	100	3
2	D-5	100	100	3
3	AUDIO COMPANY SWITCH	100	100	3
4	D-A1	100	60	3
5	D-D2	225	200	3
6	D-DR1	100	60	3
7	D-DR2	225	200	3
8	D-D1	100	100	3
9	LUTRON PANEL DPA	100	15	3
10	SPARE	225	200	3
11	SPARE	100	100	3
12	SPACE & HARDWARE	225		3
13	SPACE & HARDWARE	100		3

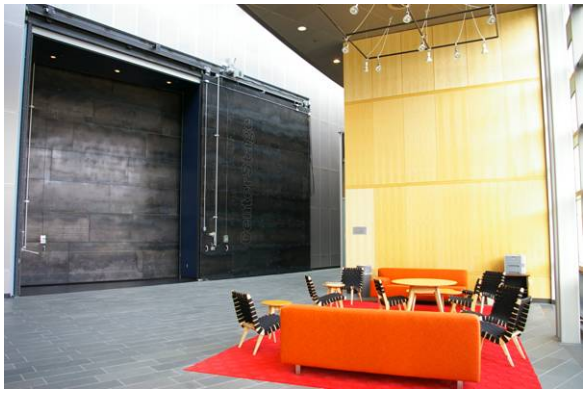
Table 5.6 – Distribution Panelboard DLB Schedule (New Layout)

Space 2: Center Stage Lobby (A special purpose space)

General Summary:



Located just outside the Center Stage black box theatre and in the middle of a long hallway that winds through the entire length of the building, the Center Stage lobby marks the point at which the architect has chosen to change the use of materials from a warm wood glow to a more harsh and technical steel and aluminum. This change was characterized as personifying the learning experience as you travel to the "back of the house" of the theatrical world, where things aren't quite as warm and beautiful as the end result on stage. This breakout space also serves as one of the three entrances to the new construction portion of the building and has quite and extensive square footage of glass, both along the perimeter wall and at the skylight in the ajoining corridor to the north west.



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Existing Conditions:

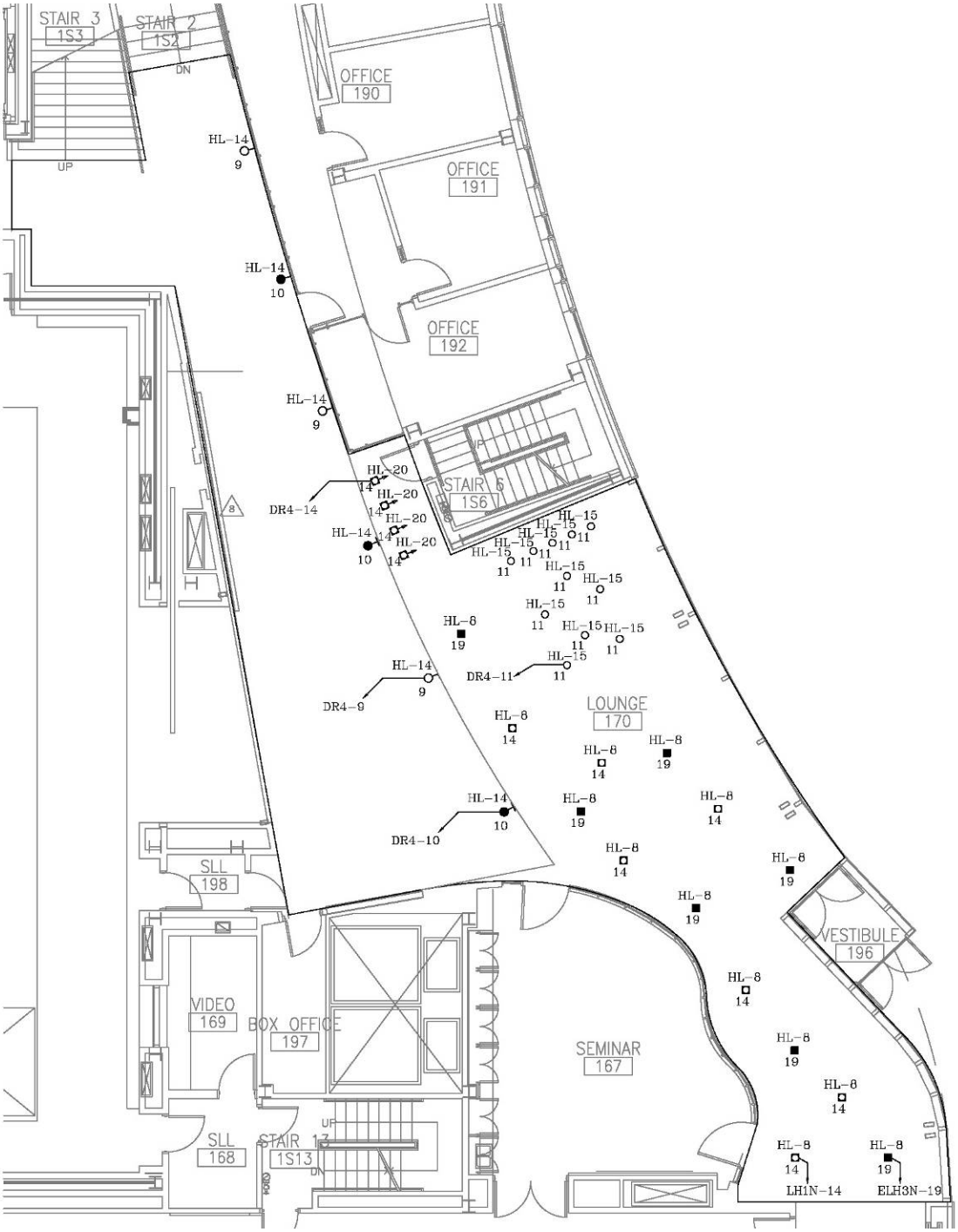

Figure 6.1 – Circuiting Plan (Existing Layout)

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Panelboard Schedules & Feeders

Dimmer Rack - DR4									
Location: Dimmer Room #356									Feeder Size:
Serviced By: Main Switchgear SB3, Item #6, w/ 200A C/B									(4) #3/0 + (1) #6G in 2"C
Rack No.	Circuit #	Dimmer Slot	Zone	Description	Fixture Load	Qty	Total Load (W)	Emergency	Panel #
4	DR4-1	289	1	Cove at Floor 2	2680	1	1280	No	
4	DR4-2	290	1	Cove at Floor 2	2680	1	1400	No	
4	DR4-3	291	2	Cove at Floor 3	2280	1	2280	No	
4	DR4-4	292	3	Track at Stairs	90	4	360	No	
4	DR4-5	293	4	Track at Stairs	90	5	450	No	
4	DR4-6	294	5	DL at Center Stair	100	4	400	Yes	EL3S-21
4	DR4-7	295	6	Jelly Jars	100	16	1600	Yes	EL3S-23
4	DR4-8	296	7	Jelly Jars	100	10	1000	Yes	EL3S-25
4	DR4-9	297	8	Skylight Fixtures	270	3	810	No	
4	DR4-10	298	8	Skylight Fixtures	270	3	810	Yes	EL3S-27
4	DR4-11	299	9	Lobby Grid	90	11	990	No	
4	DR4-12	300	10	SLL 282	100	7	700	Yes	EL3S-29
4	DR4-13	301	11	Second Floor Hallway	100	3	300	Yes	EL3S-22
4	DR4-14	302	11	Second Floor Hallway	46	4	184	No	
4	DR4-15	303	12	Grid Receptacle	575	2	1150	No	
4	DR4-16	304	13	Grid Receptacle	575	2	1150	No	
4	DR4-17	305	14	Grid Receptacle	575	2	1150	No	
4	DR4-18	306	15	Grid Receptacle	575	2	1150	No	
4	DR4-19	307	16	Grid Receptacle	575	2	1150	No	
					Total Connected Load:		18314		

Table 6.1 - Dimmer Rack DR4 (Existing Layout)

PANELBOARD SCHEDULE												
VOLTAGE: 480Y/277V,3PH,4W SIZE/TYPE BUS: 150A SIZE/TYPE MAIN: 125A M.L.O.			PANEL TAG: LH1N PANEL LOCATION: Electrical Closet #184 PANEL MOUNTING: SURFACE					MIN. C/B AIC: 22K OPTIONS: Conductors are: (4) #1 + (1) #6G in 2"C				
DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
unknown	unknown	3545	20A/1P	1	*			2	20A/1P	3545	unknown	unknown
unknown	unknown	3545	20A/1P	3		*		4	20A/1P	3545	Rec. Dock	unknown
unknown	unknown	3545	20A/1P	5			*	6	20A/1P	3545	Main Corr	unknown
unknown	unknown	3545	20A/1P	7	*			8	20A/1P	3545	2nd Fl	unknown
unknown	2nd Fl Corr	3545	20A/1P	9		*		10	20A/1P	3545	Hall #091	unknown
unknown	unknown	3545	20A/1P	11			*	12	20A/1P	3545	Waiting Area	unknown
unknown	unknown	3545	20A/1P	13	*			14	20A/1P	322	Lobby East	CFL Downlights
unknown	unknown	3545	20A/1P	15		*		16	20A/1P	3545	unknown	unknown
unknown	unknown	3545	20A/1P	17			*	18	20A/1P	3545	unknown	unknown
unknown	unknown	3545	20A/1P	19	*			20	70A/3P	15519	El. Cl. #184	T4 Xfrm to PL1N
unknown	unknown	3545	20A/1P	21		*		22	-----	15519	---	--------
unknown	unknown	3545	20A/1P	23			*	24	-----	15519	---	--------
unknown	unknown	3545	20A/1P	25	*			26	1P	0	---	Spare
Spare	---	0	1P	27		*		28	1P	0	---	Spare
Spare	---	0	1P	29			*	30	1P	0	---	Spare
Non-existant	None	0		31	*			32		0	None	Non-existant
Non-existant	None	0		33		*		34		0	None	Non-existant
Non-existant	None	0		35			*	36		0	None	Non-existant
Non-existant	None	0		37	*			38		0	None	Non-existant
Non-existant	None	0		39		*		40		0	None	Non-existant
Non-existant	None	0		41			*	42		0	None	Non-existant
CONNECTED LOAD (KW) - A		40.66								TOTAL DESIGN LOAD (KW)		112.86
CONNECTED LOAD (KW) - B		40.33								POWER FACTOR		1.00
CONNECTED LOAD (KW) - C		40.33								TOTAL DESIGN LOAD (AMPS)		136

Table 6.2 - Panelboard Schedule LH1N (Existing Layout)

PANELBOARD SCHEDULE

VOLTAGE: 480Y/277V,3PH,4W
SIZE/TYPE BUS: 150A
SIZE/TYPE MAIN: 125A M.L.O.

PANEL TAG: ELH3N
PANEL LOCATION: Emergency Closet #358
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: Conductors are:
2hr Fire Rated (3)#4 in Metal Sheath.

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Fluorescent Ltg	Stair 13	3545	20A/1P	1	*			2	20A/1P	3545	Elev. Pent.	Fluorescent Ltg
Fluorescent Ltg	Stair 13	3545	20A/1P	3		*		4	20A/1P	3545	Scene Shop	HID Canister
unknown	unknown	3545	20A/1P	5			*	6	20A/1P	3545	Act Studio	Fluorescent Ltg
unknown	unknown	6651	30A/3P	7	*			8	20A/1P	3545	2nd Fl Corr	unknown
--------	---	6651	-----	9		*		10	20A/1P	3545	unknown	unknown
--------	---	6651	-----	11			*	12	20A/1P	3545	unknown	unknown
unknown	unknown	3545	20A/1P	13	*			14	20A/1P	1380	Dance Studio	Fluorescent Ltg
unknown	unknown	3545	20A/1P	15		*		16	20A/1P	3545	unknown	unknown
CFL Downlights	2nd Fl Corr	3545	20A/1P	17			*	18	20A/1P	3545	unknown	unknown
CFL Downlights	Lobby East	322	20A/1P	19	*			20	20A/1P	3545	unknown	unknown
Non-existant	None	0		21		*		22		0	None	Non-existant
Non-existant	None	0		23			*	24		0	None	Non-existant
Non-existant	None	0		25	*			26		0	None	Non-existant
Non-existant	None	0		27		*		28		0	None	Non-existant
Non-existant	None	0		29			*	30		0	None	Non-existant
Non-existant	None	0		31	*			32		0	None	Non-existant
Non-existant	None	0		33		*		34		0	None	Non-existant
Non-existant	None	0		35			*	36		0	None	Non-existant
Non-existant	None	0		37	*			38		0	None	Non-existant
Non-existant	None	0		39		*		40		0	None	Non-existant
Non-existant	None	0		41			*	42		0	None	Non-existant

CONNECTED LOAD (KW) - A	26.08	TOTAL DESIGN LOAD (KW)	73.83
CONNECTED LOAD (KW) - B	24.38	POWER FACTOR	1.00
CONNECTED LOAD (KW) - C	24.38	TOTAL DESIGN LOAD (AMPS)	89

Table 6.3 - Panelboard Schedule ELH3N (Existing Layout)

New Design:

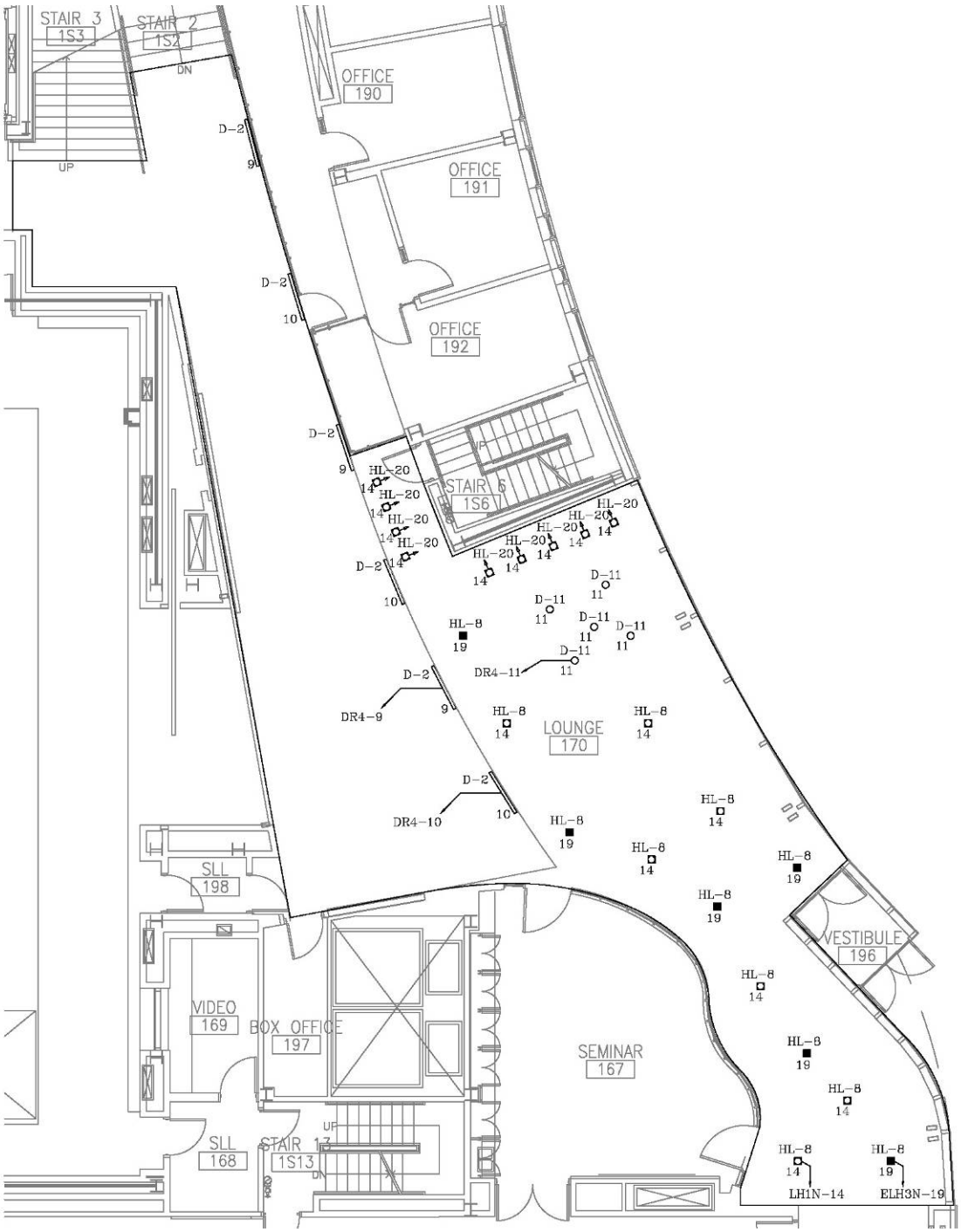

Figure 6.2 – Circuiting Plan (New Layout)

Panelboard Schedules & Feeders

Dimmer Rack - DR4									
Location: Dimmer Room #356									Feeder Size:
Serviced By: Main Switchgear SB3, Item #6, w/ 125A C/B									(4) #1 + (1) #6G in 1.5"C
Rack No.	Circuit #	Dimmer Slot	Zone	Description	Fixture Load	Qty	Total Load (W)	Emergency	Panel #
4	DR4-1	289	1	Cove at Floor 2	2680	1	1280	No	
4	DR4-2	290	1	Cove at Floor 2	2680	1	1400	No	
4	DR4-3	291	2	Cove at Floor 3	2280	1	2280	No	
4	DR4-4	292	3	Track at Stairs	90	4	360	No	
4	DR4-5	293	4	Track at Stairs	90	5	450	No	
4	DR4-6	294	5	DL at Center Stair	100	4	400	Yes	EL3S-21
4	DR4-7	295	6	Jelly Jars	100	16	1600	Yes	EL3S-23
4	DR4-8	296	7	Jelly Jars	100	10	1000	Yes	EL3S-25
4	DR4-9	297	8	Skylight Fixtures	48	3	144	No	
4	DR4-10	298	8	Skylight Fixtures	48	3	144	Yes	EL3S-27
4	DR4-11	299	9	Lobby Grid	50	5	250	No	
4	DR4-12	300	10	SLL 282	100	7	700	Yes	EL3S-29
4	DR4-13	301	11	Second Floor Hallway	100	3	300	Yes	EL3S-22
4	DR4-14	302	11	Second Floor Hallway	46	9	414	No	
4	DR4-15	--------	-----	Removed Receptacles	---------	-----	-----	-----	
4	DR4-16	--------	-----	Removed Receptacles	---------	-----	-----	-----	
4	DR4-17	--------	-----	Removed Receptacles	---------	-----	-----	-----	
4	DR4-18	--------	-----	Removed Receptacles	---------	-----	-----	-----	
4	DR4-19	--------	-----	Removed Receptacles	---------	-----	-----	-----	

Table 6.4 - Dimmer Rack DR4 (New Layout)

PANELBOARD SCHEDULE												
VOLTAGE: 480Y/277V,3PH,4W SIZE/TYPE BUS: 225A SIZE/TYPE MAIN: 175A M.L.O.			PANEL TAG: LH1N PANEL LOCATION: Electrical Closet #184 PANEL MOUNTING: SURFACE							MIN. C/B AIC: 22K OPTIONS: Conductors to be: (4) #2/0 + (1) #6G in 2"C		
DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
unknown	unknown	3545	20A/1P	1	*			2	20A/1P	3545	unknown	unknown
unknown	unknown	3545	20A/1P	3		*		4	20A/1P	3545	Rec. Dock	unknown
unknown	unknown	3545	20A/1P	5			*	6	20A/1P	3545	Main Corr	unknown
unknown	unknown	3545	20A/1P	7	*			8	20A/1P	3545	2nd Fl	unknown
unknown	2nd Fl Corr	3545	20A/1P	9		*		10	20A/1P	3545	Hall #091	unknown
unknown	unknown	3545	20A/1P	11			*	12	20A/1P	3545	Waiting Area	unknown
unknown	unknown	3545	20A/1P	13	*			14	20A/1P	322	Lobby East	CFL Downlights
unknown	unknown	3545	20A/1P	15		*		16	20A/1P	3545	unknown	unknown
unknown	unknown	3545	20A/1P	17			*	18	20A/1P	3545	unknown	unknown
unknown	unknown	3545	20A/1P	19	*			20	70A/3P	15519	El. Cl. #184	T4 Xfrm to PL1N
unknown	unknown	3545	20A/1P	21		*		22	-----	15519	---	--------
unknown	unknown	3545	20A/1P	23			*	24	-----	15519	---	--------
unknown	unknown	3545	20A/1P	25	*			26	1P	0	---	Spare
Spare	---	0	1P	27		*		28	1P	0	---	Spare
Spare	---	0	1P	29			*	30	1P	0	---	Spare
Non-existant	None	0		31	*			32		0	None	Non-existant
Non-existant	None	0		33		*		34		0	None	Non-existant
Non-existant	None	0		35			*	36		0	None	Non-existant
Non-existant	None	0		37	*			38		0	None	Non-existant
Non-existant	None	0		39		*		40		0	None	Non-existant
Non-existant	None	0		41			*	42		0	None	Non-existant
CONNECTED LOAD (KW) - A		40.66								TOTAL DESIGN LOAD (KW)		108.34
CONNECTED LOAD (KW) - B		40.33								POWER FACTOR		1.00
CONNECTED LOAD (KW) - C		40.33								TOTAL DESIGN LOAD (AMPS)		130

Table 6.5 - Panelboard Schedule LH1N (New Layout)

PANELBOARD SCHEDULE

VOLTAGE: 480Y/277V,3PH,4W
SIZE/TYPE BUS: 150A
SIZE/TYPE MAIN: 125A M.L.O.

PANEL TAG: ELH3N
PANEL LOCATION: Emergency Closet #358
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: Conductors to be:
2hr Fire Rated (3)#1 in Metal Sheath.

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Fluorescent Ltg	Stair 13	3545	20A/1P	1	*			2	20A/1P	3545	Elev. Pent.	Fluorescent Ltg
Fluorescent Ltg	Stair 13	3545	20A/1P	3		*		4	20A/1P	3545	Scene Shop	HID Canister
unknown	unknown	3545	20A/1P	5			*	6	20A/1P	3545	Act Studio	Fluorescent Ltg
unknown	unknown	6651	30A/3P	7	*			8	20A/1P	3545	2nd Fl Corr	unknown
--------	---	6651	-----	9		*		10	20A/1P	3545	unknown	unknown
--------	---	6651	-----	11			*	12	20A/1P	3545	unknown	unknown
unknown	unknown	3545	20A/1P	13	*			14	20A/1P	1350	Dance Studio	Fluorescent Ltg
unknown	unknown	3545	20A/1P	15		*		16	20A/1P	3545	unknown	unknown
CFL Downlights	2nd Fl Corr	3545	20A/1P	17			*	18	20A/1P	3545	unknown	unknown
CFL Downlights	Lobby East	276	20A/1P	19	*			20	20A/1P	3545	unknown	unknown
Non-existant	None	0		21		*		22		0	None	Non-existant
Non-existant	None	0		23			*	24		0	None	Non-existant
Non-existant	None	0		25	*			26		0	None	Non-existant
Non-existant	None	0		27		*		28		0	None	Non-existant
Non-existant	None	0		29			*	30		0	None	Non-existant
Non-existant	None	0		31	*			32		0	None	Non-existant
Non-existant	None	0		33		*		34		0	None	Non-existant
Non-existant	None	0		35			*	36		0	None	Non-existant
Non-existant	None	0		37	*			38		0	None	Non-existant
Non-existant	None	0		39		*		40		0	None	Non-existant
Non-existant	None	0		41			*	42		0	None	Non-existant

CONNECTED LOAD (KW) - A	26.00	TOTAL DESIGN LOAD (KW)	73.74
CONNECTED LOAD (KW) - B	24.38	POWER FACTOR	1.00
CONNECTED LOAD (KW) - C	24.38	TOTAL DESIGN LOAD (AMPS)	89

Table 6.6 - Panelboard Schedule ELH3N (New Layout)

Space 3: Dance Rehearsal Studio (A large work space)

General Summary:

Located on the second floor of the North West corner of the building is a 3200 sq.ft. (65'x50') dance rehearsal studio that is surrounded on three sides by soaring glass curtain walls with an impressive view of the rolling landscape. There's 27 feet from floor to ceiling, which takes the room straight to the underside of the roof, leaving the mechanical and lighting systems exposed overheard, while maximizing the volume of the space. The fourth wall of the space, which isn't made of glass, is covered with eight foot tall mirrors and acoustical panels.

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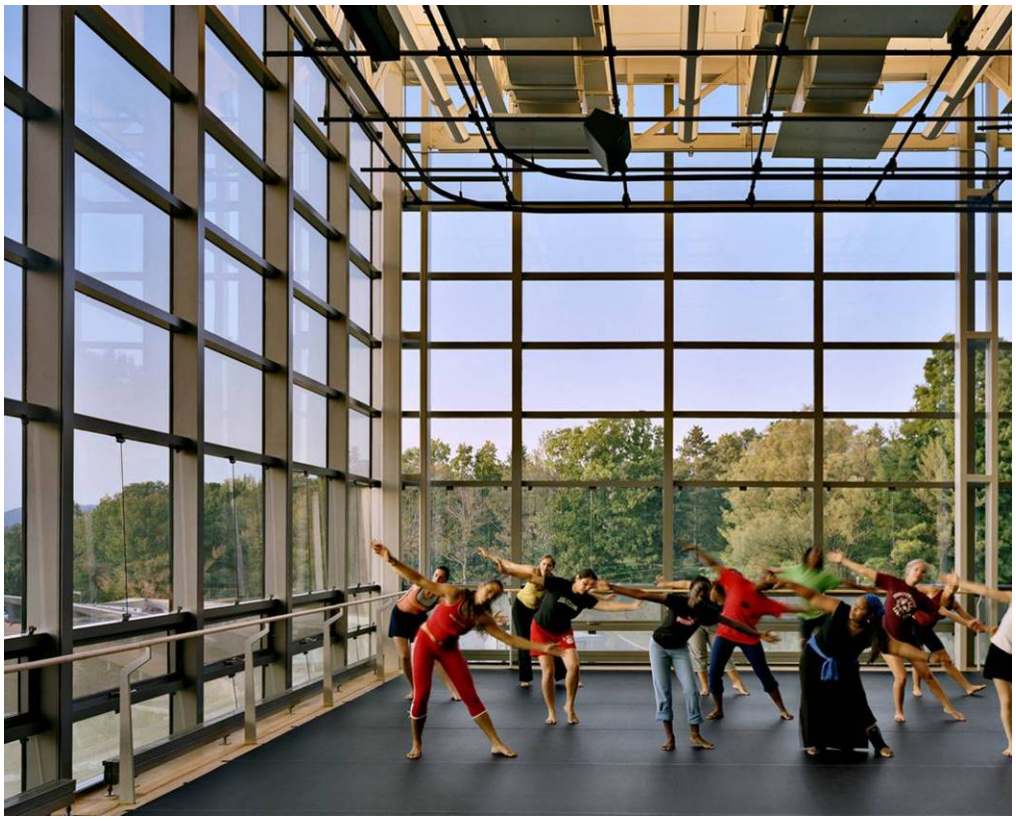

Existing Conditions:

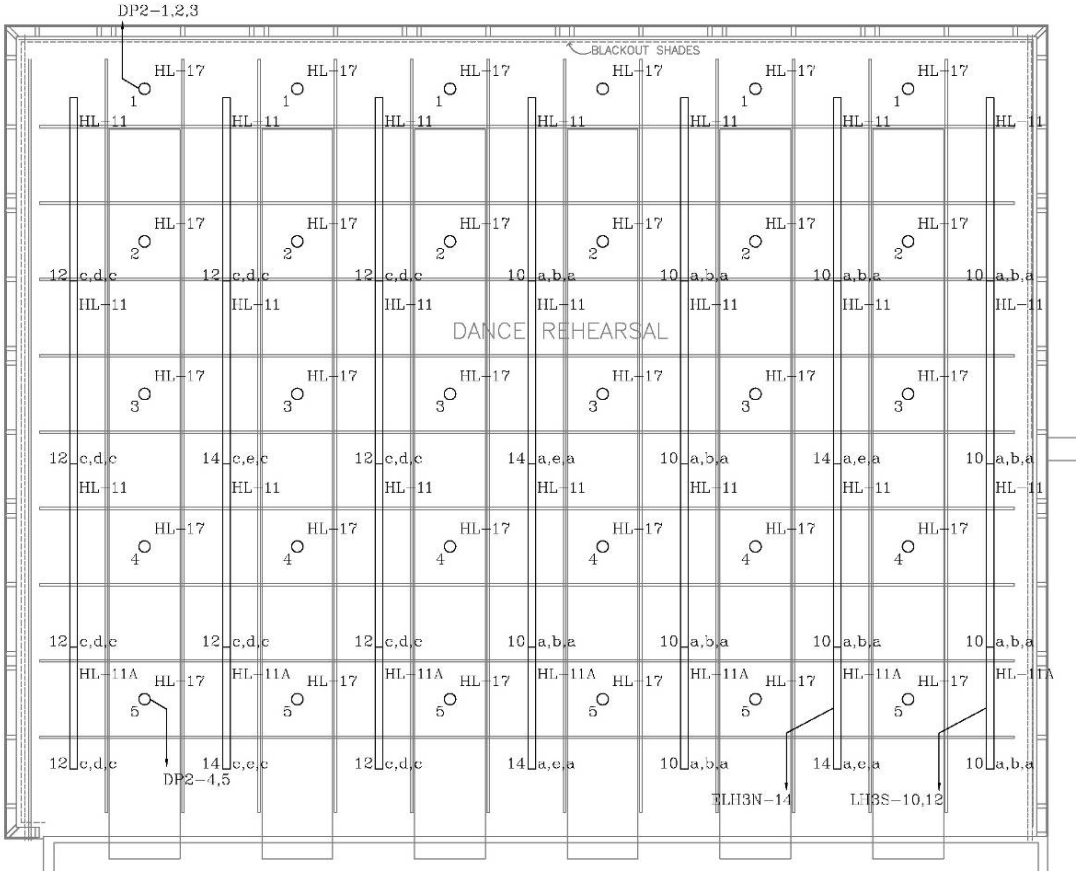

Figure 7.1 – Circuiting Plan (Existing Layout)

One panelboard has not been shown due to such a small change in the overall loading of the panel. The incandescent lighting loads, removed from dimmer panel DP-2 panel, reduces the load on panel PHGN, circuit #76, and makes the 30A 3P breaker unnecessary.

Panelboard Schedules & Feeders

Dimmer Rack - DR1									
Location: Closet #090								Feeder Size:	
Serviced By: Main Switchgear SB3, Item #3, w/600A C/B							2 Sets (4) 350MCM + (1)#1G in (2) 3"C		
Rack No.	Circuit #	Dimmer Slot	Zone	Description	Lamp Type	Qty	Total Load (W)	Emergency	Panel #
1	DP1-1	1	1	Directing Studio Downlights	150PAR38/FL	5	750	No	
1	DP1-2	2	2	Directing Studio Downlights	150PAR38/FL	5	750	No	
1	DP1-3	3	3	Directing Studio Downlights	150PAR38/FL	5	750	No	
1	DP1-4	4	4	Directing Studio Downlights	150PAR38/FL	5	750	No	
1	DP1-5	5	5	Directing Studio Downlights	150PAR38/FL	5	750	No	
1	DP1-6	6	6	SLL 089	100A/1F	1	100	No	
1	DP2-1	1	1	Dance Researsal Downlights	90PAR38/FL	6	540	No	
1	DP2-2	2	2	Dance Researsal Downlights	90PAR38/FL	6	540	No	
1	DP2-3	3	3	Dance Researsal Downlights	90PAR38/FL	6	540	No	
1	DP2-4	4	4	Dance Researsal Downlights	90PAR38/FL	6	540	No	
1	DP2-5	5	5	Dance Researsal Downlights	90PAR38/FL	6	540	No	
1	DP2-6	6	6	SLL 282	100A/1F	1	100	No	
					Total Connected Load:		6650		

Table 7.1 - Dimmer Rack DR1 (Existing Layout)

Williams College '62 Center For Theater & Dance
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PANELBOARD SCHEDULE

VOLTAGE: 480Y/277V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A M.L.O.

PANEL TAG: LH3S
PANEL LOCATION: Dimmer Room #356
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: Conductors are:
(4) #4/0 + (1) #4G in 2.5"C

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Fluorescent Ltg	2nd Fl South	3545	20A/1P	1	*			2	20A/1P	3545	WTF Office	Fluorescent Ltg
Fluorescent Ltg	Black Box	3545	20A/1P	3		*		4	20A/1P	3545	3rd Fl South	CFL Downlights
unknown	unknown	3545	20A/1P	5			*	6	20A/1P	3545	Scene Shop	HID Canister
unknown	unknown	3545	20A/1P	7	*			8	20A/1P	3545	Scene Shop	Fluorescent Ltg
unknown	unknown	3545	20A/1P	9		*		10	20A/1P	3128	Dance Studio	Fluorescent Ltg
unknown	unknown	3545	20A/1P	11			*	12	20A/1P	2576	Dance Studio	Fluorescent Ltg
unknown	unknown	3545	20A/1P	13	*			14	125A/3P	27713	Ctl Rm #348	T5 Xfrm to PLS3
unknown	unknown	3545	20A/1P	15		*		16	-----	27713	---	--------
unknown	unknown	3545	20A/1P	17			*	18	-----	27713	---	--------
Spare	---	0	1P	19	*			20	1P	0	---	Spare
Spare	---	0	1P	21		*		22	1P	0	---	Spare
Spare	---	0	1P	23			*	24	1P	0	---	Spare
Spare	---	0	1P	25	*			26	1P	0	---	Spare
Spare	---	0	1P	27		*		28	1P	0	---	Spare
Spare	---	0	1P	29			*	30	1P	0	---	Spare
Spare	---	0	1P	31	*			32	1P	0	---	Spare
Spare	---	0	1P	33		*		34	1P	0	---	Spare
Spare	---	0	1P	35			*	36	1P	0	---	Spare
Spare	---	0	1P	37	*			38	1P	0	---	Spare
Spare	---	0	1P	39		*		40	1P	0	---	Spare
Spare	---	0	1P	41			*	42	1P	0	---	Spare

CONNECTED LOAD (KW) - A	45.44	TOTAL DESIGN LOAD (KW)	127.20
CONNECTED LOAD (KW) - B	45.02	POWER FACTOR	1.00
CONNECTED LOAD (KW) - C	44.47	TOTAL DESIGN LOAD (AMPS)	153

Table 7.2 - Panelboard Schedule LH3S (Existing Layout)

PANELBOARD SCHEDULE

VOLTAGE: 480Y/277V,3PH,4W
SIZE/TYPE BUS: 150A
SIZE/TYPE MAIN: 125A M.L.O.

PANEL TAG: ELH3N
PANEL LOCATION: Emergency Closet #358
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: Conductors are:
2hr Fire Rated (3)#4 in Metal Sheath.

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Fluorescent Ltg	Stair 13	3545	20A/1P	1	*			2	20A/1P	3545	Elev. Pent.	Fluorescent Ltg
Fluorescent Ltg	Stair 13	3545	20A/1P	3		*		4	20A/1P	3545	Scene Shop	HID Canister
unknown	unknown	3545	20A/1P	5			*	6	20A/1P	3545	Act Studio	Fluorescent Ltg
unknown	unknown	6651	30A/3P	7	*			8	20A/1P	3545	2nd Fl Corr	unknown
--------	---	6651	-----	9		*		10	20A/1P	3545	unknown	unknown
--------	---	6651	-----	11			*	12	20A/1P	3545	unknown	unknown
unknown	unknown	3545	20A/1P	13	*			14	20A/1P	1380	Dance Studio	Fluorescent Ltg
unknown	unknown	3545	20A/1P	15		*		16	20A/1P	3545	unknown	unknown
CFL Downlights	2nd Fl Corr	3545	20A/1P	17			*	18	20A/1P	3545	unknown	unknown
CFL Downlights	Lobby East	322	20A/1P	19	*			20	20A/1P	3545	unknown	unknown
Non-existant	None	0		21		*		22		0	None	Non-existant
Non-existant	None	0		23			*	24		0	None	Non-existant
Non-existant	None	0		25	*			26		0	None	Non-existant
Non-existant	None	0		27		*		28		0	None	Non-existant
Non-existant	None	0		29			*	30		0	None	Non-existant
Non-existant	None	0		31	*			32		0	None	Non-existant
Non-existant	None	0		33		*		34		0	None	Non-existant
Non-existant	None	0		35			*	36		0	None	Non-existant
Non-existant	None	0		37	*			38		0	None	Non-existant
Non-existant	None	0		39		*		40		0	None	Non-existant
Non-existant	None	0		41			*	42		0	None	Non-existant

CONNECTED LOAD (KW) - A	26.08	TOTAL DESIGN LOAD (KW)	73.83
CONNECTED LOAD (KW) - B	24.38	POWER FACTOR	1.00
CONNECTED LOAD (KW) - C	24.38	TOTAL DESIGN LOAD (AMPS)	89

Table 7.3 - Panelboard Schedule ELH3N (Existing Layout)

New Design:

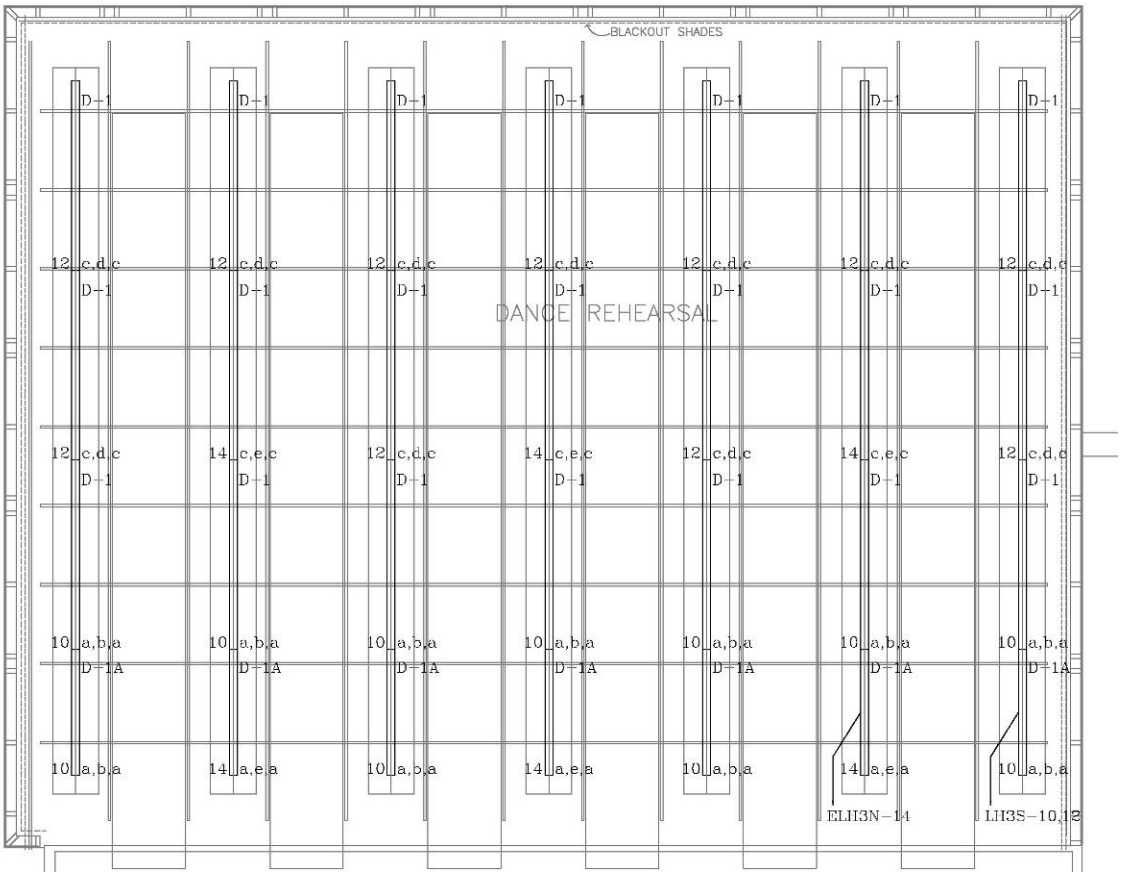


Figure 7.2 – Circuiting Plan (New Layout)

Panelboard Schedules & Feeders

Dimmer Rack - DR1									
Location: Closet #090								Feeder Size:	
Serviced By: Main Switchgear SB3, Item #3, w/20A C/B								(4) #12 + (1) #12 in 1/2"C	
Rack No.	Circuit #	Dimmer Slot	Zone	Description	Lamp Type	Qty	Total Load (W)	Emergency	Panel #
1	DP1-1	1	1	Directing Studio Downlights	150PAR38/FL	5	750	No	
1	DP1-2	2	2	Directing Studio Downlights	150PAR38/FL	5	750	No	
1	DP1-3	3	3	Directing Studio Downlights	150PAR38/FL	5	750	No	
1	DP1-4	4	4	Directing Studio Downlights	150PAR38/FL	5	750	No	
1	DP1-5	5	5	Directing Studio Downlights	150PAR38/FL	5	750	No	
1	DP1-6	6	6	SLL 089	100A/1F	1	100	No	
1	DP2-1	--------	-----	Removed DP2 from rack	---------	-----	-----	-----	
1	DP2-2	--------	-----	Removed DP2 from rack	---------	-----	-----	-----	
1	DP2-3	--------	-----	Removed DP2 from rack	---------	-----	-----	-----	
1	DP2-4	--------	-----	Removed DP2 from rack	---------	-----	-----	-----	
1	DP2-5	--------	-----	Removed DP2 from rack	---------	-----	-----	-----	
1	DP2-6	--------	-----	Removed DP2 from rack	---------	-----	-----	-----	
						Total Connected Load:	3850		

Table 7.4 - Dimmer Rack DR1 (New Layout)

PANELBOARD SCHEDULE

VOLTAGE: 480Y/277V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 200A M.L.O.

PANEL TAG: LH3S
PANEL LOCATION: Dimmer Room #356
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: Conductors are:
(4) #3/0 + (1) #6G in 2"C

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Fluorescent Ltg	2nd Fl South	3545	20A/1P	1	*			2	20A/1P	3545	WTF Office	Fluorescent Ltg
Fluorescent Ltg	Black Box	3545	20A/1P	3		*		4	20A/1P	3545	3rd Fl South	CFL Downlights
unknown	unknown	3545	20A/1P	5			*	6	20A/1P	3545	Scene Shop	HID Canister
unknown	unknown	3545	20A/1P	7	*			8	20A/1P	3545	Scene Shop	Fluorescent Ltg
unknown	unknown	3545	20A/1P	9		*		10	20A/1P	2610	Dance Studio	Fluorescent Ltg
unknown	unknown	3545	20A/1P	11			*	12	20A/1P	2970	Dance Studio	Fluorescent Ltg
unknown	unknown	3545	20A/1P	13	*			14	125A/3P	27713	Ctl Rm #348	T5 Xfrm to PLS3
unknown	unknown	3545	20A/1P	15		*		16	-----	27713	---	--------
unknown	unknown	3545	20A/1P	17			*	18	-----	27713	---	--------
Spare	---	0	1P	19	*			20	1P	0	---	Spare
Spare	---	0	1P	21		*		22	1P	0	---	Spare
Spare	---	0	1P	23			*	24	1P	0	---	Spare
Spare	---	0	1P	25	*			26	1P	0	---	Spare
Spare	---	0	1P	27		*		28	1P	0	---	Spare
Spare	---	0	1P	29			*	30	1P	0	---	Spare
Spare	---	0	1P	31	*			32	1P	0	---	Spare
Spare	---	0	1P	33		*		34	1P	0	---	Spare
Spare	---	0	1P	35			*	36	1P	0	---	Spare
Spare	---	0	1P	37	*			38	1P	0	---	Spare
Spare	---	0	1P	39		*		40	1P	0	---	Spare
Spare	---	0	1P	41			*	42	1P	0	---	Spare

CONNECTED LOAD (KW) - A	45.44	TOTAL DESIGN LOAD (KW)	127.00
CONNECTED LOAD (KW) - B	44.50	POWER FACTOR	1.00
CONNECTED LOAD (KW) - C	44.86	TOTAL DESIGN LOAD (AMPS)	153

Table 7.5 - Panelboard Schedule LH3S (New Layout)

PANELBOARD SCHEDULE

VOLTAGE: 480Y/277V,3PH,4W
SIZE/TYPE BUS: 150A
SIZE/TYPE MAIN: 125A M.L.O.

PANEL TAG: ELH3N
PANEL LOCATION: Emergency Closet #358
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: Conductors to be:
2hr Fire Rated (3)#1 in Metal Sheath.

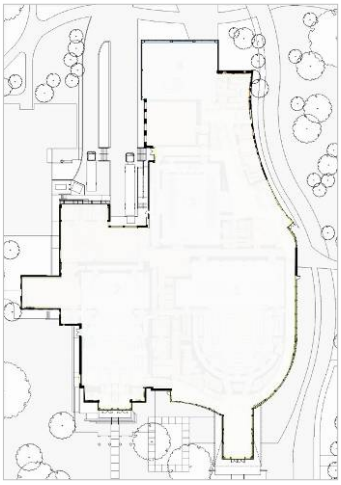
DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
Fluorescent Ltg	Stair 13	3545	20A/1P	1	*			2	20A/1P	3545	Elev. Pent.	Fluorescent Ltg
Fluorescent Ltg	Stair 13	3545	20A/1P	3		*		4	20A/1P	3545	Scene Shop	HID Canister
unknown	unknown	3545	20A/1P	5			*	6	20A/1P	3545	Act Studio	Fluorescent Ltg
unknown	unknown	6651	30A/3P	7	*			8	20A/1P	3545	2nd Fl Corr	unknown
--------	---	6651	-----	9		*		10	20A/1P	3545	unknown	unknown
--------	---	6651	-----	11			*	12	20A/1P	3545	unknown	unknown
unknown	unknown	3545	20A/1P	13	*			14	20A/1P	1350	Dance Studio	Fluorescent Ltg
unknown	unknown	3545	20A/1P	15		*		16	20A/1P	3545	unknown	unknown
CFL Downlights	2nd Fl Corr	3545	20A/1P	17			*	18	20A/1P	3545	unknown	unknown
CFL Downlights	Lobby East	276	20A/1P	19	*			20	20A/1P	3545	unknown	unknown
Non-existant	None	0		21		*		22		0	None	Non-existant
Non-existant	None	0		23			*	24		0	None	Non-existant
Non-existant	None	0		25	*			26		0	None	Non-existant
Non-existant	None	0		27		*		28		0	None	Non-existant
Non-existant	None	0		29			*	30		0	None	Non-existant
Non-existant	None	0		31	*			32		0	None	Non-existant
Non-existant	None	0		33		*		34		0	None	Non-existant
Non-existant	None	0		35			*	36		0	None	Non-existant
Non-existant	None	0		37	*			38		0	None	Non-existant
Non-existant	None	0		39		*		40		0	None	Non-existant
Non-existant	None	0		41			*	42		0	None	Non-existant

CONNECTED LOAD (KW) - A	26.00	TOTAL DESIGN LOAD (KW)	73.74
CONNECTED LOAD (KW) - B	24.38	POWER FACTOR	1.00
CONNECTED LOAD (KW) - C	24.38	TOTAL DESIGN LOAD (AMPS)	89

Table 7.6 - Panelboard Schedule ELH3N (New Layout)

Space 4: Building Facade (An outdoor space or building facade)

General Summary:



The façade of the building is currently unlit other than the glowing effects of the interior lighting. There's path lighting at the entry drive for safety, but the rest of the site is relatively unlit as well. The façade heights range from 24 to 80 feet and combine a combination of limestone veneer, glass and aluminum curtainwall, and brick. Most of the façade is surrouned by grass and is not meant to be walked along. However, there are focal points in the façade at defined entrances at the south and north ends of the building, and at a small paved courtyard on the east side. These entrances, especially the southern end, will need to be address in the lighting solution to make sure they stand out as prominent pieces of the architectural language. There's a significant number of trees on the sight which may block the view of building façade lighting and should be incorporated into the analysis to make sure lighting isn't being used in places it wont be seen.

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Existing Conditions:

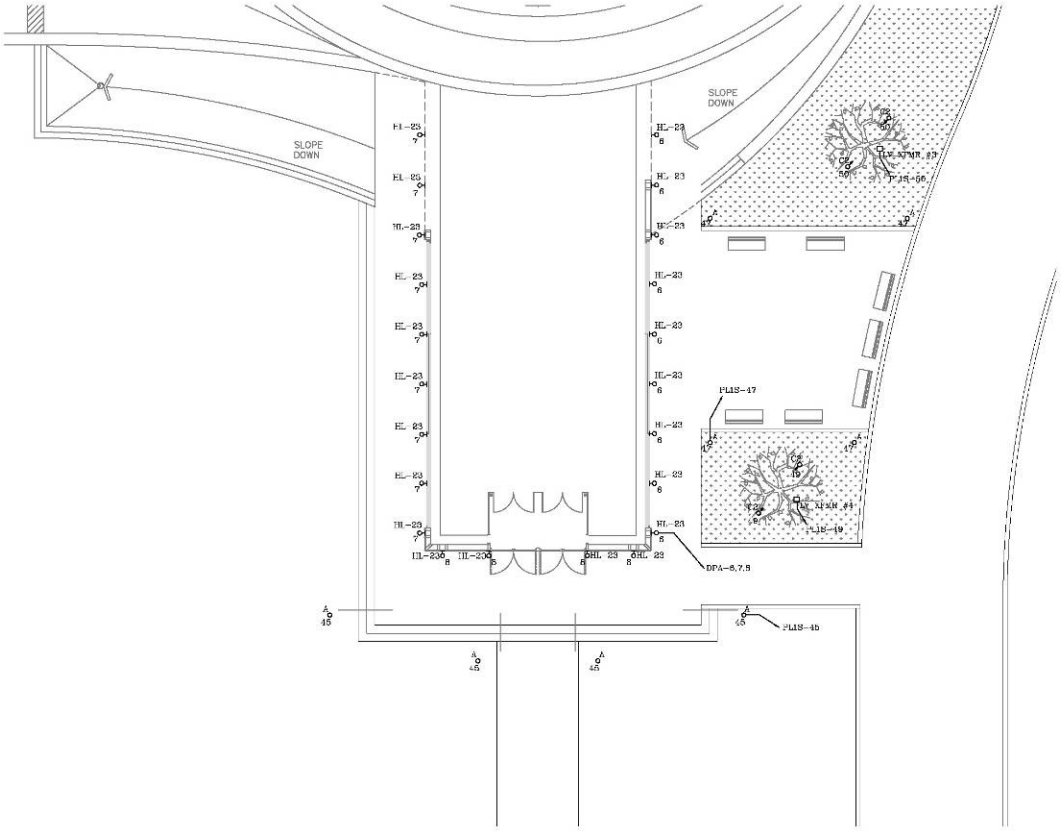


Figure 8.1 – Circuiting Plan (Existing Layout)

Williams College '62 Center For Theater & Dance
Williamstown, MA

Panelboard Schedules & Feeders

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A C/B

PANEL TAG: PL1S-1
PANEL LOCATION: Electrical Closet #161
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: Conductors are:
(4) #4/0 + (1) #4G in 2.5"C

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
unknown	unknown	1920	20A/1P	1	*			2	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	3		*		4	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	5			*	6	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	7	*			8	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	9		*		10	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	11			*	12	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	13	*			14	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	15		*		16	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	17			*	18	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	19	*			20	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	21		*		22	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	23			*	24	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	25	*			26	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	27		*		28	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	29			*	30	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	31	*			32	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	33		*		34	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	35			*	36	20A/1P	1920	unknown	unknown
Spare	---	0	1P	37	*			38	1P	0	---	Spare
Spare	---	0	1P	39		*		40	1P	0	---	Spare
Spare	---	0	1P	41			*	42	1P	0	---	Spare

CONNECTED LOAD (KW) - A	23.04	TOTAL DESIGN LOAD (KW)	82.94
CONNECTED LOAD (KW) - B	23.04	POWER FACTOR	1.00
CONNECTED LOAD (KW) - C	23.04	TOTAL DESIGN LOAD (AMPS)	230

Table 8.1 - Panelboard Schedule PL1S (1 of 2) (Existing Layout)

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 225A
SIZE/TYPE MAIN: 225A C/B

PANEL TAG: PL1S-2
PANEL LOCATION: Electrical Closet #161
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: Conductors are:
(4) #4/0 + (1) #4G in 2.5"C

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
unknown	unknown	1920	20A/1P	1	*			2	20A/1P	100	Front Lawn	LV XFMR #7
unknown	unknown	1920	20A/1P	3		*		4	20A/1P	100	Front Lawn	LV XFMR #6
unknown	unknown	1920	20A/1P	5			*	6	20A/1P	100	Front Lawn	LV XFMR #5
LV XFMR #4	Patio	200	20A/1P	7	*			8	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	9		*		10	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	11			*	12	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	13	*			14	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	15		*		16	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	17			*	18	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	19	*			20	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	21		*		22	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	23			*	24	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	25	*			26	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	27		*		28	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	29			*	30	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	31	*			32	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	33		*		34	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	35			*	36	20A/1P	1920	unknown	unknown
Spare	---	0	1P	37	*			38	1P	0	---	Spare
Spare	---	0	1P	39		*		40	1P	0	---	Spare
Spare	---	0	1P	41			*	42	1P	0	---	Spare

CONNECTED LOAD (KW) - A	19.50	TOTAL DESIGN LOAD (KW)	74.33
CONNECTED LOAD (KW) - B	21.22	POWER FACTOR	1.00
CONNECTED LOAD (KW) - C	21.22	TOTAL DESIGN LOAD (AMPS)	206

Table 8.2 - Panelboard Schedule PL1S (2 of 2) (Existing Layout)

New Design:

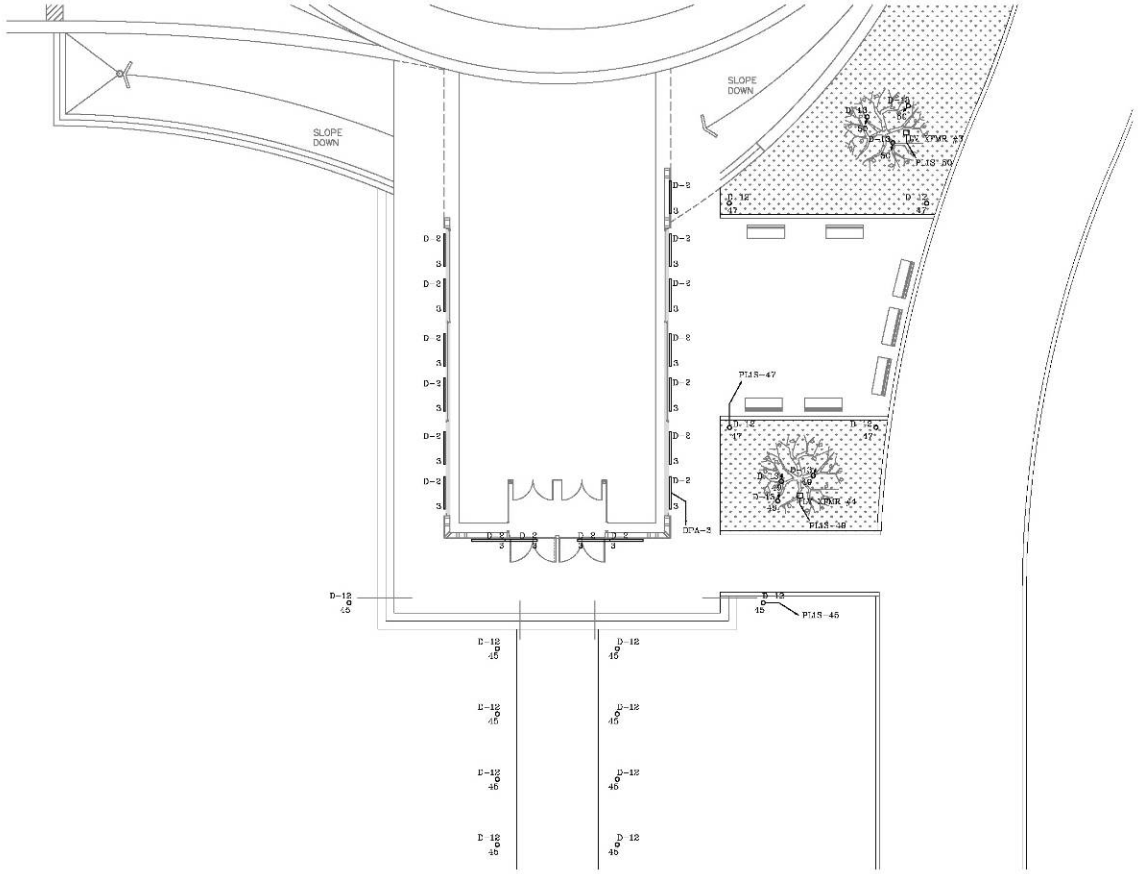


Figure 8.2 – Circuiting Plan (New Layout)

Williams College '62 Center For Theater & Dance
Williamstown, MA

Panelboard Schedules & Feeders

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 400A
SIZE/TYPE MAIN: 300A 3P C/B

PANEL TAG: PL1S-1
PANEL LOCATION: Electrical Closet #161
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: Conductors to be:
(4) 350MCM + (1) #4G in 3"C

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
unknown	unknown	1920	20A/1P	1	*			2	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	3		*		4	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	5			*	6	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	7	*			8	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	9		*		10	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	11			*	12	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	13	*			14	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	15		*		16	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	17			*	18	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	19	*			20	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	21		*		22	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	23			*	24	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	25	*			26	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	27		*		28	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	29			*	30	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	31	*			32	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	33		*		34	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	35			*	36	20A/1P	1920	unknown	unknown
Spare	---	0	1P	37	*			38	1P	0	---	Spare
Spare	---	0	1P	39		*		40	1P	0	---	Spare
Spare	---	0	1P	41			*	42	1P	0	---	Spare

CONNECTED LOAD (KW) - A	23.04	TOTAL DESIGN LOAD (KW)	77.41
CONNECTED LOAD (KW) - B	23.04	POWER FACTOR	1.00
CONNECTED LOAD (KW) - C	23.04	TOTAL DESIGN LOAD (AMPS)	215

Table 8.3 - Panelboard Schedule PL1S (1 of 2) (New Layout)

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 400A
SIZE/TYPE MAIN: 250A 3P C/B

PANEL TAG: PL1S-2
PANEL LOCATION: Electrical Closet #161
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: Conductors to be:
(4) 250MCM + (1) #4G in 2.5"C

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
unknown	unknown	1920	20A/1P	1	*			2	20A/1P	100	Front Lawn	LV XFMR #7
CMH	Front Steps	240	20A/1P	3		*		4	20A/1P	100	Front Lawn	LV XFMR #6
CMH	Patio	96	20A/1P	5			*	6	20A/1P	100	Front Lawn	LV XFMR #5
LV XFMR #4	Patio	150	20A/1P	7	*			8	20A/1P	150	Patio	LV XFMR #3
unknown	unknown	1920	20A/1P	9		*		10	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	11			*	12	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	13	*			14	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	15		*		16	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	17			*	18	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	19	*			20	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	21		*		22	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	23			*	24	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	25	*			26	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	27		*		28	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	29			*	30	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	31	*			32	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	33		*		34	20A/1P	1920	unknown	unknown
unknown	unknown	1920	20A/1P	35			*	36	20A/1P	1920	unknown	unknown
Spare	---	0	1P	37	*			38	1P	0	---	Spare
Spare	---	0	1P	39		*		40	1P	0	---	Spare
Spare	---	0	1P	41			*	42	1P	0	---	Spare

CONNECTED LOAD (KW) - A	17.68	TOTAL DESIGN LOAD (KW)	67.94
CONNECTED LOAD (KW) - B	19.54	POWER FACTOR	1.00
CONNECTED LOAD (KW) - C	19.40	TOTAL DESIGN LOAD (AMPS)	189

Table 8.4 - Panelboard Schedule PL1S (1 of 2) (New Layout)

Photovoltaic Feasibility Review

Introduction:

The Center for Theatre & Dance is located in a rather urban college setting and has an underground parking deck located on the north side of the building (shown below, figure #.#). The ground level of the parking deck has a layer of parking which is partially covered by a slanted roof, with the remainder of the parking being underground. By taking advantage of this large unused area of space and adding photovoltaic panels across it, Williams College could supply 21.1% of the building's overall energy consumption through renewable energy sources, saving them an average of $21,580/yr in energy supply costs (including transmission and distribution savings). Multiple other tax incentives and rebates are available and increase the savings of implementing a photovoltaic system.

Figure 9.1 - Satellite image of parking deck during construction

Relevant Numerical Data for Photovoltaic Feasibility	
Surface area of parking deck	23,000 ft^2 (2137.5m^2)
Cost of Electricity	$0.084/kwh
Average Bldg Energy Usage	1,219,964 kwh/yr

Table 9.1 - Project Data

State and Federal Tax Incentives:

The Massachusetts Division of Energy Resources (DOER), in conjunction with the Commonwealth of Massachusetts, offers the following state tax incentives for the introduction and application of renewable energy sources in commercial buildings. Detailed specifications of these credits can be found in the Renewable Energy & Distribution Generation Guidebook, April 2001, published by DOER and is officially listed in the Massachusetts General Laws (M.G.L.).

There are also federally regulated tax incentives that are detailed in the US Tax Code (U.S.C. c.26). A brief description of these tax credits are listed below:

1. Corporate Income Tax Deduction

    - A business which purchases a qualifying solar or wind-powered "climatic control unit" or "water heating unit" is allowed to deduct from its net income, for state tax purposes, any costs incurred from installing the unit, provided the installation is located in Massachusetts and is used exclusively in the trade or business of the corporation (M.G.L. c.63, sec. 38H.).

    - Please note that if you qualify for this deduction you may also qualify for the excise tax benefit described in M.G.L. c.63, sec. 38H(f).

2. Business Investment Tax Credit

    - 26 U.S.C.A. 48 (a) allows deduction of up to 10% of cost for investing in, purchasing, or constructing qualifying energy property for business use.

3. Renewable Energy Production Incentive

    - Local governmental entities and State entities may apply for an incentive payment from the Department of Energy for electricity produced and sold by new qualifying renewable energy generation facilities. Not-for-profit electric cooperatives that began or begin operations between October 1, 1993 and September 30, 2003 are also eligible. Annual incentive payments may total 1.5 cents per kilowatt-hour.

Feasibility Study:

Energy analysis and payback period calculations were performed using the Photovoltaic Energy Modeling tool, a piece of the Clean Energy Project Analysis Software package, provided by RETScreen International, a clean energy coalition developed through the Canadian National Government.

The program loads weather data for selected cities and uses this information to compute average energy-production rates of user-specified photovoltaic products. Using this energy generation information, the program then computes a cost analysis for the entire system, including system base cost, and outputs a payback period using base cost of energy, utility buyback, and tax incentive information.

RETScreen® Energy Model - Photovoltaic Project — *Training & Support*

Site Conditions		Estimate	Notes/Range
Project name		Center for Theatre & Dance	*See Online Manual*
Project location		Williamstown, MA	
Nearest location for weather data	-	Worcester, MA	*Complete SR&SL sheet*
Latitude of project location	°N	42.3	-90.0 to 90.0
Annual solar radiation (tilted surface)	MWh/m²	1.47	
Annual average temperature	°C	8.2	-20.0 to 30.0

System Characteristics		Estimate	Notes/Range
Application type	-	On-grid	
Grid type	-	Isolated-grid	
PV energy absorption rate	%	95.0%	
PV Array			
PV module type	-	User-defined	
PV module manufacturer / model #		BP Solar/ BP175B	*See Product Database*
Nominal PV module efficiency	%	13.5%	4.0% to 15.0%
NOCT	°C	45	40 to 55
PV temperature coefficient	% / °C	0.50%	0.10% to 0.50%
Miscellaneous PV array losses	%	5.0%	0.0% to 20.0%
Nominal PV array power	kWp	**218.75**	
PV array area	m²	1,620.4	
Power Conditioning			
Average inverter efficiency	%	90%	80% to 95%
Suggested inverter (DC to AC) capacity	kW (AC)	196.9	
Inverter capacity	kW (AC)	72.0	
Miscellaneous power conditioning losses	%	0%	0% to 10%

Annual Energy Production (12.00 months analysed)		Estimate	Notes/Range
Specific yield	kWh/m²	158.6	
Overall PV system efficiency	%	10.8%	
PV system capacity factor	%	13.4%	
Renewable energy collected	MWh	300.483	
Renewable energy delivered	MWh	**256.913**	
	kWh	256,913	
Excess RE available	MWh	**13.522**	
			Complete Cost Analysis sheet

Version 3.2 © Minister of Natural Resources Canada 1997 - 2005. NRCan/CETC - Varennes

Figure 9.2 - Screen Shot of Photovoltaic Specifications & Power Output Characteristics

Data and cost figures for photovoltaic panels were drawn from BP Solar cut sheets (attached at the end of this section) and from a phone conversation with a BP Solar representative. 1250 panels were used in the calculation, at 1.593m long x 0.790m wide, to generate the nominal available power of 218.75kwp and a necessary surface area of 1620.4m2. The surface area used for calculation is conservative, at 75% of the available area that could be used. This 25% reduction of used surface area was assumed for a worst case scenario and to account for any aesthetic additions the architect may desire to hide the addition of photovoltaics to the roof. If the entire roof area were to be covered in photovoltaic panels, the nominal available power would increase to 288.00kwp and would not significantly change the payback period.

Williams College '62 Center For Theater & Dance
Williamstown, MA

Project Costs and Savings

Initial Costs				Annual Costs and Debt		
Feasibility study	0.0%	$	-	O&M	$	880
Development	0.0%	$	-	Fuel	$	-
Engineering	0.0%	$	-	Debt payments - 25 yrs	$	22,774
Energy equipment	96.1%	$	510,000	**Annual Costs and Debt - Total**	**$**	**23,654**
Balance of equipment	0.0%	$	-			
Miscellaneous	3.9%	$	20,806	**Annual Savings or Income**		
Initial Costs - Total	100.0%	**$**	**530,806**	Energy savings/income	$	22,630
Incentives/Grants		$	81,213	RE production credit income - 25 y	$	3,759
				Annual Savings - Total	**$**	**26,389**
Periodic Costs (Credits)						
Inverter Repair/Replacement		$	-			
		$	-			
		$	-			
End of project life -		$	-			

Financial Feasibility

			Calculate energy production cost?	yes/no	No
Pre-tax IRR and ROI	%	8.4%			
After-tax IRR and ROI	%	8.4%	Calculate GHG reduction cost?	yes/no	No
Simple Payback	yr	17.6			
Year-to-positive cash flow	yr	13.7	Project equity	$	265,403
Net Present Value - NPV	$	(13,680)	Project debt	$	265,403
Annual Life Cycle Savings	$	(1,393)	Debt payments	$/yr	22,774
Benefit-Cost (B-C) ratio	-	0.95	Debt service coverage	-	1.17

Figure 9.3 - Project Costs and Savings

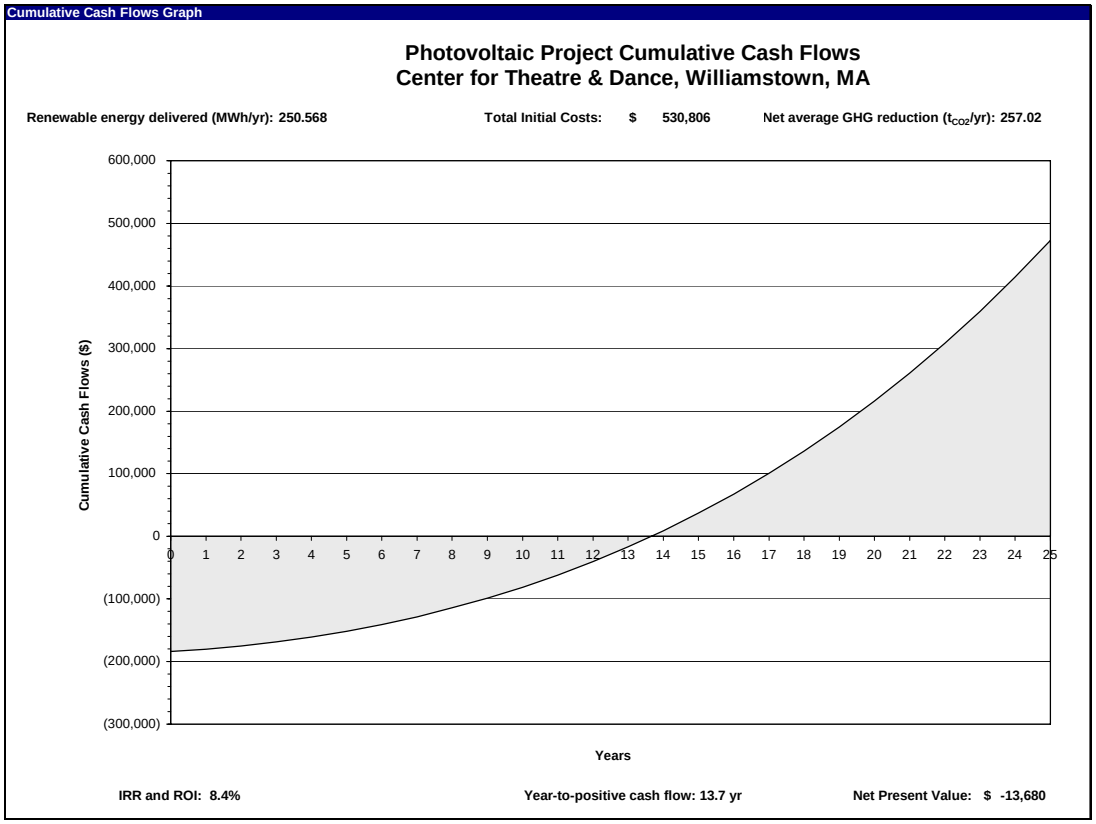


Figure 9.4 - Screen Shot of Project Cashflow Diagram Showing Payback Period and Time To Positive

Feasibility Review Summary:

Although providing 21% of the buildings energy from renewable sources is a noble undertaking, a 19 year payback period may not be enticing enough to warrant the initial $530,000 for the system. However, being that the building is a part of a campus grid and that most university buildings have a very long lifespan (significantly higher than most traditional commercial buildings), and depending on the college's stance on sustainability, the initial cost may not be as much of a burden as for some other owners. Not factored into this calculation is any increase in admission that may occur from being able to advertise their "green" initiative on campus. Without knowing the personal intentions of the board of trustees of Williams College, my professional recommendation would be that it is not economically profitable to install this system of PV's on the parking deck of the Center for Theatre & Dance. Other systems may have a cost/efficiency ratio that would create a more beneficial investment; however, a larger scale investigation into the comparison of multiple PV arrays would be necessary.

bp solar

BP 175B

175 Watt Photovoltaic Module

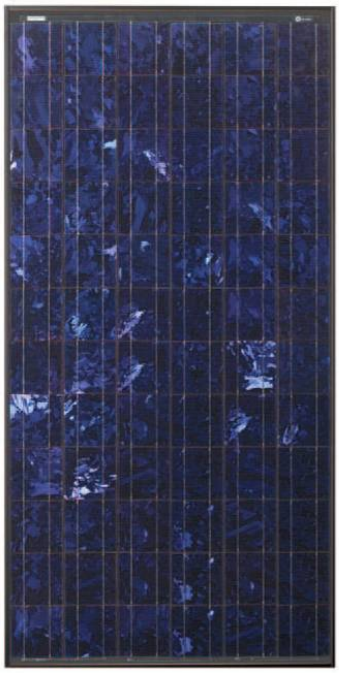
High-efficiency photovoltaic module using silicon nitride multicrystalline silicon cells.

Performance

Rated power (P_{max})	175W
Power tolerance	± 5%
Nominal voltage	24V
Limited Warranty[1]	25 years

Configuration

BP 175B	Bronze frame with output cables and polarized Multicontact (MC) connectors



Electrical Characteristics[2]

	BP175B
Maximum power (P_{max})[3]	175W
Voltage at Pmax (V_{mp})	35.8V
Current at Pmax (I_{mp})	4.9A
Warranted minimum P_{max}	166.3W
Short-circuit current (I_{sc})	5.4A
Open-circuit voltage (V_{oc})	44.2V
Temperature coefficient of I_{sc}	(0.065±0.015)%/ °C
Temperature coefficient of V_{oc}	-(160±20)mV/°C
Temperature coefficient of power	-(0.5±0.05)%/ °C
NOCT (Air 20°C; Sun 0.8kW/m²; wind 1m/s)	47±2°C
Maximum series fuse rating	15A
Maximum system voltage	600V (U.S. NEC & IEC 61215 rating)

Mechanical Characteristics

Dimensions	Length: 1593mm (62.8") Width: 790mm (31.1") Depth: 50mm (1.97")
Weight	15.0 kg (33.1 pounds)
Solar Cells	72 cells (125mm x 125mm) in a 6x12 matrix connected in series
Output Cables	RHW AWG# 12 (4mm²) cable with polarized weatherproof DC rated Multicontact connectors; asymmetrical lengths - 1250mm (-) and 800mm (+)
Diodes	***IntegraBus***™ technology includes Schottky by-pass diodes integrated into the printed circuit board bus
Construction	Front: High-transmission anti-reflective 3mm (1/8th inch) tempered glass; Back: Gray Charcoal Tedlar; Encapsulant: EVA
Frame	Anodized aluminum alloy type 6063T6 Universal frame; Color: Bronze

1. Warranty: Power output for 25 years. Freedom from defects in materials and workmanship for 5 years. See our website or your local representative for full terms of these warranties.
2. These data represent the performance of typical BP 175B products, and are based on measurements made in accordance with ASTM E1036 corrected to SRC (STC.)
3. During the stabilization process that occurs during the first few months of deployment, module power may decrease by up to 1% from typical P_{max}.

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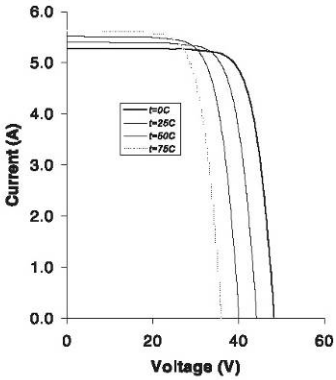
Quality and Safety

ESTI	Module power measurements calibrated to World Radiometric Reference through ESTI (European Solar Test Installation at Ispra, Italy); Certified to IEC 61215
UL	Listed by Underwriter's Laboratories for electrical and fire safety (Class C fire rating)

BP 175B I-V Curves

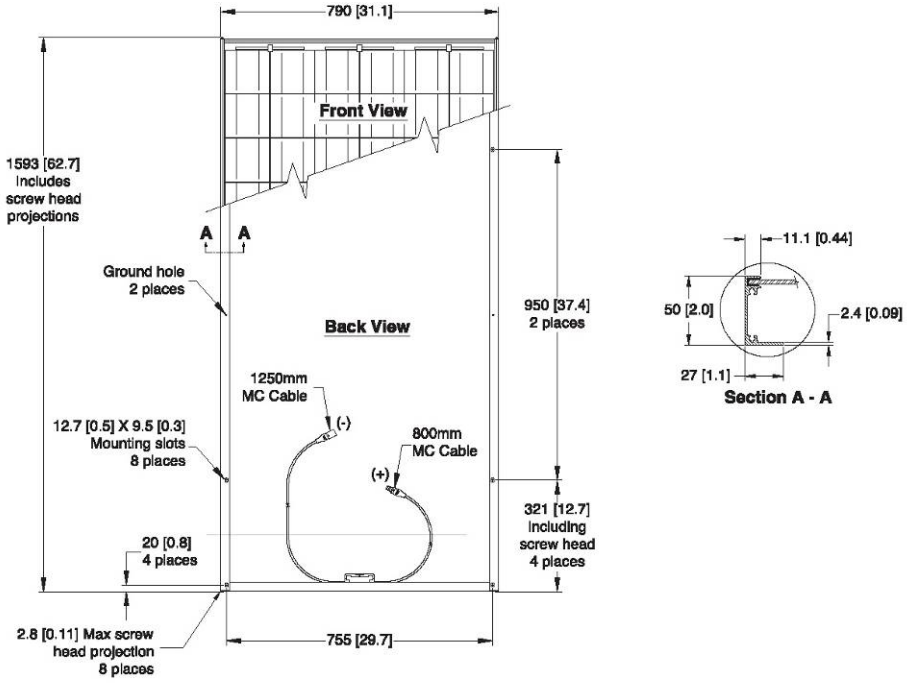


Qualification Test Parameters

Temperature cycling range	-40°C to +85°C (-40°F to 185°F)
Humidity freeze, damp heat	85% RH
Static load front and back (e.g. wind)	50psf (2400 pascals)
Front loading (e.g. snow)	113psf (5400 pascals)
Hailstone impact	25mm (1 inch) at 23 m/s (52mph)

Module Diagram

Dimensions in brackets are in inches. Unbracketed dimensions are in millimeters. Overall tolerances ±3mm (1/8")



Included with each module: self-tapping grounding screws, instruction sheet, and warranty document.

Note: This publication summarizes product warranty and specifications, which are subject to change without notice.
Additional information may be found on our web site: **www.bpsolar.us**

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Energy Efficient Transformer Analysis

Traditional building transformers tend to be over-designed to handle harmonic loads. There are, however, companies producing transformers that are designed for harmonic distribution and have been engineered to have a very high efficiency. The following analysis will review the costs and payback ratio of switching all transformers in the Center for Theatre & Dance to Powersmiths' High Efficiency, T1000 series transformers, rated for NEMA TP-1 standards in energy efficiency.

Cost information for individual transformers is provided in the following documentation on the next two pages as a part of Powersmiths' Energy Savings and Payback Calculator. Prices were referenced from a Powersmiths representative and from the 2003 Cutler-Hammer Products and Services Catalog and are listed in U.S. dollars. For documentation of transformer sizing and location, see the single-line diagram provided on the last page of the electrical depth section.

Loading percentages were estimated to approximate an average loading characteristic for the building, year-round, and based on the overall building energy consumption for the 2006 fiscal year, at 1,219,964kwh.

Using Powersmiths' Energy Savings and Payback Calculator, the installation of Powersmiths transformers would result in ~$9,500 savings per year, but due to the significant cost difference between Powersmiths and Cutler-Hammer transformers, the payback on the initial cost would be 14 years.

Since this is a campus building, which will most likely have a lifespan of 40+ years, installing the energy efficient transformers could prove beneficial, so long as the College has the initial funds with which to invest. More interestingly for a liberal arts college in a rural Massachusetts setting, emissions reductions from the installation of Powersmiths' transformers would be equivalent to planting 13 acres of forest, planting back almost one and a half times the area of the building's site, at 8.21 acres.

POWERSMITHS

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

The ESP Calculator™

Energy Savings Payback Calculator

Project Description Williams College, '62 Center for Theatre & Dance
Date 6-Apr-07

Data Entry

Transformers on Project

QTY	kVA	Price (PwrSm / CH)
5	15	$6000 / 1350
3	30	$7000 / 1725
2	45	$8000 / 2100
7	75	$12000 / 2970
	112.5	$16000 / 4300
	150	$21000 / 5400
	225	$28000 / 7900
1	300	$35000 / 10000
	500	
	750	
	1000	
	1500	
	2000	
	7.5	

		Calc Load kW	Calc Annual kWh
Available Full Load kW	**1080**		
Average kVA (calc)	**60**		
equipment operating hrs/ day	12		
equipment operating days/yr	300		
Load during normal operating hours	25%	270	972,000
Load outside operating hours	5%	54	278,640
		Total Annual Load kWhr	**1,250,640**

Annual Cost to Operate Load Only

kWh rate	$ 0.084	Annual Consumption:	$	105,054
demand rate ($/kW/mo) ex. $10.00	$5.50	Annual Demand:	$	17,820
		Total Cost to run load	**$**	**122,874**

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

Nameplate Linear efficiency (normal op hrs)	97.2%	% electronics or current THD	80.0%
Calculated operating efficiency	93.4%		
Transformer kW Losses (Normal Operation)	19.1 kW		
Status quo Efficiency (Outside op. hrs)	91.0%		
Transformer kW Losses (Outside op. hrs)	5.3 kW		
Annual addititional kWh from transformers	96,332 kWh		
Annual Cost of Transformer Losses	$ 9,353		
A/C System Performance (kW/ton)	1.27		
Additional Tons of Cooling (on peak)	5.43 tons		
Annual addititional kWh from A/C	34,756 kWh		
Annual Cost of Associated A/C	$ 3,374		

Summary with Status Quo Transformer

Annual Cost of feeding Building Load	$	122,874
Annual Cost of Transformer Losses	$	9,353
Annual Cost of Associated A/C	$	3,374
Electrical Bill (Status Quo Transformer)	**$**	**135,601**

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doc#807-000440-110-A02

POWERSMITHS 1-Mar-07

POWERSMITHS

Page 2

The ESP Calculator™

Energy Savings Payback Calculator

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

Using Powersmiths instead of status quo transformers

Powersmiths Efficiency (Normal Operation)	98.2%	
Powersmiths kW Losses (Normal Operation)	4.9	kW
Powersmiths Efficiency (Outside op. hrs)	97.6%	
Transformer kW Losses (Outside op. hrs)	1.3	kW
Annual addititional kWh from transformers	24,669	kWh
Annual Cost of Powersmiths Losses	$ 2,399	
Additional Tons of Cooling (on peak)	1.41	tons
Annual addititional kWh from A/C	8,900	kWh
Annual Cost of Associated A/C	$ 865	

Comparing Status Quo & Powersmiths

	Status Quo	Powersmiths	
Annual Cost of feeding Building Load	$ 122,874	$ 122,874	
Annual Cost of Transformer Losses	$ 9,353	$ 2,399	
Annual Cost of Associated A/C	$ 3,374	$ 865	**Reduction**
Annual estimated Electrical Bill	$ 135,601	$ 126,138	**7%**

Peak kW reduction (normal op hours)	**14.2**	**kW**
Annual kWh reduction	**97,520**	**kWh**
Reduction in Air Conditioning Load (on peak)	**4.02**	**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	$12,727	$459,735	$1,048,755
Powersmiths Transformers	$3,264	$117,913	$268,984
Savings with Powersmiths	**$9,463**	**$341,822**	**$779,771**

Cost	Cost
Powersmiths Transformers	$186,000
Status Quo Transformers	$46,915

Payback on total cost	14.70	years	current kWh rate:
Cost of Energy Savings	$ 0.045	/kWh	$0.084
Cost - Benefit Ratio	1.9	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	**$11,862**	**$14,469**	**$18,409**
Net Annual Cost with savings	$2,399	$5,006	$8,947

Summary of Environmental Benefits

Annual Reduction in Greenhouse Gases (per EPA)	Equivalence
72 tons of CO2	13 Acres trees planted
233 tons of Coal	10 Car Emissions
564 kgs of SO2	10 homes heated
243 kgs of NOx	

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1-Mar-07

Protective Device Coordination Study

I have selected a single run from the lighting distribution panel for space 3, the dance rehearsal studio, back to the main switchgear, to verify this series of protective devices have been adequately coordinated. A simplified diagrammatic representation of this coordination path is shown below. The following pages list the individual trip curves that were assumed for the particular circuit breakers in the system and a coordination graph, showing that all devices are coordinated for acceptable protection. It should be noted that in order for this compliance to occur, the 1200A circuit breaker in the main switchgear would need to have a short delay pickup rating of at least 4 times the rating of the circuit breaker (4800A). Short circuit capacity information was unavailable as this is a campus facility and is tied into their main distribution loop.

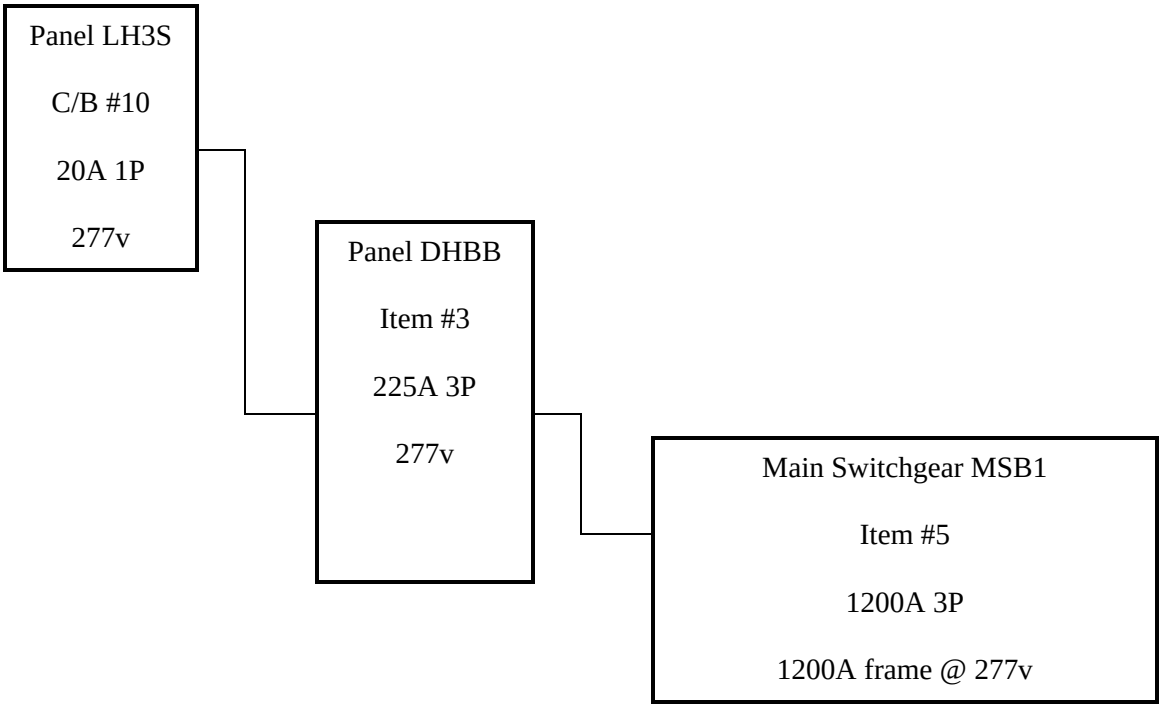


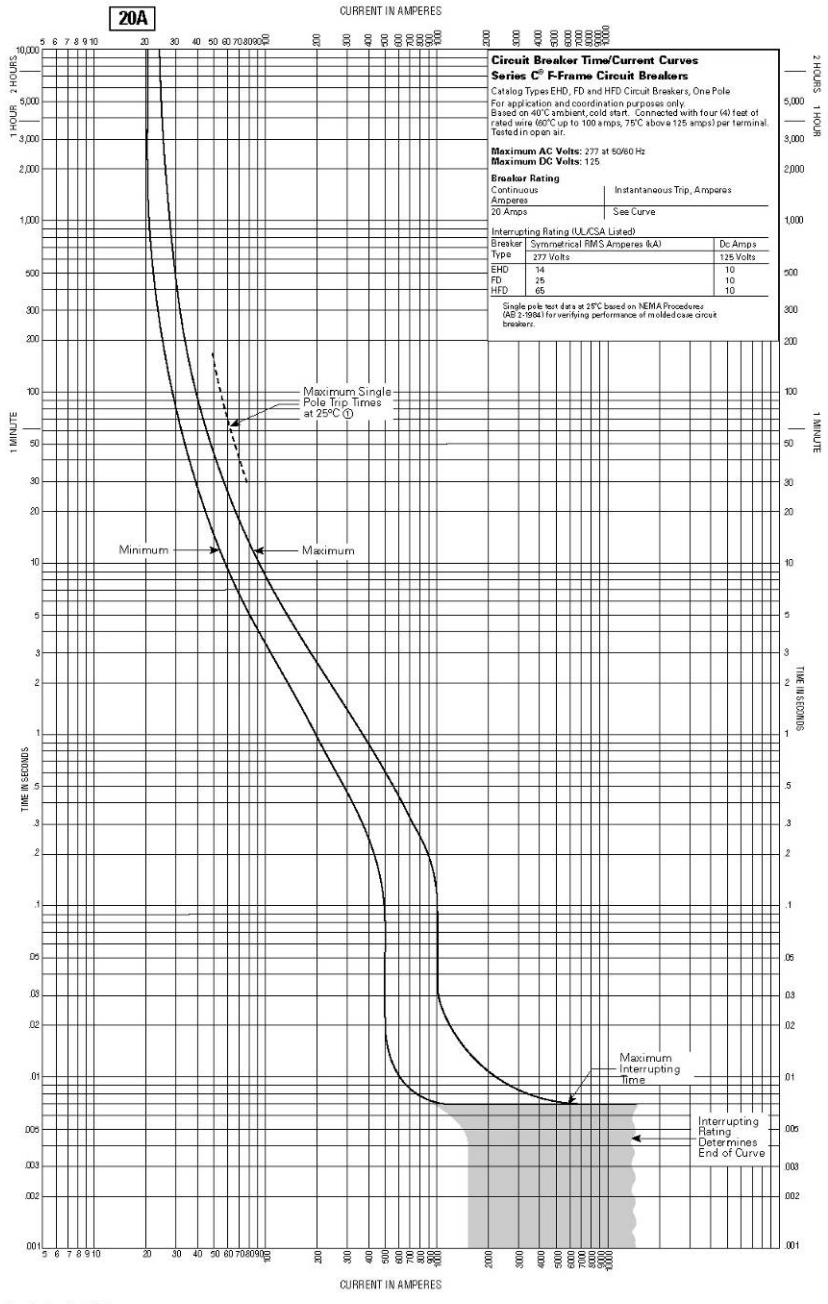
Figure 11.1 - Diagram of Coordination Study Path

Application Data
29-167F

Page 4

AB DE-ION Circuit Breakers

Types EHD, FD and HFD 20 Amperes



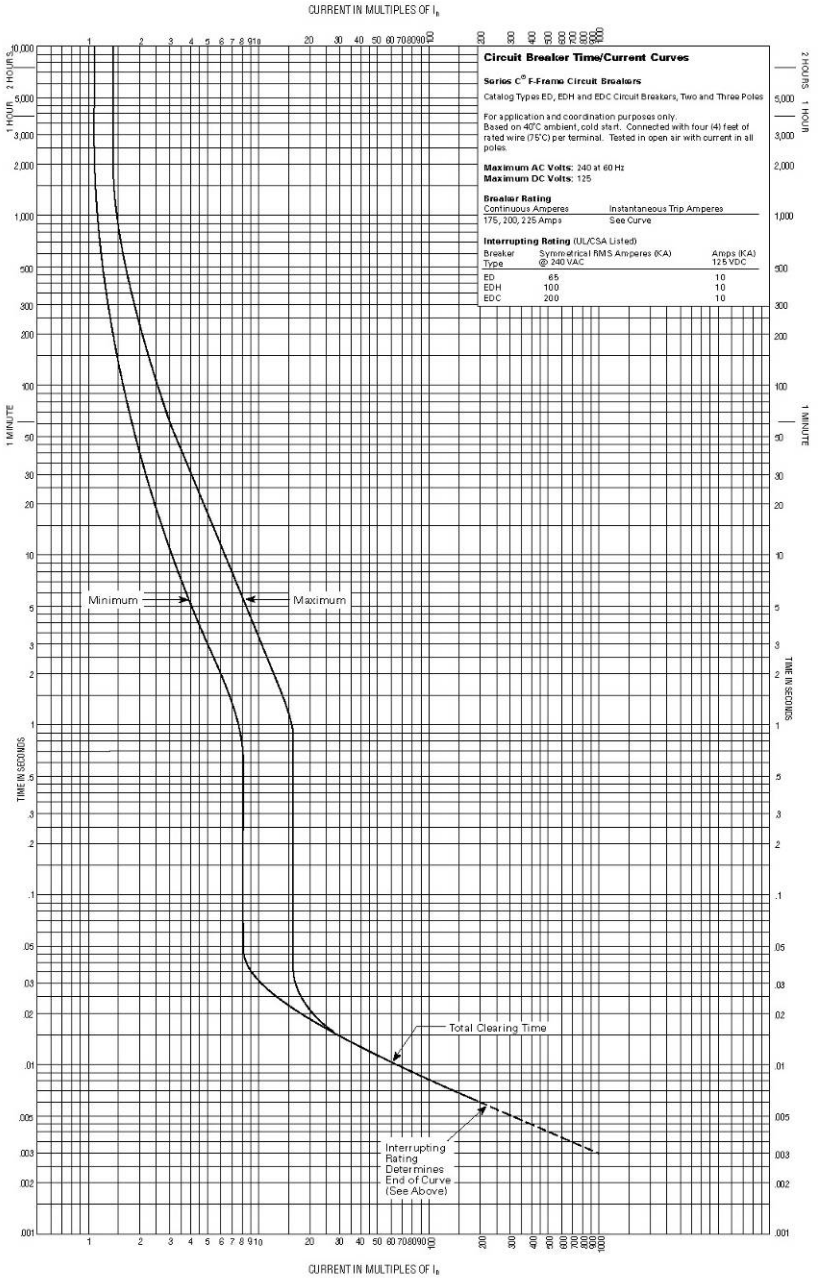
Curve No. SC-4424-88A

October 1997

Figure 11.2 - 20A C/B Trip Curve from Lighting Distribution Panelboard LH3S

AB DE-ION Circuit Breakers

Types ED, EDH and EDC 225 Amperes



Curve No. SC-5805-94A

October 1997

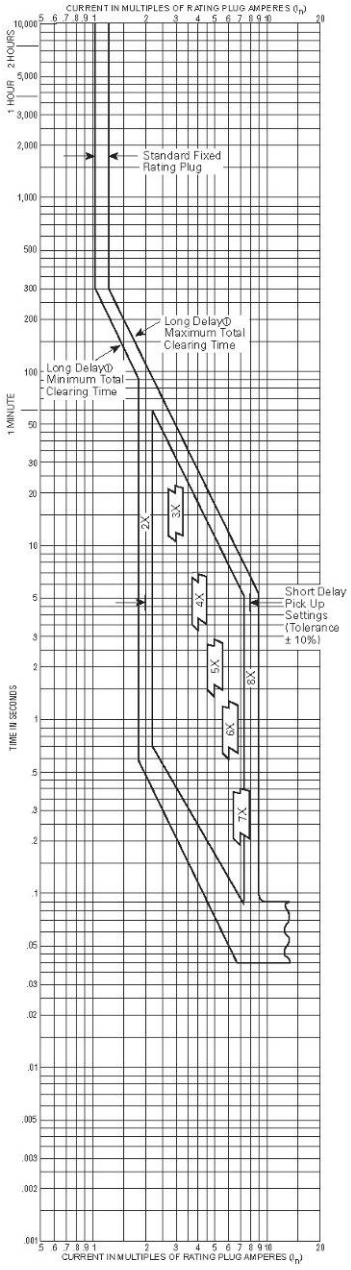
Figure 11.3 - 225A C/B Trip Curve from Main Distribution Board DHBB

Application Data
29-167N

Page 2

AB DE-ION Circuit Breakers

Types ND, CND, HND, CHND, NDC, CNDC Equipped With Type NES Digitrip RMS 310 Trip Units With I²t Ramp Short Time Delay (Phase Protection)



Circuit Breaker Time/Current Curves (Phase Current)
Series C® N-Frame Circuit Breakers
Equipped With Type NES Digitrip RMS 310 Trip Units

The NES Digitrip RMS 310 Trip Units are AC only devices that employ microprocessor based technology that provides true RMS current sensing means for proper correlation with thermal characteristics of conductors and equipment. They are used with Circuit Breaker Types ND, CND, HND, CHND, NDC, and CNDC.

I²t Ramp Short Time Delay

Typical Trip Unit Nameplate

Frame Rating Amperes (Max.)	Available Rating Plugs Ampere Rating (In)	Type	Catalog Number	Short Delay Pickup Range Amperes
800	800	Fixed	8NES800T	1600-6400
	700	Fixed	8NES700T	1400-5600
	630	Fixed	8NES630T④	1260-5040
	600	Fixed	8NES600T	1200-4800
	550	Fixed	8NES550T	1100-4400
	500	Fixed	8NES500T	1000-4000
	450	Fixed	8NES450T	900-3600
	400	Fixed	8NES400T	800-3200
	400, 500, 600, 800	Adj.	A8NES800T1	800-6400
	400, 500, 630, 800	Adj.	A8NES800T2④	800-6400
1200	1200	Fixed	12NES1200T	2400-9600
	1000	Fixed	12NES1000T	2000-8000
	900	Fixed	12NES900T④	1800-7200
	800	Fixed	12NES800T	1600-6400
	700	Fixed	12NES700T	1400-5600
	630	Fixed	12NES630T④	1260-5040
	600	Fixed	12NES600T	1200-4800
	600, 800, 1000, 1200	Adj.	A12NES1200T1	1200-9600

Interrupting Ratings – 50/60 Hz
RMS Sym. Amperes (kA)

Breaker Type	UL/CSA 240V	480V	600V	IEC 947-2 220-240V	380-415V
ND, CND	65	50	25	65	50
HND, CHND	100	65	35	100	65
NDC, CNDC	200	100	50	200	100

Ics = .25 Icu
IΔn = 15 kA @ .5S
U_{imp} = 8kV

Notes

Curve accuracy applies from -20°C to +55°C ambient. For possible ampere derating for ambient above 40°C, refer to Cutler-Hammer.

Digitrip RMS 300 trip units are suitable for functional field testing with test kit Cat. No. STK2. For field testing using primary injection methods, follow NEMA publication AB-4-1991.

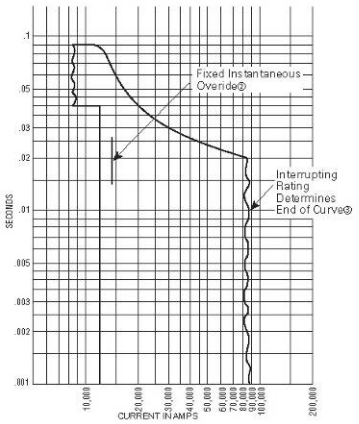
For ground fault time-current curves see SC-5377-92A.

① There is a memory effect that can act to shorten the long delay. The memory effect comes into play if a current above the long delay pick up value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately five minutes is required between overloads to completely reset the memory.

② For high fault current levels a fixed instantaneous override is provided at 14000A (Tolerance ±15%).

③ The end of the curve is determined by the interrupting rating of the circuit breaker. See above tabulations.

④ Not UL/CSA Listed.



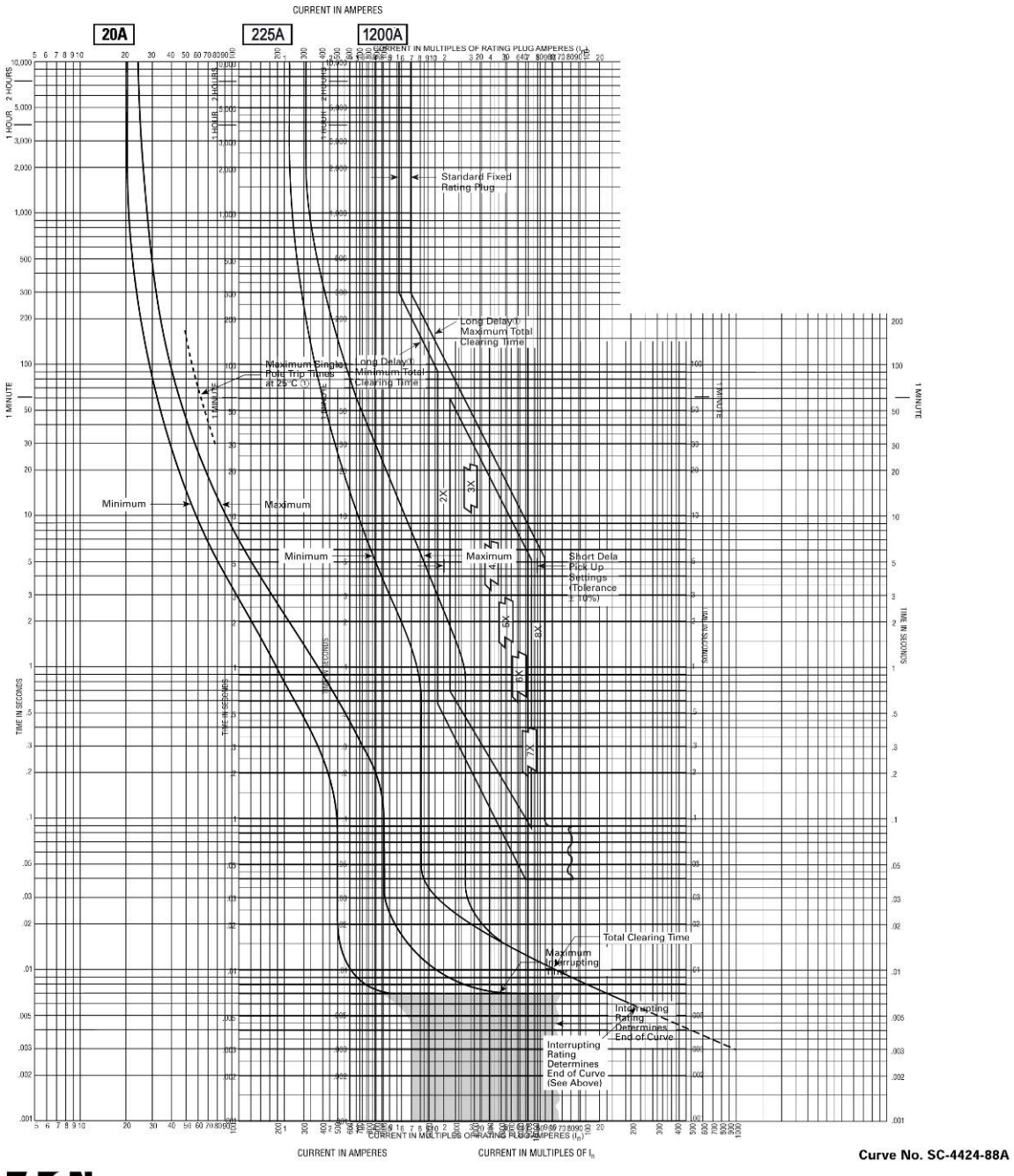
EATON

Curve No. SC-5375-92A
October 1997

Figure 11.4 - 1200A C/B Trip Curve from MSB1 Switchgear

Application Data

AB DE-ION Circuit Breakers



Curve No. SC-4424-88A

October 1997

Figure 11.5 - Trip Curve Coordination Study Graph

Williams College '62 Center For Theater & Dance
Williamstown, MA

LEED Breadth
(Green Roof Feasibility Review)

17th story penthouse with a view? How about a 17th story penthouse with a garden, front porch, and scenic walkway to say hi to your neighbors. Luxury living at its finest meets sustainable design in a harmonic union.

The world of the future? Maybe, but for now, hopefully we can be satisfied by helping to save the environment and saving a little money on energy consumption along with it.

Introduction

Global warming, an increase in air pollutants, and the loss of potable water in natural aquifers are becoming significant issues in today's environment. These issues have been spawned by multiple factors in today's economic practices, but are spearheaded by the exponential growth of commercial and residential buildings throughout the world. Current building standards accept black membranes, tar, and rock as the proper solution to roofing of commercial buildings. These black surfaces radiate absorbed heat back into the atmosphere, raising the mean ambient temperature of the surrounding air, allow heat to transfer through the roof surfaces into the building, increasing the load necessary from the mechanical system, and collect rainwater into stormwater drains, which would otherwise be absorbed into the ground.

By adding a green roof to the Williams College Center for Theatre & Dance, many of these issues can be averted, saving the college money over the building's life cycle and making them feel a little better about saving the environment. Conditions of the feasibility of the implementation of a green roof are dependant on multiple factors, including the type of green roof used, available roof surface area, and climate. It has been shown in previous case studies that green roofs are feasible on buildings of this nature. This review will outline a comparison between the different types of available green roofs, including benefits and costs of each, a description of building parameters, as they pertain to the needs of these systems, and a cost analysis to determine if the addition of a green roof system is financially beneficial.

What is a Green Roof?

A green roof is a living plant-surface layer applied on top of a traditional roof structure that protects the roof from water damage, reduces solar heat gain into the building, absorbs stormwater, and increases oxygen production rates. There are two unique classifications of green roofs: Extensive and Intensive.

Extensive: Extensive green roofs are thin layers of naturally-occurring low-maintenance plants and weeds that require minimal water and are seasonally regenerative. They are generally not meant to be occupied spaces and are generally not meant for beautification of the building. They do, however, have significant benefits for applications on existing buildings. First, extensive green roofs are designed to be very light, usually between 2 and 6 inches of growing medium, reducing the additional load added to the roof's structural system. This, in turn, helps to reduce to overall cost of the system. Secondly, extensive green roofs don't require regular reseeding or maintenance. If a roof area is being considered for a green roof and is not readily accessible to maintenance crews, an extensive green roof is the way to go.

Figure 12.1 - Extensive Green Roof

Intensive: Intensive green roofs are very thick, landscaped areas that are usually designed to be occupied and used as a roof "garden" or terrace. The increase in growing medium is required for trees, shrubs, and flowers to grow naturally, but it increases the weight and average cost of the installation of this type of system. Growing medium depths are generally between 8 and 24 inches, depending on the types of plants that are chosen. In addition to a more attractive space, intensive green roofs require significant more maintenance than extensive green roofs, often times needing a grounds crew to maintain it, to mow the lawn, trim bushes, pull weeds. If a large enough intensive green roof is installed, similar to the green roof in figure 2, an irrigation system may need to be installed as well, further increasing the overall weight of the system. In most instances though, these types of green roofs will significantly increase the property value of the building and, depending on the application, could be paramount to the increase in public attention.

Figure 12.2 - Intensive Green Roof

Regardless of which type of green roof is chosen, some maintenance will be required during the first few months to initially establish the growing media. All green roofs, outside of the type and thickness of the growing media, have a similar membrane system to protect and insulate the roof upon which it is placed. A typical cross section of a green roof is shown below in figure 3.

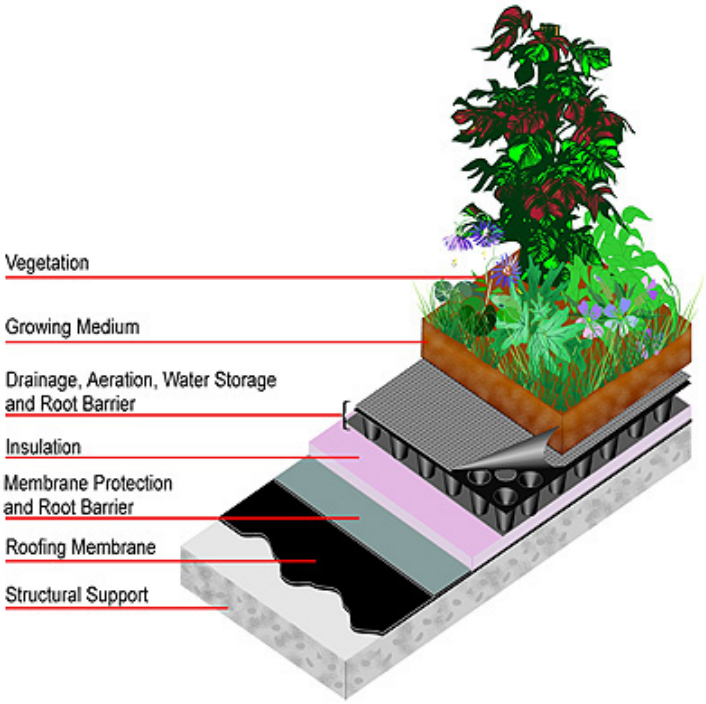


Figure 12.3 - Typical Layers of A Green Roof

The major differences between green roof constructions occur in the growing medium and vegetation layers. These also happen to the layers that provide the largest differences in building performance outcomes. The differences between these systems are provided in the following table:

	Extensive	Intensive	Black Tar
Types of Vegetation	Low growing, heat & drought resistant	Grass, Trees, Flowers	0
Growing Media Depth (inches)	2 - 6	8 - 24	0
Additional Weight (lb/sq.ft.)	18 - 31	45+	0
Stormwater Retention Capacity	2.10 - 6.12	7.91+	0
Maintenance	~ none	Daily	~ none
Average Cost ($/sq.ft.)	10 - 12	15 - 35	4 - 6

Table 12.1 - Graphical comparison of roofing types

Ultimately, the decision of the type of green roof comes down to the available budget for the project and the desired use of the space. Careful consideration should be put into all factors before making a decision on a type of green roof.

Since this type of construction is still relatively new, most of the statistical figures come from cases studies throughout the U.S. and Europe. Case studies have shown that buildings can save approximately 18 cents/kwh on energy consumption due to heating and cooling loads. The increase in thermal mass at the roof of the structure provides, on average, a 92% reduction in solar heat gain and a 26% reduction on heating losses. The graph below shows the results of tests performed on roof heat transfer by the National Research Council of Canada.

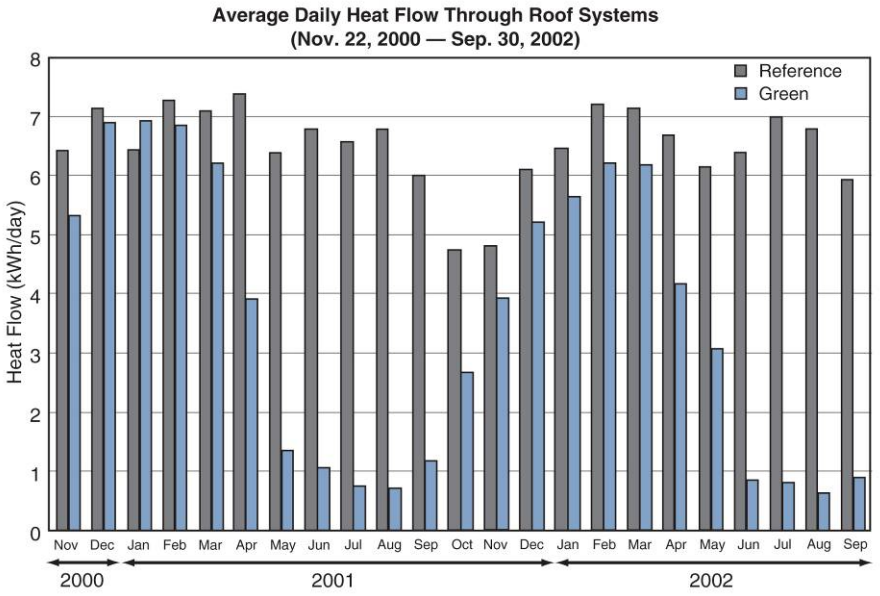


Table 12.2 - Measurement of heat flow through roof shows exceptional performance in summer months

Williams College Facility

The Williams College '62 Center for Theatre and Dance is a 126,000 square feet performing arts center that has two large professional theatres, a state of the art black box theatre, a dance rehearsal studio, and many other classrooms and support spaces. Four spaces on the building's roof are potential candidates for a green roof application. A roof plan is provided below in figure 4, showing these potential locations and their surface areas.

Dance Rehearsal Studio

Black Box Theater

550 Seat Theater

Main Corridor

Figure 12.4 - Roof Plan Showing Potential Locations for Green Roof Application

These four areas make up the major sections of the roof of the building, each being located above major spaces in the building that require heating and cooling throughout the year. The main corridors and east lobby are, by far, the most important spaces for the addition of a green roof. These spaces are constantly occupied and the hardest to keep at a consistent temperature due to their proximity to so many exterior walls, including the roof. Since none of these locations are easily accessible to the occupants of the building, the best choice for this type of building is the extensive green roof. The following pages will detail the feasibility topics for the implementation of an extensive green roof onto all four of the above spaces. Necessary topics for feasibility include energy reduction due to increased thermal mass, reduction in stormwater runoff, cost & payback period for the system, the ability for the structural system to support the added weight, and a discussion of urban heat island effect.

Energy Savings:

Due to the increased thickness of the roof surface, which adds to the overall insulation value, the ability for growing medias to absorb heat, and the fact that grass reflects more infra-red light than a black tar membrane, the addition of a green roof to a building significantly reduces the necessary loads from the HVAC system. Through multiple case studies, it has been found that a 92% reduction in cooling loads and a 26% reduction in heating loads can be achieved with the installation of an extensive green roof. The Williams College Center for Theatre & Dance uses, on average, 1,219,964kwh/year. Approximately nine of the twelve months of the year are in heating, with the other three being in cooling. Generating a comprehensive average, a 42.5% reduction in HVAC loads can be achieved. Since approximately 60% of the buildings energy consumption is attributed to HVAC loads, the addition of a green roof could amount to a savings of $26,067/year, given that the price of electricity is 8.4 cents/kwh. It has been shown through multiple case studies that adding a green roof not only increases the efficiency of the roof insulation, but it also reduces temperature fluctuations. Figure 5 shows an example of the common results of a study on outer and inner membrane temperatures between green roofs and traditional black tar membrane roofs. This reduction in peak temperatures will equate in greater savings in energy costs, as this will help to reduce peak load consumption for the building, billed separately as the demand rate.

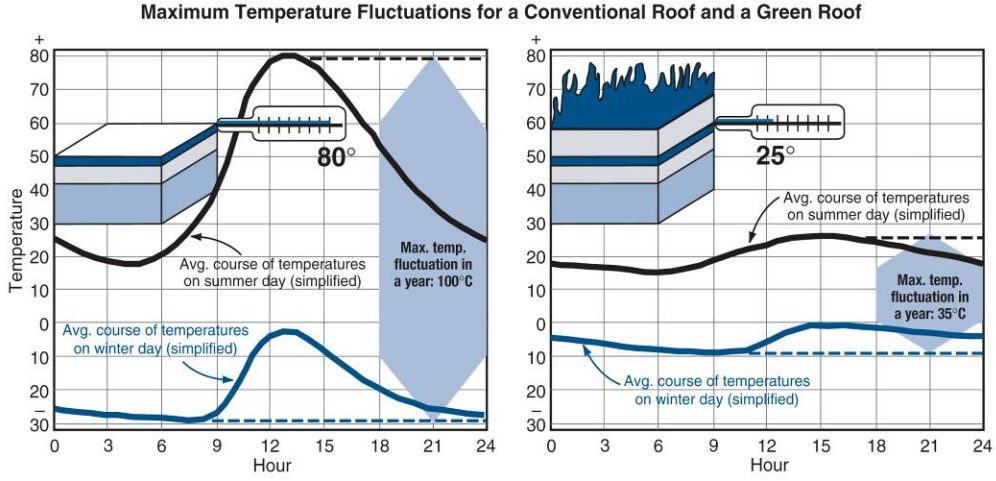


Figure 12.5 - Temperature fluctuations between a green roof and a conventional roof

Stormwater Runoff Reduction:

Relocating stormwater because of impervious surfaces is bad all-around. When buildings are built over normally grassy areas, all the stormwater that would have previously been absorbed, filtered, and carried to natural aquifers and streams, ends up getting channeled into stormwater piping and sent to water filtration plants. By reducing the size and quantity of this stormwater piping, a significant amount of money can be saved by both the building owner and the water company. Green roofs absorb rainwater, much like the ground does, filters it and then either evaporates or is consumed in the photosynthesis process of the plant material. While not all rainwater can be collected, it has been found that with only four inches of growing media, a green roof can retain an average of 71% of it, with the other 29% still needing to be drained elsewhere. A study by Roofscapes, Inc, a green roofing supplier and contractor in Philadelphia, PA, shows that four inches of growing media can retain a 3.50" threshold storm, while seven inches of growing media can retain a 6.12" threshold storm. Table 3 below shows average weather data for Williamstown, Massachusetts. Average rainfall during each of the months never exceeds 4.6 inches, well within the limits of 100% retention for six inches of growth media. Therefore, the addition of a green roof could reduce the sizes of a stormwater management system by 80-100%. It's important to note that the runoff from a green roof has been proven clean enough to use for irrigation or the flushing of toilets, allowing the runoff to be collected and used in the building.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. High	28°	31°	40°	54°	66°	74°	78°	77°	68°	58°	45°	34°
Avg. Low	7°	8°	18°	31°	41°	48°	54°	52°	45°	35°	27°	15°
Mean	18°	20°	30°	42°	54°	62°	67°	65°	58°	47°	37°	24°
Avg. Precip.	3.5 in	3.4 in	3.9 in	4.3 in	4.6 in	4.5 in	4.1 in	4.3 in	3.8 in	3.8 in	4.6 in	4.3 in

Table 12.3 - Weather Data for Williamstown, MA

Cost/Benefit Analysis:

While environmental considerations are a very philanthropic concept, the ability to pay for and maintain those considerations is the strongest of these considerations. This study proposes the addition of 17,680 square feet of green roof to be added to the Center for Theatre & Dance. Accounting for the price of extensive green roofs, the whole system would cost an average of $194,500. If the cost analysis is considered over the average lifetime of a green roof, 40 years, which probably an acceptable estimate for this being an academic building, we must consider the cost implications of standard roof replacement for black tar membrane roofs, which generally only have a lifespan of 10-15 years. This means that a traditional roof would need to be replaced three times during the lifespan of a single green roof.

	Green Roof	Traditional Roof
Initial Cost	$194,500	$88,400
Energy Savings	$26,067	0
Replacement	0	$265,200
System Lifecycle Cost	(-$848,200)	$353,600
Simple Payback	7 years	---------

Table 12.4 - Payback Analysis derived over a 40 year period (neglecting inflation)

Structural Capacity:

One of the important factors as to whether a green roof can be added to the building is whether the current roof structural system is capable of withstanding the added weight. The following loading parameters were referenced from the 2003 IBC (International Building Code), 13th Edition of the AISC (American Institute of Steel Construction) Steel Construction Manual, and trade-accepted assumptions for standard buildings material parameters.

Weight of Concrete	$150lb/ft^3$
Snow Load (Williamstown, MA)	60psf
Suspended Mechanical (assumed)	15psf
Suspended Theatrical (assumed)	10psf
E_{steel}	29000ksi
Governing Loading Characteristic	1.2L + 1.6Snow

Table 12.5 - Loading parameters

An analysis was performed on a girder in each of the four roof sections listed above. The performance of each girder can be reviewed, in depth, in the structural breadth section that follows this one. In summary, all four sections are capable of withstanding the extra load, in worst case scenario, of 32 psf that a fully saturated green roof would add. This verifies that no additional cost for structural reinforcement would be necessary to add a green roof to the Center for Theatre & Dance in all four locations.

Urban Heat Island Effect:

Current research in urban environment and planning has found that as more and more black surfaces, including roads and building roofs, are built, covering the surface of the earth, heat plenums are built up in the lower levels of the atmosphere, trapping solar radiation and increasing the mean ambient temperature of the earth occupied atmosphere. As the mean ambient temperature increases, buildings need to consume more energy in order to keep the spaces comfortably conditioned. Scientists at the U.S. Department of Energy's Lawrence Berkeley National Laboratory have estimated that "using alternative surfaces to reduce the temperature of ambient air in cities by just 5.4 degrees Fahrenheit would save up to $6 billion per year in energy costs, nationwide." While this effect is generally occurring most rapidly in large cities, where many acres of land are covered by black, absorptive surfaces, building construction rates continue to grow at a rapid pace and it's better to start now than when it's too late. Global warming and air quality are huge issues in the environment today. Plant mass contributes a significant amount of oxygen to the air, filtering harmful contaminants. By removing our buildings from the environment's eye, we can slow the processes of global warming and, in a matter of speaking, turn back the hands of time on building growth (considering the percentage of the earth's surface area being covered by impervious materials).

Conclusions & Recommendations

With a seven year payback on investment and a total lifecycle savings of over one million dollars, the addition of a green roof seems economically beneficial for Williams College to invest in. Green roofs are helping the environment in many different ways, from maintaining natural aquifers to reducing the urban heat island effect. In most instances, it's hard to find a new standard that is both economically feasible and environmentally beneficial, but a green roof seems it may be one.

The following section will outline calculations performed to determine if the structural system of the roof, in the following four spaces, is sufficient to carry an additional green roof load or if they need to be redesigned for load compliance. Please reference the following plan with provided structural plans.

Dance Rehearsal Studio

Black Box Theater

550 Seat Theater

Main Corridor

Figure 13.1 - Roof Plan Showing Potential Locations for Green Roof Application

Location 1:

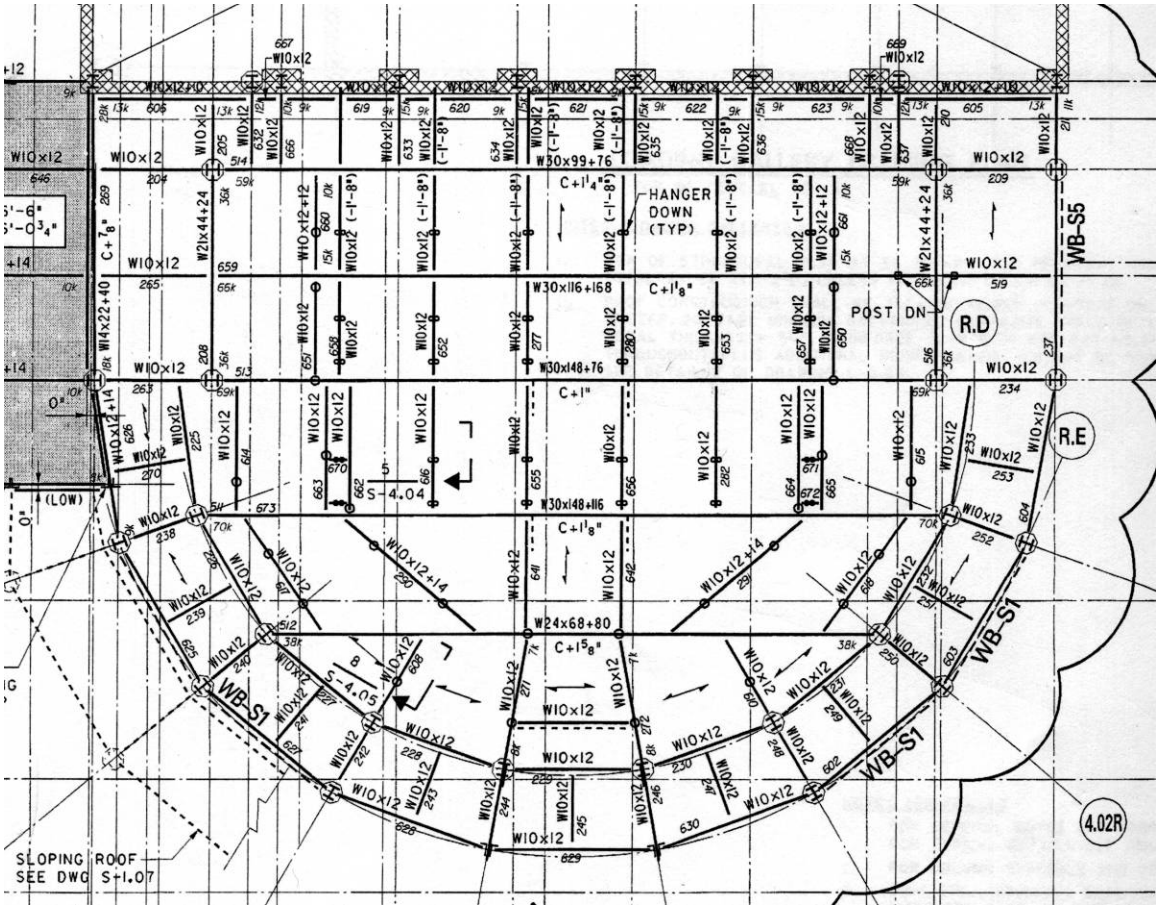


Figure 13.2 - Structural Plan for Location 1 (550 seat main theatre) n.t.s.

To check for compliance in this area, I chose to analyze the W30x148 in the center of the space. Since the roof is made of composite steel joists, I've used the LRFD method to determine the maximum moment on the beam due to a simplified distributed load. Snow loads in Williamstown were approximated using the 2003 IBC and found to be approximately 60psf. Other loads, such as mechanical, electrical and decorative ceiling panels, were approximated as additional dead load. The loading factors that dominated were 1.2D + 1.6S. Calculating the distributed load from a tributary width of 10', the steel joist is carrying 2.4kips/lf. Calculation of the maximum moment assumed a beam supported on both ends, spanning 62 feet, and resulted in 1,153kip-ft. Comparing this value to the maximum available strength for a W30x116, a smaller member than I have, my calculated moment is well within the 1890kip-ft available. The addition of 35plf from the green roof increases the moment to 1320kip-ft, which is still less than 1890kip-ft.

Therefore, this beam would be capable of supporting the additional load with no need for redesign.

Location 2:

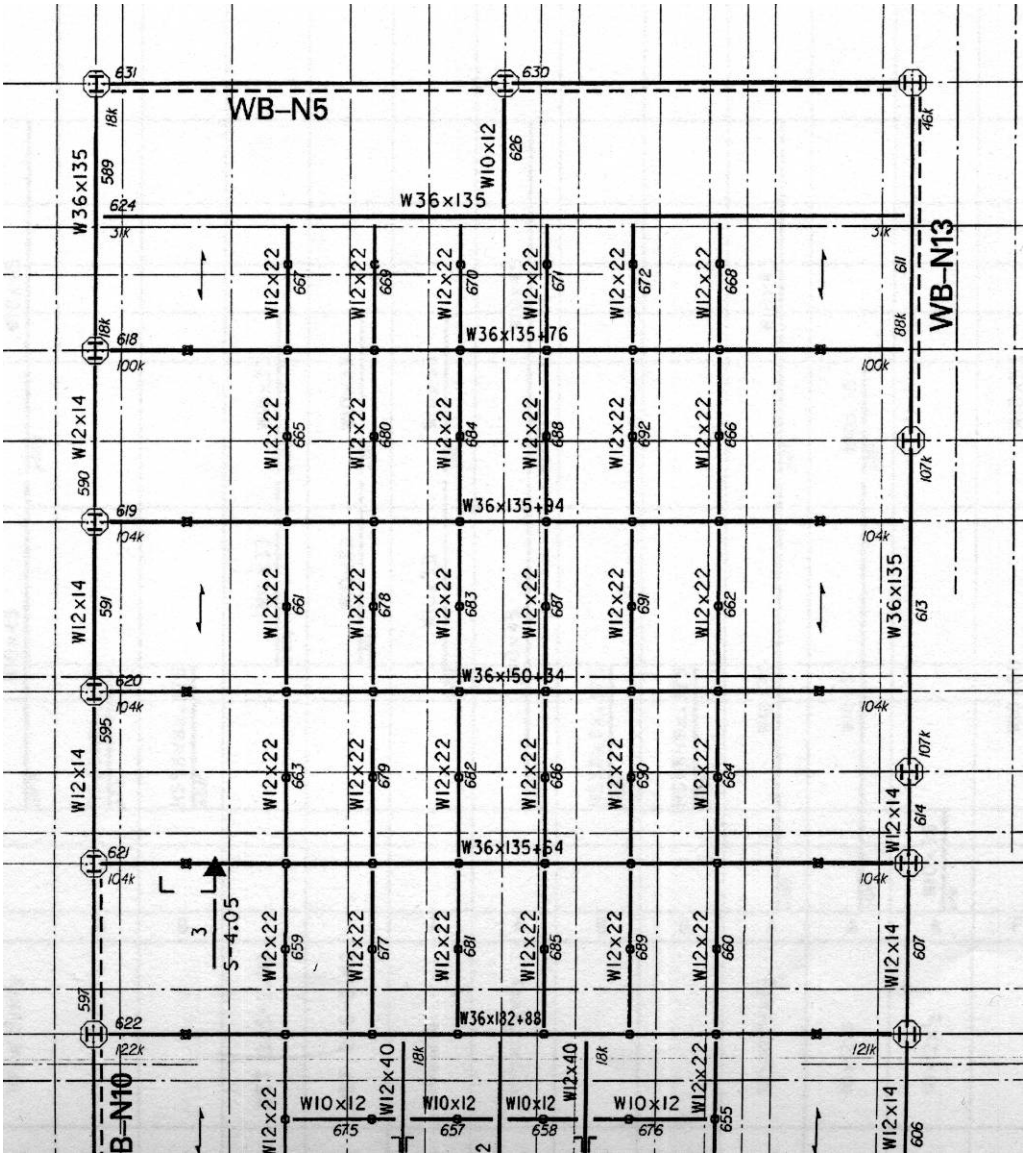


Figure 13.3 - Structural Plan for Location 2 (center stage black box theatre) n.t.s.

Compliance in this space was checked against a W36x135, spanning 54'. Loading characteristics are very similar in this situation. Because a wire mesh grid is suspended from the roof joists and will have multiple people working on it with theatrical lighting fixtures, an additional 40psf live load was also factored in. With a tributary width of 11', the maximum moment on the beam is 1026kip-ft. The maximum moment allowable on a W36x135 is 2550, assuming worst case scenario, and therefore complies.

Location 3:

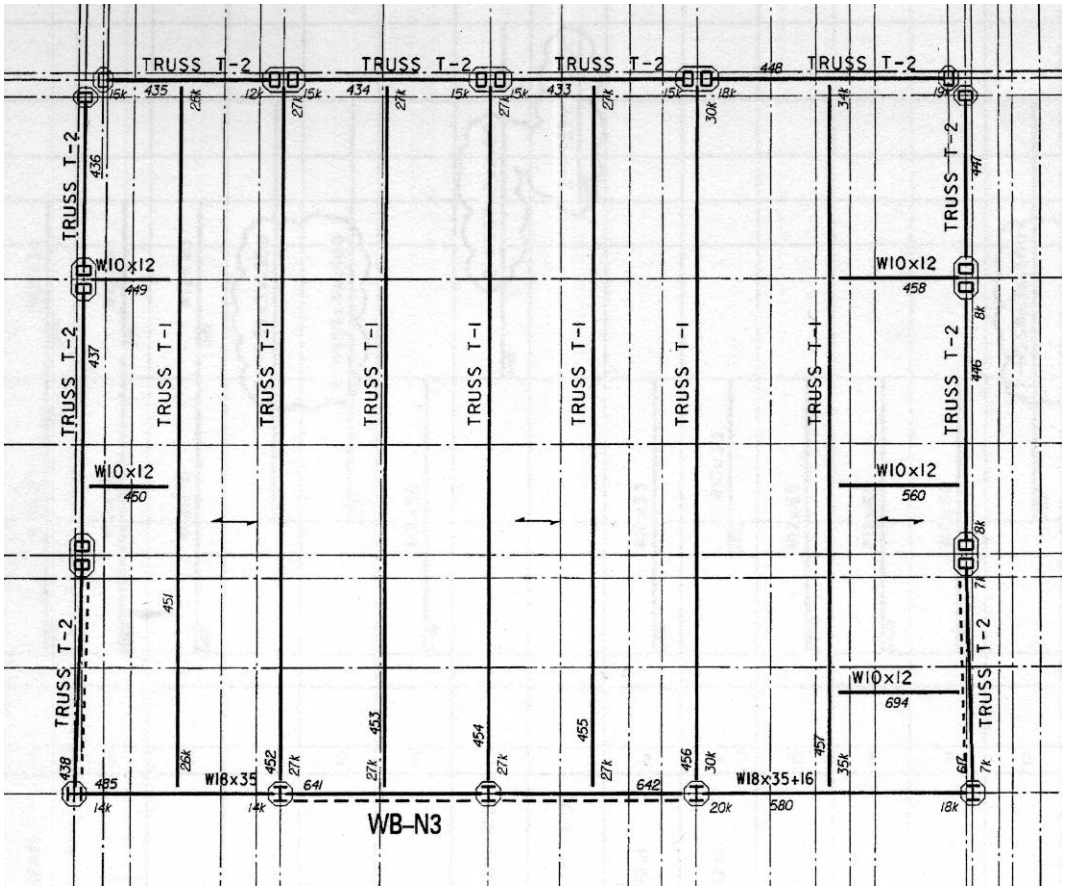


Figure 13.4 - Structural Plan for Location 3 (dance rehearsal studio) n.t.s.

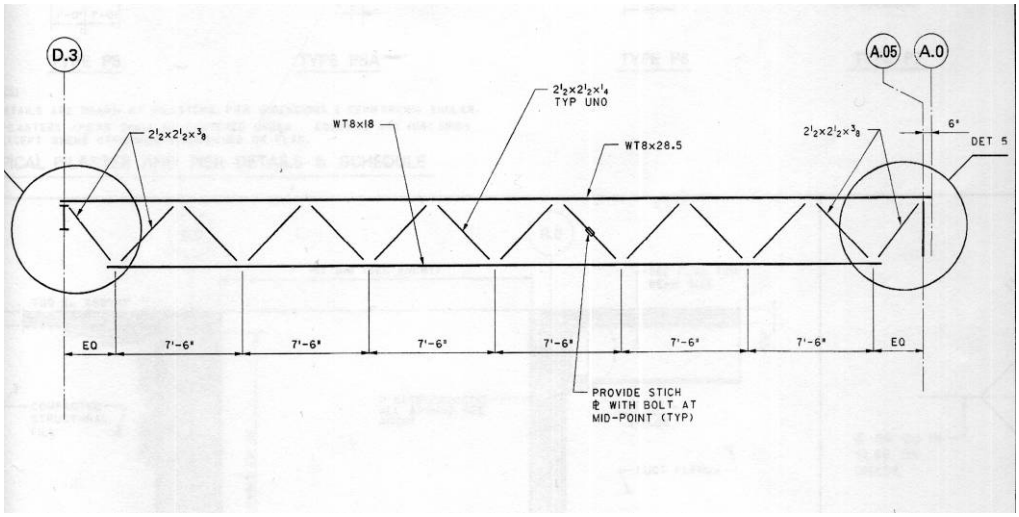


Figure 13.5 - Open Web Steel Joist Elevation n.t.s.

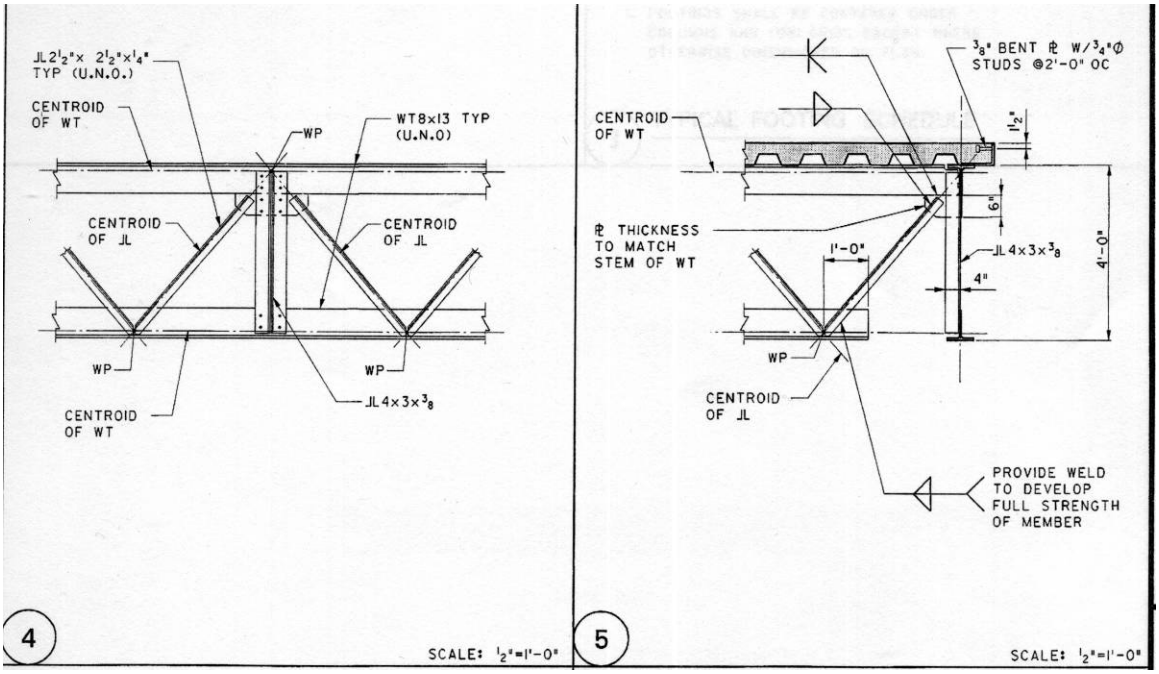


Figure 13.6 - Open Web Steel Joist Details n.t.s.

Compliance in this space was checked on one of the open web steel joists, T-1. To check the ability for these members to carry the load without performing a full point analysis and design of a truss, which I have background for, I have approximate this truss with the closest standard truss from the Vulcraft catalog and checked the loading against their maximum loading values. The span of the trusses is 52', with a tributary width of 7.5'. The concrete lab in this section is a 3" slab with metal decking. The largest 4' joist from the Vulcraft catalog, the 48LH17, spanning 52', is capable of withstanding 1107lb/lf. Considering loading conditions for dead and snow loads, the distributed load on the truss is approximately 1129lb/lf. This joist would fail under the existing loading conditions, but it's understood that the custom-made open web steel joist detailed above is designed with WT beams and the Vulcraft joists are designed with smaller steel angles. I have no basis for the difference in structural capacity that switching these to WT's will add, but I've compared the moment of inertia of the WT8x28.5 of the custom made joist with the L6x6x1/2 and found the W8x28.5 to be 2.45 times larger. Applying a conservative 65% of this increased moment of inertia, at 1.59 times the strength of the Vulcraft joist, results in a maximum available moment capacity of 1766lb/lf. With the additional load of the green roof, this increases the linear load on the joist to 1391lb/lf, which is within the range of the original joists capacity. While a more detailed analysis of the joist would be necessary to prove in it's entirety, I believe that the additional 35psf for the extensive green roof would be able to be supported by the existing system.

Location 4:

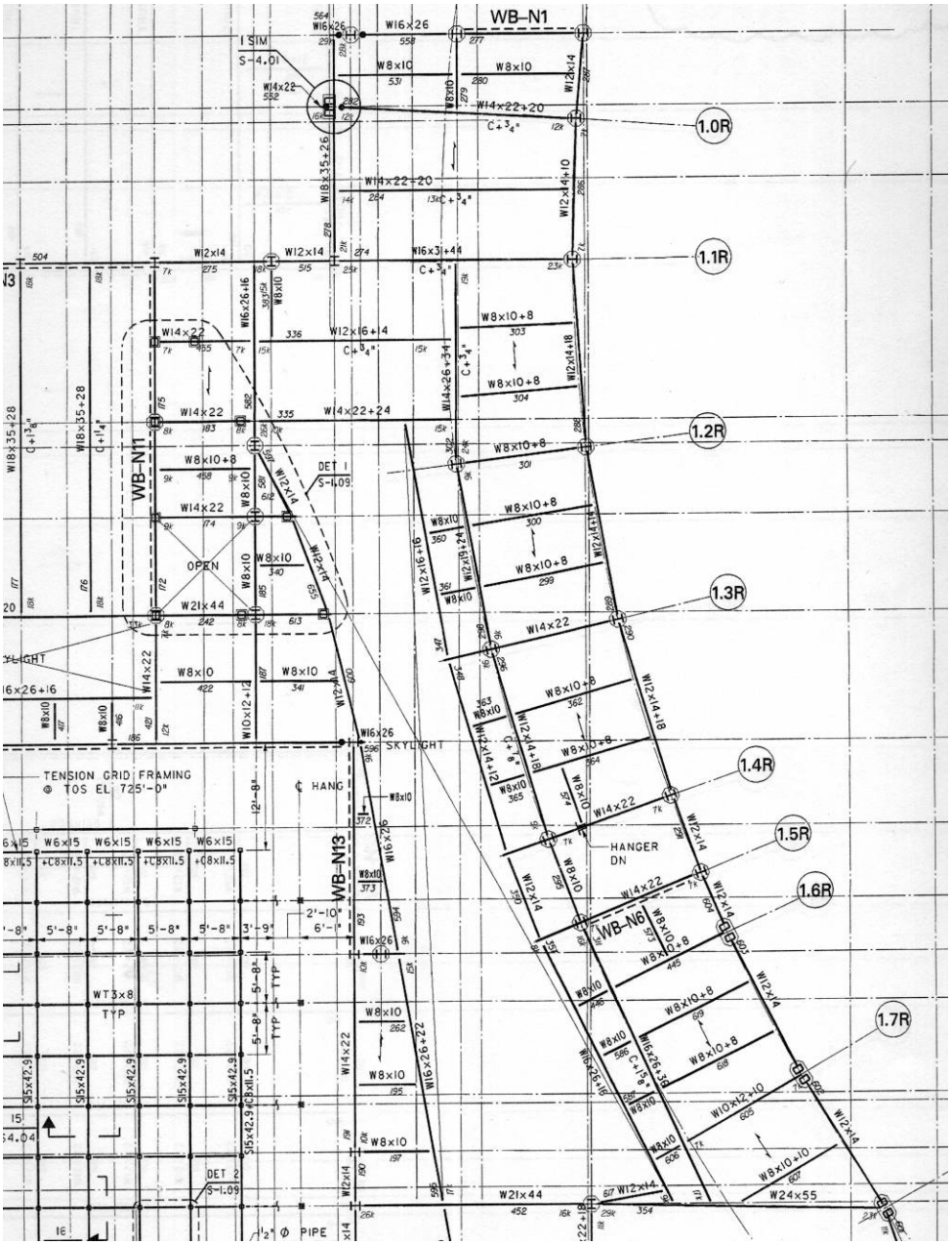


Figure 13.7 - Structural Plan for Location 4 (hallways)

Compliance was checked against the W8x10 member with a 7' tributary width and a length of 14'. The LRFD Steel Manual specifies the maximum allowable load on a W8x10 at 7' as 37.6kips. The total load on the member in this system is 9.1kips. The additional load of the green roof would add 3.43kips, bringing the total load on the entire system to 12.5kips, still only a third of t he capacity of the member.

Conclusions

While not all proposed solutions had the most enticing payback period or desired outcome, one saving factor for this building is that it's a part of a college campus, where lifespans of buildings are often times 40+ years. Many economic analysis' that would fail for a spec grade office building, lifespan of 4-6 years and often with immediate turnaround, prove to hold up to a building that will stay around for a long time and be owned and operated on site. Adding energy efficient transformers to this building is a big investment with a wait for a return on that investment, but when compared with planting 13 acres of forest every year to combat the CO_2 produced by transformers that aren't as efficient, things begin to come into perspective.

I have always been a proponent of lighting for the emotional perspective. Light is a fundamental piece of our every day life; pure, vibrant, and every changing. If we were meant to live in a world with boring, even, functional illumination, the sky would be a grey, diffuse mask. As the one piece of building systems that can affect a person on deep levels of their emotions, I've always felt a need to honor that factor that nature does so well. I felt the introduction of color and the varied levels of illumination that direct a person through the space was very successful and created a dynamic space that could get someone in the mood to watch a theatrical performance. It has long been my understanding that when a person enters a space, they shouldn't have to think. Thinking takes away from experiencing. Our duty as lighting designers is to reduce the need for thinking by justifying action, without doubt, so that experience can be as strong as possible. The major change to LED's is risky at this time, as the technology is still in infancy, but the future is promising and there *are* some manufacturers that are a cut above the rest.

The Williams College Center for Theatre & Dance was designed very recently and completed construction in 2006, employing many of the strategies for efficiency that we use today. It was a utilitarianist design that sought to meet the requirements for functionality in most instances. In the theatre, the performer is experience, not the props. Possibly this philosophy has found its way into the heart of the building which consumes these performers.

My conclusions seek that with an initial investment, Williams College can save a considerable amount of energy and money, be it from an addition of a green roof, energy efficient transformers, or taking that leap of faith that says compact fluorescents really can look incandescent. Maybe the idea of putting photovoltaics to work for this building didn't look the best, but everything is relative in scale, and all depends on how much extra money is set aside that no one would miss for the next 25 years. Create for experience and beauty, engineer to make those real.

Appendix A (Luminaire Schedules)

HLB LUMINAIRE SCHEDULE

Fixture Type	Lamps		Manufacturer & Catalog No.	Voltage	Mounting
	No.	Type			
HL-1	1	100A/1F	LIGHTOLIER G7057CLW/G410	120	RECESSED
HL-2	1	100W A19	LIGHTOLIER C4AWCLW/C4120	120	RECESSED
HL-3	1	Q50MR16/C/NFL25	TRANSLITE SOROMA MICROSPOT L 211-AL	120	SURFACE
HL-3A	1	Q50MR16/C/NFL25	TRANSLITE SOROMA MICROSPOT L 211-AL	120	SURFACE
HL-4	-	5 WATT XENON	STARFIRE LIGHTING XF-3-5-72"-24v WITH XF-ASW REFLECTOR	120	SURFACE
HL-4A	-	5 WATT XENON	STARFIRE LIGHTING XF-3-5-84"-24v WITH XF-ASW REFLECTOR	120	SURFACE
HL-4B	-	5 WATT XENON	STARFIRE LIGHTING XF-3-5-96"-24v WITH XF-ASW REFLECTOR	120	SURFACE
HL-4C	-	5 WATT XENON	STARFIRE LIGHTING XF-3-5-120"-24v WITH XF-ASW REFLECTOR	120	SURFACE
HL-4D	-	5 WATT XENON	STARFIRE LIGHTING XF-3-5-144"-24v WITH XF-ASW REFLECTOR	120	SURFACE
HL-5	2	Q500PAR56MFL	KIRLIN SR31245-38-99-WB-MOD	120	WALL
HL-6	1	PLT-26W/830/4P/ALTO	LIGHTOLIER 8021 CCLW/6132BU	277	RECESSED
HL-7			Not Used		
HL-8	1	PLT-42W/830/4P/ALTO	LIGHTOLIER 8022 CCLW/7142BU	277	RECESSED
HL-9	1	50PAR20/H/SP10	STONCO 30KL	120	SURFACE
HL-10	1	Q350T3/CL/HIR	STONCO CPH515L	120	SURFACE
HL-11	3	F32T8/TL835	LINEAR LIGHTING CD27P-1-3-ET8-277-PRD-C-24-BW-ED-12	277	PENDANT
HL-11A	3	F32T8/TL835	LINEAR LIGHTING CD27P-1-3-ET8-277-PRD-C-24-BW-ED-8	277	PENDANT
HL-12	1	PLT-42W/830/4P/ALTO	DELRAY LIGHTING 2072SO-32-277-E	277	PENDANT
HL-13	-		Not Used		
HL-13A	-		Not Used		
HL-13B	1	F54T5/830/HO	LIGHTOLIER 8269WH	277	SUSPENDED
HL-14	3	90WPAR38/HAL/WFL/60/WLL	RSA COMBO - MODIFIED FOR WALL MOUNT	120	WALL
HL-15	1	90PAR38/H/FL25	LIGHTOLIER 8747WH/6196WH C-CLAMP MONOPOINT	120	SURFACE
HL-16	1	Q350T3/CL/HIR	INSIGHT LIGHTING TM501-RCB-1-1-CC-SS-MOD	120	WALL
HL-17	1	90PAR38/H/FL25	LIGHTOLIER 7026AD/7249	120	WALL
HL-18	2	Q500PAR56MFL	KIRLIN SR 31245-38-99-___	120	SURFACE
HL-19	-		Not Used		
HL-20	1	PLT-42W/830/4P/ALTO	LIGHTOLIER 8022WW CCLW/7142BU	277	RECESSED
HL-21	1	PLT-26W/830/4P/ALTO	LIGHTOLIER 8046 CCLW/61322BU	277	RECESSED
HL-22	1	90WPAR38/HAL/WFL/60/WLL	LIGHTOLIER C6P38A/C6D120	120	RECESSED
HL-23	1	CDM35/T6/U/830/G12	INSIGHT LIGHTING TM517-WCB-1-1-N-SS	120	WALL
HL-24	1	100A/1F	SPERO VX215-41-G	120	SURFACE
HL-25	1	22 WATT T5 R	WILA 202-70-SA-OR/10-120	120	SURFACE

THEATRE LUMINAIRE SCHEDULE

Fixture Type	Lamps		Manufacturer & Catalog No.	Voltage	Mounting
	No.	Type			
BL	1	40W19/F	BEGA 2226P-MOD-INC		SURFACE
FL1	1	F32T8/TL835	COLUMBIA CS4-132-EB8-120-CSWG4	120	CEILING SURFACE
FL2	1	F32T8/TL835	COLUMBIA CS4-132-EB8-120-CSWG4	120	SUSPENDED
FL3	2	F32T8/TL835	COLUMBIA WC4-232-EB8-120	120	SURFACE
WL	1	1000T 3Q/P/CL	HUBBELL QL-1505		CATWALK RAIL

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ELECTRICAL ENGINEER LUMINAIRE SCHEDULE

Fixture Type	Lamps		Manufacturer & Catalog No.	Voltage	Mounting
	No.	Type			
C1	1	500 T3Q/P/CL	STONCO CPH515		SURFACE
C2	1	50MR16/VWFL/60(FNV)	BK LIGHTING NS-9-BZP-9-11 TRANSFORMER CUS-1826-02-BZP TREE STRAP TS-TMC-BZP-6"		SURFACE
EC1	-	LED	DUAL LITE LESCS-G-(X/R/L/D/C)A		CEILING SURFACE
EC2	-	LED	DUAL LITE LESCS-G-(X/R/L/D/C)A		CEILING SURFACE
EC3	-	LED	DUAL LITE LESCS-G-(X/R/L/D/C)A		CEILING SURFACE
EC4	-	LED	DUAL LITE SEGWIN		CEILING SURFACE
EW1	-	LED	DUAL LITE LESCS-G-(X/R/L/D/C)A		WALL SURFACE
EW2	-	LED	DUAL LITE LESCS-G-(X/R/L/D/C)A		WALL SURFACE
EW3	-	LED	DUAL LITE SEGWIN		WALL SURFACE
EW4	2	FURNISHED WITH LAMP	DUAL LITE EZ-2		WALL
FC1	4	F32T8/TL835	COLUMBIA CSR8-232-EB8LH-277-CSWG4	277	CEILING SURFACE
FC1A	2	F32T8/TL835	COLUMBIA CSR4-232-EB8LH-277-CSWG4	277	CEILING SURFACE
FC1B	1	F17T8/TL835	COLUMBIA CH2-117-EB8LH-277	277	CEILING SURFACE
FC2	4	F32T8/TL835	COLUMBIA CS8-232-EB8LH-277-CSWG4	277	CEILING SURFACE
FC3	2	F32T8/TL835	COLUMBIA WC4-232-EB8-277	277	CEILING SURFACE
FC4	2	F32T8/TL835	COLUMBIA CS4-232-EB8LH-277-CSWG4	277	CEILING SURFACE
FC5	2	F32T8/TL835	COLUMBIA CS4-232-EB8-277-CSWG4	277	CEILING SURFACE
FC6	4	F32T8/TL835	COLUMBIA CS8-232-EB8LH-277	277	CEILING SURFACE
FC7	1	PLC-26W/38	CANLET BFCF26H1-GHC-277	277	CEILING
FC8	1	FC12T9/CWHL	LITHONIA 10991-277	277	CEILING SURFACE
FC9	2	F32T8/TL835	COLUMBIA STR24-232G-MPO-EB8LH-277	277	CEILING SURFACE
FR1	2	F32T8/TL835	COLUMBIA 4PS24-232G-FSA12.125-EB8LH-277	277	RECESSED
FR1A	2	FB32T8/TL835/6	COLUMBIA 4PS22-232U6G-FSA12.125-EB8LH-277	277	RECESSED
FR2	2	F32T8/TL835	COLUMBIA HC24-232G-LD29-S-EB8LH-277	277	RECESSED
FR2A	2	FB32T8/TL835/6	COLUMBIA HC22-232U6G-LD34-S-EB8LH-277	277	RECESSED
FR2B	3	FT40W/2G11/RS/35	COLUMBIA HC22-40TT-G-LD34-S-EB8LH-277	277	RECESSED
FR3	1	PLC-26W/35	PRESCOLITE CFT832-HEB-ST-F802H		RECESSED
FR4	2	F32T8/TL835	COLUMBIA STR24-232G-MPO-EB8LH-277	277	RECESSED
FR5	3	F32T8/TL835	COLUMBIA 4PS24-332G-FSA12.125-EB8LH-277	277	RECESSED
FR6	3	F32T8/TL835	COLUMBIA HC24-332G-LD39-S-EB8LH-277	277	RECESSED
FR7	2	F32T8/TL835	COLUMBIA HC24-232F-LD29-S-EB8LH-277	277	RECESSED
FR8	1	PLC-26W/35	PRESCOLITE CFT832-HEB-STT1P-B6-277	277	RECESSED
FS1	4	F32T8/TL835	COLUMBIA CSR8-232-EB8LH-277-CSWG4	277	SUSPENDED
FS1A	2	F32T8/TL835	COLUMBIA CSR4-232-EB8LH-277-CSWG4	277	SUSPENDED
FS2	2	F32T8/TL835	COLUMBIA CS4-232-EB8-277-CSWG4	277	SUSPENDED
FS3	4	F32T8/TL835	LINEAR LIGHTING CD27P-B-2-ET8-277-PRD-24-BW-8'	277	SUSPENDED
FS3A	2	F32T8/TL835	LINEAR LIGHTING CD27P-B-2-ET8-277-PRD-24-BW-4'	277	SUSPENDED
FS4	2	F32T8/TL835	COLUMBIA WC 4-232-EB8-277	277	SUSPENDED
FW1	4	F32T8/TL835	COLUMBIA F4-2DT8-WM-LD-EB8LH-277-8-SGL	277	WALL SURFACE
FW1A	2	F25T8/TL835	COLUMBIA F4-2DT8-WM-LD-EB8LH-277-MW-6-SGL	277	WALL SURFACE
FW1B	2	F32T8/TL835	COLUMBIA F4-2DT8-WM-LD-EB8LH-277-MW-4-SGL	277	WALL SURFACE
FW1C	1	F17T8/TL835	COLUMBIA F4-1DT8-WM-LD-EB8LH-277-MW-2-SGL	277	WALL SURFACE
FW2	4	F32T8/TL835	COLUMBIA WAL 8-232-EB8LH-277	277	WALL SURFACE
FW2A	2	F32T8/TL835	COLUMBIA WAL 4-232-EB8LH-277	277	WALL SURFACE
FW3	1	PLC-26W/35	CANLET BFWF26H1D-GHC-277	277	WALL SURFACE
FW4	2	F32T8/TL835	COLUMBIA CS4-232-EB8-277-CSWG4	277	WALL SURFACE
FW5	1	FC12T9/CWHL	LITHONIA 10991-277	277	WALL SURFACE
FW6	1	PLC-26W/35	CANLET BFWF26H1D-GHC-120	120	WALL SURFACE
FW7	1	PLS-13W/35	BEGA 2294P-277	277	WALL
MC1	1	MH175/U/M	SPAULDING PDI-M175PS-MT-Q2-SGB		CEILING SURFACE
MS1	1/1	MS320/PS/BU-ONLY 250Q/CL/MC	HUBBELL BL320 W8 HG16 WH-QST		SUSPENDED
MS2	1	CDM150/TD/830	HUBBELL BL150 W8 HG16 WH WG16		SUSPENDED

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ELECTRICAL ENGINEER LUMINAIRE SCHEDULE (cont.)

Fixture Type	Lamps		Manufacturer & Catalog No.	Voltage	Mounting
	No.	Type			
MS2A	1/1	CDM150/TD/830 250Q/CL/MC	HUBBELL BL150 W8 HG16 WH WG16-QST		SUSPENDED
P1	1	MH175/C/U/MED ED-17	SPRING CITY WILLIAM & MARY EFED-H-3-CO SPRING CITY HARRISBURG/BALTIMORE 10'-11 1/2" POST HT		POLE
R1	1	150PAR38/2FL	EDISON PRICE DL38/45/5AA		RECESSED
R2	1	150PAR38/2FL	EDISON PRICE DL38/6/COL		RECESSED
R3	1	20W MC	BEGA 2908-120V	120	RECESSED
R4	1	150PAR38FL	EDISON PRICE DL38/5 COL		RECESSED
S1	1	75WPAR30	LIGHTILIER 8202/8235WH-6190WH-120	120	SUSPENDED
S2	1	150PAR38FL	PRESCOLITE 1125-976		SUSPENDED
T1	-	75WPAR16	PRESCOLITE TV141 WH PRESCOLITE TS4-WH TRACK		TRACK
W1	1	60W G25	COLE LIGHTING VS-6"-WG		WALL SURFACE

NEW LIGHTING LUMINAIRE SCHEDULE

Fixture Type	Lamps		Manufacturer & Catalog No.	Voltage	Mounting
	No.	Type			
D-1	9	F28T5/830	LEDALITE CACHE 891-5-S03-L-N-12-9-2-E-W	277	SUSPENDED
D-1A	6	F28T5/830	LEDALITE CACHE 891-5-S03-L-N-08-9-2-E-W	277	SUSPENDED
D-2	48	1W WARM WHITE LED	EXTERIEUR VERT ML6-41-0-1-4-10R-1-4 / E-096-7	277	SURFACE
D-3	-	0.72W LED FESTOONS	TIVOLI CLL-2-R/B/B-12VDC / CLLCHAN / CLL-LC	277	SURFACE
D-4	-	LED	IOLIGHTING LUXRAIL 0-06-SSS-1-WM-NR-45-R/B-LENGTH-2-I	277	SURFACE
D-5	-	LED	IOLIGHTING LINE0.75 0-03-I-3K-10-100-1-16-2-4-I	277	SURFACE
D-6	1	PLT-26W/830/4P/ALTO	EDISON PRICE TRPV-26/6-277-BFL	277	RECESSED
D-7	1	PLT-26W/830/4P/ALTO	EDISON PRICE TRPV-26/6-277-WHFL	277	RECESSED
D-8	1	Q71/H	FIBERSTARS STAR KIT / FS1L-SPW/NC-120	120	RECESSED
D-9	1	Q50MR16/C/FL40	TARGETTI FOHO PRO MR16 P US1T0686D1	120	SURFACE
D-10	1	PLT-18W/830/4P/ALTO	EDISON PRICE TRPV-18/6-277-WHFL	277	RECESSED
D-11	1	Q50MR16/C/NFL25	LIGHTOLIER C4MRD CLP / C4AICLVE1	120	RECESSED
D-12	18	1.2W LED	THORNE PROMENADE BOL LED WHI/RGB 1150MM MPL ANT	24/120	SURFACE
D-13	1	Q50MR16/C/WFL60	BK LIGHTING NS-9-BZP-9-11 TRANSFORMER CUS-1826-02-BZP TREE STRAP TS-TMC-BZP-6"	12/120	TREE
D-14	2	F32T8/TL835	866-1-T20-AE-12-7-2-E	277	SUSPENDED

Appendix B (Mechanical Equipment Schedules)

Mechanical Loads								
Designation	Type	Voltage	F.L.Amps	Phase	Power (HP)	Power (KVA)	PF	Power (KW)
ACLC-1	Air Chiller	480	46	3	44	38.24	0.90	34.42
AHU-1A	Air Handling Unit	480	96	3	75	79.81	0.90	71.83
AHU-1B	Air Handling Unit	480	96	3	75	79.81	0.90	71.83
AHU-1C	Air Handling Unit	480	40	3	30	33.26	0.90	29.93
AHU-1D	Air Handling Unit	480	40	3	30	33.26	0.90	29.93
AHU-2A	Air Handling Unit	480	34	3	25	28.27	0.90	25.44
AHU-2B	Air Handling Unit	480	14	3	10	11.64	0.90	10.48
AHU-3A	Air Handling Unit	480	14	3	10	11.64	0.90	10.48
AHU-3B	Air Handling Unit	480	7.6	3	5	6.32	0.90	5.69
AHU-4A	Air Handling Unit	480	27	3	20	22.45	0.90	20.20
AHU-4B	Air Handling Unit	480	11	3	7.5	9.15	0.90	8.23
AHU-5A	Air Handling Unit	480	21	3	15	17.46	0.90	15.71
AHU-5B	Air Handling Unit	480	11	3	7.5	9.15	0.90	8.23
AHU-6	Air Handling Unit	480	7.6	3	5	6.32	0.90	5.69
AHU-7	Air Handling Unit	480	11	3	7.5	9.15	0.90	8.23
AHU-8	Air Handling Unit	480	7.6	3	5	6.32	0.90	5.69
AHU-9A	Air Handling Unit	480	21	3	15	17.46	0.90	15.71
AHU-9B	Air Handling Unit	480	4.8	3	3	3.99	0.90	3.59
AHU-10	Air Handling Unit	480	7.6	3	5	6.32	0.90	5.69
AHU-11	Air Handling Unit	480	7.6	3	5	6.32	0.90	5.69
AHU-12A	Air Handling Unit	277	4.9	1	0.5	1.36	0.85	1.15
AHU-12B	Air Handling Unit	277	4.9	1	0.5	1.36	0.85	1.15
AHU-13	Air Handling Unit	277	2.2	1	0.167	0.61	0.85	0.52
AHU-14	Air Handling Unit	277	2.2	1	0.167	0.61	0.85	0.52
AHU-15A	Air Handling Unit	277	4.9	1	0.5	1.36	0.85	1.15
AHU-15B	Air Handling Unit	277	4.9	1	0.5	1.36	0.85	1.15
AHU-16	Air Handling Unit	277	4.9	1	0.5	1.36	0.85	1.15
AHU-17A	Air Handling Unit	277	4.9	1	0.5	1.36	0.85	1.15
AHU-17B	Air Handling Unit	277	4.9	1	0.5	1.36	0.85	1.15
AHU-19	Air Handling Unit	277	2.2	1	0.167	0.61	0.85	0.52
AHU-21A	Air Handling Unit	277	4.9	1	0.5	1.36	0.85	1.15
AHU-21B	Air Handling Unit	277	4.9	1	0.5	1.36	0.85	1.15
B-1	Boiler	480	3.4	3	2	2.83	0.90	2.54
CP-1	Condensate Pump	480	13.5	3	9.36	11.22	0.90	10.10
CUH-1	Unit Heater	277	4.9	1	0.5	1.36	0.85	1.15
CUH-2	Unit Heater	277	4.9	1	0.5	1.36	0.85	1.15
CUH-3	Unit Heater	120	5.8	1	0.25	0.70	0.85	0.59
CUH-4	Unit Heater	120	2.9	1	0.125	0.35	0.85	0.30
CUH-5	Unit Heater	120	2.9	1	0.125	0.35	0.85	0.30
CUH-6	Unit Heater	277	4.9	1	0.5	1.36	0.85	1.15
CUH-7	Unit Heater	120	2.9	1	0.125	0.35	0.85	0.30
CUH-8	Unit Heater	277	4.9	1	0.5	1.36	0.85	1.15
CUH-10	Unit Heater	120	4.4	1	0.167	0.53	0.85	0.45

Mechanical Loads								
Designation	**Type**	**Voltage**	**F.L.Amps**	**Phase**	**Power (HP)**	**Power (KVA)**	**PF**	**Power (KW)**
DC-1	Dust Collector	480	11	3	7.5	9.15	0.90	8.23
EH-1	Humidification	480	20	3	6.71	16.63	0.90	14.96
EH-2	Humidification	480	20	3	6.71	16.63	0.90	14.96
EUH-1	Electric Unit Heater	480	20	3	6.96	16.63	0.90	14.96
EUH-2	Electric Unit Heater	277	1.5	1	0.125	0.42	0.85	0.35
F-01	Fan	480	1	3	0.5	0.83	0.90	0.75
F-02	Fan	480	2.6	3	1.5	2.16	0.90	1.95
F-03	Fan	120	7.2	1	0.33	0.86	0.85	0.73
F-04	Fan	480	1.4	3	0.75	1.16	0.90	1.05
F-05	Fan	120	5.8	1	0.25	0.70	0.85	0.59
F-06	Fan	120	5.8	1	0.25	0.70	0.85	0.59
F-08	Fan	480	1.8	3	1	1.50	0.90	1.35
F-09	Fan	480	1.8	3	1	1.50	0.90	1.35
F-010	Fan	480	1.4	3	0.75	1.16	0.90	1.05
F-011	Fan	120	13.8	1	0.75	1.66	0.85	1.41
F-012	Fan	120	5.8	1	0.25	0.70	0.85	0.59
F-013	Fan	120	5.8	1	0.25	0.70	0.85	0.59
F-014	Fan	480	1.8	3	1	1.50	0.90	1.35
F-015	Fan	480	1.8	3	1	1.50	0.90	1.35
F-016	Fan	480	1.8	3	1	1.50	0.90	1.35
F-017	Fan	480	1.4	3	0.75	1.16	0.90	1.05
FPB-6	Fan Powered Box	277	1.5	1	0.167	0.42	0.85	0.35
FPB-8	Fan Powered Box	277	2.9	1	0.25	0.80	0.85	0.68
FPB-10	Fan Powered Box	277	4.9	1	0.5	1.36	0.85	1.15
FPB-12	Fan Powered Box	277	10	1	1.5	2.77	0.85	2.35
FPB-14	Fan Powered Box	277	8	1	1	2.22	0.85	1.88
P-1	Pump	480	52	3	40	43.23	0.90	38.91
P-2	Pump	480	52	3	40	43.23	0.90	38.91
P-3	Pump	480	27	3	25	22.45	0.90	20.20
P-4	Pump	480	27	3	25	22.45	0.90	20.20
P-5	Pump	480	7.6	3	5	6.32	0.90	5.69
P-6	Pump	480	7.6	3	5	6.32	0.90	5.69
P-7	Pump	480	3	3	1.5	2.49	0.90	2.24
P-8	Pump	480	3	3	1.5	2.49	0.90	2.24
P-10	Pump	480	1.8	3	1	1.50	0.90	1.35
P-20	Pump	480	1.4	3	0.75	1.16	0.90	1.05
P-21	Pump	120	2.9	1	0.167	0.35	0.85	0.30
P-30	Pump	120	9.5	1	0.4	1.14	0.85	0.97
P-31	Pump	120	2.2	1	0.083	0.26	0.80	0.21
P-40	Pump	480	1	3	0.5	0.83	0.90	0.75
P-41	Pump	120	2.2	1	0.083	0.26	0.80	0.21
P-50	Pump	480	1	3	0.5	0.83	0.90	0.75
P-60	Pump	120	2.9	1	0.167	0.35	0.85	0.30
P-61	Pump	120	2.2	1	0.083	0.26	0.80	0.21

Williams College '62 Center For Theater & Dance
Williamstown, MA

Mechanical Loads								
Designation	**Type**	**Voltage**	**F.L.Amps**	**Phase**	**Power (HP)**	**Power (KVA)**	**PF**	**Power (KW)**
P-71	Pump	120	2.2	1	0.083	0.26	0.80	0.21
P-80	Pump	120	9.5	1	0.4	1.14	0.85	0.97
P-81	Pump	120	2.2	1	0.083	0.26	0.80	0.21
P-90	Pump	120	2.9	1	0.167	0.35	0.85	0.30
RFM-1	Radiant Floor Manifold	120	7.2	1	0.33	0.86	0.85	0.73
WWP-1	Pump	120	0.72	1	0.033	0.09	0.80	0.07
UH-1	Unit Heater	120	2.9	1	0.167	0.35	0.85	0.30
UH-2	Unit Heater	120	5.8	1	0.25	0.70	0.85	0.59
UH-3	Unit Heater	120	0.98	1	0.05	0.12	0.80	0.09
AC-1	Air Compressor	480	21	3	15	17.46	0.90	15.71
RP-1	Recirculation Pump	120	7.2	1	0.33	0.86	0.85	0.73
NGB-1	Gas Booster	480	2.1	3	1	1.75	0.90	1.57
D-1	Dryer	208	2.4	1	0.75	0.50	0.85	0.42
WH-1	Water Heater	120	0.98	1	0.05	0.12	0.80	0.09
					Total:	24.81		22.01

Williams College '62 Center For Theater & Dance
Williamstown, MA

Appendix C (Electrical Tables)

	Demand Load	Gross Sq.Ft.	Available KW	Demand Factor	Total Available KW	Available KW
Lighting	1.5	126054	189.08	1	189.08	
Performance Ltg	4	126054	504.22	0.4	201.69	
Receptacles	0.5	126054	63.03	1	63.03	
Mechanical	-------	----------	638.55	1	638.55	
Heaters	-------	----------	25.39	1.25	31.74	
Elevators	-------	----------				
				Overall Building Demand Load:	1124.08	----------
				+ Expansion (x1.25):	1405.10	3000.00

1. Note that some demand load and gross sq.ft. columns are blank, meaning the available KW loads were based on calculated loads within the building.

2. Performance lighting demand load was included as a separate item in the building demand load calculation because of the nature of the building occupancy and the intense lighting load that theatrical fixtures can have on an electrical system. The 0.4 d

3. I've been unable to ascertain the elevator loads in the building. I've contacted the architect multiple times to get the information and he has said that he's working on it. The elevator specifications were in volume one of the specification set and

INDIVIDUAL TRANSFORMER SCHEDULE

Linear Dry-Type Transformers

TAG	PRIMARY VOLTAGE	SECONDARY VOLTAGE	SIZE	TYPE	TEMP. RISE	TAPS	MOUNTING
T0	1500KVA, 3PH, 3W	480/277, 3PH, 4W	N/A	N/A	N/A	N/A	PAD MOUNTED
T1	480/277, 3PH, 3W	208Y/120, 3PH, 4W	9	DRY	115 DEGREE C	(6) 2.5%	CEILING SUSPENDED
T2	480/277, 3PH, 3W	208Y/120, 3PH, 4W	15	DRY	150 DEGREE C	(6) 2.5%	CEILING SUSPENDED
T3	480/277, 3PH, 3W	208Y/120, 3PH, 4W	30	DRY	150 DEGREE C	(6) 2.5%	CEILING SUSPENDED
T4	480/277, 3PH, 3W	208Y/120, 3PH, 4W	45	DRY	150 DEGREE C	(6) 2.5%	CEILING SUSPENDED
T5	480/277, 3PH, 3W	208Y/120, 3PH, 4W	75	DRY	150 DEGREE C	(6) 2.5%	PAD MOUNTED
T6	480/277, 3PH, 3W	208Y/120, 3PH, 4W	112.5	DRY	150 DEGREE C	(6) 2.5%	PAD MOUNTED
T7	480/277, 3PH, 3W	208Y/120, 3PH, 4W	150	DRY	150 DEGREE C	(6) 2.5%	PAD MOUNTED
T8	480/277, 3PH, 3W	208Y/120, 3PH, 4W	225	DRY	150 DEGREE C	(6) 2.5%	PAD MOUNTED
T9	480/277, 3PH, 3W	208Y/120, 3PH, 4W	300	DRY	150 DEGREE C	(6) 2.5%	PAD MOUNTED
TSB	480/277, 3PH, 3W	208Y/120, 3PH, 4W	1500	DRY	150 DEGREE C	(6) 2.5%	PAD MOUNTED

Non-Linear Dry-Type Transformers

TAG	PRIMARY VOLTAGE	SECONDARY VOLTAGE	SIZE	TYPE	TEMP. RISE	TAPS	MOUNTING
T1C	480/277, 3PH, 3W	208Y/120, 3PH, 4W	9	DRY	150 DEGREE C	(6) 2.5%	CEILING SUSPENDED
T2C	480/277, 3PH, 3W	208Y/120, 3PH, 4W	15	DRY	150 DEGREE C	(6) 2.5%	CEILING SUSPENDED
T3C	480/277, 3PH, 3W	208Y/120, 3PH, 4W	30	DRY	150 DEGREE C	(6) 2.5%	CEILING SUSPENDED
T4C	480/277, 3PH, 3W	208Y/120, 3PH, 4W	45	DRY	150 DEGREE C	(6) 2.5%	CEILING SUSPENDED
T5C	480/277, 3PH, 3W	208Y/120, 3PH, 4W	75	DRY	150 DEGREE C	(6) 2.5%	PAD MOUNTED
T6C	480/277, 3PH, 3W	208Y/120, 3PH, 4W	112.5	DRY	150 DEGREE C	(6) 2.5%	PAD MOUNTED
T7C	480/277, 3PH, 3W	208Y/120, 3PH, 4W	150	DRY	150 DEGREE C	(6) 2.5%	PAD MOUNTED
T8C	480/277, 3PH, 3W	208Y/120, 3PH, 4W	225	DRY	150 DEGREE C	(6) 2.5%	PAD MOUNTED

NOTES:
1. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS

Williams College '62 Center For Theater & Dance
Williamstown, MA

Structural Breadth
(Roof Structure Coordination Review)

Green roof additions to existing buildings are much more difficult than designing a system to carry a green from the beginning. Ripping out structural steel and replacing it to introduce a green roof to a building would, in most instances, make it very difficult to justify the cost.

Appendix D (Luminaire Cut Sheets)

[Cut sheets for all referenced luminaires in the project are provided on the following pages, split between new design cuts and existing cuts. New design cut sheets are all labeled with a D prefix. Specifications for exact luminaire types can be found on the fixture schedule]

FRESNO SERIES

Cat. #		Approvals
Job	Type	

SPAULDING LIGHTING

APPLICATIONS

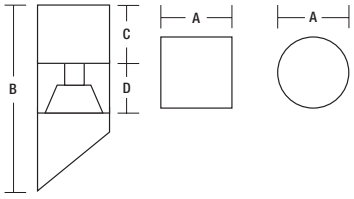
- Walkways and courtyards.

SPECIFICATIONS

- Extruded aluminum square or round housing, with tamper resistant hardware. Flat top, or optional dome top for round FN2. Single screw access for top relamping.
- Sealed one-piece, clear acrylic lens. Specular, anodized aluminum optical systems; dual reflector, tube optics, or internal louvers.
- Concealed, galvanized steel anchor base. Four 1/2" x 10" anchor bolts.
- Medium porcelain socket, pulse rated, with spring-loaded, nickel-plated center contact and reinforced lamp grip screw shell.
- HPF ballast, starting rated at -20°F (-40°F for HPS). Metal Halide is CWA or Super CWA type. HPS is CWA, HR, or Reactor type.
- Durable Lektrocote® TGIC thermoset polyester powder coat paint finish assures long life and maintenance-free service.

LISTINGS/CERTIFICATIONS

- UL1598 listed and CSA certified for outdoor use in wet locations.



	A	B	C	D	Weight
FN1	6.75" sq.	42.0"	6.0"	4.0"	41 lbs
	171 mm	1067 mm	152 mm	102 mm	19 kg
FN2	7.0" dia	42.0"	6.0"	4.0"	41 lbs
	178 mm	1067 mm	152 mm	102 mm	19 kg

ORDERING INFORMATION

ORDERING EXAMPLE

FN1 - P50 - DO - Q - DB - P1

Series | Wattage/Source | Optics | Voltage | Color | Options

SERIES

FN1	Fresno Square
FN2	Fresno Round

WATTAGE/SOURCE

PULSE START METAL HALIDE	
P50	50W (ED-17)
P70	70W (ED-17)
P10	100W (ED-17)
HIGH PRESSURE SODIUM	
S35[3]	35W (ED-17)
S50	50W (ED-17)
S70	70W (ED-17)
S10	100W (ED-17)

OPTICS

DO	Dual Reflector with Cone (standard)
TO[4]	Tube Optics
IL	Internal Horizontal Louvers

VOLTAGE

Q[1]	Quad-Tap® - 120/208/240/277V
T[1]	120/277/347V CSA
5[2]	480V

1 Factory wired for highest voltage unless specified.
2 100W PSMH or HPS only.
3 120 volt only.
4 Upper reflector with no lower cone.

COLOR

DB	Dark Bronze
BL	Black
WH	White
GR	Gray
PS	Platinum Silver
RD	Red (premium color)
FG	Forest Green (premium color)
CC	Custom Color (consult factory)

OPTIONS

F1	Fusing - 120V
F2	Fusing - 208V
F3	Fusing - 240V
F4	Fusing - 277V
F5	Fusing - 480V
F6	Fusing - 347V
P1	Photo Button - 120V
P2	Photo Button - 208V
P3	Photo Button - 240V
P4	Photo Button - 277V
P6	Photo Button - 347V
DM	Dome Top (round only)
24	24" Luminaire Height
30	30" Luminaire Height
36	36" Luminaire Height
HS90	Internal Shield - 90° (FN1 only)
HS160	Internal Shield - 160°
HS180	Internal Shield - 180° (FN2 only)
L	Lamp

Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE
WILLIAMSTOWN, MA

TYPE: A
AUTH: DMM
DATE: 04/12/07

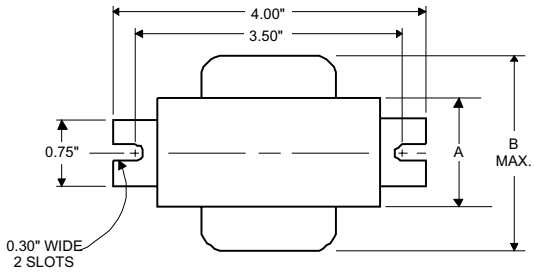
ADVANCE™

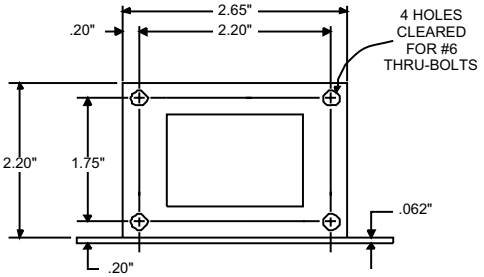
Metal Halide Lamp Ballast

Catalog Number 71A5137BP
For 50W M110
60 Hz R-HPF
Status: Active

DIMENSIONS AND DATA

2 5/8 X 2 3/16 CORE





INPUT VOLTS		277				
CIRCUIT TYPE	R-HPF					
POWER FACTOR (min)	90%					
REGULATION						
Line Volts	±5%					
Lamp Watts	±10%					
LINE CURRENT (Amps)						
Operating		0.22				
Open Circuit		0.55				
Starting		0.35				
UL TEMPERATURE RATINGS						
Insulation Class	H(180°C)					
Coil Temperature Code	1029	A				
MIN. AMBIENT STARTING TEMP.	-20°F or -30°C					
NOM. OPEN CIRCUIT VOLTAGE	277					
INPUT VOLTAGE AT LAMP DROPOUT		190				
INPUT WATTS	62					
RECOMMENDED FUSE (Amps)		2				
CORE and COIL						
Dimension (A)	1.10					
Dimension (B)	2.60					
Weight (lbs.)	2.2					
Lead Lengths	12"					
CAPACITOR REQUIREMENT						
Microfarads	5.0					
Volts (min.)	280					
Fault Current Withstand (amps)						
60 Hz TEST PROCEDURES (Refer to Advance Test Procedure for HID Ballasts - Form 1270)						
High Potential Test (Volts)						
1 minute	2000					
2 seconds	2500					
Open Circuit Voltage Test (Volts)	260-290					
Short-Circuit Current Test (Amps)						
Secondary Current	0.65-0.95					
Input Current		0.25 0.35	-	-	-	-

Capacitor: 7C050L33

Capacitance: 5
Dia/Oval Dim: 1.25
Height: 2.9
Temp Rating: 105°C

Ignitor: INTEGRAL

An ignitor integral to the core and coil assembly is used to start the lamp.

Ballast to Lamp Distance (BTL) = 2 feet
Temp Rating: 125°C

Wiring Diagram:

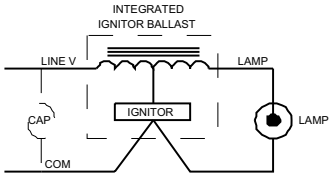


Fig. H

U.L. RECOGNIZED

Typical Ordering Information

(please call Advance for suffix availability)

Order Suffix	Description
500DB	Ballast With Integral Igniter and Dry Film Capacitor
510DB	Ballast w/Welded Bracket, Integral Igniter & Dry Film Cap.
600B	Ballast and Integral Igniter, No Capacitor
610B	Ballast w/Welded Bracket and Integral Igniter, No Capacitor

Data is based upon tests performed by Advance Transformer in a controlled environment and representitive of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice.

ADVANCE
O'HARE INTERNATIONAL CENTER · 10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Customer Support/Technical Service: Phone: 800-372-3331 · Fax: 630-307-3071
Corporate Offices: Phone: 800-322-2086

05/15/03

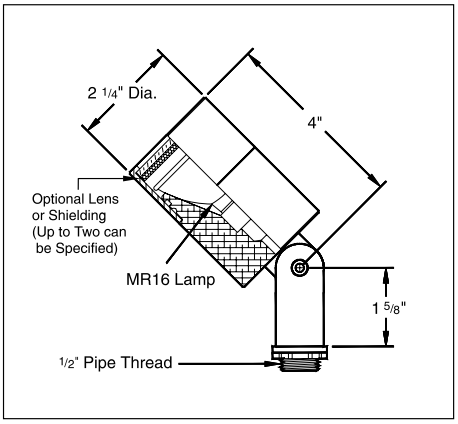
Nite Star™

Nite Star™ is a fully machined aluminum MR16 lighting instrument. The Nite Star is fully enclosed and waterproof because of its unique sleeved design. Nite Star is finished in a durable, luxurious, polyester powder coating. All hardware is stainless steel. The Nite Star, along with the wide choice of MR16 lamps and optical accessories, gives the lighting designer an economical, yet highly architectural lighting fixture for the most discriminating designs.

Features

- Tamper proof design.
- Raintight optical compartment.
- Enclosed wireway mounting knuckle.
- Clear, tempered glass lens, factory sealed.
- Machined aluminum construction with stainless steel hardware.
- & Listed with MR16 lamps to 50 watts.
- For use with remote transformers, see pages 92, 94, and 97.

Available in Brass, see page 90.



CATALOG NUMBER LOGIC

Example: NS - 9 - SAP - 9 - 11

Series

Lamp Type

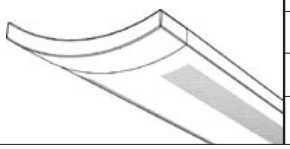
0 - By others	16 - EYS(42W), 25° N. Flood
1 - ESX(20W), 12° Spot	17 - EYP(42W), 40° Flood
2 - BAB(20W), 40° Flood	6 - EXT(50W), 13° Spot
3 - FRB(35W), 12° Spot	7 - EXZ(50W), 26° N. Flood
4 - FRA(35W), 23° N. Flood	8 - EXN(50W), 40° Flood
5 - FMW(35W), 40° Flood	9 - FNV(50W), 60° W. Flood
15 - EYR(42W), 12° Spot	

Finish

Powder Coat Color	Satin	Wrinkle
Bronze	BZP	BZW
Black	BLP	BLW
White(Gloss)	WHP	WHW
Aluminum	SAP	—
Verde	—	VER

Lens Type
9 - Clear (Standard), 10 - Spread, 12 - Soft Focus, 13 - Rectilinear

Shielding
11 - Honeycomb Baffle



Suspended
3 T5HO
Semi-indirect
8915H03

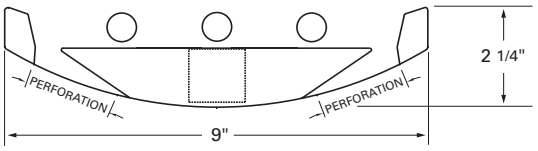
- High performance optical system designed to accommodate T8 and T5HO lamps.
- Available in a wide range of factory colors.
- Two lighting distributions to choose from: Indirect or Semi-indirect
- Factory pre-wired with quick-wire connectors for fast, easy installation.
- Affordable pricing & fast delivery - standard orders can ship in 9 working days
- Suspended and wall mount options available

RESPONSE READY

Order Number Guide

891	5	H03	L	N	— —	—	—	E	—
Series Cachet	*Type* Semi-indirect	*Lamps* 3 T5HO	*Lower Optics* L - Semi-perf	*Upper Optics* **N** - Standard	*Length* **04** - 4ft **08** - 8ft **12** - 12ft	*Wiring Options* **1** - 1cct **2** - 2 cct **3** - 1cct w/ Emergency cct **4** - 2cct w/ Emergency cct **5** - 1cct w/ Battery Pack **6** - 2cct w/ Battery Pack **7** - 1cct w/ Dimming **8** - 1cct w/ Thru Wire **9** - 2cct w/ Thru Wire Consult factory for complete list of standard wiring	*Voltage* **1** - 120V **2** - 277V **3** - 347V* * Consult factory for availability	*Ballast* Electronic	*Finish* **W** - Standard White **C** - Factory Color* **X** - Custom Color *See factory color chart

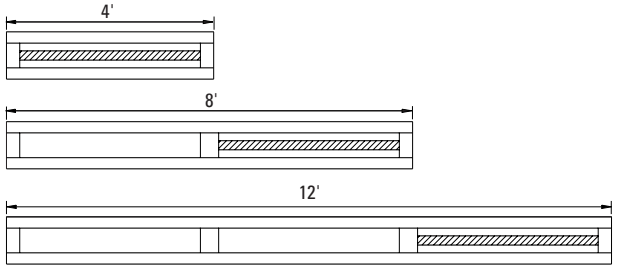
Cross Section



Weight 3.02 lb/ft

Modules

Linear runs are made by combining 4ft, 8ft and 12ft modules



Indicates location of:
- Optional emergency modules (controls all lamps) OR
- Optional battery pack (standard controls one lamp only)

Indicates:
- Module length / Mounting distance
*Module length does not include endcaps

Ends / Joints

END-CAP
8913EANA_

INLINE JOINT
8913JNNN

L0122 Rev. 3

 Phone: 604-888-6811 **Toll Free Fax:** 1-800-665-LEDA (5332) **Fax:** 604-888-2003 **Email:** info@ledalite.com **www.**ledalite.com

Ledalite

Studio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: D-1
AUTH: DMM
DATE: 04/12/07

Suspended	3T5HO	Semi-indirect	8915H03

Specifications

Housing
Die-formed 20 gauge cold-rolled steel.

Ends
Molded reinforced high-impact polymer. Baked Powder coat finish.

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

Optical System
Constructed of highly specular aluminum, 96% reflective white steel, and perforated optical filter with acrylic overlay to produce a semi-indirect distribution.

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 shall be factory pre-wired to section ends with quick-wire connectors.

Ballast
Electronic.

Approvals
Certified to UL & CSA standards.

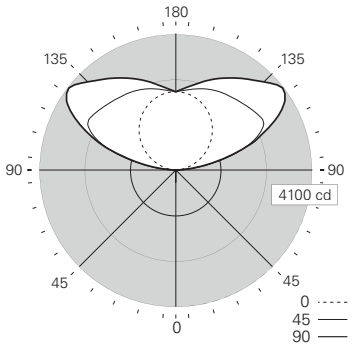
Finish
High-quality powder coat, factory applied to meet AAMA 2603-98. Available in Ledalite Standard White (textured matte finish), a selection of optional factory colors (see factory color chart), or custom colors. Consult factory for details.

RESPONSE READY

Available with Response Integrated Controls
See www.ledalite.com for details

Due to continuing product improvements, Ledalite reserves the right to change specifications without notice.

Photometry



Report#	2101446
Efficiency	93.0%
Peak Candela Value	4054 @ 127.5°
Peak: Zenith Ratio	1.7:1

AVERAGE LUMINANCE (cd/m²)

Vert. angle	Horizontal angle		
	0	45	90
55	99	206	227
65	125	260	251
75	220	315	299
85	655	889	842

CANDELA DISTRIBUTION

Vert. Angle	Horizontal Angle					Zonal Lumens
	0	22.5	45	67.5	90	
0	21	21	21	21	21	
5	21	21	21	20	20	2
15	20	21	22	23	24	7
25	20	20	23	26	27	11
35	18	18	25	27	28	15
45	16	19	26	29	30	19
55	14	21	29	31	32	24
65	13	20	27	26	26	24
75	14	18	20	20	19	20
85	14	16	19	19	18	20
90	12	22	19	18	15	
95	113	331	429	338	352	409
105	438	1456	1795	1660	1709	1564
115	821	1712	2863	3085	3136	2365
125	1202	1871	2970	3819	4008	2502
135	1553	2038	2836	3515	3748	2141
145	1854	2199	2745	3212	3366	1691
155	2089	2307	2652	2940	3031	1212
165	2254	2355	2529	2675	2715	713
175	2342	2362	2394	2433	2442	235
180	2353	2353	2353	2353	2353	

COEFFICIENTS OF UTILIZATION (%)

Ceiling	80				70			50			0
Wall	70	50	30	10	70	50	30	50	30	10	0
RCR											
0	88	88	88	88	76	76	76	52	52	52	0
1	80	76	73	70	68	65	63	45	43	42	0
2	73	67	61	57	62	57	53	39	37	34	0
3	66	58	52	47	56	50	45	34	31	29	0
4	60	51	45	39	51	44	38	30	27	24	0
5	55	45	38	33	47	39	33	27	23	20	0
6	51	40	33	28	43	35	29	24	20	17	0
7	46	36	29	24	40	31	25	21	18	15	0
8	43	32	26	21	36	28	22	19	16	13	0
9	40	29	23	18	34	25	20	17	14	11	0
10	37	26	20	16	31	23	18	16	12	10	0

Based on a floor reflectance of 0.2

Note: *The stated values for lamp lumens and luminaire efficiency consider the lamp/luminaire combination at conditions similar to that of most architectural spaces. Lamp manufacturers' data states that T-5 high output lamps produce a maximum output of 5000 lumens at 35° Celsius. Further, the IESNA's standards for photometric testing require an ambient temperature of 25° Celsius. At 25° Celsius, the bare T-5 high output lamp produces 93% of its maximum output, or 4650 lumens. When placed inside a luminaire, the T-5 high output lamp operates at a slightly higher ambient temperature than in free air. The increase in ambient temperature raises the lamp's output above 4650 lumens. This temperature effect causes the lamp/luminaire combination to produce more light output than the bare lamp alone. As a result, in very optically efficient luminaires, luminaire efficiencies over 100% are possible and correct. Ledalite feels that this method of photometric testing is the best representation of lamp and luminaire performance, adheres to current IESNA standards, and most closely represents how the lighting system will operate in the field.*

Note : IES photometric files available for download at www.ledalite.com

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Ledalite

Ustudio

Williams College
'62 Center For Theatre & Dance

Williamstown, MA

TYPE: D-1

AUTH: DMM

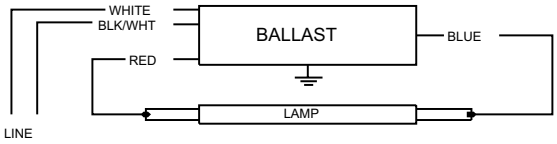
DATE: 04/12/07

VCN-132-MC	
Brand Name	CENTIUM MICRO CAN
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F21T5	1	21	50/10	0.10	27	1.10	10	0.98	1.7	4.07
F25T8	1	25	0/-18	0.09	25	0.98	10	0.98	1.7	3.92
* F28T5	1	28	50/10	0.11	30	0.98	10	0.99	1.7	3.27
F32T8	1	32	0/-18	0.11	30	0.98	10	0.98	1.7	3.27
F32T8/ES (30W)	1	30	60/16	0.10	28	0.98	10	0.98	1.7	3.50

Wiring Diagram



Diag. 63

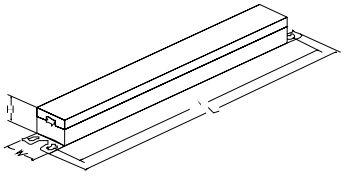
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White	25L	63.5
Blue	31R	78.7
Red	37L	94
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	25L	63.5
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.08 "	1.05 "	8.91 "
9 1/2	1 2/25	1 1/20	8 91/100
24.1 cm	2.7 cm	2.7 cm	22.6 cm

Revised 07/23/2004

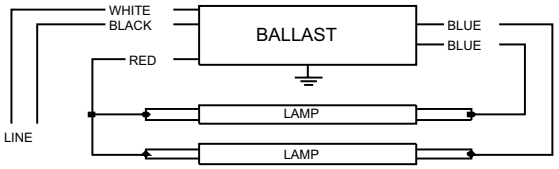
ADVANCE
O'HARE INTERNATIONAL CENTER · 10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Customer Support/Technical Service: Phone: 800-372-3331 · Fax: 630-307-3071
Corporate Offices: Phone: 800-322-2086

VCN-2M32-MC	
Brand Name	CENTIUM MICRO CAN
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F21T5	2	21	50/10	0.18	50	1.10	10	0.98	1.7	2.20
F25T8	2	25	0/-18	0.18	49	0.88	10	0.99	1.7	1.80
* F28T5	2	28	50/10	0.22	60	0.98	10	0.99	1.7	1.63
F32T8	2	32	0/-18	0.21	59	0.88	10	0.99	1.7	1.49
F32T8/ES (30W)	2	30	60/16	0.20	54	0.88	10	0.99	1.7	1.63

Wiring Diagram



Diag. 64

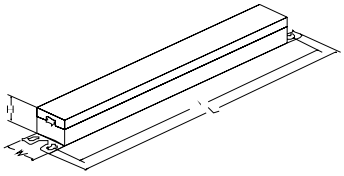
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White	25L	63.5
Blue	31R	78.7
Red	37L	94
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	25L	63.5
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.08 "	1.05 "	8.91 "
9 1/2	1 2/25	1 1/20	8 91/100
24.1 cm	2.7 cm	2.7 cm	22.6 cm

Revised 07/23/2004

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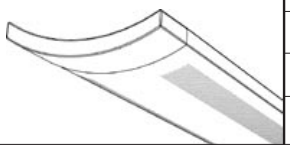
Corporate Offices: Phone: 800-322-2086



Suspended
3 T5HO
Semi-indirect
8915H03

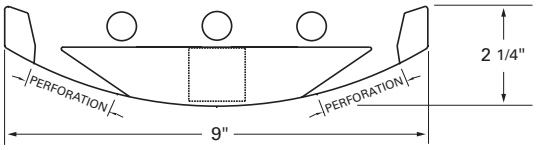
- High performance optical system designed to accommodate T8 and T5HO lamps.
- Available in a wide range of factory colors.
- Two lighting distributions to choose from: Indirect or Semi-indirect
- Factory pre-wired with quick-wire connectors for fast, easy installation.
- Affordable pricing & fast delivery - standard orders can ship in 9 working days
- Suspended and wall mount options available

RESPONSE READY

Order Number Guide

891	5	H03	L	N	— —	—	—	E	—
Series Cachet	*Type* Semi-indirect	*Lamps* 3 T5HO	*Lower Optics* L - Semi-perf	*Upper Optics* **N** - Standard	*Length* **04** - 4ft **08** - 8ft **12** - 12ft	*Wiring Options* **1** - 1cct **2** - 2 cct **3** - 1cct w/ Emergency cct **4** - 2cct w/ Emergency cct **5** - 1cct w/ Battery Pack **6** - 2cct w/ Battery Pack **7** - 1cct w/ Dimming **8** - 1cct w/ Thru Wire **9** - 2cct w/ Thru Wire Consult factory for complete list of standard wiring	*Voltage* **1** - 120V **2** - 277V **3** - 347V* * Consult factory for availability	*Ballast* Electronic	*Finish* **W** - Standard White **C** - Factory Color* **X** - Custom Color *See factory color chart

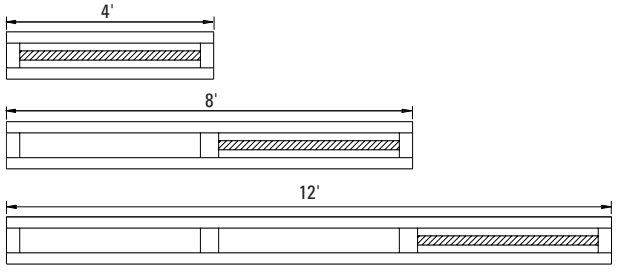
Cross Section



Weight 3.02 lb/ft

Modules

Linear runs are made by combining 4ft, 8ft and 12ft modules



Indicates location of:
- Optional emergency modules (controls all lamps) OR
- Optional battery pack (standard controls one lamp only)

Indicates:
- Module length / Mounting distance
*Module length does not include endcaps

Ends / Joints

END-CAP
8913EANA_

INLINE JOINT
8913JNNN

L0122 Rev. 3

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Ledalite

Ustudio

Williams College
'62 Center For Theatre & Dance

Williamstown, MA

TYPE: D-1A
AUTH: DMM
DATE: 04/12/07

Suspended	3T5HO	Semi-indirect	8915H03

Specifications

Housing
Die-formed 20 gauge cold-rolled steel.

Ends
Molded reinforced high-impact polymer. Baked Powder coat finish.

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

Optical System
Constructed of highly specular aluminum, 96% reflective white steel, and perforated optical filter with acrylic overlay to produce a semi-indirect distribution.

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 shall be factory pre-wired to section ends with quick-wire connectors.

Ballast
Electronic.

Approvals
Certified to UL & CSA standards.

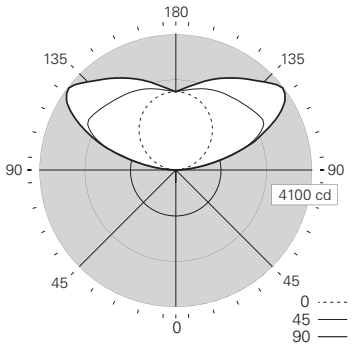
Finish
High-quality powder coat, factory applied to meet AAMA 2603-98. Available in Ledalite Standard White (textured matte finish), a selection of optional factory colors (see factory color chart), or custom colors. Consult factory for details.

RESPONSE READY

Available with Response Integrated Controls
See www.ledalite.com for details

Due to continuing product improvements, Ledalite reserves the right to change specifications without notice.

Photometry



Report#	2101446
Efficiency	93.0%
Peak Candela Value	4054 @ 127.5°
Peak: Zenith Ratio	1.7:1

AVERAGE LUMINANCE (cd/m²)

Vert. angle	Horizontal angle		
	0	45	90
55	99	206	227
65	125	260	251
75	220	315	299
85	655	889	842

CANDELA DISTRIBUTION

Vert. Angle	Horizontal Angle					Zonal Lumens
	0	22.5	45	67.5	90	
0	21	21	21	21	21	
5	21	21	21	20	20	2
15	20	21	22	23	24	7
25	20	20	23	26	27	11
35	18	18	25	27	28	15
45	16	19	26	29	30	19
55	14	21	29	31	32	24
65	13	20	27	26	26	24
75	14	18	20	20	19	20
85	14	16	19	19	18	20
90	12	22	19	18	15	
95	113	331	429	338	352	409
105	438	1456	1795	1660	1709	1564
115	821	1712	2863	3085	3136	2365
125	1202	1871	2970	3819	4008	2502
135	1553	2038	2836	3515	3748	2141
145	1854	2199	2745	3212	3366	1691
155	2089	2307	2652	2940	3031	1212
165	2254	2355	2529	2675	2715	713
175	2342	2362	2394	2433	2442	235
180	2353	2353	2353	2353	2353	

COEFFICIENTS OF UTILIZATION (%)

Ceiling	80				70			50			0
Wall	70	50	30	10	70	50	30	50	30	10	0
RCR											
0	88	88	88	88	76	76	76	52	52	52	0
1	80	76	73	70	68	65	63	45	43	42	0
2	73	67	61	57	62	57	53	39	37	34	0
3	66	58	52	47	56	50	45	34	31	29	0
4	60	51	45	39	51	44	38	30	27	24	0
5	55	45	38	33	47	39	33	27	23	20	0
6	51	40	33	28	43	35	29	24	20	17	0
7	46	36	29	24	40	31	25	21	18	15	0
8	43	32	26	21	36	28	22	19	16	13	0
9	40	29	23	18	34	25	20	17	14	11	0
10	37	26	20	16	31	23	18	16	12	10	0

Based on a floor reflectance of 0.2

Note: *The stated values for lamp lumens and luminaire efficiency consider the lamp/luminaire combination at conditions similar to that of most architectural spaces. Lamp manufacturers' data states that T-5 high output lamps produce a maximum output of 5000 lumens at 35° Celsius. Further, the IESNA's standards for photometric testing require an ambient temperature of 25° Celsius. At 25° Celsius, the bare T-5 high output lamp produces 93% of its maximum output, or 4650 lumens. When placed inside a luminaire, the T-5 high output lamp operates at a slightly higher ambient temperature than in free air. The increase in ambient temperature raises the lamp's output above 4650 lumens. This temperature effect causes the lamp/luminaire combination to produce more light output than the bare lamp alone. As a result, in very optically efficient luminaires, luminaire efficiencies over 100% are possible and correct. Ledalite feels that this method of photometric testing is the best representation of lamp and luminaire performance, adheres to current IESNA standards, and most closely represents how the lighting system will operate in the field.*

Note : IES photometric files available for download at www.ledalite.com

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Ledalite

Ustudio

Williams College
'62 Center For Theatre & Dance

Williamstown, MA

TYPE: D-1A

AUTH: DMM

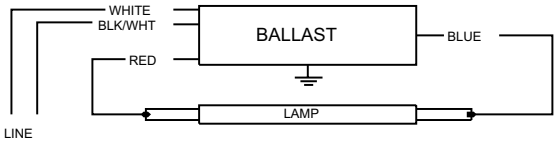
DATE: 04/12/07

VCN-132-MC	
Brand Name	CENTIUM MICRO CAN
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F21T5	1	21	50/10	0.10	27	1.10	10	0.98	1.7	4.07
F25T8	1	25	0/-18	0.09	25	0.98	10	0.98	1.7	3.92
* F28T5	1	28	50/10	0.11	30	0.98	10	0.99	1.7	3.27
F32T8	1	32	0/-18	0.11	30	0.98	10	0.98	1.7	3.27
F32T8/ES (30W)	1	30	60/16	0.10	28	0.98	10	0.98	1.7	3.50

Wiring Diagram



Diag. 63

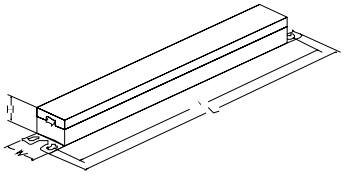
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White	25L	63.5
Blue	31R	78.7
Red	37L	94
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	25L	63.5
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.08 "	1.05 "	8.91 "
9 1/2	1 2/25	1 1/20	8 91/100
24.1 cm	2.7 cm	2.7 cm	22.6 cm

Revised 07/23/2004

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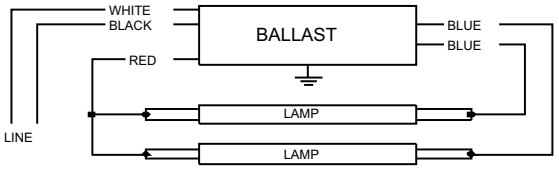
Customer Support/Technical Service: Phone: 800-372-3331 · Fax: 630-307-3071
Corporate Offices: Phone: 800-322-2086

VCN-2M32-MC	
Brand Name	CENTIUM MICRO CAN
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F21T5	2	21	50/10	0.18	50	1.10	10	0.98	1.7	2.20
F25T8	2	25	0/-18	0.18	49	0.88	10	0.99	1.7	1.80
* F28T5	2	28	50/10	0.22	60	0.98	10	0.99	1.7	1.63
F32T8	2	32	0/-18	0.21	59	0.88	10	0.99	1.7	1.49
F32T8/ES (30W)	2	30	60/16	0.20	54	0.88	10	0.99	1.7	1.63

Wiring Diagram



Diag. 64

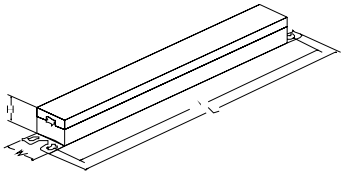
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White	25L	63.5
Blue	31R	78.7
Red	37L	94
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	25L	63.5
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.08 "	1.05 "	8.91 "
9 1/2	1 2/25	1 1/20	8 91/100
24.1 cm	2.7 cm	2.7 cm	22.6 cm

Revised 07/23/2004

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Customer Support/Technical Service: Phone: 800-372-3331 · Fax: 630-307-3071
Corporate Offices: Phone: 800-322-2086

ML6 SERIES

Extérieur Vert

SURFACE REAR MOUNTED PROJECTOR
High Output LED Source
1W / 24V

MINILINI™

IP 66 | 1W | 24V

Projector body

- Suitable for wet locations, IP66 rated
- Compact low profile under 2" diameter
- Lengths available in 1', 2', 3' and 4'
- Consult factory for other lengths
- Grey powder coat (RAL#9006) Standard
- For additional colors consult factory
- 24V DC Remote constant voltage (R56) power supply
- UL Listed
- 10 Year Warranty anti-corrosion
- 3 Year Warranty on driver

Lamp / Optics

- Nominal LED spacing: 1" or 2" on center
- Light source: High power 1W Warm White LED
- Aluminum reflector - 10°, 25° & 50° refractive spot optics
- 50,000 hour lamp life @ 70% lumen output

Remote Power Supply

- 120-277V Primary 24VDC Secondary power supply (required) ordered separately
- 15' max length for remote power supply
- Consult factory for longer lengths
- Modules can be daisy chained together for Linear installations with 0 clearance between fixtures (Consult Factory)

Cover

- UV polycarbonate lens cover
- UV Stabilized (Non yellowing)

Mounting

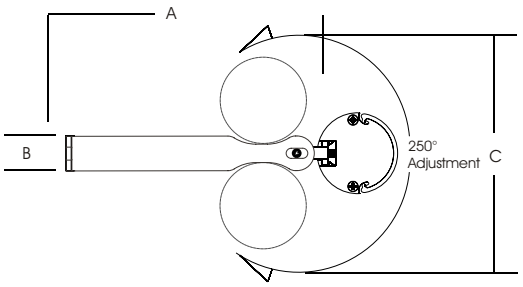
- Can be mounted end to end with zero clearance
- Mounted horizontal or vertical and can be rotated 220° on its axis

Features

- Available in 1', 2', 3' & 4' lengths
- Adjustable mounting brackets
- High light output LEDs (1.2W/LED)
- IP 66 rated
- Class 1 fixture continuous runs of 15' plus available (consult factory)

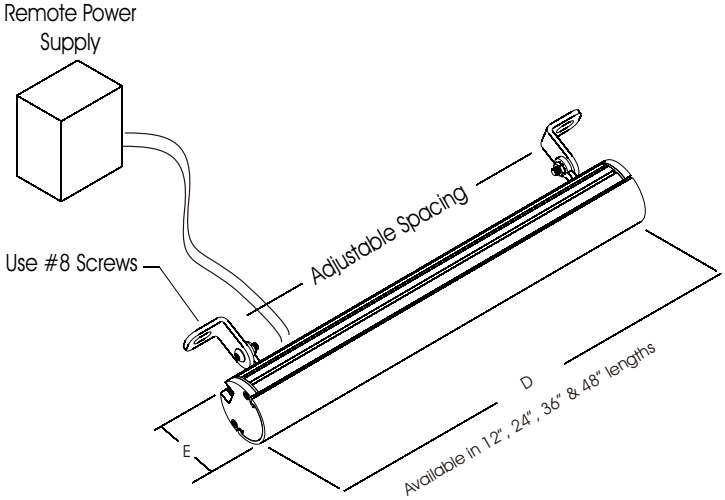
Applications

- Building facade lighting
- Wall washing
- Area Lighting
- Effects Lighting



Dimensions

A Bracket Length	B Bracket Width	C	D Fixture Length	E Fixture Diameter
Standard 1"	0.75"	4.5"	12.5"	1.75"
3"	0.75"	4.5"	24.5"	1.75"
5"	0.75"	4.5"	36.5"	1.75"
			48.5"	1.75"



LED technology is changing rapidly, consult website for most current information

EXTERIEUR VERT a division of TARGETTI NORTH AMERICA
www.exterieurvert.com

1513 E. Saint Gertrude Place
Santa Ana, Ca 92705
Tel 714 957-4960
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Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: D-2
AUTH: DMM
DATE: 04/12/07

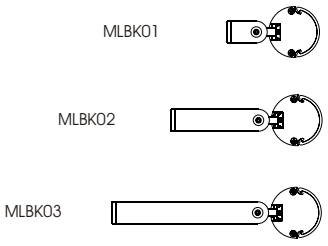
Extérieur Vert

MINILINI

Part # Logic

ML6	41	0	2	1	10R	1	4
Base Part#	Lamp Type	LED color	LED Spacing	Length	Optics	Wattage	Finish
ML6-Minilini Projector	LED	0 - Warm White LED	1= 1" Spacing 2= 2" Spacing	1=1 foot 2=2 foot 3=3 foot 4=4 foot	10R=10° refractive spot 25R=25° refractive spot 50R=50° refractive spot	1=1 Watt	Color 4 - Grey (std.) 9 - Custom

Required Choices for Mounting Fixture



MLBK01, MLBK02 or MLBK03 can be used with any of the three available fixture lengths.

Part No.	Extension from wall
MLBK01	1" mounting bracket length
MLBK02	3" mounting bracket length
MLBK03	5" mounting bracket length

LED driver

E	096	1
Placement	Wattage	Input Voltage
I=Interior E=Exterior	096 = 96Watt / 1 Circuit	1=120 Volt 7=277 Volt

OTHER LED DRIVER OPTIONS

300W 3 (Circuits) X 100W - 36' with multiple feeds

* Consult Factory

LED Spacing	Fixture Length	Max # of Fixtures per 96W Driver
1" Spacing	1 foot	6
1" Spacing	2 foot	3
1" Spacing	3 foot	2
1" Spacing	4 foot	1
2" Spacing	1 foot	12
2" Spacing	2 foot	6
2" Spacing	3 foot	4
2" Spacing	4 foot	3

* Overall run length not to exceed 60'

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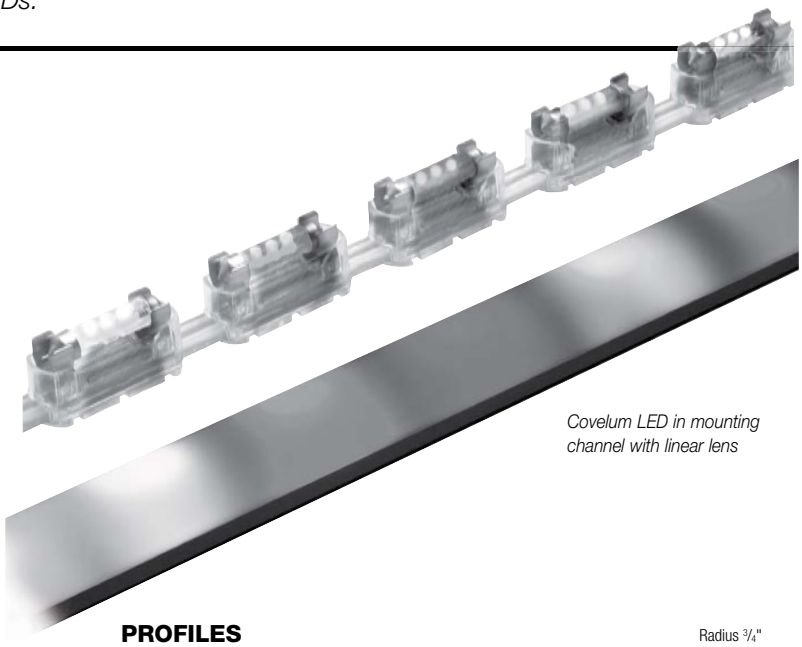
tivolinear™

A concealed, flexible, energy-efficient light fixture for ceiling and wall curves, cabinets, galleries, and elevators. Uses 0.24W 12V DC, long-life LEDs.

COVELUM™ LED

FEATURES

- Flexible, field cuttable system.
- Low maintenance, energy efficient lighting for interior applications.
- Uses 0.24W, 12V DC, directional LEDs in festoon envelope.
- 3 LEDs per module available in amber, red, green, blue, and white.
- LED life:
  - 100,000 hours for amber, red, green
  - 40,000 hours for blue and white
- Lamp spacing: 2.5", 3", 4", 6" O.C.
- Light is distributed in individually adjustable directional LED modules, 220° viewing angle.
- Aluminum mounting channel for linear lighting.
- Linear lens mounts in channel to diffuse light glare.
- Class II 12V DC transformer required. See Transformer specification sheet.



Covelum LED in mounting channel with linear lens

LISTING

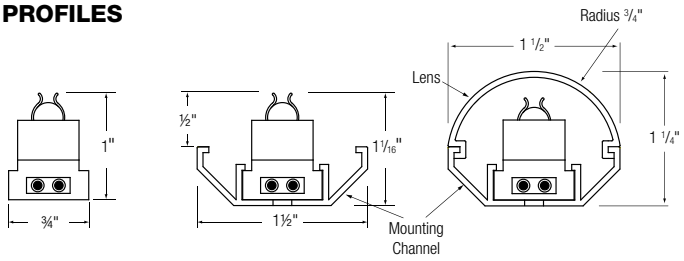
- U.L. Listed. c UL us

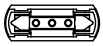
LED DATA

LAMP	DESIGN VOLTAGE*	WATTAGE	LAMP LIFE†
Covelum LED	12V DC	0.24W	White, Blue, Green - 40,000 hrs. Red, Amber - 100,000 hrs.

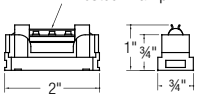
** Lamps operate at 80% of design voltage. † Readings at 80% of design voltage.*

PROFILES





LED Festoon Lamp



LED SPACING

Different LED spacings can create dramatically varied effects. Tighter spacing is most appropriate for close range viewing applications. Perspective also alters the effect of different spacings.

MAX. LEDS PER FEED POINT

LAMP/SYSTEM	WATTAGE	VOLTAGE	AMPS	MAX. LAMPS PER FEED POINT
Covelum LED	0.24W	12V	5A	200

MAXIMUM FIXTURE RUN LENGTH (Lmax)

Determine maximum fixture run length with the following formula:

Lmax = F x P x S / W

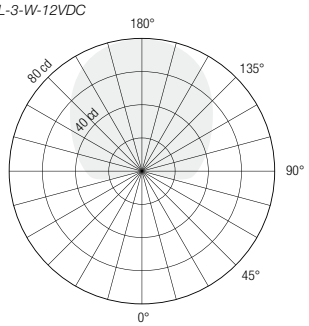
F:	Factor for safety (0.8 ~ 0.9)
P:	Transformer- or breaker-rated power
S:	LED or lamp spacing
W:	LED or lamp wattage

MEAN TIME BETWEEN FAILURES (MTBF) FOR LEDS

While Tivoli utilizes LEDs provided by industry leading vendors, these are electrical components with calculated mean time between failure (MTBF). MTBF for LEDs typically exceeds 100,000 hours. MTBF indicates the point at which 50% of the LEDs will lose 50% of their original brightness. Conditions such as excessive voltage, vibration, heat, and other adverse environments may negatively effect the life of LEDs.

CANDELA DISTRIBUTION

CLL-3-W-12VDC



** Candela distribution may vary with lamp and power supply conditions.*

tivoli®

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WILLIAMS COLLEGE
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WILLIAMSTOWN, MA

TYPE: D-3

AUTH: DMM

DATE: 04/12/07

COVELUM™
LED

COVELUM LED ORDERING INFORMATION

DESCRIPTION	CAT. NO.	LAMP SPACING	LAMP COLOR
Covelum LED 12V DC	**CLL-2-A-12VDC**	2.5" O.C.	Amber
	CLL-3-A-12VDC	3" O.C.	
	CLL-4-A-12VDC	4" O.C.	
	CLL-6-A-12VDC	6" O.C.	
	CLL-2-R-12VDC	2.5" O.C.	Red
	CLL-3-R-12VDC	3" O.C.	
	CLL-4-R-12VDC	4" O.C.	
	CLL-6-R-12VDC	6" O.C.	
	CLL-2-G-12VDC	2.5" O.C.	Green
	CLL-3-G-12VDC	3" O.C.	
	CLL-4-G-12VDC	4" O.C.	
	CLL-6-G-12VDC	6" O.C.	
	CLL-2-B-12VDC	2.5" O.C.	Blue
	CLL-3-B-12VDC	3" O.C.	
	CLL-4-B-12VDC	4" O.C.	
	CLL-6-B-12VDC	6" O.C.	
	CLL-2-W-12VDC	2.5" O.C.	White
	CLL-3-W-12VDC	3" O.C.	
	CLL-4-W-12VDC	4" O.C.	
	CLL-6-W-12VDC	6" O.C.	

FIXTURE SELECTION

Lamp Spacing

Select longest lamp spacing necessary for desired effect. (Tight lamps spacing does not add more impact, but lamps will blur to appear like a light cable instead of separate distinct lamps.)

Lamp Type

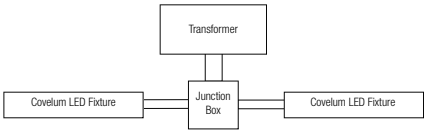
0.24W, 12V DC, LEDs in amber, red, green, blue and white.

Voltage Drop

Consider voltage drop parameters and maximum fixture length. Refer to Tivoli voltage drop chart and suggested system layout.

Maximum Fixture Length

- Max. load of fixture must not exceed capacity of recommended transformer
- For longer runs use multiple fixtures with independent feed run to transformer



ACCESSORIES

DESCRIPTION	CAT.NO
Junction Box	**CL-JBOX**
End Caps	**CLL-EC**
Polycarbonate Mounting Clamp	**CLL-MC**
Terminal Block	**TERMBLK**
Linear Aluminum Channel, 8' sections	**CLLCHAN**
Opaque Linear Lens Cover, 8' sections	**CLL-LC**
Amber LED	**CLLA**
Red LED	**CLLR**
Green LED	**CLLG**
Blue LED	**CLLB**
White LED	**CLLW**

CHANNEL END CAPS
Clear poly carbonate Channel End Caps cover both ends of Aluminum Channel and Opaque Lens to prevent debris from entering Channel.

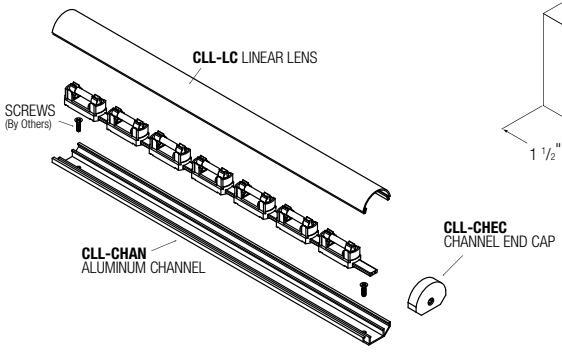
For straight run applications. Channel screws in place, lamp sockets snap into channel ensuring linear integrity and reducing installation time. The finish is standard satin aluminum. Comes in 8' sections.

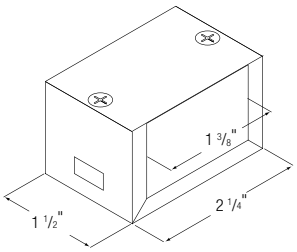
END CAPS
Each length of Covelum LED comes with vinyl end caps that protect and insulate the conductors at the end of a run.

POLYCARBONATE MOUNTING CLAMP
Clear polycarbonate mounting clip secures Covelum to surface with single screw on each side of clip. (Screws not provided).

OPAQUE LENS
Opaque polycarbonate lens for channel shields and protects lamps from direct contact. Comes in 8' sections.

JUNCTION BOX
Covers connections. Terminal block connector is mounted inside. One end of connector screws directly into the Covelum LED fixture, the other accepts AWG # 10, 12, 14 wire.





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WILLIAMS COLLEGE
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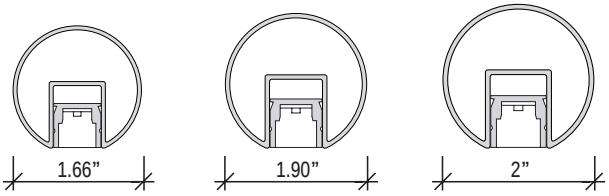
WILLIAMSTOWN, MA

TYPE: D-3
AUTH: DMM
DATE: 04/12/07

luxrail

Hand Rail Size Options



Power Supply (Driver) Information

Standard Light Output

TYPE	SUPPLIES	REMOTE DISTANCE
24v20w	up to 78"	32'-0" (w/18awg)
24v100w	up to 35'-0"	18'-0" (w/18awg)
	(2) runs up to 49' with (1) run nte 35'-0"	46'-0" (w/14awg)
		71'-0" (w/12awg)

High Output

TYPE	SUPPLIES	REMOTE DISTANCE
24v100w	up to 12'-0"	18'-0" (w/18awg)
		46'-0" (w/14awg)
		71'-0" (w/12awg)

Application
ANSI and ADA compliant luxrail, is an indoor/outdoor handrail that delivers functional illumination. Two intensities may be specified; “standard light output” & “high output”. The standard lightoutput version delivers illuminance levels appropriate for exterior applications (3 to 4 footcandles at grade) as well as dark interior environments with low ambient illumination levels, (i.e. theatres, themed environments). The high output version delivers illuminance levels applicable to interior environments – providing in excess of 10 footcandles along the path of egress (ANSI required). Independent photometric test reports and IES Format data are available upon request from io Lighting.

luxrail’s standard handrail gripping surfaces are circular in cross section and meet ADAAG (Americans with Disability Act Accessibility Guidelines). Beam spread options include 10, 45, and 65 degrees. The 45 and 65 degree beam patterns are most suitable for illuminating pathways while the 10 degree beam spread offers accent lighting to optional glass or stainless steel cable railing infills. Reference page 8 for information regarding infill options. LED lumen depreciation at 50,000 hrs. is 30%.

Light Output
luxrail is available with two luminous intensities:

Standard:
- Warm White: 38 lms/ft
- Cool White: 48 lms/ft

High Output:
- Warm White: 127 lms/ft
- Cool White: 145 lms/ft

Construction
luxrail is available in stainless steel, aluminum or brass. luxrail may be post mounted or wall mounted. Mounting hardware (post or wall) is required up to 5' or 6' O.C., depending on the handrail alloy. The lighting fixture component of the luxrail is a stand alone unit and is available in incremental nominal lengths that range from 6" to 60". Vandal resistant access chamber allows units to be removed for maintenance purposes.

The light fixture’s housing is made of a light weight, yet durable aluminum, providing the recommended heat sink requirements for the LEDs. Housing, optical assembly and stainless steel end caps are bonded to prevent water infiltration.

Electrical
luxrail houses a low voltage LED based light fixture which is integrated into the underside of the handrail. It comes complete with the linear light fixture installed in the handrail and required power supplies (aka “drivers”). Electrical “daisy chain” connections must be made on site. 120 or 277 volt drivers are available. The drivers must be remotely located. Refer to Driver Chart (shown on left) for additional information.

Power Consumption
- standard: 2 w/ft
- high output: 8 w/ft

Finish
luxrail is available in a variety of finishes: polished or brushed stainless steel (satin finish with brush grain along the longitudinal axis), clear anodized aluminum and polished brass. Custom finishes may be available upon request.

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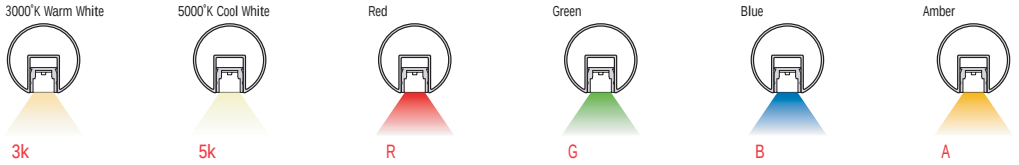
‘62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: D-4
AUTH: DMM
DATE: 04/12/07

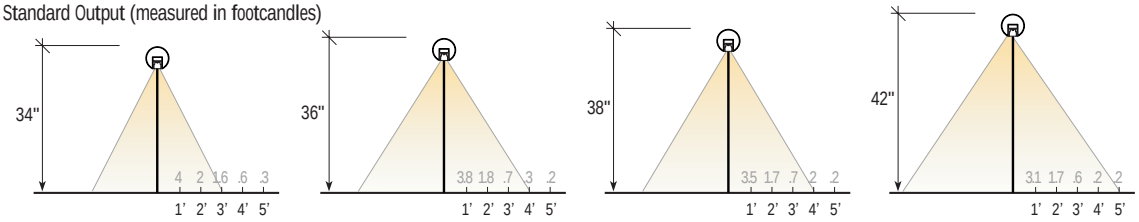
luxrail

Color Options

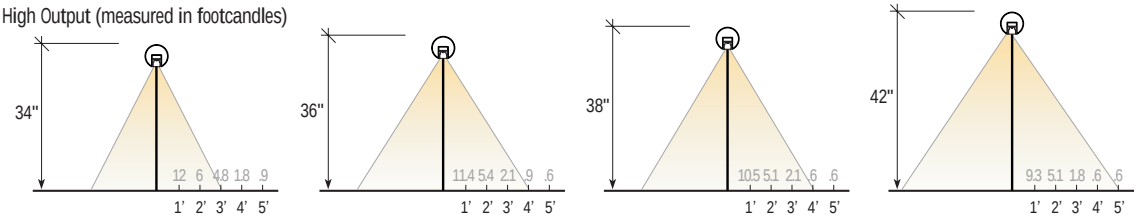


Light Output

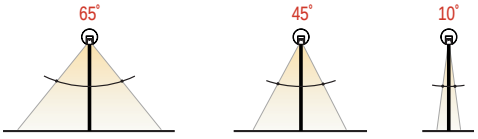
Standard Output (measured in footcandles)



High Output (measured in footcandles)



Distributions



Mounting Options

PM post mounted

WM wall mounted

Infill Options

Glass infill
(glass provided by others)

Stainless steel cable infill

Order Code

0	06	□□□	□	□□	□□	□□	□□	1	□	□
io	luxrail	Alloy/Finish	Size	Mounting	Infill	Light Distribution	Light Color	Length	Voltage/Dimming	Driver Enclosure

Alloy/Finish
- SSS Stainless Steel Satin
- SSP Stainless Steel Polished
- CAA Clear Anodized Aluminum
- BR Brass Polished

Size
- 1 1.66" O.D.* (1 1/4" pipe size) [available for SS & CAA]
- 2 1.90" O.D.* (1 1/2" pipe size) [available for SS & CAA]
- 3 2.0" O.D.* [available for SS & BR]

see page 6 for alloy dimensions

Mounting
- PM Post Mounted
- WM Wall Mounted

Infill
- AC Aircraft Cable
- GL Glass *(provided by others)*
- C Custom
- NR Not Req'd

Light Distribution
- 10 10 Degree
- 45 45 Degree
- 65 65 Degree
- NI Handrail only (not illuminated)

Light Color
- 3k Warm White
- 5k Cool White
- 3kHO Warm White
- 5kHO Cool White
- R Red
- G Green
- B Blue
- A Amber

Length
Provide overall length of each handrail section. *see note.

Note: Each handrail application will be somewhat custom to accommodate varying field conditions and design requirements. Shop drawings will be required to manage specifics of each handrail section.

Voltage/Dimming (SIDE FEED STANDARD)
- 1 120v
- 2 277v
- 3 120v w/dim
- 4 277v w/dim
- 5 other

Driver Enclosure
- I Interior
- E Exterior
- N Not Req'd by io *(provided by others)*

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WILLIAMS COLLEGE
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WILLIAMSTOWN, MA

TYPE: D-4
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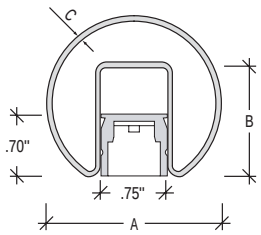
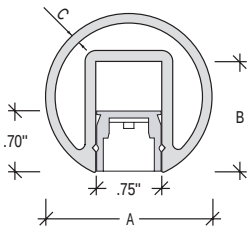
handrail options

Stainless Steel



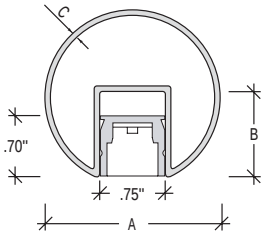
A	B	C
1.66"	1"	.059"
1.90"	1.25"	.059"
2"	1.25"	.059"

Aluminum



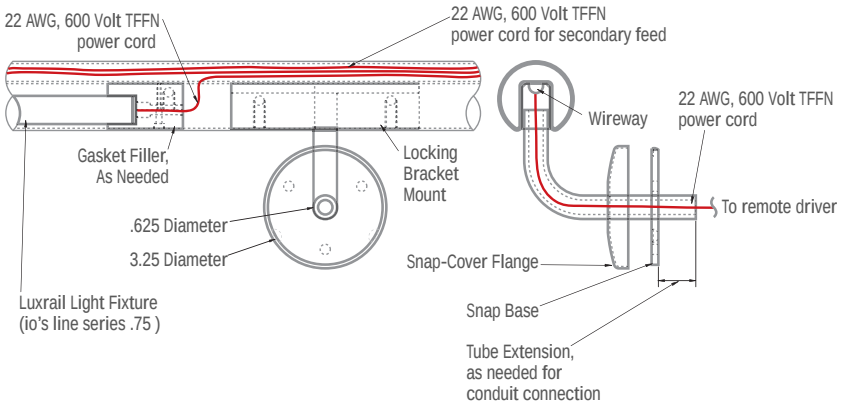
A	B	C
1.66"	1"	.109"
1.90"	1.25"	.109"

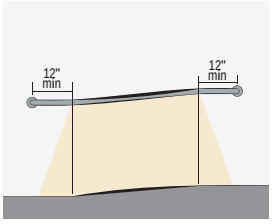
Brass



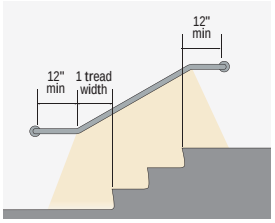
A	B	C
2"	1"	.062"

wall mounted details





Wall mounted ramp rail



Return to wall

Return to wall electrical feed

Wall bracket
(may be used as an electrical feed)

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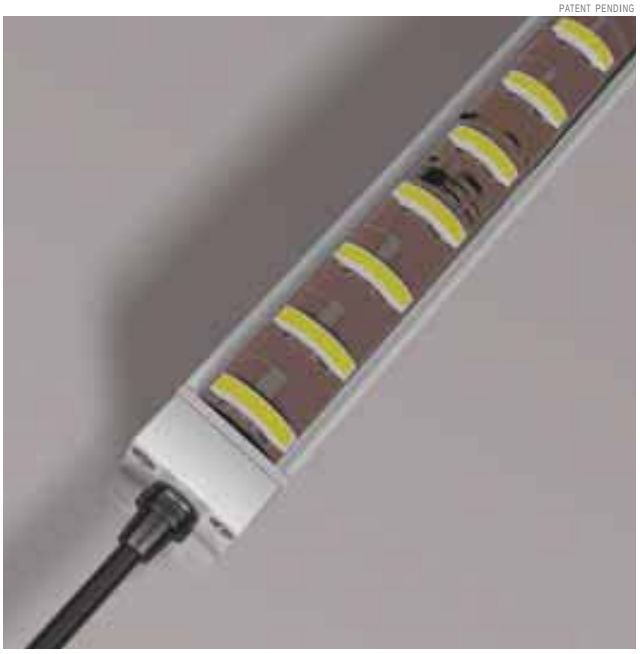
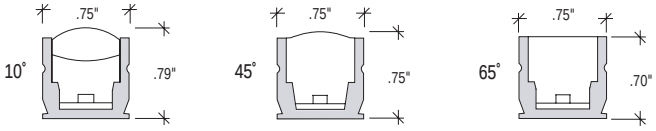
line
series .75

10°, 45°, 65°

PATENT PENDING



Beam Spread Options



Power Supply (Driver) Information

Standard Light Output

TYPE	SUPPLIES	REMOTE DISTANCE
24V20W	UP TO 78"	32'-0" (W/18AWG)
24V100W	UP TO 35'-0"	18'-0" (W/18AWG)
	(2) RUNS UP TO 49' WITH (1) RUN NTE 35'-0"	46'-0" (W/14AWG)
		71'-0" (W/12AWG)

High Output

TYPE	SUPPLIES	REMOTE DISTANCE
24V100W	UP TO 12'-0"	18'-0" (W/18AWG)
		46'-0" (W/14AWG)
		71'-0" (W/12AWG)

Application

io lighting's line series .75 is approximately .75" x .75" in cross section. UL listed for dry locations, its low profile housing enables functional luminous intensities from "tight" architectural details such as niches, coves, handrails & casework. Similar to halogen light sources, LEDs are point sources that offer superior definition to three dimensional objects and sparkle to reflective surfaces.

series .75 is a low voltage linear accent luminaire that may be ordered in incremental nominal lengths that range from 6" to 96". Optional beam spreads along the perpendicular axis of the fixture include 10°, 45°, and 65°. For details on the asymmetric beam spread, see dedicated specification sheet. Average rated life for series .75 is 50,000 hours. Lamp lumen depreciation at 50,000 hrs. is 30%.

Light Output

line series .75 is available with two lumen outputs for white light only. Red, green, blue and amber are available in standard output only:

Standard:
- Warm White: 38 lms/ft
- Cool White: 48 lms/ft

High Output:
- Warm White: 127 lms/ft
- Cool White: 145 lms/ft

Refer to light output tables for footcandle values at various distances. IES format files may be obtained from the factory or downloaded from iolighting.com.

Construction

The light weight, yet durable extruded aluminum housing provides recommended heat sink requirements for LEDs. Precision optic is composed of a customized acrylic material that offers very high transmisivity, UV stability, and excellent longevity. series .75 is UL listed for dry locations only.

Electrical

Universal 120 or 277 Volt supply required for 24 volt remote driver. 4'-0" 22 AWG, 600 volt TFFN rated power cords are supplied with strain reliefs for both electric feed and connectors (for continous row application).

Power Consumption

- standard: 2 w/ft
- high output: 8 w/ft

Finish

Anodized aluminum finish is standard. Custom finishes available upon request.

370 Corporate Woods Pkwy Vernon Hills, IL 60061-3107
T 847.735.7000 F 847.735.7001 E info@iolighting.com W iolighting.com

c UL us

Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: D-5

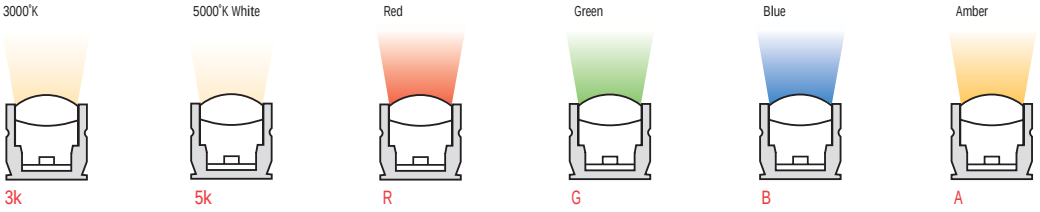
AUTH: DMM

DATE: 04/12/07

io line
series .75

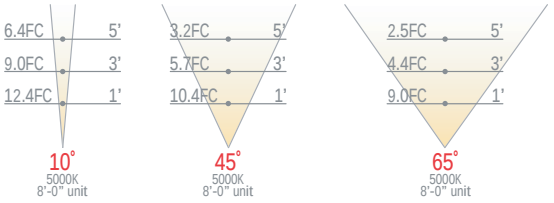
10°, 45°, 65°
PATENT PENDING

Color Options

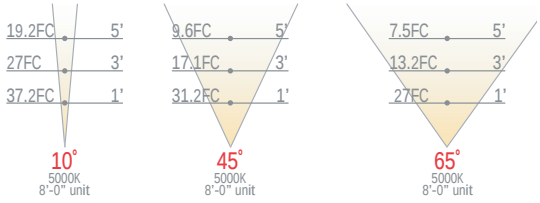


Applications / Light Output

Standard Light Output

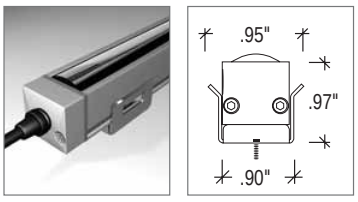


High Output

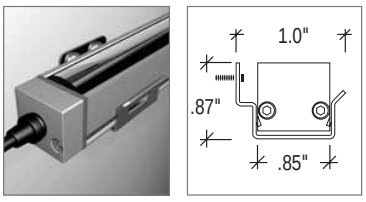


Mounting Options

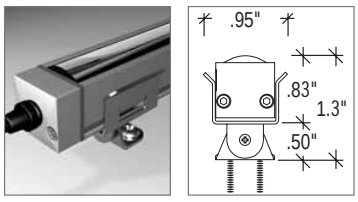
100 surface



101 side surface



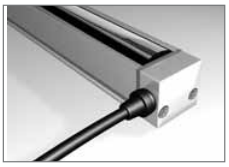
102 field adjustable



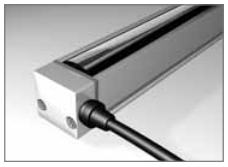
Electrical End Feed Options

2 end feed

3 right side feed



4 left side feed



5 bottom feed

Order Code

0	03	I	□□□□	□□	□□□	□	□□	□	□	□
io	Line .75	location	Color	Distribution	Mounting	Finish	Length	Electrical Feed	Voltage/Dimming	Driver Enclosure OPTIONAL
		Interior only	3k 3000°K 3kHO 3000°K High Output 5k 5000°K 5kHO 5000°K High Output R Red G Green B Blue A Amber	10 10 degree 45 45 degree 65 65 degree	100 Surface 101 Side surface 102 Field adjustable	1 Anodized Aluminum 2 Anodized Custom Color	UNITS (actual) 01 6" (6.15") 02 12" (11.84") 03 18" (17.59") 04 24" (23.15") 05 30" (28.84") 06 36" (34.59") 07 42" (40.15") 08 48" (45.84") 09 54" (51.59") 10 60" (57.15") 11 66" (62.84") 12 72" (68.59") 13 78" (79.84") 14 84" (85.59") 15 90" (91.15") 16 96" (96.84")	2 End feed 3 Right side feed 4 Left side feed 5 Bottom feed FOR CONTINOUS ROW 2-2 Right end feed Left end feed 3-4 Right side feed Left side feed 5-5 Right bottom feed Left bottom feed	1 120v 2 277v 3 120v w/dim 4 277v w/dim 5 other	I Interior Rated N Not Req'd by io *Supplied by others*

Note: "Actual" length provided includes end feed and non-feed endcaps. Add .27 when electrical feed occurs on both ends (for continous row mounting).

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T 847.735.7000 F 847.735.7001 E info@iolighting.com W iolighting.com

Ustudio

Williams College
'62 Center For Theatre & Dance

Williamstown, MA

TYPE: D-5

AUTH: DMM

DATE: 04/12/07

TRIPLES-V 26/6

recessed compact fluorescent downlight/wallwasher

Spec Sheet

COMPACT FLUORESCENT
1-130

FEATURES

Triples-V 26/6 is an efficient 6" aperture low brightness downlight designed for use with one 26-watt triple-tube compact fluorescent lamp of the 4-pin types made by GE, Sylvania or Philips. Triples-V 26/6 provides a shielding angle of 38°.

One housing allows interchangeable use of downlight and wallwash reflectors, permitting housings to be installed first and reflectors to be installed or changed at any time.

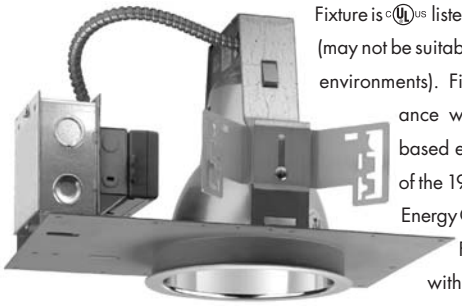
Triples-V 26/6 uses one 26-watt lamp providing 1800 lumens (more than a 100-watt incandescent), a 10,000-hour life, a color rendering index (CRI) of 82, and color temperatures as warm as 2700°K (nearly duplicating the color qualities of incandescent).

Reflectors are available in clear, natural aluminum in three finishes: **EvenTone**, our standard clear finish, partially diffuse, anti-iridescent and gently luminous in appearance; **OptiTone**, specular and anti-iridescent, with minimum brightness and maximum efficiency; and **EasyTone**, diffuse and luminous. Additionally, reflectors are available in champagne gold, wheat, pewter and bronze. Wallwash (120°), corner wallwash (210°) and double wallwash (2x120°) reflectors are also available.

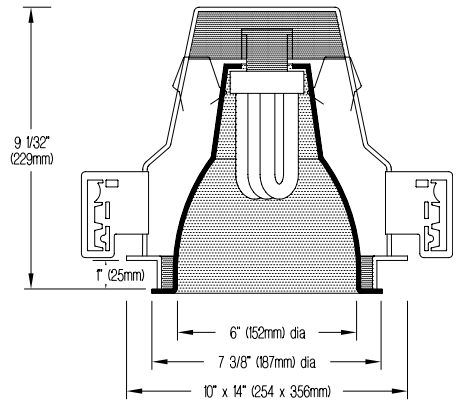
Triples-V 26/6 includes a pair of mounting bars (¾" x 27" C channel). Specialty bars for wood joist and T-bar installations are also available.

APPLICATIONS

Fixture is suitable for downlighting or wallwashing in nearly all architectural environments, especially those spaces where non-directional luminaires are preferred over rectangular troffers. These include offices, stores, lobbies, corridors, restrooms and public areas.



Fixture is c UL us listed for Damp Location (may not be suitable for some outdoor environments). Fixture is in compliance with the component based efficiency standards of the 1995 New York State Energy Conservation Code. Fixture is prewired with high power factor Class P electronic ballast, suitable for use in a fire rated ceiling, and approved for ten #12 wire 75°C branch circuit pull-through wiring. Removal of the reflector allows access to the ballast and junction box.



Requires ceiling opening of 6 15/16" (176mm)

PRODUCT CODE

For complete product code, list basic unit and select one item from each following box.

Basic Unit	TRPV 26/6

Reflector Type			
Downlight	no suffix	Corner Wallwash	CWW
Wallwash	WW	Double Wallwash	DWW

Voltage			
120 volt service	120	277 volt service	277

Reflector and Flange Color	*Overlap*	*Flush*
EvenTone Clear	VOL	VFL
OptiTone Clear	COL	CFL
EasyTone Clear	ECOL	ECFL
Champagne Gold	GOL	GFL
Wheat	WHOL	WHFL
Pewter	POL	PFL
Bronze	ZOL	ZFL

Other reflector finishes are available on special order.

Standard reflector flange continues reflector finish. White painted flanges and custom painted flanges are available on special order. Add WF (white flange) or CCF (custom color flange).

OPTIONS

Specify by adding to the basic unit.

Dimmable 3-wire ballast; not for outdoor application ..... – DM

Emergency battery pack operates lamp in event of power outage. Fixture footprint increases to 10 x 17½" (254 x 444mm). Not available with a CWW reflector. Not for outdoor application ..... – EM

⅛" (3mm) thick **clear acrylic shield**, spring-mounted within reflector ..... – PS

- For combinations of the Options above, contact factory or Edison Price Lighting representative.
- A modified fixture suitable for 2" maximum ceiling thickness is available on special order. Contact factory.
- A modified fixture suitable for 347-volt service is available on special order. Contact factory.
- An install-from-below version of this fixture, suitable for installation outside North America, is available on special order. Contact factory.
- Decorative reflector rings are available on special order. Contact factory.

EDISON PRICE LIGHTING

41-50 22ND STREET, LIC NY 11101 TEL 718.685.0700 FAX 718.786.8530 www.epl.com

03-07

Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: D-6
AUTH: DMM
DATE: 04/12/07

TRIPLES-V 26/6

PHOTOMETRIC REPORT

Report No. 44968. Original Independent Testing Laboratories, Inc. (ITL) test report furnished upon request.

Luminaire ..... recessed compact fluorescent downlight with spun aluminum reflector, specular finish
Lamp ..... Philips 26-watt triple-tube compact fluorescent, 4-pin GX24q-3 base, 1800 lumens
Efficiency 62.9%
Spacing Criteria ..... 0°-1.1, 90°-1.1

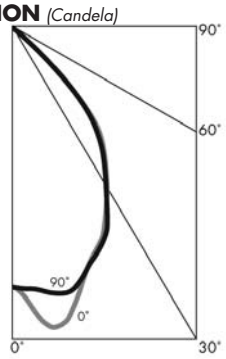
BALLAST INFORMATION

Voltage	*120*	*277*
Input Watts	28	28
Line Current (A)	.25	.11
Power Factor (%)	>98	>98
THD (%)	<10	<10
Min. Starting Temp* (°F)	0	0

**Consult lamp manufacturers for specific temperatures.*

CANDLEPOWER DISTRIBUTION *(Candela)*

Vertical Angle	*Horizontal Angle*		
	0.0	*45.0*	*90.0*
0	843	843	843
5	945	897	853
15	858	872	842
25	702	656	714
35	518	482	505
45	208	218	230
55	0	0	0
65	0	0	0
75	0	0	0
85	0	0	0
90	0	0	0



LUMINANCE DATA

(Candela/m²)

Vertical Angle	*Average 0° Longitude*	*Average 90° Longitude*
45	14858	16429
55	0	0
65	0	0
75	0	0
85	0	0

To convert cd/m² to footlamberts, multiply by 0.2919.

ZONAL LUMEN SUMMARY

Zone	*Lumens*	*% Lamp*	*% Fixture*
0 - 30°	650	36.1	57.4
0 - 40°	963	53.5	85.1
0 - 60°	1132	62.9	100.0
0 - 90°	1132	62.9	100.0
90 -180°	0	0.0	0.0
0 -180°	1132	62.9	100.0

COEFFICIENTS OF UTILIZATION – ZONAL CAVITY METHOD

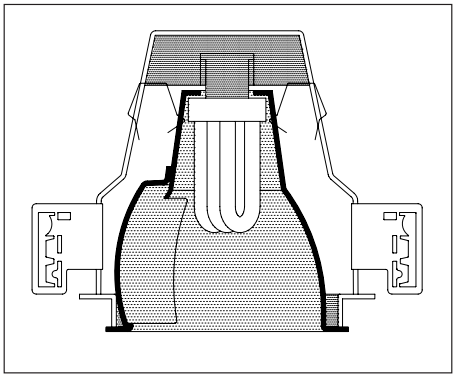
Effective Floor Cavity Reflectance 20%

Ceiling Reflectance (%)	*80*				*70*				*50*			*30*			*10*			*0*
Wall Reflectance (%)	*70*	*50*	*30*	*10*	*70*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*0*
Room Cavity Ratio																		
0	75	75	75	75	73	73	73	73	70	70	70	67	67	67	64	64	64	63
1	71	69	68	66	70	68	66	65	65	64	63	63	62	61	61	60	59	58
2	67	64	61	59	66	63	60	58	61	59	57	59	57	56	57	56	55	54
3	63	59	56	53	62	58	55	53	57	54	52	55	53	51	54	52	50	49
4	60	55	51	48	59	54	50	48	53	50	47	51	49	47	50	48	46	45
5	56	51	47	44	55	50	46	44	49	46	43	48	45	43	47	44	42	41
6	53	47	43	40	52	47	43	40	46	42	40	45	42	39	44	41	39	38
7	50	44	40	37	49	43	39	37	43	39	37	42	39	36	41	38	36	35
8	47	41	37	34	47	41	37	34	40	36	34	39	36	34	38	36	33	33
9	45	38	34	31	44	38	34	31	37	34	31	37	33	31	36	33	31	30
10	42	36	32	29	42	36	32	29	35	31	29	34	31	29	34	31	29	28

TRIPLES-V 26/6 WW

WALLWASH INFORMATION

Distance From Ceiling (Feet)	*2'6" From Wall; 2'6" O.C.*		*3' From Wall; 3' O.C.*		*3'6" From Wall; 3'6" O.C.*	
	Below Fixture	*Between Fixtures*	*Below Fixture*	*Between Fixtures*	*Below Fixture*	*Between Fixtures*
1	7	7	4	4	3	3
2	11	10	7	6	5	4
3	17	18	9	9	6	5
4	20	20	13	14	8	9
5	18	18	14	14	10	10
6	15	15	13	13	10	10
7	12	13	11	11	9	10
8	10	10	9	9	8	8
9	9	9	8	8	7	7
10	7	7	7	7	6	6
11	6	6	6	6	6	6
12	5	5	5	5	5	5



All vertical footcandles are initial values with no contribution from ceiling or floor reflectances. Computation performed with at least five wallwashers.

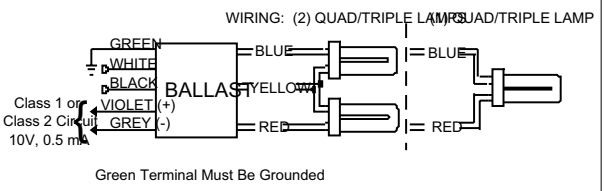
IZT-2S26-M5-LD@277

Brand Name	MARK 7 0-10V
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts) (min/max)	Ballast Factor (min/max)	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
* CFTR26W/GX24Q	1	26	50/10	0.10	08/28	0.03/1.00	10	0.99	1.6	3.57
CFTR26W/GX24Q	2	26	50/10	0.18	13/49	0.03/1.00	10	0.99	1.6	2.04

Wiring Diagram



Diag. 166

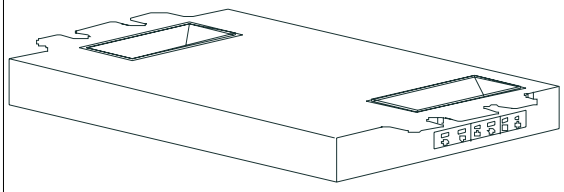
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow	0	0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White		0
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
4.98 "	3.00 "	1.18 "	4.60 "
4 49/50	3	1 9/50	4 3/5
12.6 cm	7.6 cm	3 cm	11.7 cm

Revised 02/13/2004

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

ADVANCE
O'HARE INTERNATIONAL CENTER · 10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Customer Support/Technical Service: Phone: 800-372-3331 · Fax: 630-307-3071
Corporate Offices: Phone: 800-322-2086

TRIPLES-V 26/6

recessed compact fluorescent downlight/wallwasher

Spec Sheet

COMPACT FLUORESCENT
1-130

FEATURES

Triples-V 26/6 is an efficient 6" aperture low brightness downlight designed for use with one 26-watt triple-tube compact fluorescent lamp of the 4-pin types made by GE, Sylvania or Philips. Triples-V 26/6 provides a shielding angle of 38°.

One housing allows interchangeable use of downlight and wallwash reflectors, permitting housings to be installed first and reflectors to be installed or changed at any time.

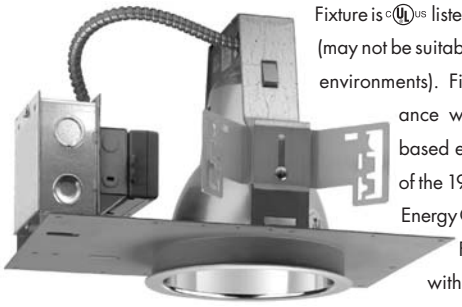
Triples-V 26/6 uses one 26-watt lamp providing 1800 lumens (more than a 100-watt incandescent), a 10,000-hour life, a color rendering index (CRI) of 82, and color temperatures as warm as 2700°K (nearly duplicating the color qualities of incandescent).

Reflectors are available in clear, natural aluminum in three finishes: **EvenTone**, our standard clear finish, partially diffuse, anti-iridescent and gently luminous in appearance; **OptiTone**, specular and anti-iridescent, with minimum brightness and maximum efficiency; and **EasyTone**, diffuse and luminous. Additionally, reflectors are available in champagne gold, wheat, pewter and bronze. Wallwash (120°), corner wallwash (210°) and double wallwash (2x120°) reflectors are also available.

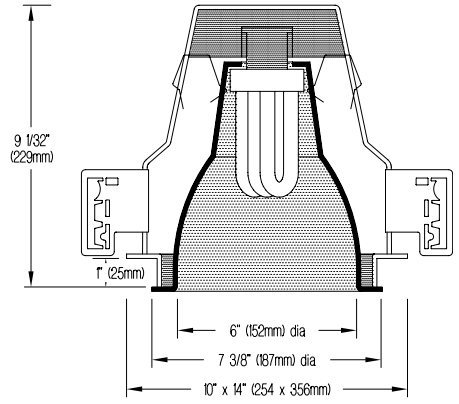
Triples-V 26/6 includes a pair of mounting bars (¾" x 27" C channel). Specialty bars for wood joist and T-bar installations are also available.

APPLICATIONS

Fixture is suitable for downlighting or wallwashing in nearly all architectural environments, especially those spaces where non-directional luminaires are preferred over rectangular troffers. These include offices, stores, lobbies, corridors, restrooms and public areas.



Fixture is c(UL)us listed for Damp Location (may not be suitable for some outdoor environments). Fixture is in compliance with the component based efficiency standards of the 1995 New York State Energy Conservation Code. Fixture is prewired with high power factor Class P electronic ballast, suitable for use in a fire rated ceiling, and approved for ten #12 wire 75°C branch circuit pull-through wiring. Removal of the reflector allows access to the ballast and junction box.



Requires ceiling opening of 6 15/16" (176mm)

PRODUCT CODE

For complete product code, list basic unit and select one item from each following box.

Basic Unit	TRPV 26/6

Reflector Type			
Downlight	no suffix	Corner Wallwash	CWW
Wallwash	WW	Double Wallwash	DWW

Voltage			
120 volt service	120	277 volt service	277

Reflector and Flange Color	*Overlap*	*Flush*
EvenTone Clear	VOL	VFL
OptiTone Clear	COL	CFL
EasyTone Clear	ECOL	ECFL
Champagne Gold	GOL	GFL
Wheat	WHOL	WHFL
Pewter	POL	PFL
Bronze	ZOL	ZFL

Other reflector finishes are available on special order.

Standard reflector flange continues reflector finish. White painted flanges and custom painted flanges are available on special order. Add WF (white flange) or CCF (custom color flange).

OPTIONS

Specify by adding to the basic unit.

Dimmable 3-wire ballast; not for outdoor application ..... – DM

Emergency battery pack operates lamp in event of power outage. Fixture footprint increases to 10 x 17½" (254 x 444mm). Not available with a CWW reflector. Not for outdoor application ..... – EM

⅛" (3mm) thick **clear acrylic shield**, spring-mounted within reflector ..... – PS

- For combinations of the Options above, contact factory or Edison Price Lighting representative.
- A modified fixture suitable for 2" maximum ceiling thickness is available on special order. Contact factory.
- A modified fixture suitable for 347-volt service is available on special order. Contact factory.
- An install-from-below version of this fixture, suitable for installation outside North America, is available on special order. Contact factory.
- Decorative reflector rings are available on special order. Contact factory.

EDISON PRICE LIGHTING

41-50 22ND STREET, LIC NY 11101 TEL 718.685.0700 FAX 718.786.8530 www.epl.com

03-07

Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: D-7

AUTH: DMM

DATE: 04/12/07

TRIPLES-V 26/6

PHOTOMETRIC REPORT

Report No. 44968. Original Independent Testing Laboratories, Inc. (ITL) test report furnished upon request.

Luminaire ..... recessed compact fluorescent downlight with spun aluminum reflector, specular finish
Lamp ..... Philips 26-watt triple-tube compact fluorescent, 4-pin GX24q-3 base, 1800 lumens
Efficiency 62.9%
Spacing Criteria ..... 0°-1.1, 90°-1.1

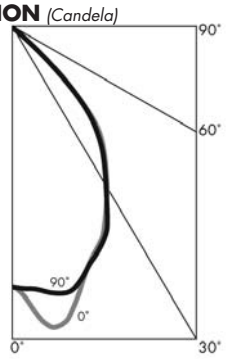
BALLAST INFORMATION

Voltage	*120*	*277*
Input Watts	28	28
Line Current (A)	.25	.11
Power Factor (%)	>98	>98
THD (%)	<10	<10
Min. Starting Temp* (°F)	0	0

**Consult lamp manufacturers for specific temperatures.*

CANDLEPOWER DISTRIBUTION *(Candela)*

Vertical Angle	*Horizontal Angle*		
	0.0	*45.0*	*90.0*
0	843	843	843
5	945	897	853
15	858	872	842
25	702	656	714
35	518	482	505
45	208	218	230
55	0	0	0
65	0	0	0
75	0	0	0
85	0	0	0
90	0	0	0



LUMINANCE DATA

(Candela/m²)

Vertical Angle	*Average 0° Longitude*	*Average 90° Longitude*
45	14858	16429
55	0	0
65	0	0
75	0	0
85	0	0

To convert cd/m² to footlamberts, multiply by 0.2919.

ZONAL LUMEN SUMMARY

Zone	*Lumens*	*% Lamp*	*% Fixture*
0 - 30°	650	36.1	57.4
0 - 40°	963	53.5	85.1
0 - 60°	1132	62.9	100.0
0 - 90°	1132	62.9	100.0
90 -180°	0	0.0	0.0
0 -180°	1132	62.9	100.0

COEFFICIENTS OF UTILIZATION – ZONAL CAVITY METHOD

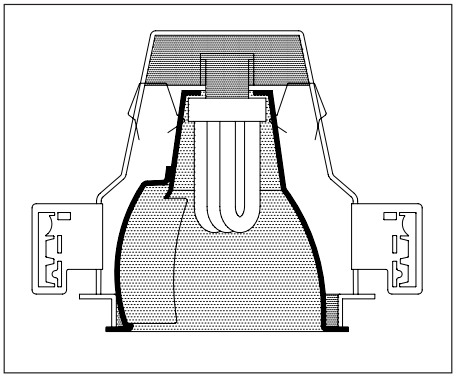
Effective Floor Cavity Reflectance 20%

Ceiling Reflectance (%)	*80*				*70*				*50*			*30*			*10*			*0*
Wall Reflectance (%)	*70*	*50*	*30*	*10*	*70*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*0*
Room Cavity Ratio																		
0	75	75	75	75	73	73	73	73	70	70	70	67	67	67	64	64	64	63
1	71	69	68	66	70	68	66	65	65	64	63	63	62	61	61	60	59	58
2	67	64	61	59	66	63	60	58	61	59	57	59	57	56	57	56	55	54
3	63	59	56	53	62	58	55	53	57	54	52	55	53	51	54	52	50	49
4	60	55	51	48	59	54	50	48	53	50	47	51	49	47	50	48	46	45
5	56	51	47	44	55	50	46	44	49	46	43	48	45	43	47	44	42	41
6	53	47	43	40	52	47	43	40	46	42	40	45	42	39	44	41	39	38
7	50	44	40	37	49	43	39	37	43	39	37	42	39	36	41	38	36	35
8	47	41	37	34	47	41	37	34	40	36	34	39	36	34	38	36	33	33
9	45	38	34	31	44	38	34	31	37	34	31	37	33	31	36	33	31	30
10	42	36	32	29	42	36	32	29	35	31	29	34	31	29	34	31	29	28

TRIPLES-V 26/6 WW

WALLWASH INFORMATION

Distance From Ceiling (Feet)	*2'6" From Wall; 2'6" O.C.*		*3' From Wall; 3' O.C.*		*3'6" From Wall; 3'6" O.C.*	
	Below Fixture	*Between Fixtures*	*Below Fixture*	*Between Fixtures*	*Below Fixture*	*Between Fixtures*
1	7	7	4	4	3	3
2	11	10	7	6	5	4
3	17	18	9	9	6	5
4	20	20	13	14	8	9
5	18	18	14	14	10	10
6	15	15	13	13	10	10
7	12	13	11	11	9	10
8	10	10	9	9	8	8
9	9	9	8	8	7	7
10	7	7	7	7	6	6
11	6	6	6	6	6	6
12	5	5	5	5	5	5



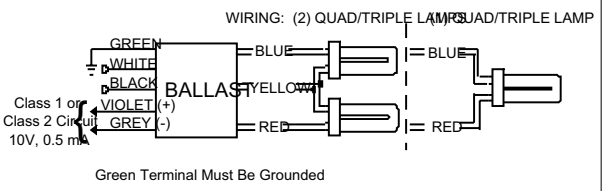
All vertical footcandles are initial values with no contribution from ceiling or floor reflectances. Computation performed with at least five wallwashers.

IZT-2S26-M5-LD@277	
Brand Name	MARK 7 0-10V
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts) (min/max)	Ballast Factor (min/max)	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
* CFTR26W/GX24Q	1	26	50/10	0.10	08/28	0.03/1.00	10	0.99	1.6	3.57
CFTR26W/GX24Q	2	26	50/10	0.18	13/49	0.03/1.00	10	0.99	1.6	2.04

Wiring Diagram



Diag. 166

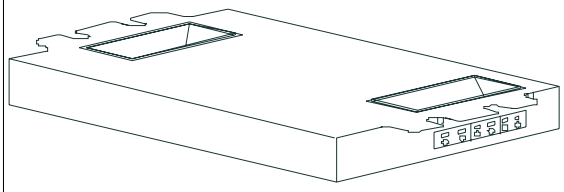
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow	0	0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White		0
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
4.98 "	3.00 "	1.18 "	4.60 "
4 49/50	3	1 9/50	4 3/5
12.6 cm	7.6 cm	3 cm	11.7 cm

Revised 02/13/2004

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

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SUGGESTIONS

DENSITY

The appropriate density, or quantity of points in an area, is highly subjective. Most ceilings use between 1 and 6 points of light per square foot of surface area. Lower ceilings (less than 10 feet high) require more density than higher ceilings (more than 15 feet high) in order to look natural. Sparser layouts tend to look more natural, and denser layouts tend to look more glitzy.

DISTRIBUTION

Natural stars look splotchy. To best recreate the beauty of the natural sky, we urge you to vary the spacing between points. Some areas should have several stars together and other areas very few stars. Consider incorporating a dense Milky Way section into your project.

CONSTELLATIONS

You may want to have a few stars that form a constellation. Use several larger strands of fiber in the same hole to make a constellation star point that is brighter than the other star points.

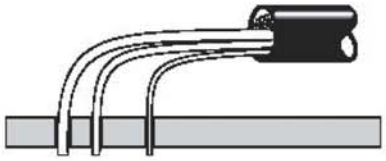
INSTALLATION

Install each illuminator in an accessible location that allows each cable to reach the ceiling with 3 feet of slack. Drill a hole through the ceiling and, working from above the ceiling, insert the proper size fiber through the hole, allowing it to protrude several inches into the room. Secure the fiber in place with adhesive. Allow the adhesive to dry. Clip the fibers to approximately 3/8 from the ceiling and apply a light coat of latex paint over the ceiling and fibers (optional). After the paint has dried, clip the fibers to 1/8, or to 1/4 if you prefer to allow for a future repainting and re-clipping.

Plan View:

Technical Remarks:
LOCATE ILLUMINATOR(S) IN AN ACCESSIBLE, VENTILATED AREA. ROUTE CABLES TO LOCATIONS OF STAR POINTS. COIL EXCESS CABLE IF NEEDED. OPTIONAL SHOOTING STAR IS SHOWN.

Section View:



Installation Sequence:
PAINT CEILING, DRILL HOLES, INSERT FIBERS, ADHERE FIBERS IN PLACE, LIGHTLY REPAINT CEILING, TRIM FIBERS TO 1/8". LEAVING AN ADDITIONAL 1/8" WOULD ALLOW FOR FUTURE REPAINTING OF THE CEILING.

300 total points

STAR KIT A

Description:
Small Star Kit

Specifications:

Intensity:	300 TOTAL POINTS
Max Lit Length:	9 CABLES OF STAR 34/50, 10 FEET LONG
Mounting:	DRILL HOLE, INSERT FIBER, SECURE WITH EPOXY OR ADHESIVE
Illuminator:	FS11L-SPW/NC-120-005
Technical Remarks:	SPARKLE WHEEL INCLUDED

500 total points

STAR KIT B

Description:
Medium Star Kit with shooting star

Specifications:

Intensity:	500 TOTAL POINTS
Max Lit Length:	9 CABLES OF STAR 34/50, 10 FEET LONG; 200 SHOOTING STAR CABLES, 10 FEET LONG
Mounting:	DRILL HOLE, INSERT FIBER, SECURE WITH EPOXY OR ADHESIVE
Illuminator:	FS1L-SPW/NC-120
Technical Remarks:	SPARKLE WHEEL INCLUDED

800 total points

STAR KIT C

Description:
Large Star Kit with 2 shooting stars

Specifications:

Intensity:	800 TOTAL POINTS
Max Lit Length:	18 CABLES OF STAR 34/50, 20 FEET LONG; 200 SHOOTING STARS, 20 FEET LONG
Mounting:	DRILL HOLE, INSERT FIBER, SECURE WITH EPOXY OR ADHESIVE
Illuminator:	FS1L-SPW/NC-120
Technical Remarks:	SPARKLE WHEEL INCLUDED

FS1L ILLUMINATOR
description_ordering guide_specifications

71 watt quartz halogen

FS1L ILLUMINATOR

Description:
The FS1L is a small, fanless light source primarily used for end emitting points of light for animated signs and special effects. It uses a 71 watt quartz halogen lamp with 3200° Kelvin color temperature and is U.L. listed for dry locations. The FS1L has a high fiber capacity of up to 3200 of 0.75mm fibers.

illuminator ordering guide

Model:
FS1L

Voltage Options:
120 120V, 60 Hz

Color Wheel Options:
CCW* CUSTOM COLOR WHEEL
CSW CUSTOM SPARKLE WHEEL

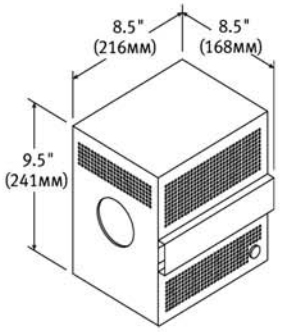
* COLORS AND SEQUENCES MUST BE SPECIFIED AT TIME OF ORDER.

Options:
CUST 3200 FIBER CAPACITY – MUST BE PRE-PORTED BY FACTORY
ANI CUSTOM ANIMATION – CONSULT FACTORY

Specifications:

Maximum Exposure Rating:	DRY LOCATION
Ventilation:	FANLESS
Thermal Output:	275 BTU/HR
Acoustic Rating (dB):	15
Weight:	5 LBS
Rec. Mounting Clearance:	12" MINIMUM (304.8MM)
Operating Temperature:	5° TO 25° C
Storage Temperature:	5° TO 70° C
Continuous Load @ 120V:	0.75 AMPS
Startup Load @ 120V:	0.75 AMPS
Replacement Lamp:	HI-071
Lamp Wattage:	71W
Lamp Type:	QUARTZ HALOGEN
Lamp Life:	4000 HOURS
Restrike Delay:	0 MINUTES
Color Temperature:	3200° K
CRI:	95
Materials:	ALUMINUM
Color Filter Options:	CONSULT FACTORY

Dimensions:



Technical Remarks:
Unit is convection cooled (fanless) and extremely quite. Add 10" (250mm) to length dimension in order to accommodate the fiber bending radius. Fiber must be factory ported.

Mounting Positions:
HORIZONTAL
DO NOT INVERT

1 [800] 327-7877

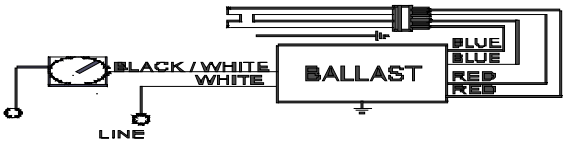
VEZ-1Q18-M2-BS

Brand Name	MARK 10 POWERLINE
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts) (min/max)	Ballast Factor (min/max)	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
CFQ18W/G24Q	1	18	50/10	0.07	07/22	0.05/1.00	10	0.99	1.6	4.55
* CFTR18W/GX24Q	1	18	50/10	0.08	07/22	0.05/1.00	10	0.99	1.6	4.55

Wiring Diagram



Diag. 134

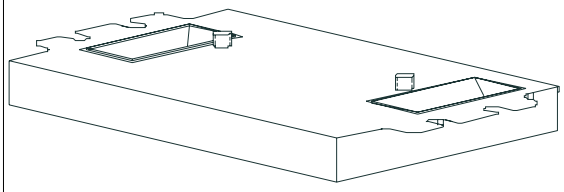
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White		0
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
4.98 "	3.00 "	1.29 "	2.00 "
4 49/50	3	1 29/100	2
12.6 cm	7.6 cm	3.3 cm	5.1 cm

Revised 08/17/2006

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

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TARGETTI

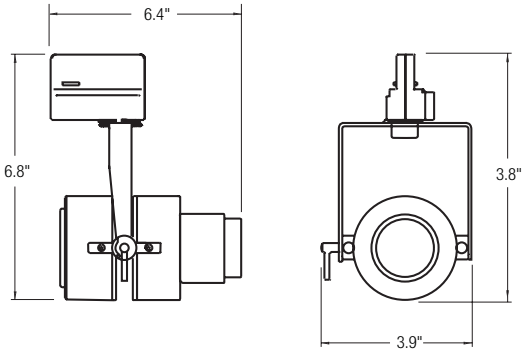
Foho Pro

MR16 Projector

Professional directional projector for use with an 50W MR16 Halogen lamp.

Type:_____

Project: _____



Details

Features

- Die-cast aluminum joints, fitted with graduated ring for tool-less aim locking
- Painted aluminum body with die-cast titanium-colored painted supports
- Mounts to wall, ceiling or track
- 359° horizontal rotation and 90° vertical tilt, with directional locking (90° locks in position)
- 120V electronic transformer separate from the optical assembly to optimize heat dispertion and ensure the lamp maintains a constant operating temperature
- Available linear spread and softening lenses
- Accepts chromatic and UV stop filters

Lens

- Borosilicate safety glass

Lamp

- 50W max. MR16 Halogen lamp

Transformer

- Supplied with 120V primary, for 277V consult factory
- Thermal protection that meets UL and NEC requirements

Accessories (1 Max. per fixture)

- Framing projector
- Adjustable barn doors
- UV stop filter
- Chromatic filters in red, green, blue, yellow and magenta
- Consult factory for multiple accessories

Labels

- UL listed

TARGETTI a division of TARGETTI NORTH AMERICA
www.targettiusa.com
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Santa Ana, CA 92705
ph 714.957.4950
fx 714.957.4955

Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: D-9

AUTH: DMM

DATE: 04/12/07

Foho Pro
MR16 Projector

TARGETTI

Ordering Information

Fixture

TRIM	CAT. #	MOUNT	LAMP	COLOR*
FOHO PRO MR16 Projector	**US1T0687D1**	Wall/Ceiling	50W MR16	White
	US1T1376D1			Black
	US1T0686D1			Aluminum
	US1T0691D1	Two Circuit Track		White
	US1T1377D1			Black
	US1T0690D1			Aluminum


Adjustable Barn Doors


Framing Projector


Chromatic / UV Stop Filters

Accessories

DESCRIPTION	COLOR	CAT. #
Framing Projector	Aluminum	**US1T0742**
Adjustable Barn Doors	Black	**US1T0741**
Chromatic Dichroic Filters – Ø 1.38" for use with Framing Projector	Red	**US49891**
	Green	**US49892**
	Blue	**US49896**
	Yellow	**US49897**
	Magenta	**US49898**
Chromatic Dichroic Filters – Ø 2"	Red	**US49881**
	Green	**US49882**
	Blue	**US49886**
	Yellow	**US49887**
	Magenta	**US49959**
UV Stop Filter	Clear	**US49880**
Corrective FIlters	Light Peach	**US1T1750**
	Medium Peach	**US1T1751**
	Dark Peach	**US1T1752**
	Light Pink	**US1T1741**
	Medium Pink	**US1T1742**
	Dark Pink	**US1T1743**
	Light Blue	**US1T1744**
	Medium Blue	**US1T1745**
	Dark Blue	**US1T1746**
	Light Yellow	**US1T1747**
	Medium Yellow	**US1T1748**
	Dark Yellow	**US1T1749**

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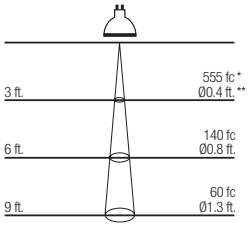
fx 714.957.4955

Foho Pro
MR16 Projector

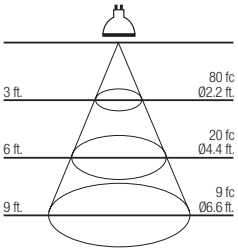
TARGETTI

Photometric Information

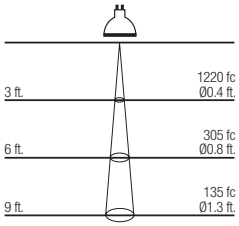
20MR16Q/8°/NSP (ESX)
CBCP: 5000 cd
Avg. Rated Life: 2000 hrs.



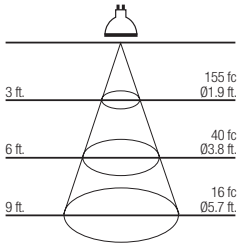
20MR16Q/40°/FL (BAB)
CBCP: 700 cd
Avg. Rated Life: 2000 hrs.



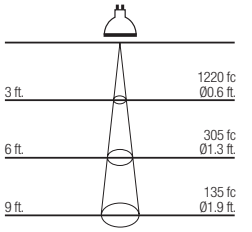
35MR16Q/8°/NSP (FRB)
CBCP: 11,000 cd
Avg. Rated Life: 3000 hrs.



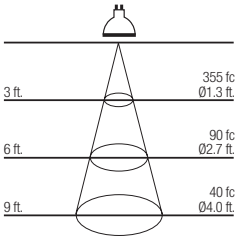
35MR16Q/35°/FL (FMW)
CBCP: 1400 cd
Avg. Rated Life: 3000 hrs.



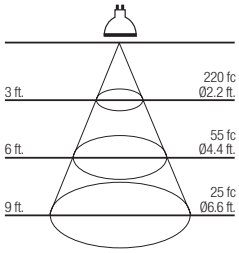
50MR16Q/12°/NSP (EXT)
CBCP: 11,000 cd
Avg. Rated Life: 3500 hrs.



50MR16Q/25°/NFL (EXZ)
CBCP: 3200 cd
Avg. Rated Life: 3500 hrs.



50MR16Q/40°/FL (EXN)
CBCP: 2000 cd
Avg. Rated Life: 3500 hrs.



* fc= footcandles
** diameter in feet
CBCP= center beam candle power
cd= candella

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WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE
WILLIAMSTOWN, MA

TYPE: D-9
AUTH: DMM
DATE: 04/12/07

TRIPLES-V 18/6

recessed compact fluorescent downlight/wallwasher

Spec Sheet

COMPACT FLUORESCENT
1-125

FEATURES

Triples-V 18/6 is an efficient 6" aperture low brightness downlight designed for use with one 18-watt triple-tube compact fluorescent lamp of the 4-pin types made by GE, Sylvania or Philips. Triples-V 18/6 provides a shielding angle of 40°.

One housing allows interchangeable use of downlight and wallwash reflectors, permitting housings to be installed first and reflectors to be installed or changed at any time.

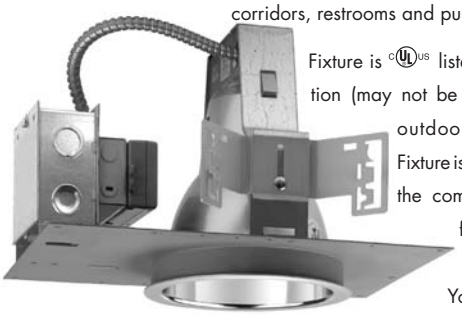
Triples-V 18/6 uses one 18-watt lamp providing 1200 lumens (more than a 75-watt incandescent), a 10,000-hour life, a color rendering index (CRI) of 82, and color temperatures as warm as 2700°K (nearly duplicating the color qualities of incandescent).

Reflectors are available in clear, natural aluminum in three finishes: **EvenTone**, our standard clear finish, partially diffuse, anti-iridescent and gently luminous in appearance; **OptiTone**, specular and anti-iridescent, with minimum brightness and maximum efficiency; and **EasyTone**, diffuse and luminous. Additionally, reflectors are available in champagne gold, wheat, pewter and bronze. Wallwash (120°), corner wallwash (210°) and double wallwash (2x120°) reflectors are also available.

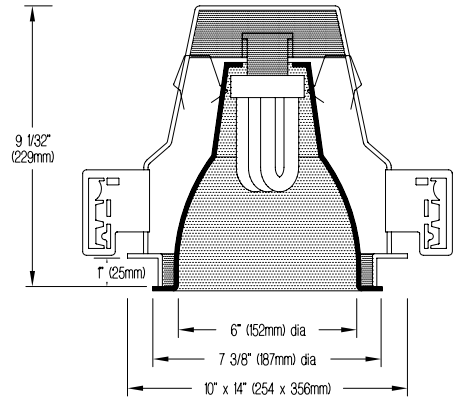
Triples-V 18/6 includes a pair of mounting bars (¾" x 27" C channel). Specialty bars for wood joist and T-bar installations are also available.

APPLICATIONS

Fixture is suitable for downlighting or wallwashing in nearly all architectural environments, especially those spaces where non-directional luminaires are preferred over rectangular troffers. These include offices, stores, lobbies, corridors, restrooms and public areas.



Fixture is c UL us listed for Damp Location (may not be suitable for some outdoor environments). Fixture is in compliance with the component based efficiency standards of the 1995 New York State Energy Conservation Code. Fixture is prewired with high power factor Class P electronic ballast, suitable for use in a fire rated ceiling and approved for ten #12 wire 75°C branch circuit pull-through wiring. Removal of the reflector allows access to the ballast and junction box.



Requires ceiling opening of 6 15/16" (176mm)

PRODUCT CODE

For complete product code, list basic unit and select one item from each following box.

Basic Unit	TRPV 18/6

Reflector Type			
Downlight	no suffix	Corner Wallwash	CWW
Wallwash	WW	Double Wallwash	DWW

Voltage			
120 volt service	120	277 volt service	277

Reflector and Flange Color	*Overlap*	*Flush*
EvenTone Clear	VOL	VFL
OptiTone Clear	COL	CFL
EasyTone Clear	ECOL	ECFL
Champagne Gold	GOL	GFL
Wheat	WHOL	WHFL
Pewter	POL	PFL
Bronze	ZOL	ZFL

Other reflector finishes are available on special order.

Standard reflector flange continues reflector finish. White painted flanges and custom painted flanges are available on special order. Add WF (white flange) or CCF (custom color flange).

OPTIONS

Specify by adding to the basic unit.

Dimmable 3-wire ballast; not for outdoor application ..... – DM

Emergency battery pack operates lamp in event of power outage. Fixture footprint increases to 10 x 16 ¾" (254 x 425mm). Not available with a CWW reflector. Not for outdoor application ..... – EM

1/8" (3mm) thick **clear acrylic shield**, spring-mounted within reflector ..... – PS

- For combinations of the Options above, contact factory or Edison Price Lighting representative.
- A modified fixture suitable for 2" maximum ceiling thickness is available on special order. Contact factory.
- A modified fixture suitable for 347-volt service is available on special order. Contact factory.
- An install-from-below version of this fixture, suitable for installation outside North America, is available on special order. Contact factory.
- Decorative reflector rings are available on special order. Contact factory.

EDISON PRICE LIGHTING

41-50 22ND STREET, LIC NY 11101 TEL 718.685.0700 FAX 718.786.8530 www.epl.com

03-07

Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: D-10

AUTH: DMM

DATE: 04/12/07

TRIPLES-V 18/6

PHOTOMETRIC REPORT

Report No. 44758. Original Independent Testing Laboratories, Inc. (ITL) test report furnished upon request.

Luminaire ..... recessed compact fluorescent downlight with spun aluminum reflector, specular finish
Lamp ..... Philips 18-watt triple-tube compact fluorescent, 4-pin GX24q-2 base, 1200 lumens
Efficiency 64.3%
Spacing Criteria ..... 0°-1.2, 90°-1.1

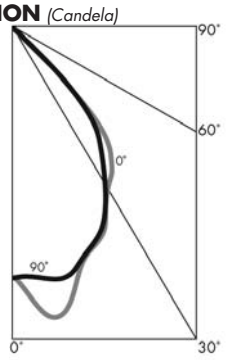
BALLAST INFORMATION

Voltage	*120*	*277*
Input Watts	22	22
Line Current (A)	.19	.08
Power Factor (%)	>98	>98
THD (%)	<10	<10
Min. Starting Temp* (°F)	0	0

**Consult lamp manufacturers for specific temperatures.*

CANDLEPOWER DISTRIBUTION *(Candela)*

Vertical Angle	*Horizontal Angle*		
	0.0	*45.0*	*90.0*
0	557	557	557
5	627	589	561
15	575	580	553
25	489	456	482
35	385	354	349
45	143	158	162
55	1	0	0
65	0	0	0
75	0	0	0
85	0	0	0
90	0	0	0



LUMINANCE DATA

(Candela/m²)

Vertical Angle	*Average 0° Longitude*	*Average 90° Longitude*
45	10215	11572
55	88	0
65	0	0
75	0	0
85	0	0

To convert cd/m² to footlamberts, multiply by 0.2919.

ZONAL LUMEN SUMMARY

Zone	*Lumens*	*% Lamp*	*% Fixture*
0 - 30°	436	36.3	56.5
0 - 40°	661	55.1	85.7
0 - 60°	772	64.3	100.0
0 - 90°	772	64.3	100.0
90 -180°	0	0.0	0.0
0 -180°	772	64.3	100.0

COEFFICIENTS OF UTILIZATION – ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 20%

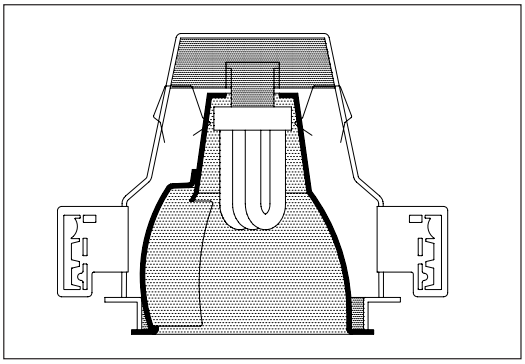
Ceiling Reflectance (%)	*80*				*70*				*50*			*30*			*10*			*0*
Wall Reflectance (%)	*70*	*50*	*30*	*10*	*70*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*0*
Room Cavity Ratio																		
0	76	76	76	76	75	75	75	75	71	71	71	68	68	68	65	65	65	64
1	73	71	69	67	71	69	68	66	67	65	64	64	63	62	62	61	61	59
2	69	65	62	60	67	64	62	59	62	60	58	60	58	57	58	57	56	55
3	65	60	57	54	63	59	56	54	58	55	53	56	54	52	55	53	51	50
4	61	56	52	49	60	55	51	49	54	51	48	52	50	47	51	49	47	46
5	57	52	48	45	56	51	47	44	50	46	44	49	46	44	48	45	43	42
6	54	48	44	41	53	47	43	41	46	43	40	45	42	40	45	42	40	39
7	51	45	40	37	50	44	40	37	43	40	37	42	39	37	42	39	37	36
8	48	42	37	34	47	41	37	34	40	37	34	40	36	34	39	36	34	33
9	46	39	35	32	45	38	35	32	38	34	32	37	34	32	37	34	31	31
10	43	36	32	30	42	36	32	30	35	32	29	35	32	29	34	31	29	28

TRIPLES-V 18/6 WW

WALLWASH INFORMATION

Distance From Ceiling (Feet)	*2'6"From Wall; 2'6" O.C.*		*3' From Wall; 3' O.C.*	
	Below Fixture	*Between Fixtures*	*Below Fixture*	*Between Fixtures*
1	5	5	3	3
2	8	7	5	4
3	13	13	7	6
4	15	15	10	10
5	13	13	10	10
6	10	11	9	9
7	9	8	8	8
8	7	7	6	6
9	6	6	5	5

All vertical footcandles are initial values with no contribution from ceiling or floor reflectances. Computation performed with at least five wallwashers.



Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

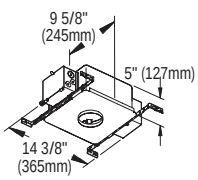
WILLIAMSTOWN, MA

TYPE: D-10
AUTH: DMM
DATE: 04/12/07

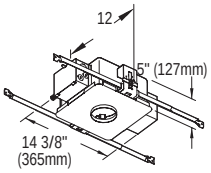
Calculite® Evolution Incandescent Open Downlight **C4MRD**

4 1/2" Aperture, MR16 Reflector Trim

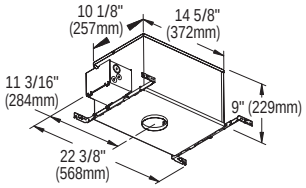
C4ALV

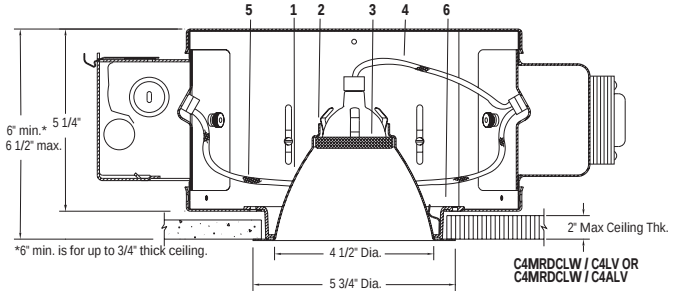


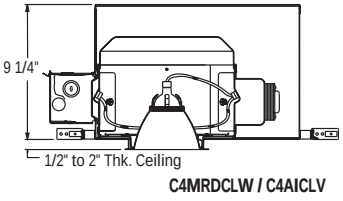
C4LV



C4AICLV







Ceiling Cutout: 5 1/16" (129 mm) Dia.

Reflector Trim		Frame-In Kit		
		Non-IC 120V/277V	Non-IC AirSeal® 120V/277V	IC AirSeal® 120V
C4MRD CLW	Specular Clear, White Flange			
C4MRD CLP	Specular Clear, Polished Flange	**C4LVMU** Magnetic 120/277V **C4LVE1** Electronic 120V **C4LVE2** Electronic 277V	**C4ALVMU** Magnetic 120/277V **C4ALVE1** Electronic 120V	**C4AICLVM1** Magnetic 120V **C4AICLVE1** Electronic 120V
C4MRD ☐	Add suffix. See options for other finishes.	42-75W MR16(12V)	42-75W MR16(12V)	20-50W MR16(12V)
		Remodel Frame-In Kit		
		Non-IC 120V		
		C4LVE1RM 50W Max. MR16 (12V) See C4LVE1RM specification sheet for more information.		

Features

1. **Reflector:** 16 ga. aluminum, 50° visual cutoff to lamp and lamp image. Available with painted white or polished flange. Interchangeable with other Evolution 4 1/2" low voltage trims.
2. **Lamp Support:** Die-formed aluminum with spring tension clips to hold lamp and lens allowing fast snap-in, snap-out relamping from below. Matte black finish. Cover glass may be replaced with a color filter or lens accessory.
3. **Cover Glass:** High temperature, tempered glass. Perimeter frost.
4. **Socket Harness:** Porcelain bi-pin socket. Pre-wired with No. 18 Teflon® leads.
5. **Power Harness:** Provides power to transformer.
6. **Frame-In Kit:** Compatible Frame-In Kits are listed above.
   Non-IC and Non-IC AirSeal® - Insulation must be kept 3" away from fixture sides and wiring compartments, and must not be placed above fixture in a manner which will entrap heat.
   IC-AirSeal® - Fixture may be in direct contact with insulation.

Options & Accessories

Cone Finishes[1]

Clear: CL Gold: GD White: WH
Black: BK
Comfort Clear Diffuse: CCD
Champagne Bronze: CCZ

Specify desired flange: **W** White; **P** Polished

Evolution 4" Trims with Non-IC and AIC Frames
C4MRD 1 Secondary Color Lens *or* 1 Mixing Color Lens *or* 1 Specialty Filter

Options & Accessories (cont.)

Labels

UL Listed (suitable for damp locations), I.B.E.W.

Teflon® is a registered trademark of E.I. DuPont.
US Patent No. 5,957,573. Other US and Foreign Patents Pending.

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.

LIGHTOLIER®

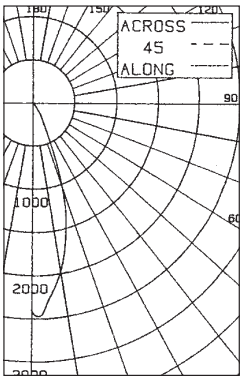
WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: D-11
AUTH: DMM
DATE: 04/12/07

SPACING RATIO = 0.6

CERTIFIED TEST REPORT NO. 0881FR
COMPUTED BY LSI PROGRAM **TEST-LITE**
RECESSED OPEN REFLECTOR DOWNLIGHT
4 1/2" DIA. APERTURE, SPECULAR CLEAR FINISH REFLECTOR
73W MR16 PHILLIPS LAMP, 36 DEG. FL. LUMEN RATING = 1320 LMS.



CANDLEPOWER SUMMARY

ANGLE	MEAN CP	LUMENS
0	2410	
5	2287	214
10	1973	
15	1552	432
20	1016	
25	423	241
30	223	
35	115	79
40	52	
45	17	17
50	0	
55	0	0
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	% LUMINAIRE
0-30	886	67.17	90.23
0-40	965	73.17	98.29
0-60	982	74.44	100.00
0-90	982	74.45	100.00
40-90	16	1.27	10.71
60-90	0	.00	.00
90-180	0	.00	.00
0-180	982	74.45	100.00

**EFFICIENCY =74.4% **

DATE: AUGUST 11, 1999
PREPARED FOR
LIGHTOLIER, FALL RIVER, MA

TESTED ACCORDING TO IES PROCEDURES. TEST DISTANCE EXCEEDS FIVE TIMES THE GREATEST LUMINOUS OPENING OF LUMINAIRE.

COEFFICIENTS OF UTILIZATION
% EFFECTIVE CEILING CAVITY REFLECTANCE

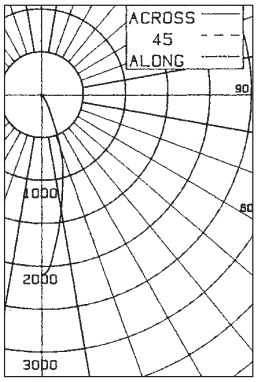
ROOM CAVITY RATIO	80			70			50			30			10			0
	% WALL REFLECTANCE															
	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.85	.83	.82	.83	.82	.81	.80	.79	.78	.77	.77	.76	.75	.74	.74	.73
2	.81	.79	.77	.80	.78	.76	.77	.76	.75	.75	.74	.73	.73	.73	.72	.71
3	.78	.76	.74	.77	.75	.73	.75	.74	.72	.74	.72	.71	.72	.71	.70	.69
4	.75	.73	.71	.75	.72	.70	.73	.71	.69	.72	.70	.69	.71	.69	.68	.67
5	.73	.70	.68	.72	.69	.68	.71	.69	.67	.70	.68	.66	.69	.67	.66	.65
6	.71	.68	.66	.70	.67	.66	.69	.67	.65	.68	.66	.65	.67	.66	.64	.64
7	.68	.65	.63	.68	.65	.63	.67	.65	.63	.66	.64	.63	.66	.64	.62	.62
8	.66	.63	.61	.65	.63	.61	.65	.63	.61	.65	.62	.61	.64	.62	.60	.60
9	.64	.61	.59	.64	.61	.59	.63	.61	.59	.63	.60	.59	.62	.60	.59	.58
10	.62	.60	.57	.62	.60	.57	.61	.59	.57	.61	.59	.57	.61	.59	.57	.56

20% FLOOR CAVITY REFLECTANCE

Conversion Factors
75W MR16 FL: Clear, C.U. x 1.00; Diffuse, C.U. x 0.85; Gold C.U. x 0.95

SPACING RATIO = 0.5

CERTIFIED TEST REPORT NO. 0931FR
COMPUTED BY LSI PROGRAM **TEST-LITE**
RECESSED OPEN REFLECTOR DOWNLIGHT
4 1/2" DIA. APERTURE, SPECULAR CLEAR FINISH REFLECTOR
50W MR16 GE, FL / 40 DEG. LUMEN RATING = 800 LMS.



CANDLEPOWER SUMMARY

ANGLE	MEAN CP	LUMENS
0	2098	
5	1798	168
10	1364	
15	987	281
20	625	
25	283	156
30	154	
35	85	57
40	37	
45	13	12
50	0	
55	0	0
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	% LUMINAIRE
0-30	605	75.64	89.76
0-40	661	82.74	98.19
0-60	674	84.27	100.00
0-90	674	84.27	100.00
40-90	12	1.52	1.81
60-90	0	.00	.00
90-180	0	.00	.00
0-180	674	84.27	100.00

**EFFICIENCY = 84.3% **

DATE: SEPT. 17, 1999
PREPARED FOR
LIGHTOLIER, FALL RIVER, MA

TESTED ACCORDING TO IES PROCEDURES. TEST DISTANCE EXCEEDS FIVE TIMES THE GREATEST LUMINOUS OPENING OF LUMINAIRE.

COEFFICIENTS OF UTILIZATION
% EFFECTIVE CEILING CAVITY REFLECTANCE

ROOM CAVITY RATIO	80			70			50			30			10			0
	% WALL REFLECTANCE															
	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.96	.94	.93	.94	.93	.92	.91	.90	.89	.88	.87	.86	.85	.84	.84	.82
2	.92	.90	.88	.90	.88	.87	.88	.86	.85	.85	.84	.83	.83	.82	.81	.80
3	.88	.86	.84	.87	.85	.83	.85	.83	.82	.84	.82	.80	.82	.81	.79	.78
4	.85	.83	.80	.85	.82	.80	.83	.81	.79	.81	.79	.78	.80	.78	.77	.76
5	.83	.79	.77	.82	.79	.77	.80	.78	.76	.79	.77	.75	.78	.76	.75	.74
6	.80	.77	.75	.80	.77	.74	.78	.76	.74	.77	.75	.74	.77	.75	.73	.72
7	.78	.74	.72	77	.74	.72	.76	.73	.72	.75	.73	.71	.75	.72	.71	.70
8	.75	.72	.70	.74	.72	.70	.74	.71	.69	.73	.71	.69	.73	.70	.69	.68
9	.73	.70	.68	.73	.70	.68	.72	.69	.67	.71	.69	.67	.71	.69	.67	.66
10	.71	.68	.66	.71	.68	.65	.70	.67	.65	.70	.67	.65	.69	.67	.65	.64

20% FLOOR CAVITY REFLECTANCE

Conversion Factors:
20W to 50W MR16 FL: Clear, C.U.x 1.00: Diffuse / Gold, C.U.x 0.95.

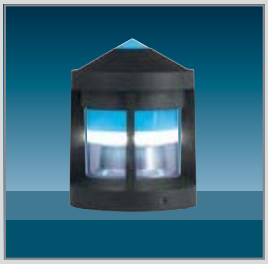
LIGHTOLIER®

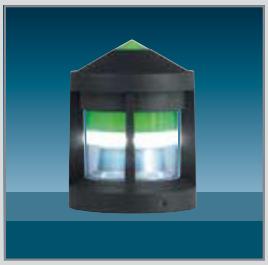
Job Information | Type:

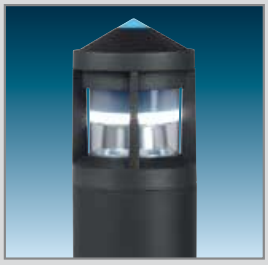
Lightolier a Genlyte company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710
We reserve the right to change details of design, materials and finish.

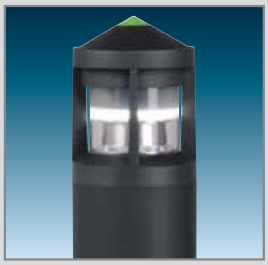
Promenade LED

Circular bollard and parapet luminaires with unique optical system combined with LED technology to provide white light and colour effect









Designer: Chr. Hvidt

- Elegant design for easy integration in a variety of applications
- Same design as standard Promenade bollard for retrofitting
- Robust and vandal resistant die-cast aluminium (LM6) body
- Versions for flange, root or parapet mounting
- Expresses safety, strength and harmony in urban amenity lighting applications
- Polycarbonate diffuser with sand-blasted anti-glare band
- Optimised output ensures no obtrusive light
- Low voltage LEDs for energy savings, long life and reduced maintenance, other lamp types available

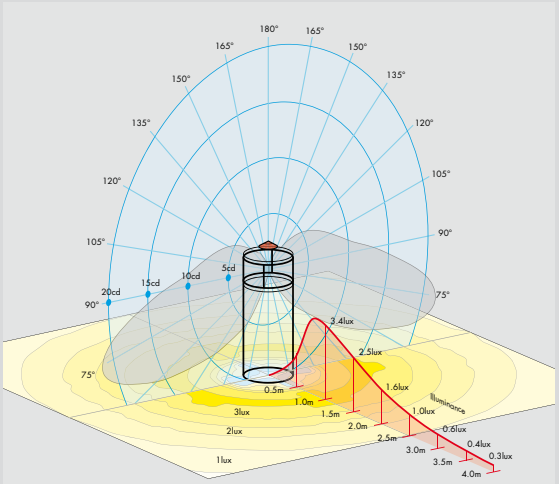
Lamps
15 x white DMX LEDs 1.2W
3 x colour DMX LEDs 1.2W (blue, green, red, amber, or RGB on request) 21.6W total output. Also available in 42W TC-TEL compact fluorescent, 70W HSE-I high pressure sodium and 80W HME high pressure mercury.

Materials/Finish
Head and body: powder coated die-cast LM6 aluminium, anthracite (close to RAL 7024)
Top cone: opal polycarbonate
Diffuser: clear polycarbonate with internal sand-blasted band

Installation/Mounting
Flange mounting plate or support for root mounting. LED module and power supply can easily be retrofitted into an existing bollard.

Standards
Designed and manufactured to comply with EN60598
Class II Electrical
850°C fire retardant
IK10 impact resistance
IP54
CE

Specification
To specify state: Decorative aluminium bollard with clear diffuser including a sand blasted band and with small luminous cone. Complete with 18 x 1.2W DMX LEDs. Parapet/flange/root mounted. As Thorn Promenade LED.

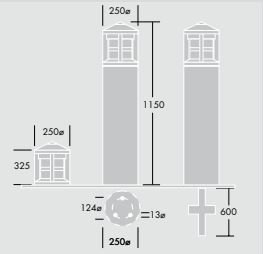


Promenade LED

Ordering Guide
Lamps to be ordered separately (except LED versions)

Description	Ilcos Code	Socket	Weight (Kg)	SAP Code
Parapet mounted				
PROMENADE BOL LED WHI/AMB 325MM MPL ANT	–	–	8	96231685
PROMENADE BOL LED WHI/RED 325MM MPL ANT	–	–	8	96231684
PROMENADE BOL LED WHI/GRN 325MM MPL ANT	–	–	8	96231683
PROMENADE BOL LED WHI/BLU 325MM MPL ANT	–	–	8	96231682
Bollard flange mounted				
PROMENADE BOL LED WHI/AMB 1150MM MPL ANT	–	–	15	96250884
PROMENADE BOL LED WHI/RED 1150MM MPL ANT	–	–	15	96250885
PROMENADE BOL LED WHI/GRN 1150MM MPL ANT	–	–	15	96250886
PROMENADE BOL LED WHI/BLU 1150MM MPL ANT	–	–	15	96250887
Other lamp types, Parapet mounted				
PROMENADE BOL 42W TC-TEL 325MM MPL ANT	FSM	GX24q-4	8	96100262
Other lamp types, Bollard flange mounted				
PROMENADE BOL 70W HSE-I 1150MM MPL ANT	SE/I	E27	15	96100249
PROMENADE BOL 42W TC-TEL HF 1150MM MPL ANT	FSM	GX24q-4	15	96004371
PROMENADE BOL 80W HME 1150MM MPL ANT	QE	E27	15	96004372
Root mounted attachment				
V/PROM/MAD BOL GROUND SPIKE	–	–	8	96005367

Project Example:
Promenade LED only
Pathway for pedestrians
Pathway width: 1.5m
bollard installed at 15cm from the pathway
Single sided
Spacing 10m
Emin: 0.6 lx Eav: 2.2 lx
Emin/Eav: 0.25
Lighting class: S6 according to EN13201



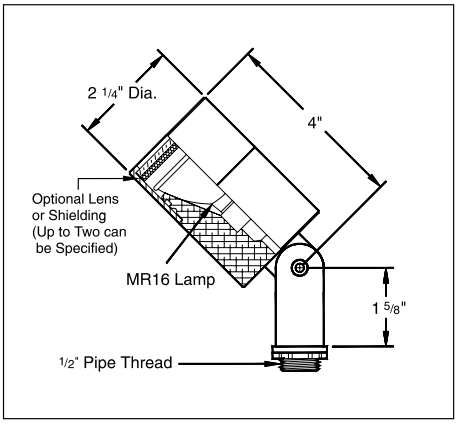
Nite Star™

Nite Star™ is a fully machined aluminum MR16 lighting instrument. The Nite Star is fully enclosed and waterproof because of its unique sleeved design. Nite Star is finished in a durable, luxurious, polyester powder coating. All hardware is stainless steel. The Nite Star, along with the wide choice of MR16 lamps and optical accessories, gives the lighting designer an economical, yet highly architectural lighting fixture for the most discriminating designs.

Features

- Tamper proof design.
- Raintight optical compartment.
- Enclosed wireway mounting knuckle.
- Clear, tempered glass lens, factory sealed.
- Machined aluminum construction with stainless steel hardware.
- cULus & cULus Listed with MR16 lamps to 50 watts.
- For use with remote transformers, see pages 92, 94, and 97.

Available in Brass, see page 90.



CATALOG NUMBER LOGIC

Example: NS - 9 - SAP - 9 - 11

Series

Lamp Type

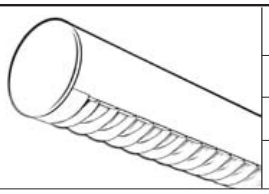
0 - By others	16 - EYS(42W), 25° N. Flood
1 - ESX(20W), 12° Spot	17 - EYP(42W), 40° Flood
2 - BAB(20W), 40° Flood	6 - EXT(50W), 13° Spot
3 - FRB(35W), 12° Spot	7 - EXZ(50W), 26° N. Flood
4 - FRA(35W), 23° N. Flood	8 - EXN(50W), 40° Flood
5 - FMW(35W), 40° Flood	9 - FNV(50W), 60° W. Flood
15 - EYR(42W), 12° Spot	

Finish

Powder Coat Color	Satin	Wrinkle
Bronze	BZP	BZW
Black	BLP	BLW
White(Gloss)	WHP	WHW
Aluminum	SAP	——
Verde	——	VER

Lens Type
9 - Clear (Standard), 10 - Spread, 12 - Soft Focus, 13 - Rectilinear

Shielding
11 - Honeycomb Baffle



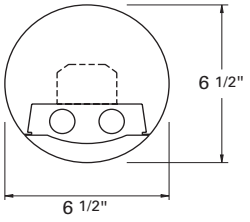
Suspended
2T8
Direct
8661T20 A or C

High performance optical system designed to accommodate a variety of T8 lamping options.
Extruded aluminum housing available in Suspended and Wall Mount versions
Three lighting distributions to choose from: Direct/Indirect, Direct, or Indirect.
Modular components allow for creative pattern and space frame design.
Factory pre-wired with quick-connect plugs for fast, easy installation.

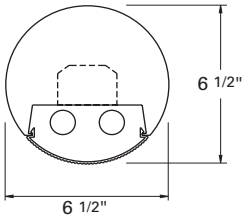
Order Number Guide

866	1	T20	___	E	___ ___	___	___	E	___
Series TLS 6.5"	*Type* Direct	*Lamps* 2 T8 - 2 Down	*Lower Optics* **A** - Curved Acrylic Lens **C** - Curved Baffle	*Upper Optics* **E** - None	*Length* **04** - 4ft 2in **08** - 8ft 2in **12** - 12ft 2in	*Wiring Options* **1** - 1cct **2** - 2cct **3** - 1cct w/ Emergency cct **4** - 2cct w/ Emergency cct **5** - 1cct w/ Battery Pack **6** - 2cct w/ Battery Pack **7** - 1cct w/ Dimming* **8** - 1cct w/ Thru Wire **9** - 2cct w/ Thru Wire	*Voltage* **1** - 120V **2** - 277V **3** - 347V* **X** - Custom * Consult factory for availability	*Ballast* Electronic	*Finish* **W** - Standard White **C** - Factory Color* **X** - Custom Color *See factory color chart

Cross Section



Curved Baffle

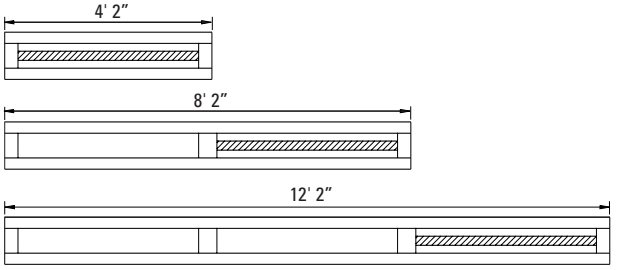


Curved Acrylic

Weight 4.4 lb/ft

Modules

Linear runs are made by combining 4ft, 8ft and 12ft modules

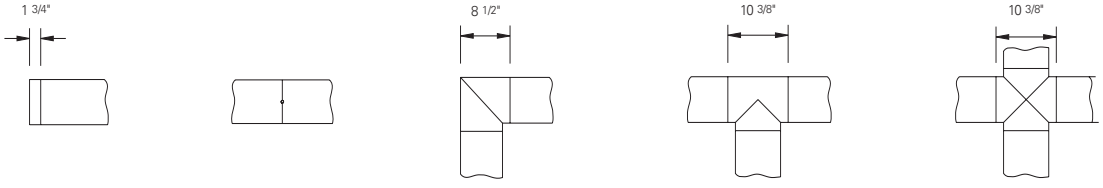


Indicates location of:
- Optional emergency modules (controls all lamps) OR
- Optional battery pack (standard controls one lamp only)

Indicates:
- Module length / Mounting distance

*Module length does not include endcaps

Ends / Intersections



ENDCAP
8661EBN__

INLINE JOINT
8661JNN_N

"L" INTERSECTION
8661MLL__

"T" INTERSECTION
8661MLT__

"X" INTERSECTION
8661MLX__

L0016 Rev. 5

 Phone: 604-888-6811 **Toll Free Fax:** 1-800-665-LEDA (5332) **Fax:** 604-888-2003 **Email:** info@ledalite.com **www.**ledalite.com

Ledalite

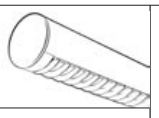
Ustudio

Williams College
'62 Center For Theatre & Dance

Williamstown, MA

TYPE: D-14
AUTH: DMM
DATE: 04/12/07

Suspended	2 T8	Direct	8661T20 A or C



Specifications

Housing
6063 T5 extruded aluminum.

Optical System
Constructed of highly reflective 24 gauge metal. Louvers are semi-specular 13/16" deep and 2" on center.

Endcaps
Aluminum endcaps.

Joints & Intersections
All joints shall be accomplished using QuickLock™ joining system. Optional intersections, in "L" "T" or "X" configurations, shall be mitered aluminum extrusion.

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 shall be factory pre-wired to section ends with quick-connect plugs.

Ballast
Electronic.

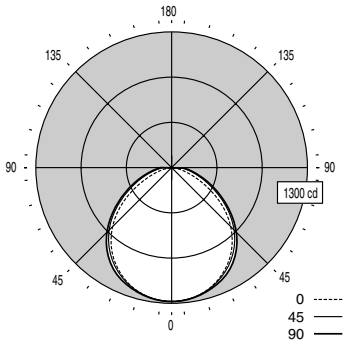
Approvals:
Certified to UL & CSA standards.

Finish
High-quality powder coat, factory applied to meet AAMA 2603-98. Available in Ledalite Standard White (textured matte finish), a selection of optional factory colors (see factory color chart), or custom colors. Consult factory for details.

Due to continuing product improvements, Ledalite reserves the right to change specifications without notice.

Photometry

Optical Setting AE:
Curved Acrylic Lens



Report# 2101084
Efficiency 61.0%

CANDELA DISTRIBUTION

Vert. Angle	Horizontal Angle 0	22.5	45	67.5	90	Zonal Lumens
0	1282	1282	1282	1282	1282	
5	1276	1274	1276	1276	1278	122
15	1230	1225	1230	1230	1238	347
25	1134	1127	1146	1153	1168	528
35	993	985	1017	1035	1051	635
45	800	795	845	858	874	642
55	557	562	628	639	655	544
65	298	332	406	418	437	380
75	115	161	235	247	260	223
85	17	63	119	132	144	111
90	0	35	81	96	107	
95	0	0	0	0	0	0
105	0	0	0	0	0	0
115	0	0	0	0	0	0
125	0	0	0	0	0	0
135	0	0	0	0	0	0
145	0	0	0	0	0	0
155	0	0	0	0	0	0
165	0	0	0	0	0	0
175	0	0	0	0	0	0
180	0	0	0	0	0	

COEFFICIENTS OF UTILIZATION (%)

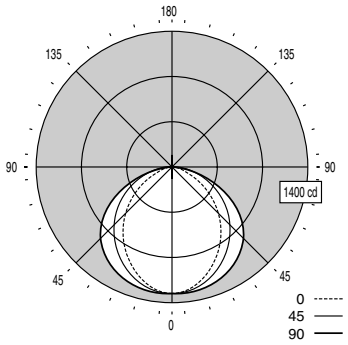
Ceiling	80				70			50			0
Wall	70	50	30	10	70	50	30	50	30	10	0
RCR											
0	72	72	72	72	70	70	70	67	67	67	60
1	66	63	60	58	64	61	59	59	57	55	50
2	60	55	51	47	58	54	50	51	48	45	42
3	55	48	43	39	53	47	43	45	41	38	36
4	50	43	37	33	49	42	37	40	36	33	30
5	46	38	33	29	45	38	32	36	32	28	26
6	42	34	29	25	41	34	29	33	28	25	23
7	39	31	26	22	38	31	26	30	25	22	20
8	37	28	23	20	36	28	23	27	23	20	18
9	34	26	21	18	33	26	21	25	21	18	16
10	32	24	19	16	31	24	19	23	19	16	15

Based on a floor reflectance of 0.2

AVERAGE LUMINANCE (cd/m²)

Vert. angle	Horizontal angle 0	45	90
55	7256	6532	6288
65	5269	5205	5030
75	3320	4088	3883
85	1457	3378	3200

Optical Setting CE:
Curved Baffle



Report# 2101085
Efficiency 62.5%

CANDELA DISTRIBUTION

Vert. Angle	Horizontal Angle 0	22.5	45	67.5	90	Zonal Lumens
0	1305	1305	1305	1305	1305	
5	1292	1291	1299	1304	1307	126
15	1200	1205	1244	1273	1293	351
25	1052	1071	1140	1202	1245	526
35	878	908	1004	1099	1164	631
45	676	717	843	961	1042	652
55	458	510	664	775	850	581
65	245	306	465	537	584	427
75	108	143	274	282	299	241
85	32	55	115	86	52	88
90	0	31	74	57	6	
95	0	0	0	0	0	0
105	0	0	0	0	0	0
115	0	0	0	0	0	0
125	0	0	0	0	0	0
135	0	0	0	0	0	0
145	0	0	0	0	0	0
155	0	0	0	0	0	0
165	0	0	0	0	0	0
175	0	0	0	0	0	0
180	0	0	0	0	0	

COEFFICIENTS OF UTILIZATION (%)

Ceiling	80				70			50			0
Wall	70	50	30	10	70	50	30	50	30	10	0
RCR											
0	74	74	74	74	72	72	72	69	69	69	62
1	67	64	62	59	66	63	61	60	58	56	52
2	61	56	52	48	60	55	51	53	49	47	43
3	56	49	44	40	54	48	43	46	42	39	36
4	51	44	38	34	50	43	38	41	37	33	31
5	47	39	33	29	46	38	33	37	32	29	27
6	43	35	29	25	42	34	29	33	29	25	23
7	40	32	26	22	39	31	26	30	25	22	20
8	37	29	24	20	36	28	23	28	23	20	18
9	35	26	21	18	34	26	21	25	21	18	16
10	33	24	19	16	32	24	19	23	19	16	15

Based on a floor reflectance of 0.2

AVERAGE LUMINANCE (cd/m²)

Vert. angle	Horizontal angle 0	45	90
55	5967	6907	8160
65	4332	5962	6722
75	3118	4766	4466
85	2743	3264	1156

Note : IES photometric files available for download at www.ledalite.com

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Ledalite

Studio

Williams College
'62 Center For Theatre & Dance

Williamstown, MA

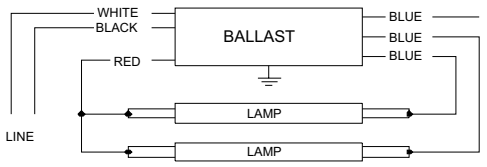
TYPE: D-14
AUTH: DMM
DATE: 04/12/07

VOP-3P32-SC	
Brand Name	OPTANIUM
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Parallel
Input Voltage	277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F32T8	1	32	0/-18	0.14	37	1.08	20	0.94	1.7	2.92
* F32T8	2	32	0/-18	0.23	62	0.94	10	0.98	1.7	1.52
F32T8	3	32	0/-18	0.30	82	0.88	10	0.99	1.7	1.07

Wiring Diagram



Diag. 70

Insulate unused blue lead for 1000V

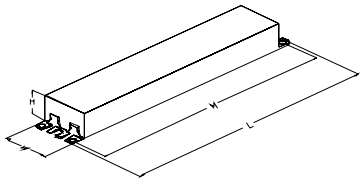
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	25L	63.5
White	25L	63.5
Blue	31R	78.7
Red	37L	94
Yellow	0	0
Gray	0	0
Violet	0	0

	in.	cm.
Yellow/Blue	0	0
Blue/White	0	0
Brown	0	0
Orange	0	0
Orange/Black	0	0
Black/White	0	0
Red/White	0	0

Enclosure



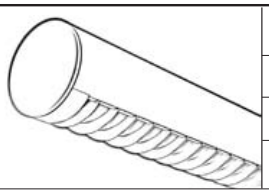
Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.7 "	1.18 "	8.90 "
9 1/2	1 7/10	1 9/50	8 9/10
24.1 cm	4.3 cm	3 cm	22.6 cm

Revised 06/09/2003

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

ADVANCE
O'HARE INTERNATIONAL CENTER · 10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Customer Support/Technical Service: Phone: 800-372-3331 · Fax: 630-307-3071
Corporate Offices: Phone: 800-322-2086



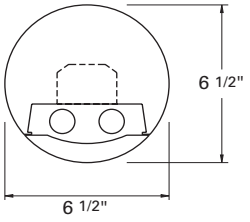
Suspended
2T8
Direct
8661T20 A or C

High performance optical system designed to accommodate a variety of T8 lamping options.
Extruded aluminum housing available in Suspended and Wall Mount versions
Three lighting distributions to choose from: Direct/Indirect, Direct, or Indirect.
Modular components allow for creative pattern and space frame design.
Factory pre-wired with quick-connect plugs for fast, easy installation.

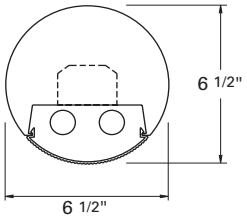
Order Number Guide

866	1	T20	___	E	___ ___	___	___	E	___
Series TLS 6.5"	*Type* Direct	*Lamps* 2 T8 - 2 Down	*Lower Optics* **A** - Curved Acrylic Lens **C** - Curved Baffle	*Upper Optics* **E** - None	*Length* **04** - 4ft 2in **08** - 8ft 2in **12** - 12ft 2in	*Wiring Options* **1** - 1cct **2** - 2cct **3** - 1cct w/ Emergency cct **4** - 2cct w/ Emergency cct **5** - 1cct w/ Battery Pack **6** - 2cct w/ Battery Pack **7** - 1cct w/ Dimming* **8** - 1cct w/ Thru Wire **9** - 2cct w/ Thru Wire	*Voltage* **1** - 120V **2** - 277V **3** - 347V* **X** - Custom * Consult factory for availability	*Ballast* Electronic	*Finish* **W** - Standard White **C** - Factory Color* **X** - Custom Color *See factory color chart

Cross Section



Curved Baffle

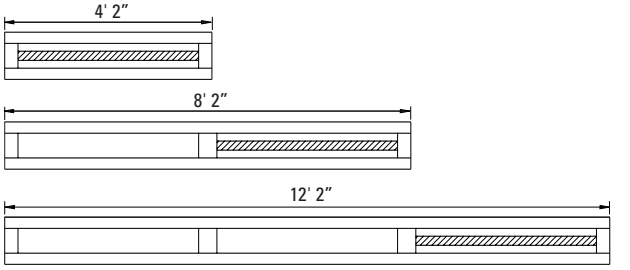


Curved Acrylic

Weight 4.4 lb/ft

Modules

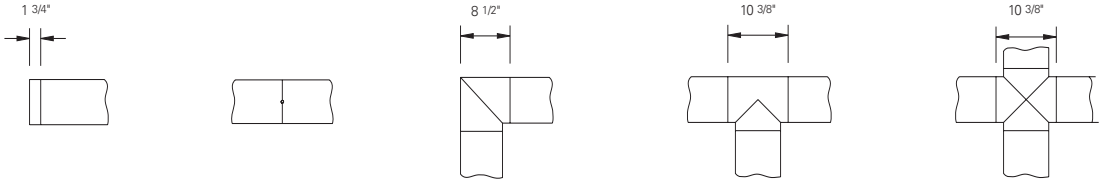
Linear runs are made by combining 4ft, 8ft and 12ft modules



Indicates location of:
- Optional emergency modules (controls all lamps) OR
- Optional battery pack (standard controls one lamp only)

Indicates:
- Module length / Mounting distance
*Module length does not include endcaps

Ends / Intersections



ENDCAP
8661EBN__

INLINE JOINT
8661JNN_N

"L" INTERSECTION
8661MLL__

"T" INTERSECTION
8661MLT__

"X" INTERSECTION
8661MLX__

L0016 Rev. 5

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Ledalite

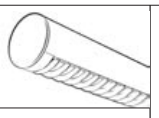
Ustudio

Williams College
'62 Center For Theatre & Dance

Williamstown, MA

TYPE: D-14A
AUTH: DMM
DATE: 04/12/07

Suspended	2 T8	Direct	8661T20 A or C



Specifications

Housing
6063 T5 extruded aluminum.

Optical System
Constructed of highly reflective 24 gauge metal. Louvers are semi-specular 13/16" deep and 2" on center.

Endcaps
Aluminum endcaps.

Joints & Intersections
All joints shall be accomplished using QuickLock™ joining system. Optional intersections, in "L" "T" or "X" configurations, shall be mitered aluminum extrusion.

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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.

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All luminaires shall be factory pre-wired to section ends with quick-connect plugs.

Ballast
Electronic.

Approvals:
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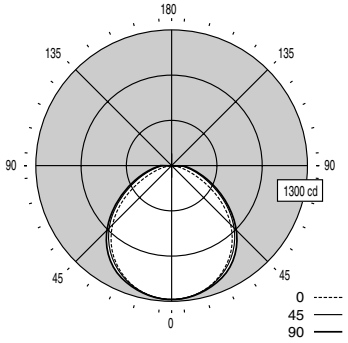
Finish
High-quality powder coat, factory applied to meet AAMA 2603-98. Available in Ledalite Standard White (textured matte finish), a selection of optional factory colors (see factory color chart), or custom colors. Consult factory for details.

Due to continuing product improvements, Ledalite reserves the right to change specifications without notice.

Photometry

Optical Setting AE:
Curved Acrylic Lens



Report# 2101084
Efficiency 61.0%

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Vert. Angle	Horizontal Angle 0	22.5	45	67.5	90	Zonal Lumens
0	1282	1282	1282	1282	1282	
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35	993	985	1017	1035	1051	635
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75	115	161	235	247	260	223
85	17	63	119	132	144	111
90	0	35	81	96	107	
95	0	0	0	0	0	0
105	0	0	0	0	0	0
115	0	0	0	0	0	0
125	0	0	0	0	0	0
135	0	0	0	0	0	0
145	0	0	0	0	0	0
155	0	0	0	0	0	0
165	0	0	0	0	0	0
175	0	0	0	0	0	0
180	0	0	0	0	0	

COEFFICIENTS OF UTILIZATION (%)

Ceiling	80				70			50			0
Wall	70	50	30	10	70	50	30	50	30	10	0
RCR											
0	72	72	72	72	70	70	70	67	67	67	60
1	66	63	60	58	64	61	59	59	57	55	50
2	60	55	51	47	58	54	50	51	48	45	42
3	55	48	43	39	53	47	43	45	41	38	36
4	50	43	37	33	49	42	37	40	36	33	30
5	46	38	33	29	45	38	32	36	32	28	26
6	42	34	29	25	41	34	29	33	28	25	23
7	39	31	26	22	38	31	26	30	25	22	20
8	37	28	23	20	36	28	23	27	23	20	18
9	34	26	21	18	33	26	21	25	21	18	16
10	32	24	19	16	31	24	19	23	19	16	15

Based on a floor reflectance of 0.2

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65	5269	5205	5030
75	3320	4088	3883
85	1457	3378	3200

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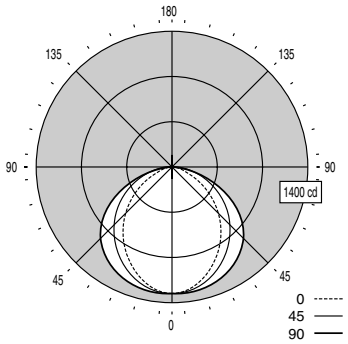
Curved Baffle



Report# 2101085
Efficiency 62.5%

CANDELA DISTRIBUTION

Vert. Angle	Horizontal Angle 0	22.5	45	67.5	90	Zonal Lumens
0	1305	1305	1305	1305	1305	
5	1292	1291	1299	1304	1307	126
15	1200	1205	1244	1273	1293	351
25	1052	1071	1140	1202	1245	526
35	878	908	1004	1099	1164	631
45	676	717	843	961	1042	652
55	458	510	664	775	850	581
65	245	306	465	537	584	427
75	108	143	274	282	299	241
85	32	55	115	86	52	88
90	0	31	74	57	6	
95	0	0	0	0	0	0
105	0	0	0	0	0	0
115	0	0	0	0	0	0
125	0	0	0	0	0	0
135	0	0	0	0	0	0
145	0	0	0	0	0	0
155	0	0	0	0	0	0
165	0	0	0	0	0	0
175	0	0	0	0	0	0
180	0	0	0	0	0	

COEFFICIENTS OF UTILIZATION (%)

Ceiling	80				70			50			0
Wall	70	50	30	10	70	50	30	50	30	10	0
RCR											
0	74	74	74	74	72	72	72	69	69	69	62
1	67	64	62	59	66	63	61	60	58	56	52
2	61	56	52	48	60	55	51	53	49	47	43
3	56	49	44	40	54	48	43	46	42	39	36
4	51	44	38	34	50	43	38	41	37	33	31
5	47	39	33	29	46	38	33	37	32	29	27
6	43	35	29	25	42	34	29	33	29	25	23
7	40	32	26	22	39	31	26	30	25	22	20
8	37	29	24	20	36	28	23	28	23	20	18
9	35	26	21	18	34	26	21	25	21	18	16
10	33	24	19	16	32	24	19	23	19	16	15

Based on a floor reflectance of 0.2

AVERAGE LUMINANCE (cd/m²)

Vert. angle	Horizontal angle 0	45	90
55	5967	6907	8160
65	4332	5962	6722
75	3118	4766	4466
85	2743	3264	1156

Note : IES photometric files available for download at www.ledalite.com

 Phone: 604-888-6811 **Toll Free Fax:** 1-800-665-LEDA (5332) **Fax:** 604-888-2003 **Email:** info@ledalite.com **www.**ledalite.com

Ledalite

Studio

Williams College
'62 Center For Theatre & Dance

Williamstown, MA

TYPE: D-14A

AUTH: DMM

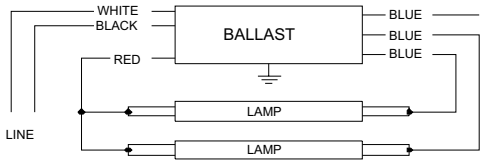
DATE: 04/12/07

VOP-3P32-SC	
Brand Name	OPTANIUM
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Parallel
Input Voltage	277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F32T8	1	32	0/-18	0.14	37	1.08	20	0.94	1.7	2.92
* F32T8	2	32	0/-18	0.23	62	0.94	10	0.98	1.7	1.52
F32T8	3	32	0/-18	0.30	82	0.88	10	0.99	1.7	1.07

Wiring Diagram



Diag. 70

Insulate unused blue lead for 1000V

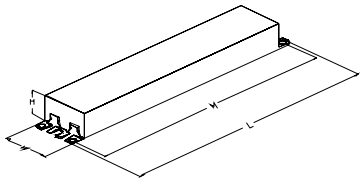
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	25L	63.5
White	25L	63.5
Blue	31R	78.7
Red	37L	94
Yellow	0	0
Gray	0	0
Violet	0	0

	in.	cm.
Yellow/Blue	0	0
Blue/White	0	0
Brown	0	0
Orange	0	0
Orange/Black	0	0
Black/White	0	0
Red/White	0	0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.7 "	1.18 "	8.90 "
9 1/2	1 7/10	1 9/50	8 9/10
24.1 cm	4.3 cm	3 cm	22.6 cm

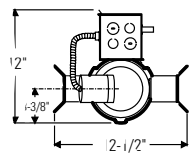
Revised 06/09/2003

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

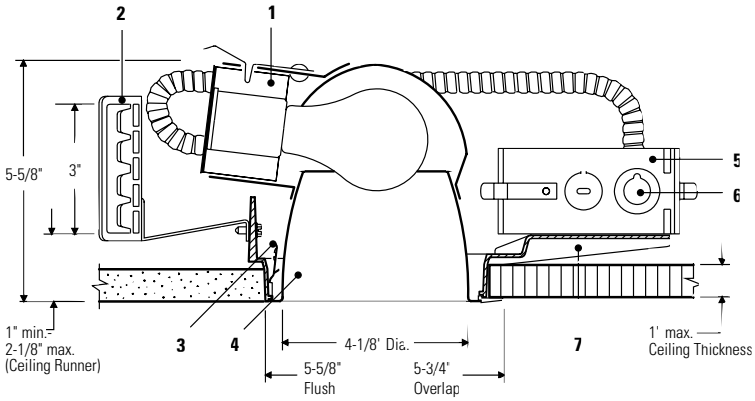
ADVANCE
O'HARE INTERNATIONAL CENTER · 10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Customer Support/Technical Service: Phone: 800-372-3331 · Fax: 630-307-3071
Corporate Offices: Phone: 800-322-2086

Calculite® Incandescent Open Downlight **G7057**

4 1/2" Aperture A19 Lamp Horizontal



Top View



Flush Trim
(Molded trim ring removed)

Molded
Trim Ring

Overlap Self-Flange
Matte White or Polished

Ceiling Cutout: 5 1/16" Dia.

Reflector Trims	
G7057CLW	Specular Clear finish with white flange
G7057CLP	Specular Clear finish with polished flange
G7057CL	Specular Clear finish with molded trim ring (flangeless)
G7057 ☐	Add suffix for other finishes (see options)

Frame-In Kit	Lamp
G410	A19, 100W max.

Remodeler	Lamp
G410RM	Same as G410

Features

1. **Socket Cup:** Heat-dissipating die-formed aluminum contains medium base porcelain socket with nickel plated screw shell wired with No. 18 SF1 leads to J-Box. Installs on reflector with positive position locking springs to assure proper optical alignment of lamp to reflector—attached without tools.
2. **Mounting Brackets:** Adjust vertically from inside of fixture. Durable 16 ga. steel construction. Use with standard 3/4" or 1 1/2" lathing channels (by others), or Lightolier accessory mounting bars.
3. **Retaining Springs:** Precision-tooled springs secure reflector to mounting frame for quick tool-less installation.
4. **Reflector:** 16 ga. Specular Alzak® aluminum, 50° visual cut-off to lamp and lamp image. Available with white or polished flange, or with removable white molded trim ring (field paintable).
5. **Junction Box:** 14 ga. steel, 4" x 4" x 2" box allows inspection from below.
6. **Thermal Protector:** Meets NEC and UL requirements. Insulation must be kept 3" away from fixture sides and wiring compartments and must not be placed above fixture in a manner which will entrap heat.
7. **Mounting Frame:** Die-cast aluminum suitable for dry or plaster ceilings. Provides flangeless trim in plaster ceiling.

Other Reflector Finish Options

Comfort Clear Diffuse	**CCD**
Specular Gold	**GD**
White	**WH**

Flange Options

White	**W**
Polished Flange	**P**
Flangeless	Leave Blank (molded trim ring)

Options & Accessories

18" Mounting Bars	**1950** (set of 2)
27" Mounting Bars	**1951** (set of 2)
T-Bar Anchor Clips	**1956** (set of 4, for 1950 & 1951 bars)
Existing Ceiling Clips	**7998** (set of 2)
Sloped Ceiling Adapters	See SCA specification sheet
Step Down Transformer	**7997** (see separate specification sheet)
Chicago Air Plenum	**LC** (add suffix to Frame-in Kit, requires access from above ceiling)

Electrical

UL Listed for maximum of 8 No. 12, 75°C through branch circuit supply conductors, or 60°C conductors for end of run.

Labels

UL Listed for damp locations, I.B.E.W.

Alzak® is a registered trademark of ALCOA.

Job Information **Type:**

Job Name:

Cat. No.:

Lamp(s):

Notes:

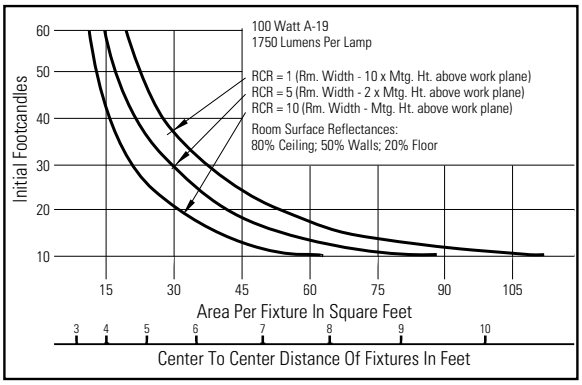
Lightolier a Genlyte Thomas Company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: HL-1
AUTH: DMM
DATE: 04/12/07

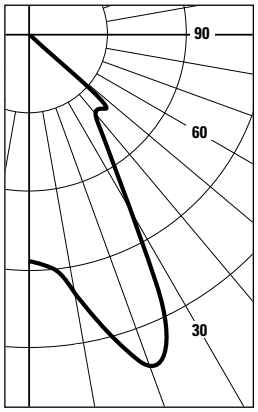


Use quick calculator chart to determine spacing of luminaires for desired level of illumination.

Conversion Factor: 100W A19 (gold): F.C. x 0.90

Spacing Ratio= 1.1

ITL REPORT NO. 31338
DATE 9-27-85



Lamp: 100 Watt A19
Efficiency: 58.5%

Candlepower Summary

DEG	CP	ZONAL FLUX
0	559	13
5	575	43
10	641	83
15	769	135
20	852	177
25	775	165
30	507	114
35	307	89
40	245	91
45	259	95
50	120	9
55	6	1
60	2	0
65	2	1
70	0	0
75	2	1
80	1	1
85	0	1

ZONAL SUMMARY

ZONE	LUMENS	LAMP	FIXT
0- 30	617	35.4	60.6
0- 40	819	47.1	80.5
0- 60	1014	58.3	99.6
0- 90	1018	58.5	100.0
90- 180	0	0.0	0.0
0- 180	1018	58.5	100.0

Total Luminaire Efficiency = 58.5 %
CIE Type - Direct

Luminous Diameter: 4.500

Coefficients of Utilization

% Effective Ceiling Cavity Reflectance

	80			70			50			30			10			0
	% WALL REFLECTANCE															
Room Cavity Ratio	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.65	.63	.62	.64	.62	.61	.61	.60	.59	.59	.58	.58	.57	.56	.56	.55
2	.61	.59	.57	.60	.58	.56	.58	.56	.55	.56	.55	.54	.55	.54	.53	.52
3	.57	.54	.52	.56	.54	.52	.55	.53	.51	.53	.52	.50	.52	.51	.49	.48
4	.53	.50	.48	.53	.50	.48	.52	.49	.47	.50	.48	.47	.49	.48	.46	.45
5	.50	.47	.44	.50	.47	.44	.49	.46	.44	.48	.45	.43	.47	.45	.43	.42
6	.47	.44	.41	.47	.43	.41	.46	.43	.41	.45	.42	.41	.44	.42	.40	.39
7	.44	.40	.38	.43	.40	.38	.43	.40	.38	.42	.39	.38	.41	.39	.37	.36
8	.41	.37	.35	.41	.37	.35	.40	.37	.35	.39	.37	.35	.39	.36	.35	.34
9	.38	.35	.32	.38	.34	.32	.37	.34	.32	.37	.34	.32	.36	.34	.32	.31
10	.36	.32	.30	.35	.32	.30	.35	.32	.30	.34	.31	.30	.34	.31	.29	.29

20% Floor Cavity Reflectance

Conversion Factor: For 100W A19 units with gold reflector, multiply C.U.'s by 0.9.

Job Information **Type:**

Lightolier a Genlyte Thomas Company www.lightolier.com
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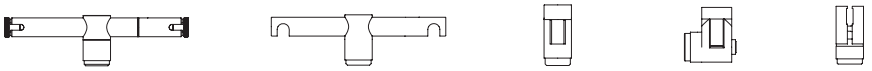
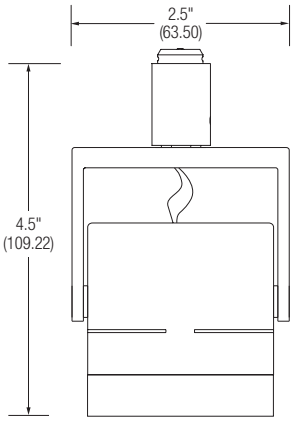
LIGHTOLIER®

Micro Spot D

System Options





( ) Denotes dimensions in millimeters

* Fixture terminates to track system or monopoint with Transjack connector. Fixtures ordered with system code include Transjack connector for that system. Order fixture with "NS" code when using a monopoint.

Ordering Information

MID - _____ - _____ - _____

Fixture	System	Overall Length	Finish
MID-Micro Spot D (Not Field Adjustable)	**CA4** - Cable 4" **CA6** - Cable 6" **TR4** - Twin Rail 4" **TR6** - Twin Rail 6" **BTC** - Basis Ceiling **BTW** - Basis Wall (Max.16") **LT** - Liana **NS** - No System Connector*	**ST** - Standard 4" **5"–72"** - Specify Length (When ordering non-standard overall length, use whole numbers only—no fractional inches.)	**AL** - Satin Aluminum **PN** - Polished Nickel **RB** - Rubbed Bronze (Rubbed Bronze is not available for Twin Rail)

Features

1. Description: Precision machined luminaire with integral single accessory holder and clear lens. Machined yoke with countersunk hardware.

2. System Options: Micro Spot D is available for Cable 4" & 6", Twin Rail 4" & 6", Basis Ceiling Mount, Basis Wall Mount, Liana and low voltage monopoints.

3. Lamping: MR16 Lamp 50w max.

4. Function: Rotates 360 degrees and pivots 180 degrees. Overall length is not field adjustable.

5. Electrical: Transjack connector contacts utilize 24kt gold plated brass pin and sleeve connector housed in aluminum.

Accessories

Filters, louvers, snoots, glass rings and double accessory holder.

Finishes

1. Satin Aluminum

2. Polished Nickel

3. Rubbed Bronze – finish is crafted with a solid brass substrate and buffed by hand to create an authentic rubbed bronze finish. Due to this hand-applied process, finish may vary.

Labels

UL and CUL Listed

Job Name: **Type:**

Cat. No.:

Lamp(s):

Notes:

Translite Sonoma **www.translitesonoma.com**
22678 Broadway Suite One : Sonoma, CA 95476
Toll free 888 999 4540 : Fax 707 996 6926
We reserve the right to change details of design, materials and finish.

Measuring Overall Length

Track System Fixtures

Overall length for a track system fixture is measured from the bottom of the track to the bottom of the fixture.

To calculate overall length, take the distance from the bottom of the fixture to the top of the Transjack connector* and add the system connector measurement for the selected system. Overall length differs according to the system connector selected.

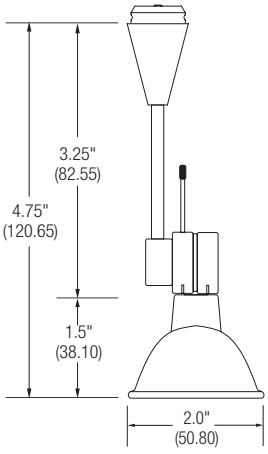
	Cable			
	Basis	Twin Rail	Liana	NS
System Connector Measurement	.38"	.63"	.94"	0"

Monopoints

Overall length for a monopoint fixture is measured from bottom of the monopoint to the bottom of the fixture. (The monopoint canopy is measured separately.)

This measurement is equivalent to the distance from the bottom of the fixture to the top of the Transjack connector.*

Rotor



( ) Denotes dimensions in millimeters

Track System Fixture Example

To calculate the overall length for the Rotor fixture on a Liana track system, add 4.75 to 0.94. Overall length for a standard Rotor on the Liana Track is 5.69". A Rotor specified at 10" would have an overall length of 10.94" on Liana.

Monopoint Fixture Example

Overall length for a standard Rotor on a monopoint is 4.75". A Rotor specified at 10" would have an overall length of 10" on a monopoint.

* In the drawing above, the distance from the bottom of the fixture to the top of the Transjack connector equals 4.75". This represents the standard (ST) length for this fixture. ST measurements in the product ordering tables are approximate for stem suspended fixtures and do not represent exact overall length. For exact ST measurements for stem suspended fixtures, reference the specification drawings.

TRANSLITE : SONOMA

Translite Sonoma **www.translitesonoma.com**
22678 Broadway Suite One : Sonoma, CA 95476
Toll free 888 999 4540 : Fax 707 996 6926
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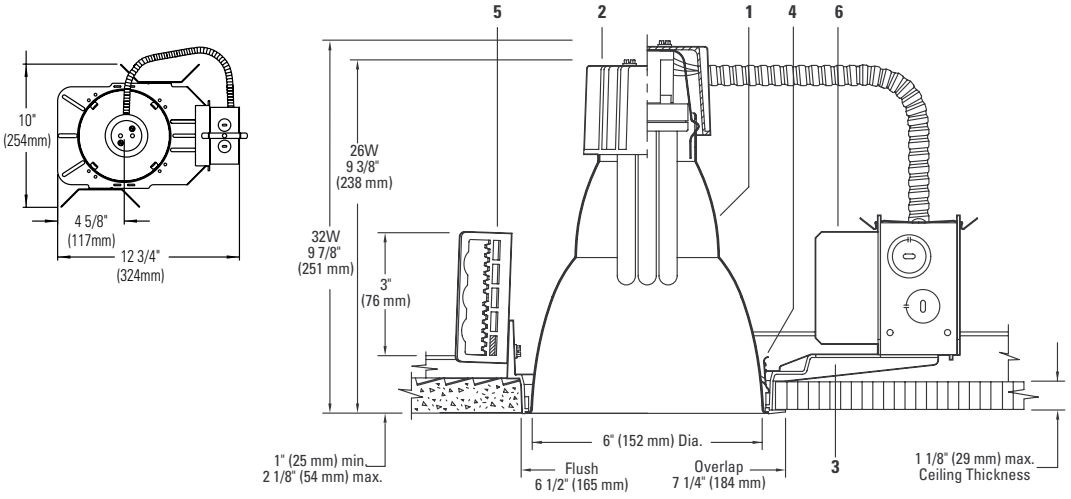
Calculite® Compact Fluorescent Open Downlighting **8021**

6" Aperture Triple Tube Vertical Lamp



Ceiling Cutout: 6 9/16" (167 mm) Dia.

Reflector Trim		Frame-In Kit			Lamp
8021 CCLW	Comfort Clear™, White Flange	**S6132BU**	Electronic	120V - 277V	**26 or 32W Triple Tube**
8021 CCLP	Comfort Clear™, Polished Flange	**S6132BCU3**	Universal Dimming	120V - 277V	4-Pin (Amalgam)
8021 CCL	Comfort Clear™, Molded Trim Ring	**S6132BJUM7**	Advance Mark7	120V - 277V	
8021 ☐	Add suffix. See options for other finishes.	**Remodeler Frame-In Kit**			**Lamp**
		6132BURM	Electronic	120V - 277V	**26 or 32W Triple Tube** 4-Pin (Amalgam)

Features

1. **Reflector:** 16 ga. Alzak® aluminum, 50° visual cutoff to lamp and lamp image, medium distribution. Comfort Clear™ low iridescence finish. Self-flanged or flangeless with molded white trim ring (field paintable).
2. **Socket Cup:** Effectively dissipates heat and positions lamp holder. Snaps onto reflector neck to assure consistently correct optical alignment without tools.
3. **Mounting Frame:** Galvanized steel for dry or plaster ceilings. Accepts other 6" Triple Tube reflectors (see S6132BU Spec Sheet).
4. **Retaining Springs:** Precision-tooled steel friction springs secure reflector to mounting frame for quick, tool-less installation.
5. **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.
6. **Ballast/J-Box:** Electronic 120V-277V. UL listed for through branch circuit wiring with max of (8) No. 12 AWG, 90°c supply conductors. Outboard mounted to reduce heat transfer and maintain lamp efficacy and life. Service from below without tools.

Electrical

Note: For ballast electrical data and latest lamp/ballast compatibility refer to **"Ballast"** specification sheet for complete electrical data.
S6132BU, S6132BCU: UL listed for through branch circuit wiring with max of (8) No. 12 AWG, 90° C supply conductors.
6132BURM: UL listed for No. 12 AWG, 90° C supply conductors.

Options and Accessories

Comfort Clear™ Finishes[1]		**Other Finishes**	
Diffuse	**CCD**	White	**WH**
Champagne Bronze	**CCZ**		
Pewter	**CPW**		

[1]Specify desired flange. **W** White, **P** Polished, Blank - Molded Ring

Other Dimming:

S6132BJ1MX	Advance MarkX, 120V	**S6132BJ1LD3**	Lutron Hi-lume®, 120V
S6132BJ2MX	Advance MarkX, 227V	**S6132BJ2LD3**	Lutron Hi-lume®, 227V

Options and Accessories (continued)

Emergency Ltg. Kit	**FA EM3E*** **FA EM4***
Fuse (Slow Blow)	Add suffix **F**
Existing/Thk. Ceiling	**FA EC6***
Emergency	Add suffix **EM***
Chicago Plenum	Use 6132BULC

*See Spec. Sheets: FAEM, FAEC

Mounting Bars & Accessories; see Specification Sheet MBA.
Sloped Ceiling Adapters; see Specification Sheet SCA.

IC Frame available; see **C6CFL32** Specification Sheet.

Labels

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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We reserve the right to change details of design, materials and finish.

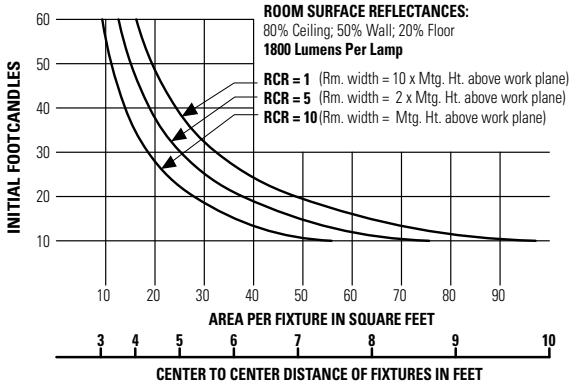
LIGHTOLIER®

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

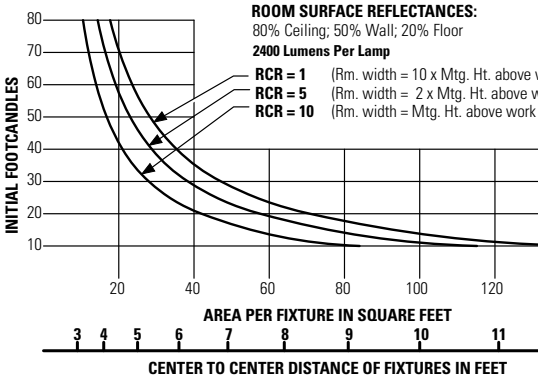
TYPE: HL-6
AUTH: DMM
DATE: 04/12/07

26W
Quick Calculator



This quick calculator chart determines the number and spacing of 1 lt.- 26W TTT units with Comfort Clear™ reflector, for any level of illumination.

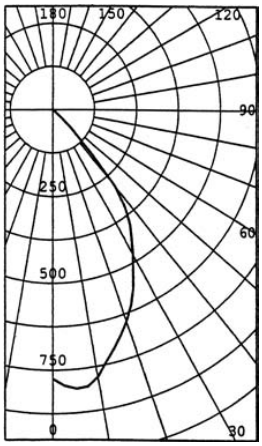
32W
Quick Calculator



This quick calculator chart determines the number and spacing of 1 lt.- 32W TTT un with Comfort Clear™ reflector, for any level of illumination

Spacing Ratio = 1.0

REPORT NO: LSI 14025
LIGHTOLIER RECESSED FLUORESCENT LUMINAIRE,
WITH COMFORT CLEAR™ REFLECTOR
ONE 26 WATT CPFL GE LAMP,
CAT# F26TBX/SPX35-835.
LUMEN RATING = 1800 LMS.



EFFICIENCY=48.1%
DATE: 4-23-99
CIE TYPE DIRECT
LUMINOUS DIAMETER: 6.000
THIS REPORT BASED ON LM-1 AND
OTHER PERTINENT IES PROCEDURES.

ZONAL SUMMARY

ANGLE	CP	LUMENS
0	775	
5	806	77
10	780	
15	708	199
20	646	
25	566	258
30	478	
35	402	245
40	285	
45	78	81
50	13	
55	4	4
60	2	
65	1	2
70	1	
75	1	1
80	0	
85	0	0

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	%LAMP	%LUMINAIRE
0-30	533	29.66	61.66
0-40	778	43.25	89.92
0-60	863	47.98	99.75
0-90	865	48.10	100.00
40-90	87	4.85	10.08
60-90	2	.12	.25
90-180	0	.00	.00
0-180	865	48.10	100.00

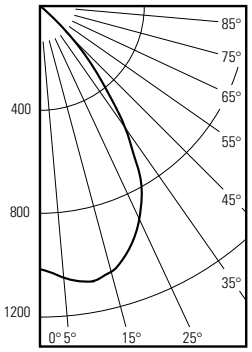
Coefficients of Utilization

EFFECTIVE FLOOR CAVITY REFLECTANCE = .20

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

Spacing Ratio = 1.1

REPORT PREPARED FOR: LIGHTOLIER 04-27-1999
REPORT NO: LRL 499-9G
LAMPS: 1 PLT-32 LUMENS: 2400
DESCRIP.: 6" DIA X 10" HT RECESSED DOWNLIGHT
WITH COMFORT CLEAR™ REFLECTOR. VERTICAL
LAMP.



EFFICIENCY=52.7%
DATE: 4-27-99
CIE TYPE DIRECT
LUMINOUS DIAMETER: 6.000
THIS REPORT BASED ON LM-1 AND
OTHER PERTINENT IES PROCEDURES.

ZONAL SUMMARY

ZONE	AVG* ZONAL	
DEG.	C.P.	LUMENS
180	0	
175	0	0
165	0	0
155	0	0
145	0	0
135	0	0
125	0	0
115	0	0
105	0	0
95	0	0
90	0	0
85	1	1
75	1	1
65	3	3
55	9	8
45	99	77
35	563	354
25	904	418
15	1063	301
5	1066	102
0	1035	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0–30	821	34.2	64.9
0–40	1175	49.0	92.9
0–60	1260	52.5	99.6
0–90	1265	52.7	100.0
40–90	90	3.8	7.1
60–90	5	0.2	0.4
90–120	0	0.0	0.0
90–150	0	0.0	0.0
90–180	0	0.0	0.0
0–180	1265	52.7	100.0

Coefficients of Utilization

EFFECTIVE FLOOR CAVITY REFLECTANCE = .20

	80			70			50			30			10			
	WALL OF REFLECTANCE															
ROOM CAVITY RATIO	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.59	.58	.57	.58	.57	.56	.56	.55	.54	.54	.53	.53	.52	.52	.51	.50
2	.56	.54	.53	.55	.54	.52	.54	.52	.51	.52	.51	.50	.51	.50	.49	.48
3	.53	.51	.50	.53	.51	.49	.51	.50	.49	.50	.49	.48	.49	.48	.47	.46
4	.51	.48	.47	.50	.48	.46	.49	.47	.46	.48	.46	.45	.47	.46	.45	.44
5	.48	.46	.44	.48	.45	.44	.47	.45	.43	.46	.44	.43	.45	.44	.43	.42
6	.46	.43	.42	.46	.43	.41	.45	.43	.41	.44	.42	.41	.44	.42	.41	.40
7	.44	.41	.39	.43	.41	.39	.43	.41	.39	.42	.40	.39	.42	.40	.39	.38
8	.41	.39	.37	.41	.39	.37	.41	.38	.37	.40	.38	.37	.40	.38	.36	.36
9	.39	.36	.35	.39	.36	.35	.38	.36	.35	.38	.36	.34	.38	.36	.34	.34
10	.35	.32	.31	.35	.32	.31	.35	.32	.30	.34	.32	.30	.34	.32	.30	.30

Job Information | Type:

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We reserve the right to change details of design, materials and finish.

LIGHTOLIER®

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE
WILLIAMSTOWN, MA

TYPE: HL-6
AUTH: DMM
DATE: 04/12/07

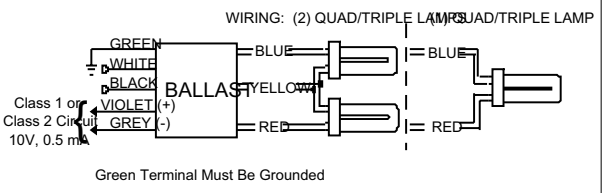
IZT-2S26-M5-LD@277

Brand Name	MARK 7 0-10V
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts) (min/max)	Ballast Factor (min/max)	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
* CFTR26W/GX24Q	1	26	50/10	0.10	08/28	0.03/1.00	10	0.99	1.6	3.57
CFTR26W/GX24Q	2	26	50/10	0.18	13/49	0.03/1.00	10	0.99	1.6	2.04

Wiring Diagram



Diag. 166

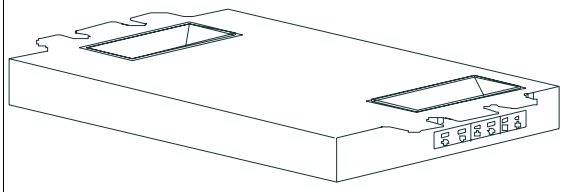
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow	0	0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White		0
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
4.98 "	3.00 "	1.18 "	4.60 "
4 49/50	3	1 9/50	4 3/5
12.6 cm	7.6 cm	3 cm	11.7 cm

Revised 02/13/2004

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

ADVANCE
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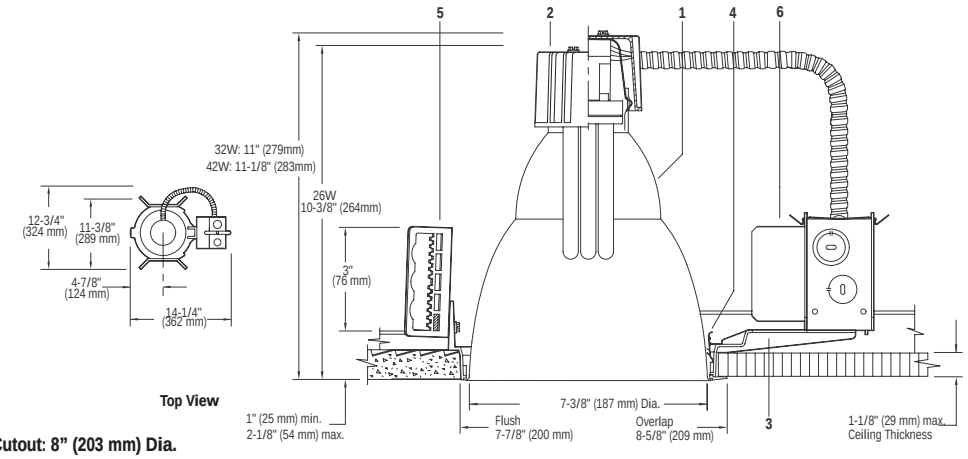
Corporate Offices: Phone: 800-322-2086

Calculite® Compact Fluorescent Open Downlight **8022**

7 3/8" Aperture Triple Tube Vertical Lamp



Ceiling Cutout: 8" (203 mm) Dia.

Reflector Trim

8022 CCLW	Comfort Clear™, White Flange
8022 CCLP	Comfort Clear™, Polished Flange
8022 CCL	Comfort Clear™, Molded Trim Ring
8022 ☐	Add suffix. See options for other finishes.

Frame-In Kit

			Lamp
7132BU	Electronic	120V - 277V	**26 or 32W Triple Tube**
7132BCU3	PowerSpec® Dimming	120V - 277V	
Note:	Add **S** for Steel frame: ex. **S7142BU-** Steel Frame Without **S**- Die Cast: ex. **7142BU -** Die Cast		
S7142BU	Electronic	120V - 277V	**42W Triple Tube**
S7142BCU3	PowerSpec® Dimming	120V - 277V	
S7142BUEM	Electronic Emergency	120V - 277V	

Remodeler Frame-In Kit

			Lamp
7142BURM	Electronic	120V - 277V	**26/32/42W Triple Tube**

Features

1. **Reflector:**16 ga. Alzak® aluminum, 50° visual cutoff to lamp and lamp image, medium distribution. Comfort Clear™ low iridescence finish. Self-flanged or flangeless with molded white trim ring (field paintable).
2. **Socket Cup:** Effectively dissipates heat and positions lamp holder. Snaps onto reflector neck to assure consistently correct optical alignment without tools.
3. **Mounting Frame:** Galvanized steel for dry or plaster ceilings. Accepts other 6" Triple Tube reflectors (see S6132BU Spec Sheet).
4. **Retaining Springs:** Precision-tooled steel friction springs secure reflector to mounting frame for quick, tool-less installation.
5. **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.
6. **Ballast/J-Box:** Electronic 120V-277V. UL listed for through branch circuit wiring with max of (8) No. 12 AWG, 90°c supply conductors. Outboard mounted to reduce heat transfer and maintain lamp efficacy and life. Service from below without tools.

Electrical

Note: Note: For ballast electrical data and latest lamp/ballast compatibility refer to "Ballast" specification sheet for complete electrical data.
S7142BU, **S7142BCU3**: UL_listed for through branch circuit wiring with maxof (8) No. 12 AWG, 90° C supply conductors.
7142BURM: UL_listed for No. 12 AWG, 90° C supply conductors.

Options and Accessories

Comfort Clear™ Finishes[1]		**Other Finishes**	
Diffuse	**CCD**	White	**WH**
Champagne Bronze	**CCZ**		

[1]Specify desired flange. **W** White, **P** Polished, Blank - Molded Ring

Other Dimming:

SJ1MX Advance MarkX, 120V	**S7142BJ1LD3** Lutron Hi-lume®, 120V
SJ2MX Advance MarkX, 277V	**S7142BJ2LD3** Lutron Hi-lume®, 277V

Options and Accessories (continued)

Emergency Ltg. Kit	**FA EM3E***
	FA EM4*
Fuse (Slow Blow)	Add suffix **F**
Existing/Thk. Ceiling	**Plaster Trim Ring CA7FL**
Emergency	Add suffix **EM***
Chicago Plenum	Use 7142, BULC

*See Spec. Sheets: FAEM, FAEC

Mounting Bars & Accessories; see Specification Sheet MBA.
Sloped Ceiling Adapters; see Specification Sheet SCA.

Labels

UL Listed for Damp Locations
Alzak® is a registered trademark of ALCOA

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

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LIGHTOLIER®

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WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

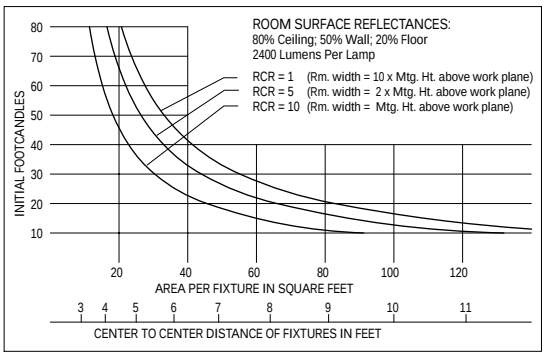
WILLIAMSTOWN, MA

TYPE: HL-8
AUTH: DMM
DATE: 04/12/07

Calculite® Compact Fluorescent Open Downlight 8022

7 3/8" Aperture Triple Tube Vertical Lamp

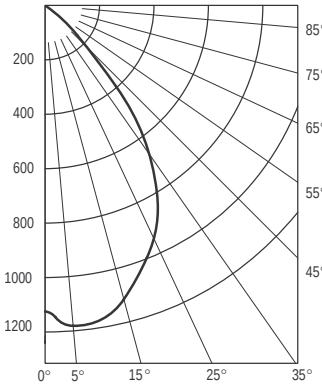
32W
Quick Calculator



This quick Calculator chart determines the number and spacing of 1 lt.-32W PL-T units with Comfort Clear™ reflector for any level of illumination. Conversion factor: 1 lt. 26W PL-T with Comfort Clear Clear™ reflector multiply, F.C. x 0.8.

Spacing Ratio = 1.1

REPORT PREPARED FOR: LIGHTOLIER
REPORT NO: LRL 499-9F2
REPORT BY: LIGHTING RESEARCH LABORATORY, INC.
DESCRIP: 7.5" DIA. RECESSED DOWNLIGHT WITH COMFORT CLEAR™
REFLECTOR LAMPS: 1PL-T 32W LUMENS=2400



Efficiency = 61.6%

CANDLEPOWER SUMMARY

ANGLE	AVERAGE CP	LUMENS
180	0	
175	0	0
165	0	0
155	0	0
145	0	0
135	0	0
125	0	0
115	0	0
105	0	0
95	0	0
85	1	1
75	2	2
65	3	3
55	11	10
45	226	175
35	678	426
25	933	432
15	1117	317
5	1179	113
0	1126	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	861	35.9	58.3
0-40	1287	53.6	87.1
0-60	1472	61.3	99.6
0-90	1478	61.6	100.0
40-90	191	8.0	12.9
60-90	6	0.3	0.4
90-120	0	0.0	0.0
90-150	0	0.0	0.0
90-180	0	0.0	0.0
0-180	1478	61.6	100.00

Coefficients Of Utilization

EFFECTIVE CEILING CAVITY REFLECTANCE

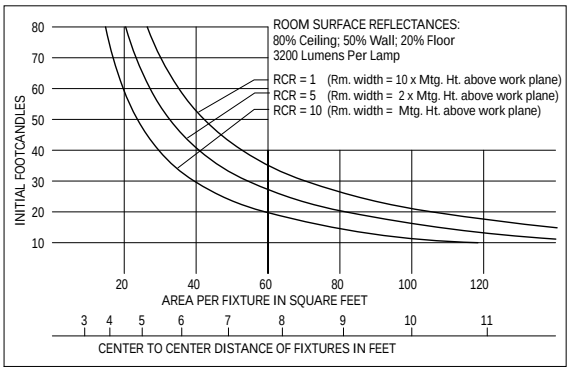
	80			70			50			30			10			0
	WALL REFLECTANCE															
	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.69	.67	.66	.67	.66	.65	.65	.64	.63	.63	.62	.61	.61	.60	.59	.58
2	.65	.63	.61	.64	.62	.60	.62	.60	.50	.60	.59	.58	.58	.57	.56	.56
3	.61	.59	.57	.61	.58	.56	.59	.57	.55	.58	.56	.55	.56	.55	.54	.53
4	.58	.55	.53	.57	.54	.52	.56	.54	.52	.55	.53	.51	.54	.52	.50	.50
5	.55	.51	.49	.54	.51	.49	.53	.50	.49	.52	.50	.48	.51	.49	.48	.47
6	.52	.48	.40	.51	.48	.40	.50	.48	.40	.50	.47	.45	.49	.47	.45	.44
7	.49	.45	.43	.46	.45	.43	.48	.45	.43	.47	.44	.43	.46	.44	.42	.42
8	.46	.42	.40	.40	.42	.40	.45	.42	.40	.44	.42	.40	.44	.41	.40	.39
9	.43	.40	.37	.43	.39	.37	.42	.39	.37	.42	.39	.37	.41	.39	.37	.36
10	.38	.35	.32	.38	.35	.32	.38	.35	.32	.37	.34	.32	.37	.34	.32	.31

ROOM CAVITY RATIO

20% FLOOR CAVITY REFLECTANCE

For 1 Lt. 26W triple tube with Comfort Clear reflector multiply C.U.'s by 1.1

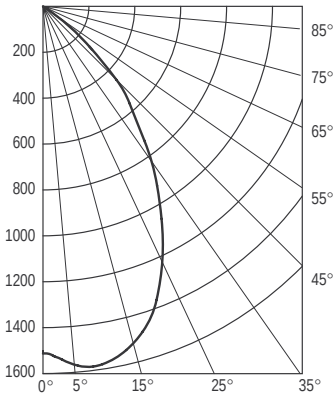
42W
Quick Calculator



This quick Calculator chart determines the number and spacing of 1 lt.-42W PL-T units with Comfort Clear™ reflector for any level of illumination.

Spacing Ratio = .9

REPORT PREPARED FOR: LIGHTOLIER
REPORT NO: LRL 499-9E
REPORT BY: LIGHTING RESEARCH LABORATORY, INC.
DESCRIP: 7.5" DIA. x 11 HT RECESSED DOWNLIGHT WITH COMFORT CLEAR™
REFLECTOR. LAMPS: 1PLT 42W LUMENS=3200



Efficiency = 59.6%

April 27, 1999

CANDLEPOWER SUMMARY

ANGLE	AVERAGE CP	LUMENS
180	0	
175	0	0
165	0	0
155	0	0
145	0	0
135	0	0
125	0	0
115	0	0
105	0	0
95	0	0
85	2	2
75	4	4
65	5	5
55	16	14
45	334	258
35	797	501
25	1178	545
15	1504	426
5	1585	151
0	1518	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	1123	35.1	58.9
0-40	1623	50.7	85.1
0-60	1896	59.3	99.4
0-90	1908	59.6	100.0
40-90	284	8.9	14.9
60-90	12	0.4	0.6
90-120	0	0.0	0.0
90-150	0	0.0	0.0
90-180	0	0.0	0.0
0-180	1908	59.6	100.00

Coefficients of Utilization

ZONAL CAVITY METHOD
EFFECTIVE FLOOR CAVITY REFLECTANCE = .20

CC WALL	80			70			50			30			10			
RCR	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.66	.65	.64	.65	.64	.63	.63	.62	.61	.60	.60	.59	.58	.58	.57	.56
2	.62	.60	.58	.61	.59	.57	.59	.58	.56	.57	.56	.55	.56	.55	.54	.53
3	.58	.55	.53	.57	.55	.53	.56	.54	.52	.54	.53	.51	.53	.52	.50	.50
4	.55	.52	.49	.54	.51	.49	.53	.50	.48	.52	.50	.48	.51	.49	.47	.46
5	.51	.48	.46	.51	.48	.45	.50	.47	.45	.49	.46	.45	.48	.46	.44	.43
6	.48	.45	.42	.48	.45	.50	.47	.44	.42	.46	.44	.42	.45	.43	.41	.41
7	.45	.42	.39	.45	.41	.39	.44	.41	.39	.43	.41	.39	.43	.40	.38	.38
8	.42	.39	.36	.42	.38	.36	.41	.38	.36	.40	.38	.36	.40	.37	.36	.35
9	.39	.36	.33	.39	.35	.33	.38	.35	.33	.38	.35	.33	.37	.35	.33	.32
10	.37	.33	.31	.36	.33	.31	.36	.33	.31	.35	.32	.30	.35	.32	.30	.30

Job Information Type:

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WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE
WILLIAMSTOWN, MA

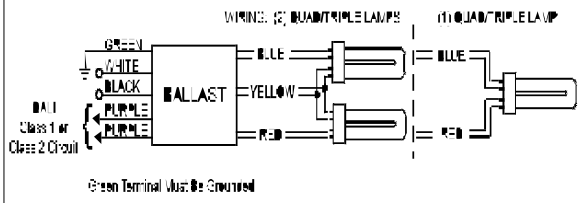
TYPE: HL-8
AUTH: DMM
DATE: 04/12/07

IDL-2S26-M5-LD@277	
Brand Name	ROVR
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts) (min/max)	Ballast Factor (min/max)	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
* CFTR42W/GX24Q	1	42	50/10	0.17	09/46	0.03/1.00	10	0.99	1.6	2.17

Wiring Diagram



Diag. 165

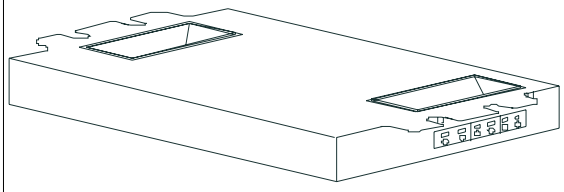
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow	0	0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White		0
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
4.98 "	3.00 "	1.18 "	4.60 "
4 49/50	3	1 9/50	4 3/5
12.6 cm	7.6 cm	3 cm	11.7 cm

Revised 08/17/2006

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

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Customer Support/Technical Service: Phone: 800-372-3331 · Fax: 630-307-3071
Corporate Offices: Phone: 800-322-2086

Cardinal CD27 & CD27P

one, two, or three T5 or T5HO lamps

or one or two T8 lamps

T5 Linear lighting

Williams College
'62 Center For Theatre & Dance

Williamstown, MA

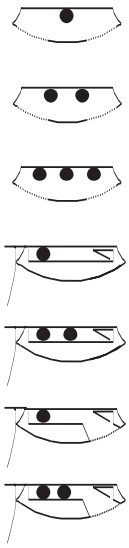
TYPE: HL-11

AUTH: DMM

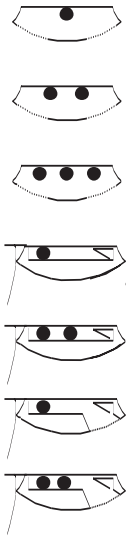
DATE: 04/12/07

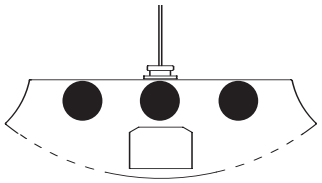
Cardinal CD27 & CD27P

T5 options

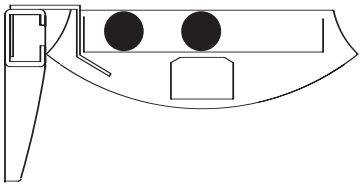


T8 options

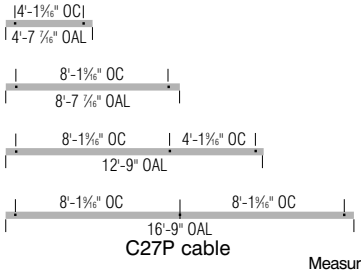




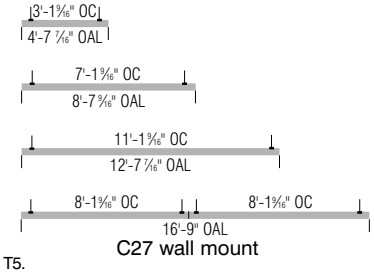
Cable
2 3/8"H. x 7 1/2"W.



Wall mount
2 3/8"H. x 7 1/2"W.



C27P cable

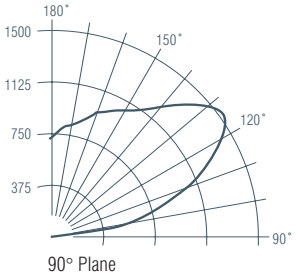


C27 wall mount

Measurements shown for T8 lamps. See website for T5.

For design use only. Not for construction. See www.linearltg.com for engineering drawings specific to job.

- Extruded aluminum housing with optional perforated panels
- 1, 2, or 3 ET5, ET5HO, or ET8 lamps
- Die-cast joiners
- Pre-wired with quick-connect plugs
- IBEW Local 3 and UL/CUL labels
- Weight per foot: 3.9 lbs. approx. (CD27)
  Weight per foot: 3.5 lbs. approx. (CD27P)



90° Plane

CD27-I-2-ET5-NS

Efficiency: 85.7%

Max. candlepower at 125°: 1527

See www.linearltg.com for complete photometrics.

Catalog No. – Dir. Lamps Ballast Voltage – Shielding Mounting Color – Add'l options – Row length

Fixture

CD27P
Perforated steel side, bidirectional

CD27
Solid body

Lamps & Electrical Options

Direction	**B**idirectional, **I**ndirect
Lamps	**1**, **2**, or **3**†
Ballast	**ET5** Electronic T5 **ET5HO** High Output T5 **ET8** Electronic T8
Voltage	**120** or **277** **347**

Mechanical & Aesthetic Options

Shielding	**NS** No Shielding *(CD27 only)* **PRD**, **PRT**, **STN**, **STK**, **HSL** *See tab for perf illustrations*
Mounting	**Sxx** Stem **Bxx** Stem-Ball **Cxx** Cable **WMT** Wall mount *xx= inches, ceiling to top of fixture*
Color	**BW** Baked White **AP** Aluminum Paint **CC** Custom Color *See color selector*

Add'l

NO	No Option
FU	Fusing
EC	Emergency Circuits
NL	Night Light
ED	Electronic Dimming*
EM	Emergency Ballast**
SC	Separate Circuits
DC	Dust Cover
ISB10	Instant Start Ballast <10%††
PSB10	Program Start Ballast <10%††
SF	Special Feature *Please define*

Feet

Fixture length

CD27P pendant
2', **3**', **4**', **5**', **6**', **7**', **8**'

CD27 & CD27P wall mount
2', **3**', **4**', **5**', **6**', **7**', **8**', **9**', **10**', **11**', **12**'

** Dimming ballasts may not be available for all T5/T5HO lamp lengths. Consult factory.*
*** EM packs may not be available for all T5/T5HO lamp lengths. Consult factory.*
† 3-light configuration available on pendant only.
†† ISB10 and PSB10 available with T8 only.

Designed for acoustical ceilings.
See www.linearltg.com for IES files and additional information.

Linear Lighting Corp.
31-30 Hunters Point Ave., Long Island City, NY 11101 ©9/04
718-361-7552 Fax 718-937-2747 Web: www.linearltg.com

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WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: HL-11

AUTH: DMM

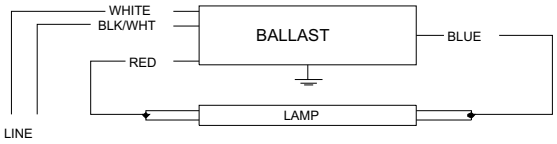
DATE: 04/12/07

VCN-132-MC	
Brand Name	CENTIUM MICRO CAN
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F21T5	1	21	50/10	0.10	27	1.10	10	0.98	1.7	4.07
F25T8	1	25	0/-18	0.09	25	0.98	10	0.98	1.7	3.92
F28T5	1	28	50/10	0.11	30	0.98	10	0.99	1.7	3.27
* F32T8	1	32	0/-18	0.11	30	0.98	10	0.98	1.7	3.27
F32T8/ES (30W)	1	30	60/16	0.10	28	0.98	10	0.98	1.7	3.50

Wiring Diagram



Diag. 63

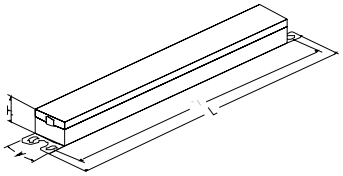
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White	25L	63.5
Blue	31R	78.7
Red	37L	94
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	25L	63.5
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.08 "	1.05 "	8.91 "
9 1/2	1 2/25	1 1/20	8 91/100
24.1 cm	2.7 cm	2.7 cm	22.6 cm

Revised 07/23/2004

ADVANCE
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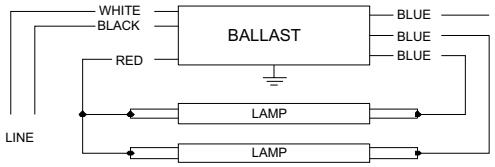
Customer Support/Technical Service: Phone: 800-372-3331 · Fax: 630-307-3071
Corporate Offices: Phone: 800-322-2086

VOP-3P32-SC	
Brand Name	OPTANIUM
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Parallel
Input Voltage	277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F32T8	1	32	0/-18	0.14	37	1.08	20	0.94	1.7	2.92
* F32T8	2	32	0/-18	0.23	62	0.94	10	0.98	1.7	1.52
F32T8	3	32	0/-18	0.30	82	0.88	10	0.99	1.7	1.07

Wiring Diagram



Diag. 70

Insulate unused blue lead for 1000V

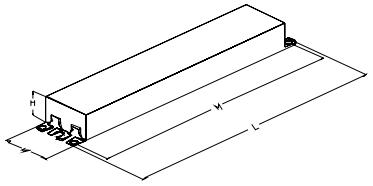
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	25L	63.5
White	25L	63.5
Blue	31R	78.7
Red	37L	94
Yellow	0	0
Gray	0	0
Violet	0	0

	in.	cm.
Yellow/Blue	0	0
Blue/White	0	0
Brown	0	0
Orange	0	0
Orange/Black	0	0
Black/White	0	0
Red/White	0	0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.7 "	1.18 "	8.90 "
9 1/2	1 7/10	1 9/50	8 9/10
24.1 cm	4.3 cm	3 cm	22.6 cm

Revised 06/09/2003

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

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Corporate Offices: Phone: 800-322-2086

Cardinal CD27 & CD27P

one, two, or three T5 or T5HO lamps

or one or two T8 lamps

Linear lighting

Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

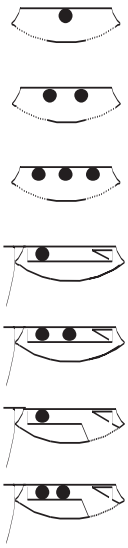
TYPE: HL-11A

AUTH: DMM

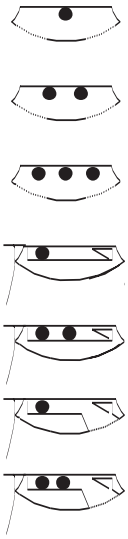
DATE: 04/12/07

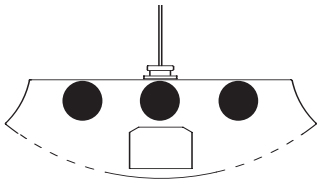
Cardinal CD27 & CD27P

T5 options

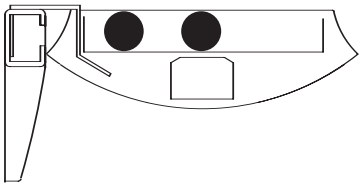


T8 options

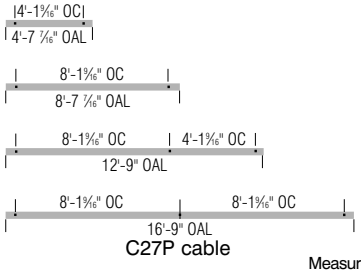




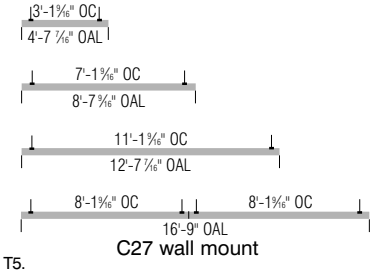
Cable
2 3/8"H. x 7 1/2"W.



Wall mount
2 3/8"H. x 7 1/2"W.



C27P cable

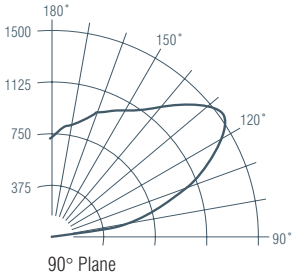


C27 wall mount

Measurements shown for T8 lamps. See website for T5.

For design use only. Not for construction. See www.linearltg.com for engineering drawings specific to job.

- Extruded aluminum housing with optional perforated panels
- 1, 2, or 3 ET5, ET5HO, or ET8 lamps
- Die-cast joiners
- Pre-wired with quick-connect plugs
- IBEW Local 3 and UL/CUL labels
- Weight per foot: 3.9 lbs. approx. (CD27)
  Weight per foot: 3.5 lbs. approx. (CD27P)



90° Plane

CD27-I-2-ET5-NS

Efficiency: 85.7%

Max. candlepower at 125°: 1527

See www.linearltg.com for complete photometrics.

Catalog No. – Dir. Lamps Ballast Voltage – Shielding Mounting Color – Add'l options – Row length

Fixture

CD27P
Perforated steel side, bidirectional

CD27
Solid body

Lamps & Electrical Options

Direction	**B**idirectional, **I**ndirect
Lamps	**1**, **2**, or **3**†
Ballast	**ET5** Electronic T5 **ET5HO** High Output T5 **ET8** Electronic T8
Voltage	**120** or **277** **347**

Mechanical & Aesthetic Options

Shielding	**NS** No Shielding *(CD27 only)* **PRD**, **PRT**, **STN**, **STK**, **HSL** *See tab for perf illustrations*
Mounting	**Sxx** Stem **Bxx** Stem-Ball **Cxx** Cable **WMT** Wall mount *xx= inches, ceiling to top of fixture*
Color	**BW** Baked White **AP** Aluminum Paint **CC** Custom Color *See color selector*

Add'l

NO	No Option
FU	Fusing
EC	Emergency Circuits
NL	Night Light
ED	Electronic Dimming*
EM	Emergency Ballast**
SC	Separate Circuits
DC	Dust Cover
ISB10	Instant Start Ballast <10%††
PSB10	Program Start Ballast <10%††
SF	Special Feature *Please define*

Feet

Fixture length

CD27P pendant
2', **3**', **4**', **5**', **6**', **7**', **8**'

CD27 & CD27P wall mount
2', **3**', **4**', **5**', **6**', **7**', **8**', **9**', **10**', **11**', **12**'

** Dimming ballasts may not be available for all T5/T5HO lamp lengths. Consult factory.*
*** EM packs may not be available for all T5/T5HO lamp lengths. Consult factory.*
† 3-light configuration available on pendant only.
†† ISB10 and PSB10 available with T8 only.

Designed for acoustical ceilings.
See www.linearltg.com for IES files and additional information.

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WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: HL-11A

AUTH: DMM

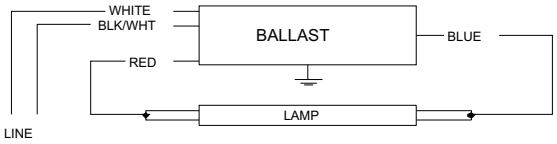
DATE: 04/12/07

VCN-132-MC	
Brand Name	CENTIUM MICRO CAN
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F21T5	1	21	50/10	0.10	27	1.10	10	0.98	1.7	4.07
F25T8	1	25	0/-18	0.09	25	0.98	10	0.98	1.7	3.92
F28T5	1	28	50/10	0.11	30	0.98	10	0.99	1.7	3.27
* F32T8	1	32	0/-18	0.11	30	0.98	10	0.98	1.7	3.27
F32T8/ES (30W)	1	30	60/16	0.10	28	0.98	10	0.98	1.7	3.50

Wiring Diagram



Diag. 63

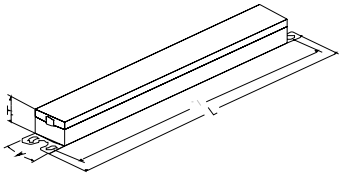
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White	25L	63.5
Blue	31R	78.7
Red	37L	94
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	25L	63.5
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.08 "	1.05 "	8.91 "
9 1/2	1 2/25	1 1/20	8 91/100
24.1 cm	2.7 cm	2.7 cm	22.6 cm

Revised 07/23/2004

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

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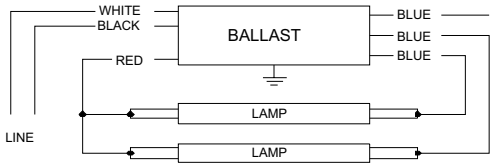
Corporate Offices: Phone: 800-322-2086

VOP-3P32-SC	
Brand Name	OPTANIUM
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Parallel
Input Voltage	277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F32T8	1	32	0/-18	0.14	37	1.08	20	0.94	1.7	2.92
* F32T8	2	32	0/-18	0.23	62	0.94	10	0.98	1.7	1.52
F32T8	3	32	0/-18	0.30	82	0.88	10	0.99	1.7	1.07

Wiring Diagram



Diag. 70

Insulate unused blue lead for 1000V

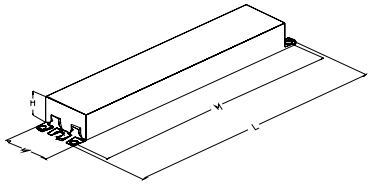
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	25L	63.5
White	25L	63.5
Blue	31R	78.7
Red	37L	94
Yellow	0	0
Gray	0	0
Violet	0	0

	in.	cm.
Yellow/Blue	0	0
Blue/White	0	0
Brown	0	0
Orange	0	0
Orange/Black	0	0
Black/White	0	0
Red/White	0	0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.7 "	1.18 "	8.90 "
9 1/2	1 7/10	1 9/50	8 9/10
24.1 cm	4.3 cm	3 cm	22.6 cm

Revised 06/09/2003

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

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Corporate Offices: Phone: 800-322-2086

COMBOLIGHT® GALLERIA Series • CGWC

FOUR (4) Light Wall Mount Swivel Column Fixture
Grid Configuration "C" • Lamp Groups 1, 2, & 3
Low Voltage, Line Voltage or Metal Halide for Remote Transformer/Ballast

Catalog #

Type

Project

DESCRIPTION:
A wall mounted fixture with a swiveling grid column.

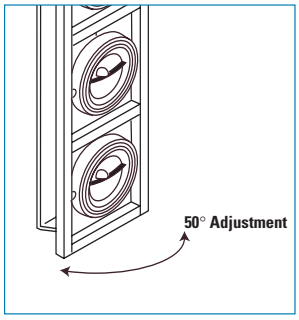
CONSTRUCTION:
All aluminum construction. Grid is made of .75" square aluminum tubing with .062" wall thickness. Weight base adds stability to fixture.

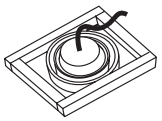
LAMP ASSEMBLY:
Four lamps mounted in adjustable double gimbal lamp holders. Dual axis 90º x 90º locking adjustability. Lamp column swivels 50º.

ELECTRICAL:
Low voltage and metal halide models are wired for use with remote transformers or ballasts. Custom configurations are available for integral transformers or ballasts - consult RSA factory for details. Low voltage and Line Voltage models are dimmable.

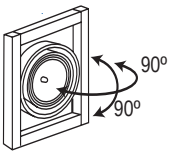
ALL RSA COMBOLIGHT PRODUCTS ARE MADE IN THE U.S.A.

Label: UL, CSA and New York Calendar

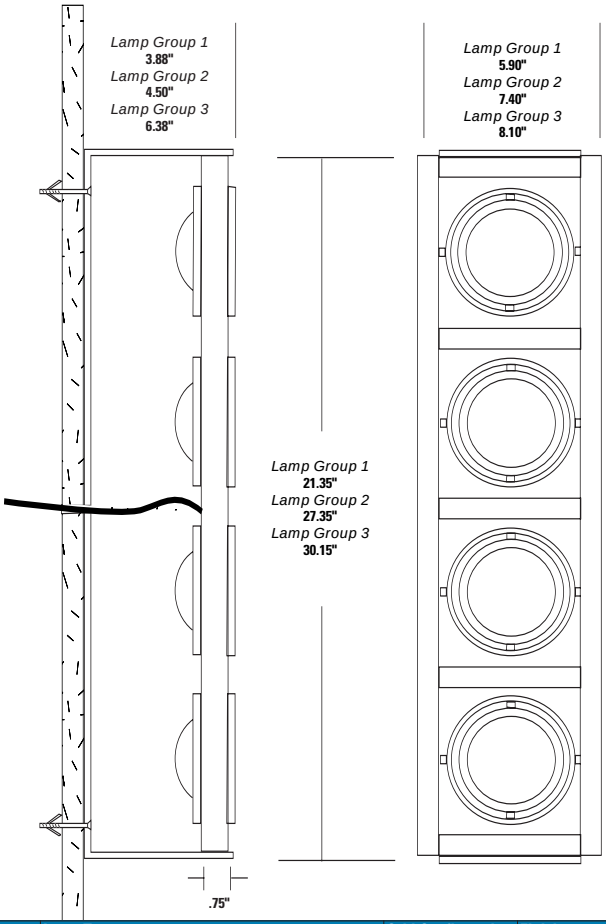




Standard lamp back cover for AR111 models hides lamp terminals and connections.



Adjustable double gimbal lamp holder accepts up to two optical accessories



GRID CONFIGURATION "C"

his sheet is for rid onfiguration . o see other grid configurations consult other ombo ight alleria Series spec sheets.

IMPORTANT: USING THIS SPEC SHEET

his fi ture is dimensioned according to lamp t pe. lease select lamp from either amp roup 1 or and then refer to the appropriate dimensions of fi ture as shown above.

Cat. # / Description	Lamp Type		Grid Configuration	Finish
CGWC - all ount Swivel olumn i ture	**Lamp Group 1**	**11 -** R1 1 0	**C -** our ight	**BK -** lack
		12 - R1 1		**WH -** hite
		13 - AR 0 1 0		**S -** Silver
		14 - AR 0 1 0		**PC -** olished hrome
		15 - AR1 1 0		**PT -** ustom
		16 - AR 0 1 0		
	Lamp Group 2	**21 -** AR 0 1 0		
		22 - AR 0 9		
		23 - AR 0 0		
		24 - AR 1 0		
		25 - AR111 1		
		26 - AR111 1 0		
		27 - AR111 1		
		28 - AR111 1 100		
	Lamp Group 3	**31 -** AR 1 0		
		32 - AR 0		
		33 - AR 100		

Optional Accessories - Details on Other Side

Baffle	Snoots	Louvers	Lenses

SPECIFY -	CGWC	31	C	PC

COOPER Lighting

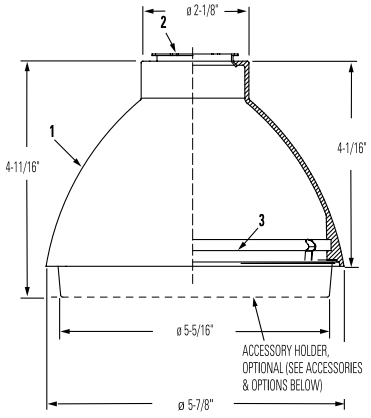
Specifications and Dimensions subject to change without notice.
RSA Lighting • 7945 Orion Ave. • Van Nuys, CA 91406 • 818-349-3030 • FAX 818-349-3031

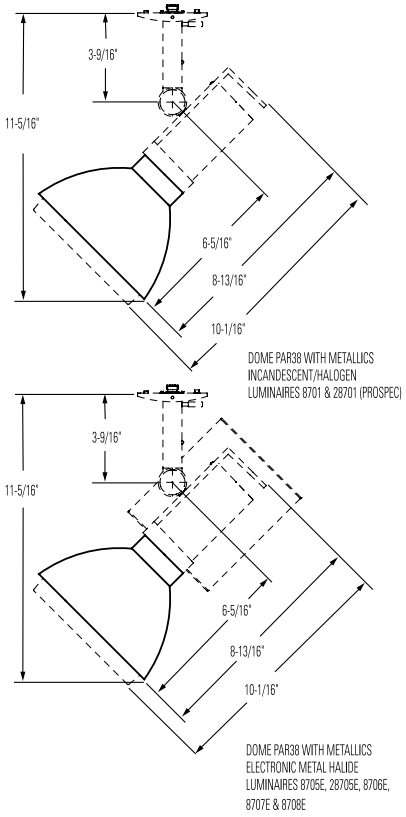
RSA LIGHTING

Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE
WILLIAMSTOWN, MA

TYPE: HL-14
AUTH: DMM
DATE: 04/12/07





Ordering Information

Catalog No.	Finishes	Lamps	Use With Metallics Adapters
8747 WH	Matte White	INCANDESCENT: PAR38 250W Max. 150W Max. with	8701
8747 TM	Dark Titanium	Accessories (When used on luminaires 8701 & 28701)	8705E
8747 NM	Natural Metal	METAL HALIDE: PAR38 70W (When used on luminaire 8706E)	8706E
		METAL HALIDE: ED-17 70W: (When used on luminaire 8705E & 28705E) (Reflector Needed)	8707E
			8708E
		METAL HALIDE: PAR38 100W (When used on luminaire 8707E)	28701
		METAL HALIDE: ED-17 100W (When used on luminaire 8708E) (Reflector Needed)	28705E

Features

1. **Shade:** Die-cast aluminum.
2. **Neck Flange:** Cold rolled steel, zinc-plated. Used to attach shade to luminaire, without tools.
3. **Groove:** To connect optional Accessory Holder to shade.

Options and Accessories

Metallics PAR38 Accessory Holder (8784) & Accessories. Order separately (See Lightolier Specification Sheet 8784).

Compatible With ED17 Reflectors:
83ED17RNS
83ED17RS
83ED17RF
83ED17RWF

Finish

All painted finishes: White or Titanium baked enamel, or Brushed Metal with protective clear coat.

Labels

UL

Job Information Type:

Job Name:

Cat. No.:

Lamp(s):

Notes:

Lightolier a Genlyte Thomas Company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: HL-15

AUTH: DMM

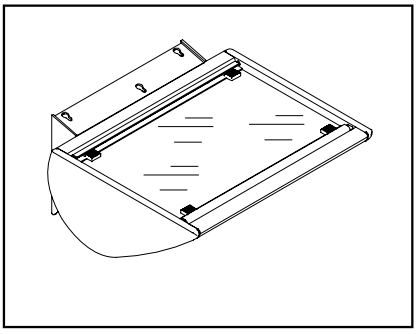
DATE: 04/12/07

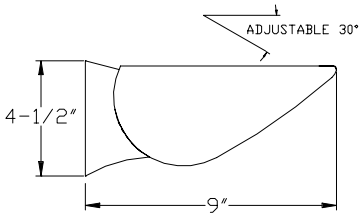
INDOOR ARCHITECTURAL LUMINAIRES

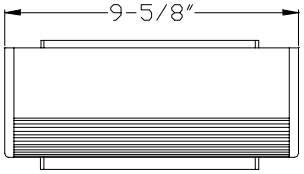
TIEMPO TM5

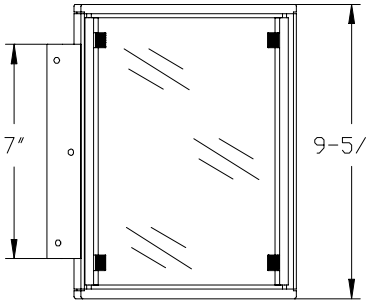
SURFACE MOUNT REMOTE BALLAST

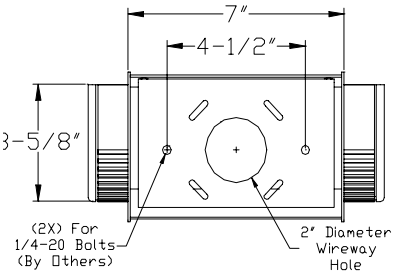
QUARTZ HALOGEN, CERAMIC METAL HALIDE AND METAL HALIDE











ORDERING

FIXTURE	MOUNTING	REFLECTOR	VOLTS	FINISH	OPTIONS
Quartz Halogen **TM501** 500W Max Mini-Can **Ceramic Metal Halide** **TM517** 35W/39W CMH (T6, G12 Base) **TM522** 70W CMH (T6, G12 Base) **TM523** 100W CMH (T6, G12 Base) **TM527** 150W CMH (T6, G12 Base) **Metal Halide** **TM540** 70W MH (E17, Med Base) **TM541** 100W MH (E17, Med Base) **TM542** 150/175W MH (E17, Med Base) (Specify Wattage)	**RCB** Surface Mount Remote Ballast	**(1)** Asymmetric Indirect **(2)** Asymmetric Wallwash	**1**=120V **2**=277V **7**=347V Quartz Halogen Available in 120V Only	**W** Semi-Gloss White **BL** Semi-Gloss Black **BR** Semi-Gloss Bronze **N** Semi-Gloss Natural **S** Semi-Gloss Satin **G** Semi-Gloss Graphite **SF** Specify Finish (See Color Chart) **CC** Custom Color (Contact Factory)	**VS** Solid Cutoff Visor **VP** Perforated Cutoff Visor **GS** External Louvered Visor **AL** Adjustable Shutter **SS** Adjustable Back Sawtooth Shield **CF** "Fade Not" Visored Color Lens **CDF** Dichroic Visored Color Lens **UV** UV Filter **F** HLR Fuseholder **QEM** Quartz Emergency Socket # **QL** Quartz Restrike—Hot/Cold Relay # **CM-X** Column Mount (X=Column Diameter)* # DC Bayonet Lamp, 50W Maximum. Available With TM517, TM522, TM523, TM527 Only. * Consult Factory For Minimum Column Dia.
ORDERING EXAMPLE: TM517 / WCB / (1) / 1 / W / GS					

SPECIFICATIONS

Housing Extruded aluminum housing with die cast end plates secured to mounting bracket with a single fastener. Fastener is hidden inside of lamp housing allowing for no visible hardware.
Lens Clear prismatic tempered glass lens. Lens is secured to an anodized extruded aluminum frame. Lamp is maintained by a tool-less doorframe with die cast aluminum latches that hinge in either direction for ease of lamping and maintenance.
Reflector Die formed highly efficient unitized reflector systems constructed of 95% specular anodized peened aluminum. Reflector can be easily adjusted in field by hand rotating lamp housing to desired position while illuminated.
Wall Bracket: The wall bracket mounts to a standard 4-0 j-box (by others). Additional structural support is required (by others).
Electrical Quartz Halogen is available in 120V only. All Metal Halide ballasts are remote, high power factor, encased & potted, thermally protected, class 'B' sound rated, and supplied with j-box for thru wiring. Butterfly brackets supplied for T-bar ceiling mounting.
Labels Underwriters Laboratories and Canadian

FIXTURE	MOUNTING TYPE	REFLECTOR	VOLTS	FINISH	OPTIONS
TM5_____	RCB				

APPROVED: _____

JOB NAME: _____

TYPE: _____

INSIGHT

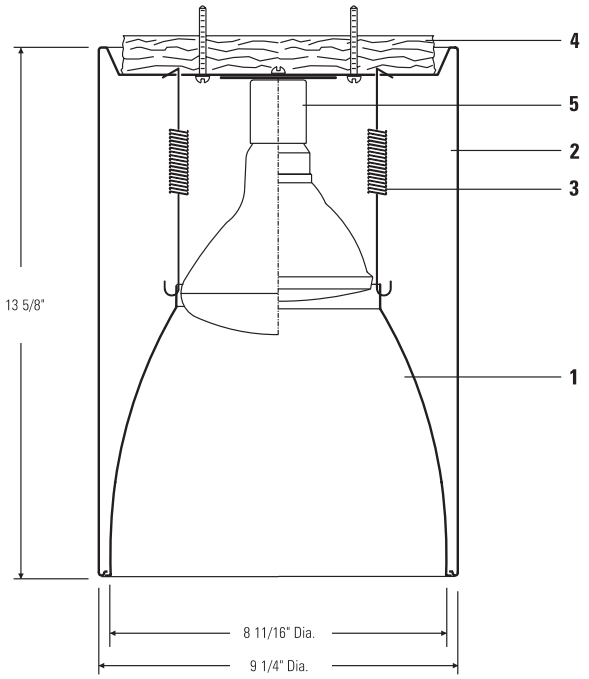
TEL: 505 345-0888 FAX: 505 345-3838
www.insightlighting.com

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE
WILLIAMSTOWN, MA

TYPE: HL-16
AUTH: DMM
DATE: 04/12/07

Calculite® Incandescent Surface Cylinder **7026AO**

9" Aperture BR40 / R40 / PAR38



Catalog Number		Lamp
7026AO	Matte white housing with specular clear reflector	**PAR38**,150W (cool beam) **PAR38**, 250W (T.H.) **R40**, 300W **BR40**, 300W

Features

1. **Reflector:** 16 ga. Specular clear Alzak® aluminum. 50° visual cut-off to lamp and lamp image .
2. **Housing:** One piece spun 16 ga. aluminum with returned bottom edge to seat reflector, no visable hardware.Matte white baked enamel finish.
3. **Retaining Springs:** Coil steel springs secure reflector to housing.
4. **Heat Insulltor:** Fiberglass bulk insulation.
5. **Socket:** Medium base porcelain, nickel plated screw shell.

Options & Accessories

Stem Kit: 7249 Matte white
Permits surface units to be stem mounted. Supplied with 1/2" dia. and 5 1/2" dia. canopy. 37 5/8" O.A. Length. Stem can be cut to length at the job site. Self aligning swivel provides up to 41° vertical adjustment.

Other reflector and housing finishes consult factory.

Electrical

Requires 75°C Supply wires. No.18 SF-1 leads to porcelain socket.

Labels

UL Listed for damp locations, I.B.E.W.

Alzak® is a registered trademark of ALCOA.

Job Information Type:

Job Name:

Cat. No.:

Lamp(s):

Notes:

Lightolier a Genlyte Thomas 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.

LIGHTOLIER®

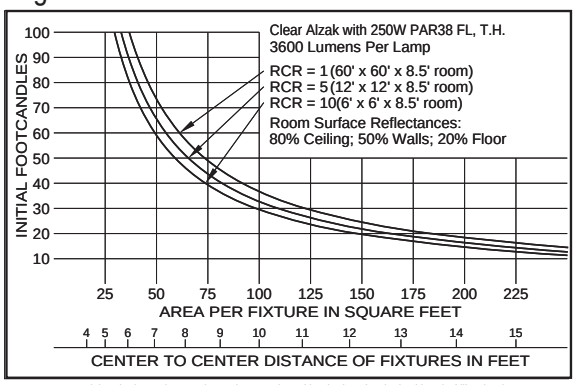
WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

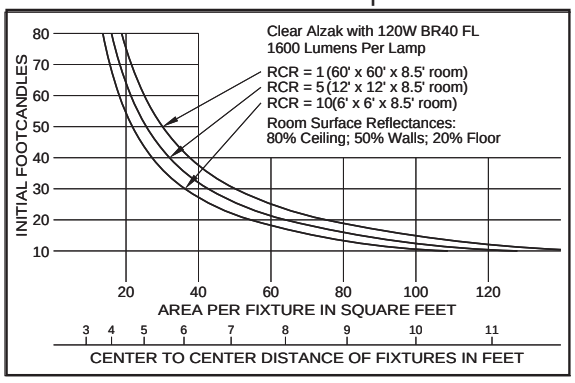
TYPE: HL-17
AUTH: DMM
DATE: 04/12/07

Calculite® Incandescent Surface Cylinder 7026AO

9" Aperture BR40 / R40 / PAR38



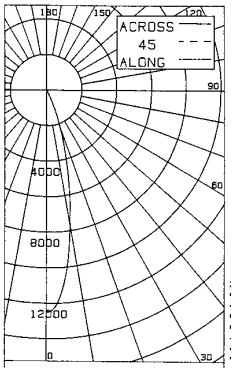
Use quick calculator chart to determine spacing of luminaires for desired level of illumination.
Conversion Factors:
100W PAR38 FL IR, F.C. X 0.6
120W PAR38 FL, F.C. X 0.5
90W PAR38 FL, F.C. X 0.4
75W & 65W IR PAR38 FL, F.C. X 0.3



Use quick calculator chart to determine spacing of luminaires for desired level of illumination.
Conversion Factors:
300W R40 FL, F.C. X 2.2
90W BR40 FL, F.C. X 0.7
75W BR40 FL, F.C. X 0.5

SPACING RATIO = 0.4

CERTIFIED TEST REPORT NO. 0870FR
COMPUTED BY LSI PROGRAM **TEST-LITE**
SURFACE CYLINDER OPEN DOWNLIGHT
8" DIA. APERTURE, SPECULAR CLEAR FINISH REFLECTOR
250W PAR38 FL (KRYPTON) PHILIPS LAMP. LUMEN RATING = 3100 LMS.



DATE: JUL 30, 1999
PREPARED FOR:
LIGHOLIER, FALL RIVER, MA

TESTED ACCORDING TO IES PROCEDURES. TEST DISTANCE EXCEEDS FIVE TIMES THE GREATEST LUMINOUS OPENING OF LUMINAIRE.

CANDLEPOWER SUMMARY

ANGLE	MEAN CP	LUMENS
0	12498	
5	11063	1009
10	7681	
15	4689	1319
20	2148	
25	677	416
30	88	
35	18	21
40	9	
45	0	2
50	0	
55	0	0
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

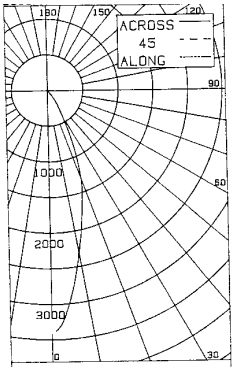
ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	% LUMINAIRE
0–30	2743	88.50	99.17
0–40	2764	89.18	99.93
0–60	2766	89.24	100.00
0–90	2766	89.24	100.00
40–90	1	.06	.07
60–90	0	.00	.00
90–180	0	.00	.00
0–180	2766	89.24	100.00

** EFFICIENCY = 89.2% **

SPACING RATIO = 0.5

CERTIFIED TEST REPORT NO.0869FR
COMPUTED BY LSI PROGRAM **TEST-LITE**
SURFACE CYLINDER DOWNLIGHT
8" DIA. APERTURE, SPECULAR CLEAR FINISH REFLECTOR
120W BR40 FL GE LAMP. LUMEN RATING = 1600 LMS



DATE: JUL 30, 1999
PREPARED FOR:
LIGHOLIER, FALL RIVER, MA

TESTED ACCORDING TO IES PROCEDURES. TEST DISTANCE EXCEEDS FIVE TIMES THE GREATEST LUMINOUS OPENING OF LUMINAIRE.

CANDLEPOWER SUMMARY

ANGLE	MEAN CP	LUMENS
0	3418	
5	2993	280
10	2325	
15	1771	508
20	1295	
25	791	381
30	413	
35	134	150
40	72	
45	0	14
50	0	
55	0	0
60	0	
65	0	0
70	0	
75	0	0
80	0	
85	0	0
90	0	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	% LUMINAIRE
0–30	1167	73.00	87.70
0–40	1317	82.35	98.95
0–60	1331	83.23	100.00
0–90	1331	83.23	100.00
40–90	14	.88	1.05
60–90	0	.00	.00
90–180	0	.00	.00
0–180	1331	83.23	100.00

** EFFICIENCY = 83.28% **

COEFFICIENTS OF UTILIZATION

%EFFECTIVE CEILING CAVITY REFLECTANCE

ROOM CAVITY RATIO	80			70			50			30			10			0
	% WALL REFLECTANCE															
	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	1.02	1.01	.99	1.00	.99	.98	.96	.96	.95	.93	.93	.92	.90	.90	.89	.88
2	.98	.96	.94	.97	.92	.93	.94	.93	.91	.92	.91	.90	.89	.89	.88	.87
3	.95	.93	.91	.94	.92	.91	.93	.91	.89	.91	.89	.88	.89	.88	.87	.86
4	.93	.91	.89	.92	.90	.88	.91	.89	.87	.89	.87	.86	.88	.86	.85	.84
5	.91	.88	.86	.90	.87	.86	.89	.87	.85	.88	.86	.84	.86	.85	.84	.83
6	.89	.86	.85	.89	.86	.84	.88	.85	.84	.87	.85	.83	.86	.84	.83	.82
7	.87	.85	.83	.87	.84	.82	.86	.84	.82	.82	.83	.81	.84	.83	.81	.81
8	.86	.83	.81	.82.	.83	.81	.84	.82	.81	.84	.82	.81	.84	.82	.80	.79
9	.84	.82	.80	.84	.81.	.80	.83	.81	.79	.83	.80	.79	.82	.80	.79	.78
10	.82	.80	.78	.82	.80	.78	.82	.79	.78	.81	.79	.78	.81	.79	.77	.77

20% FLOOR CAVITY REFLECTANCE

Conversion Factor: 45W to 250W PAR38 FL, C.U. x 1.0

COEFFICIENTS OF UTILIZATION

%EFFECTIVE CEILING CAVITY REFLECTANCE

ROOM CAVITY RATIO	80			70			50			30			10			0	
	% WALL REFLECTANCE																
	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10		
1	.94	.93	.91	.93	.91	.90	.89	.88	.87	.86	.85	.85	.83	.83	.82	0	.81
2	.90	.88	.86	.89	.87	.85	.86	.85	.83	.84	.83	.81	.82	.81	.80	.81	.79
3	.87	.84	.82	.86	.83	.81	.84	.82	.80	.82	.80	.79	.80	.79	.78	.79	.76
4	.84	.81	.78	.83	.80	.78	.81	.79	.77	.80	.76	.76	.78	.77	.75	.76	.74
5	.80	.77	.75	.80	.77	.74	.78	.76	.74	.77	.75	.73	.76	.74	.73	.74	.72
6	.78	.75	.72	.77	.74	.72	.76	.74	.72	.75	.73	.71	.74	.72	.71	.72	.70
7	.75	.72	.69	.75	.72	.69	.74	.71	.69	.73	.70	.68	.72	.70	.68	.70	.67
8	.73	.69	.67	.72	.69	.67	.71	.69	.67	.71	.68	.66	.70	.68	.66	.67	.65
9	.70	.67	.64	.70	.67	.64	.69	.66	.64	.69	.66	.64	.68	.65	.64	.65	.63
10	.68	.65	.62	.68	.65	.62	.67	.64	.62	.67	.64	.62	.66	.64	.62	.63	.61

20% FLOOR CAVITY REFLECTANCE

Conversion Factor:

65W to 120W BR40FL, C.U. x 1.0; 300W R40FL, C.U. x .95

Job Information Type:

Lightolier a Genlyte Thomas Company www.lightolier.com
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LIGHTOLIER®

Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE
WILLIAMSTOWN, MA

TYPE: HL-17
AUTH: DMM
DATE: 04/12/07

READ AND UNDERSTAND THESE INSTRUCTIONS BEFORE INSTALLING FIXTURE
This fixture is intended for installation in accordance with the National Electrical Code and local regulations. To assure full compliance with local codes and regulations, check with your local electrical inspector before installation. To prevent electrical shock, turn off electricity at fuse box before proceeding.
Retain these instructions for maintenance reference.

INSTRUCTION SHEET NO.
IS:7249A
0395 PAGE 1 OF 1

STEM KIT IS DESIGNED TO SIMPLIFY CONVERSION OF STANDARD SURFACE MOUNTED CYLINDER SERIES DOWNLIGHT TO STEM MOUNTING. STEM KITS ARE SUITABLE FOR DAMP OR DRY LOCATIONS ONLY.

A. TO INSTALL STEM KIT ON CEILING.

NOTE: STEM may be shortened by cutting STEM to desired length. This must be done before hanging. Detach STEM from stem kit by loosening SET SCREW from BALL SWIVEL. Be sure that lead wires are completely out of STEM. Cut STEM, then drill 1/8" diameter hole, through the STEM 3/16" from end. Be certain to deburr after cutting or slotting (Fig. 1.) (A slot made with a file or hacksaw will also work.) Reassemble STEM and BALL SWIVEL.

1. Bring SUPPLY LEAD WIRES from the OUTLET BOX through the center hole of the MOUNTING STRAP. For sloped ceilings, position opening in MOUNTING STRAP facing upward, then thread SCREWS through MOUNTING STRAP to OUTLET BOX (fig. 2 & 3).
2. Slide CANOPY down STEM to rest on STEM JOINT (Fig. 3)
3. Hook BALL SWIVEL on MOUNTING STRAP. Make sure GROOVE in BALL SWIVEL aligns with TAB in MOUNTING STRAP (Fig. 4)
4. Slide SAFETY CLIP to MOUNTING STRAP and tighten screw (Fig. 4).
5. Align TABS in CANOPY with NOTCHES in MOUNTING STRAP. Slide CANOPY up over MOUNTING STRAP and push up against ceiling (Fig 3).

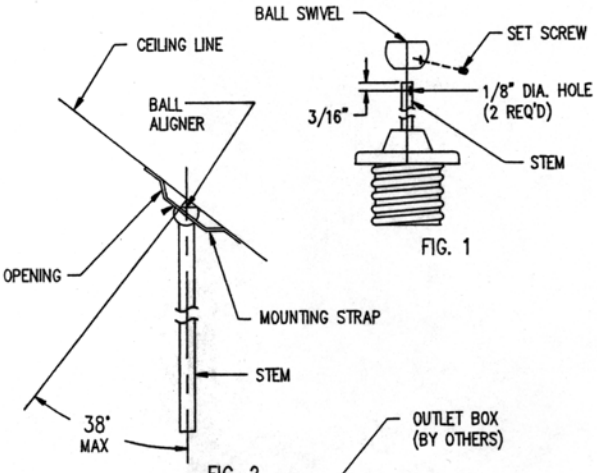


FIG. 1

FIG. 2

B. TO ATTACH FIXTURE TO STEM (FIG. 5)

1. Remove socket mounting plate from fixture, discard plate, socket, screws and insulation material if any.
2. Remove SCREW RING from STEM SOCKET.
3. Pass SOCKET through large hole (1–7/8" dia.) on top of fixture.
4. Holding fixture in place, with the top of fixture flush against ADAPTER PLATE, thread SCREW RING onto SOCKET and tighten by turning, making certain that sides of fixture are aligned according to requirements.

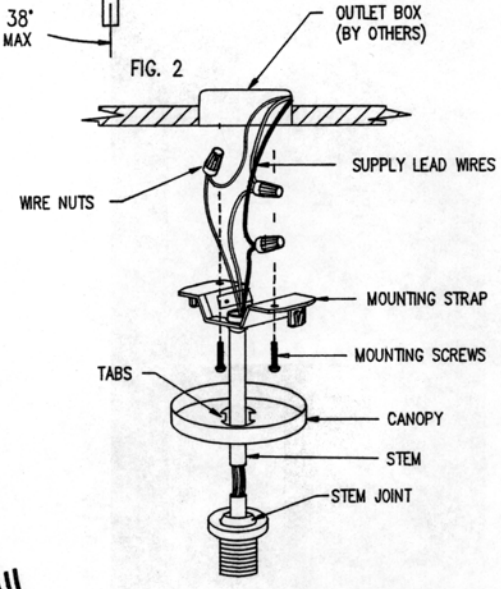


FIG. 3

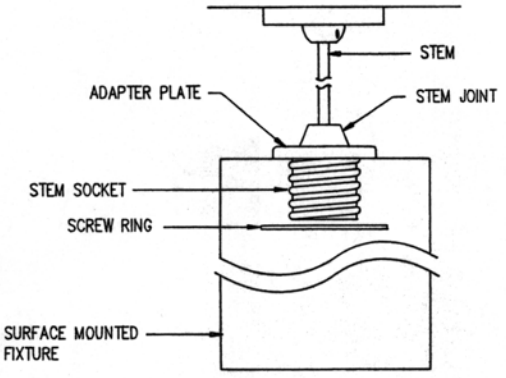


FIG. 5

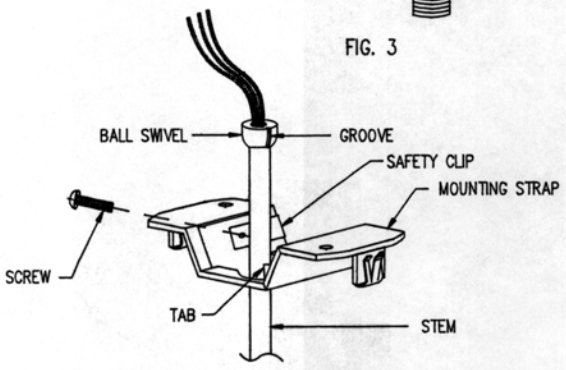
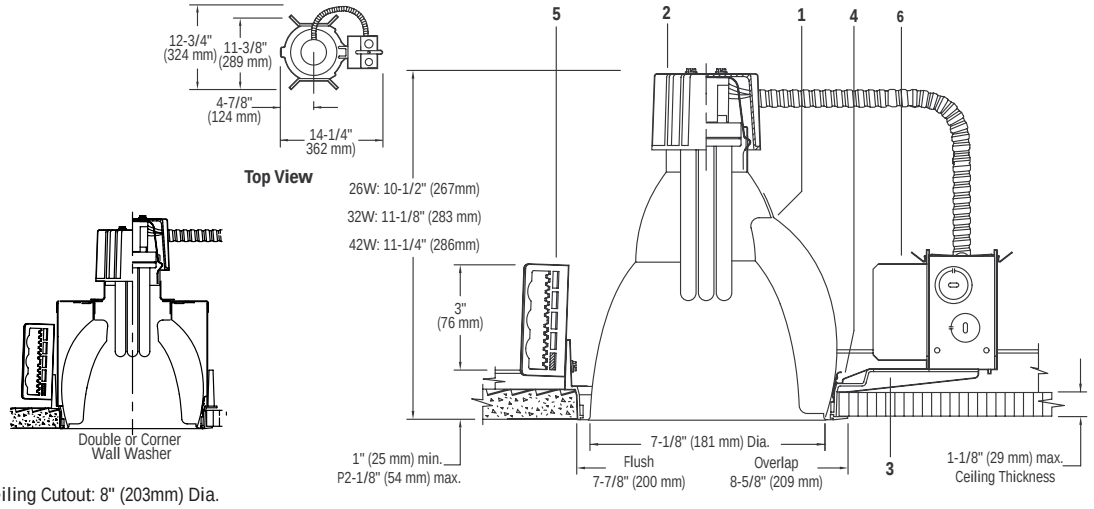


FIG. 4

LIGHTOLIER® SECAUCUS, NEW JERSEY 07096
MONTREAL, QUEBEC, CANADA

Calculite® Compact Fluorescent Open Wall Washer 8022WW

7 3/8" Aperture Triple Tube Vertical Lamp



Ceiling Cutout: 8" (203mm) Dia.

Reflector Trim

Single Wall Washer	Double Wall Washer	Corner Wall Washer
8022WWCCLW Comfort Clear™, White Flange	8022DWCCLW	8022CWCCLW
8022WWCCLP Comfort Clear™, Polished Flange	8022DWCCLP	8022CWCCLP
8022WWCCL Comfort Clear™, Molded Trim Ring	8022DWCCL	8022CWCCL

8022WW ☐ Add suffix. See options for other finishes.

Frame-In Kit

7132BU	Electronic	120V - 277V	26/32W Triple Tube
7132BCU3	PowerSpec® Dimming	120V - 277V	4-Pin (Amalgam)

Note: Add S for Steel frame: ex. S8242HU - Steel Frame
Without S- Die Cast: ex. 8242HU - Die Cast

S7142BU	Electronic	120V - 277V	42W Triple Tube
S7142BCU3	PowerSpec® Dimming	120V - 277V	4-Pin (Amalgam)
S7142BUEM	Electronic	120V - 277V	

Features

1. Downlight/Wall Washer Reflector: 16 ga. Alzak® aluminum. 50° lamp cutoff and lamp image. Provides vertical surface wall wash and downlighting. Comfort Clear™ low iridescence finish. Self-flanged or flangeless with molded white trim ring (field paintable).
2. Socket Cup: Die-cast aluminum cup effectively dissipates heat and positions lamp holder. Snaps onto reflector neck to assure consistently correct optical alignment without tools.
3. Mounting Frame: Die-cast aluminum for dry or plaster ceilings. Accepts other 7" triple tube reflectors.
4. Retaining Springs: Precision-tooled steel friction springs secure reflector to mounting frame for quick, tool-less installation.
5. 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.
6. Ballast/J-Box: Outboard mounted to reduce heat transfer and maintain lamp efficacy and life. Service from below without tools. Provides vertical surface wall wash and downlighting.

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°C supply conductors.

Options and Accessories

Comfort Clear™ Finishes[1]

Diffuse	CCD
Champagne Bronze	CCZ
White	WH

[1]Specify desired flange
W White, P Polished
Blank - Molded Ring

Options and Accessories (continued)

Emergency	Add suffix EM*
Chicago Plenum	Add suffix LC
Emergency Ltg. Kit	FAEM3E*
	FAEM4E*
Fuse (Slow Blow)	Add Suffix F

*See Spec. Sheets: FAEM

Mounting Bars & Accessories; see Specification Sheet MBA.
Sloped Ceiling Adapters; see Specification Sheet SCA.

Labels

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:

LIGHTOLIER®

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Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: HL-20
AUTH: DMM
DATE: 04/12/07

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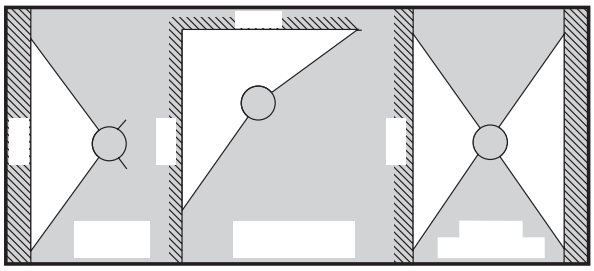

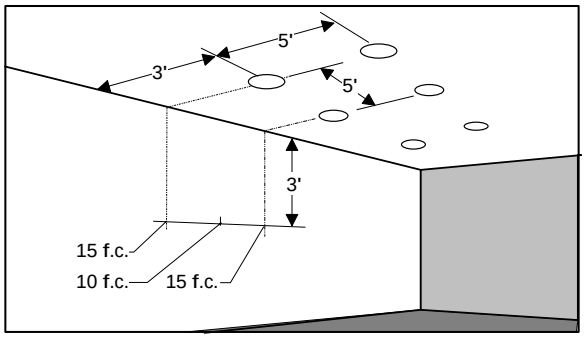

2 o 2 e e

Distance From Ceiling in Feet	2		
1	42	43	42
2	46	45	46
3	43	41	44
4	39	37	39
5	32	32	33
6	26	26	26
7	21	21	21
8	17	17	17
9	14	14	14

2 o 3 e e

Distance From Ceiling in Feet	3		
1	32	24	32
2	34	26	34
3	31	27	31
4	27	25	27
5	22	21	22
6	18	18	18
7	15	14	15
8	12	12	12
9	10	10	10

2 o 4 e er

Distance From Ceiling in Feet	4		
1	30	13	30
2	31	15	31
3	28	16	28
4	21	18	21
5	18	16	18
6	14	13	14
7	11	11	11
8	9	9	9
9	8	8	8

EXAMPLE: With multiple clear reflector units located 3' from wall and spaced 5' on center (matching downlights 5' on center), the illumination on the wall 3' down from ceiling will be 15 f.c. beneath units and 10 f.c. between units.

Footcandle values are averaged and rounded off and are based on a minimum of five units.

CONVERSION FACTORS (Clear):
32W, F.C. x 0.75
26W, F.C. x 0.55

3 o 3 e e

Distance From Ceiling in Feet	3		
1	14	14	14
2	22	22	22
3	21	20	21
4	20	19	20
5	20	18	20
6	18	17	18
7	16	16	16
8	14	14	14
9	13	12	13

3 o 4 e e

Distance From Ceiling in Feet	4		
1	12	10	12
2	17	15	17
3	16	14	16
4	16	14	16
5	15	14	15
6	14	13	14
7	12	12	12
8	11	11	11
9	10	10	10

3 o 5 e e

Distance From Ceiling in Feet	5		
1	11	7	11
2	16	10	16
3	15	10	15
4	14	10	14
5	13	11	13
6	11	10	11
7	10	9	10
8	9	9	9
9	8	8	8

3 o 6 e e

Distance From Ceiling in Feet	6		
1	11	5	11
2	15	7	15
3	14	7	14
4	13	7	13
5	12	8	12
6	10	8	10
7	9	8	9
8	8	7	8
9	7	6	7

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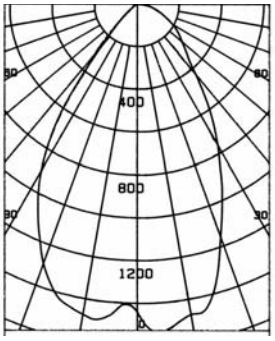
Downlight Side / Wall Washer Side



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% EFFECTIVE CEILING CAVITY REFLECTANCE

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

20% FLOOR CAVITY REFLECTANCE

Job Information Type:

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LIGHTOLIER®

Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE
WILLIAMSTOWN, MA

TYPE: HL-20
AUTH: DMM
DATE: 04/12/07

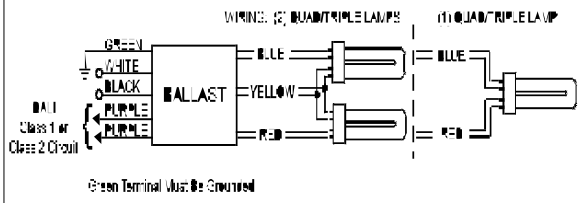
IDL-2S26-M5-LD@277

Brand Name	ROVR
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts) (min/max)	Ballast Factor (min/max)	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
* CFTR42W/GX24Q	1	42	50/10	0.17	09/46	0.03/1.00	10	0.99	1.6	2.17

Wiring Diagram



Diag. 165

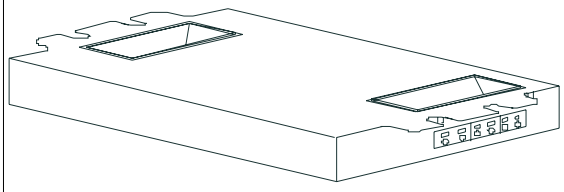
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow	0	0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White		0
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
4.98 "	3.00 "	1.18 "	4.60 "
4 49/50	3	1 9/50	4 3/5
12.6 cm	7.6 cm	3 cm	11.7 cm

Revised 08/17/2006

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

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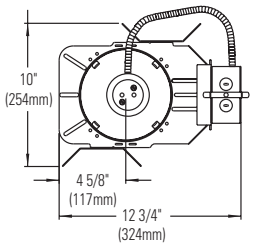
Corporate Offices: Phone: 800-322-2086

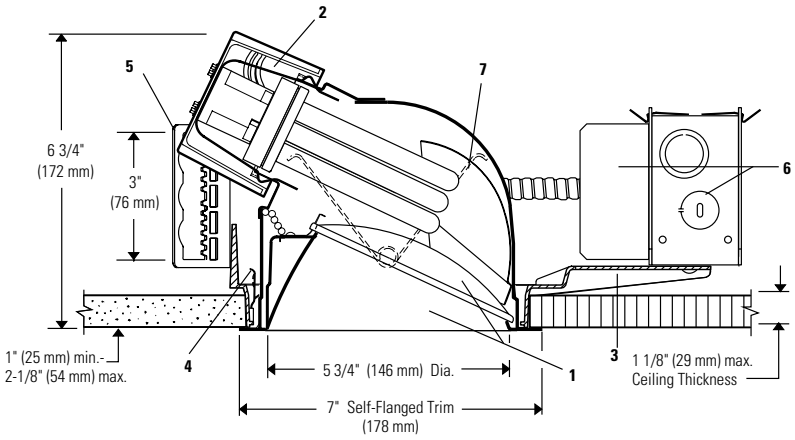
WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE
WILLIAMSTOWN, MA

TYPE: HL-20
AUTH: DMM
DATE: 04/12/07

Calculite® Compact Fluorescent Lensed Wall Washer **8046**

6" Aperture Triple Tube Wall Washer





Ceiling Cutout: 6 9/16" (167 mm) Dia.

Reflector Trim		Frame-In Kit			Lamp
8046CLW	Clear Iridescence Free, White Flange	**S6132BU**	Electronic	120V - 277V	**26 or 32W Triple Tube**
8046CLP	Clear Iridescence Free, Polished Flange	**S6132BCU3**	Universal Dimming	120V - 277V	4-Pin (Amalgam)
8046 ☐	Add suffix. See options for other finishes.	**S6132BJUM7**	Advance Mark7	120V - 277V	

Features

1. **Optics:** Directional prismatic glass spread lens and Alzak® "kick" reflector direct light smoothly across and down wall. Rotates for correct orientation. Aperture cone with Iridescence Free finish.
2. **Socket Cup:** Effectively dissipates heat and positions lamp holder. Snaps onto reflector neck to assure consistently correct optical alignment without tools.
3. **Mounting Frame:** Galvanized steel for dry or plaster ceilings. Accepts other 6" Triple Tube reflectors (see S6132BU Spec Sheet).
4. **Retaining Springs:** Precision-tooled steel friction springs secure reflector to mounting frame for quick, tool-less installation.
5. **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.
6. **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.
7. **Torsiontite Springs:** Wire formed steel holds reflector/spread lens assembly snug to housing.

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° C supply conductors.

Options and Accessories

Comfort Clear™ Finishes[1]		**Other Finishes**	
Clear	**CCL**	White	**WH**
Diffuse	**CCD**		
Champagne Bronze	**CCZ**		
Pewter	**CPW**		

[1]Specify desired flange. **W** White, **P** Polished, Blank - Molded Ring

Other Dimming:

S6132BJ1MX Advance MarkX, 120V
S6132BJ2MX Advance MarkX, 227V
S6132BJ1LD3 Lutron Hi-lume®, 120V
S6132BJ2LD3 Lutron Hi-lume®, 227V

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

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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LIGHTOLIER®

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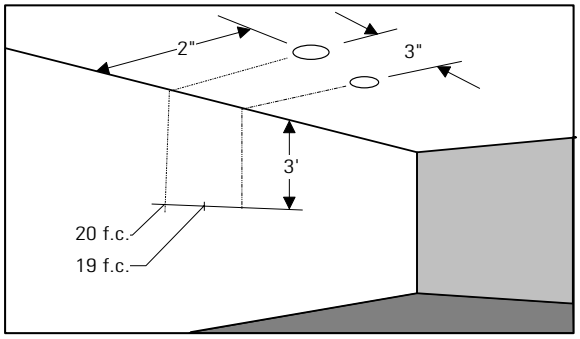
WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: HL-21
AUTH: DMM
DATE: 04/12/07

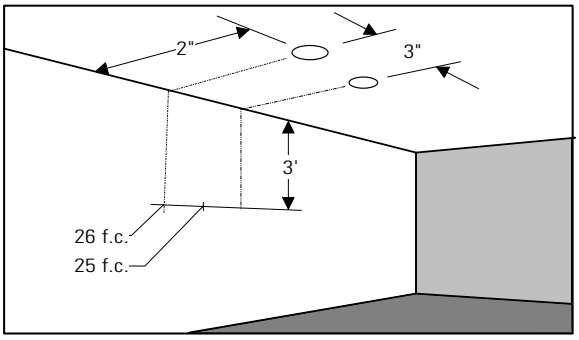
Lighting Data

Footcandles On Wall: Multiple 26w Units



EXAMPLE: With multiple clear reflector units located 2' from wall and spaced 3' on center, the illumination on the wall 3' down from ceiling will be 19 f.c. beneath units and 20 f.c. between units.

Footcandles On Wall: Multiple 32w Units



EXAMPLE: With multiple clear reflector units located 2' from wall and spaced 3' on center, the illumination on the wall 3' down from ceiling will be 26 f.c. beneath units and 25 f.c. between units.

2' From Wall-2' On Center

Distance From Ceiling in Feet	2'		
1	24	22	24
2	31	31	31
3	28	28	28
4	22	22	22
5	17	17	17
6	13	13	13
7	10	11	10
8	9	9	9
9	7	7	7

2' From Wall-3' On Center

Distance From Ceiling in Feet	3'		
1	19	12	19
2	23	19	23
3	**20**	**19**	**20**
4	15	15	15
5	12	12	12
6	9	9	9
7	8	8	8
8	6	6	6
9	6	6	6

2' From Wall-2' On Center

Distance From Ceiling in Feet	2'		
1	33	30	33
2	48	46	48
3	38	38	38
4	28	28	28
5	20	20	20
6	15	15	15
7	12	12	12
8	10	10	10
9	8	8	8

2' From Wall-3' On Center

Distance From Ceiling in Feet	3'		
1	27	16	27
2	36	27	36
3	**26**	**25**	**26**
4	19	19	19
5	14	14	14
6	11	11	11
7	9	9	9
8	7	7	7
9	6	6	6

3' From Wall-3' On Center

Distance From Ceiling in Feet	3'		
1	7	6	7
2	13	12	13
3	14	14	14
4	14	14	14
5	12	12	12
6	10	11	10
7	9	9	9
8	8	8	8
9	7	7	7

3' From Wall-4' On Center

Distance From Ceiling in Feet	4'		
1	6	4	6
2	11	9	11
3	11	10	11
4	11	10	11
5	9	9	9
6	8	8	8
7	7	7	7
8	6	6	6
9	6	6	6

3' From Wall-3' On Center

Distance From Ceiling in Feet	3'		
1	9	8	9
2	19	18	19
3	22	21	22
4	19	19	19
5	16	16	16
6	13	13	13
7	11	11	11
8	9	9	9
9	8	8	8

3' From Wall-4' On Center

Distance From Ceiling in Feet	4'		
1	8	5	8
2	16	12	16
3	17	15	17
4	15	14	15
5	12	12	12
6	10	10	10
7	8	8	8
8	7	7	7
9	6	6	6

Footcandle values are averaged and rounded off and based on minimum of five units.

LIGHTOLIER®

Job Information **Type:**

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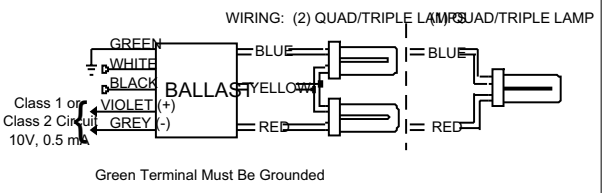
IZT-2S26-M5-LD@277

Brand Name	MARK 7 0-10V
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts) (min/max)	Ballast Factor (min/max)	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
* CFTR26W/GX24Q	1	26	50/10	0.10	08/28	0.03/1.00	10	0.99	1.6	3.57
CFTR26W/GX24Q	2	26	50/10	0.18	13/49	0.03/1.00	10	0.99	1.6	2.04

Wiring Diagram



Diag. 166

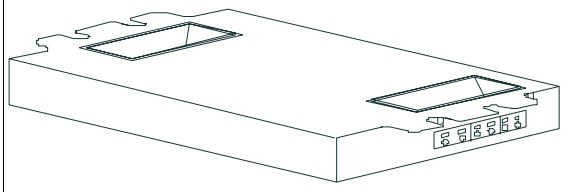
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow	0	0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White		0
Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
4.98 "	3.00 "	1.18 "	4.60 "
4 49/50	3	1 9/50	4 3/5
12.6 cm	7.6 cm	3 cm	11.7 cm

Revised 02/13/2004

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

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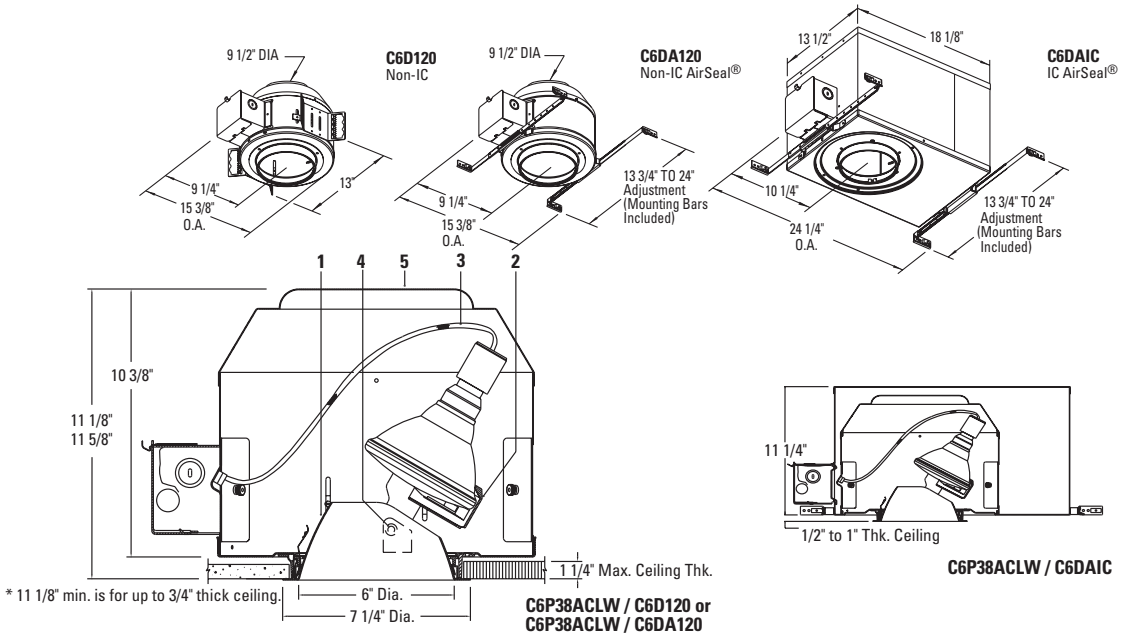
Corporate Offices: Phone: 800-322-2086

Calculite® Evolution Incandescent Adjustable Accent **C6P38A**

6" Aperture PAR38 Reflector Trim



Ceiling Cutout: 6 11/16" Dia.

Reflector Trim		Frame-In Kit		
		Non-IC	Non-IC AirSeal®	IC-AirSeal®
C6P38A CLW	Specular Clear, White Flange			
C6P38A CLP	Specular Clear, Polished Flange			
C6P38A CLW30	Specular Clear, White Flange (30° Cut)	**C6D120**	**C6DA120**	**C6DAIC**
C6P38A CLP30	Specular Clear, Polished Flange (30° Cut)	120W PAR38	120W PAR38	90W PAR38
C6P38A ☐	Add suffix. See options for other finishes			

Features

1. **Aperture Cone:** 16 ga. aluminum. Slot cut cone opening cone minimizes view into fixture. For maximum shielding order the 30° bias cut cone. Keyed to lampholder assembly for true aiming of lamp through aperture center and to prevent incorrect installation of cone. Available with painted white or polished flange. Interchangeable with other Evolution 6" line voltage trims.
2. **Lampholder Assembly:** Die-cast aluminum "U" shape lamp and accessory holder provided with tension springs for fast snap-in/snap-out side mounting of lamp and various accessories. 40° vertical tilt, 360° horizontal rotation; lockable. Can be relamped without disturbing aiming. Hot aiming can be done with the blade of screwdriver. Accepts up to two 4 3/4" dia. accessories. Can be relamped from above.
3. **Socket Harness:** Medium base porcelain socket with nickel plated screw shell, No. 18 SF-1 leads to keyed plug-in quick connector for power connection to junction box.
4. **Vertical / Horizontal Locking:** Single screw adjustment and locking system.
5. **Frame-In Kit:** Compatible frame-In kits are listed above. See separate frame-in kit specification sheets for details.
   Non-IC and Non-IC AirSeal® - Insulation must be kept 3" away from fixture sides and wiring compartments and must not be placed above fixture in a manner which will entrap heat.
   IC-AirSeal® - Fixture may be in direct contact with insulation.

Options & Accessories

Reflector Finishes[1]

Clear:	CL	Gold:	GD	White:	WH
Black:	BK	Pewter:	CPW		
Comfort Clear Diffuse:			CCD		
Champagne Bronze:			CCZ		

[1]Specify desired flange: **W** White, **P** Polished For 30° bias cut cone, add suffix "30".

Options & Accessories (cont.)

Evolution 6" Trims with Non-IC Frames

C6P38A 1 Primary Color Lens *or* 1 Secondary Color Lens *or* 1 Mixing Color Lens *and* 1 Specialty Filter

C6P38A30 1 Primary Color Lens *or* 1 Secondary Color Lens *or* 1 Mixing Color Lens *and* 1 Specialty Filter

Labels

UL listed (suitable for damp locations), I.B.E.W.

US Patent No. 5,957,573. Other US and Foreign Patents Pending.

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.

LIGHTOLIER®

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

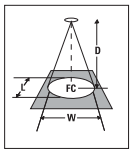
WILLIAMSTOWN, MA

TYPE: HL-22

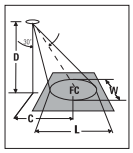
AUTH: DMM

DATE: 04/12/07

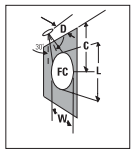
PAR38 Halogen Line Voltage Lamps



0° Aiming Angle



30° Aiming Angle



30° Aiming Angle

Lamps	Beam Spread (To 50% CBCP)	CBCP	Rated Life (Hrs.)	D	FC	L	W	D	C	FC	L	W	D	C	FC	L	W
45W PAR38 NSP	8°	10000	2500	8′	156	1.3′	1.3′	7′	4.0′	133	1.5′	1.3′	3′	5.2′	139	1.9′	0.9′
				12′	69	1.9′	1.9′	10′	5.8′	65	2.1′	1.8′	4′	6.9′	78	2.6′	1.3′
				16′	39	2.5′	2.5′	13′	7.5′	38	2.7′	2.4′	5′	8.7′	50	3.2′	1.6′
				20′	25	3.1′	3.1′	16′	9.2′	25	3.4′	2.9′	6′	10.4′	35	3.8′	1.9′
45W PAR38 SP	12°	5500	2500	6′	153	1.3′	1.3′	5′	2.9′	143	1.4′	1.2′	2′	3.5′	172	1.7′	0.8′
				8′	86	1.7′	1.7′	7′	4.0′	73	2.0′	1.7′	3′	5.2′	76	2.6′	1.3′
				10′	55	2.1′	2.1′	9′	5.2′	44	2.5′	2.2′	4′	6.9′	43	3.5′	1.7′
				12′	38	2.5′	2.5′	11′	6.4′	30	3.1′	2.7′	5′	8.7′	28	4.3′	2.1′
45W PAR38 FL	30°	1700	2500	4′	106	2.1′	2.1′	3′	1.7′	123	2.2′	1.9′	1′	1.7′	213	2.7′	1.1′
				6′	47	3.2′	3.2′	5′	2.9′	44	3.7′	3.1′	2′	3.5′	53	5.5′	2.1′
				8′	27	4.3′	4.3′	7′	4.0′	23	5.1′	4.3′	3′	5.2′	24	8.2′	3.2′
				10′	17	5.4′	5.4′	9′	5.2′	14	6.6′	5.6′	4′	6.8′	13	10.9′	4.3′
50W PAR38 NSP (HIR)	9°	14000	3000	8′	219	1.3′	1.3′	7′	4.0′	186	1.5′	1.3′	3′	5.2′	194	1.9′	0.9′
				12′	97	1.9′	1.9′	10′	5.8′	91	2.1′	1.8′	4′	6.9′	109	2.6′	1.3′
				16′	55	2.5′	2.5′	13′	7.5′	54	2.7′	2.4′	5′	8.7′	70	3.2′	1.6′
				20′	35	3.1′	3.1′	16′	9.2′	36	3.4′	2.9′	6′	10.4′	49	3.8′	1.9′
50W PAR38 FL (HIR)	2.5°	3000	3000	6′	83	2.7′	2.7′	5′	2.9′	78	3.0′	2.6′	2′	3.5′	94	4.2′	1.8′
				8′	47	3.5′	3.5′	7′	4.0′	40	4.2′	3.6′	3′	5.2′	42	6.2′	2.7′
				10′	30	4.4′	4.4′	9′	5.2′	24	5.4′	4.6′	4′	6.9′	23	8.3′	3.5′
				12′	21	5.3′	5.3′	11′	6.4′	16	6.6′	5.6′	5′	8.7′	15	10.4′	4.4′
60W PAR38 SP	10°	17500	3000	8′	273	1.4′	1.4′	7′	4.0′	232	1.6′	1.4′	3′	5.2′	243	2.1′	1.0′
				12′	12	2.1′	2.1′	10′	5.8′	114	2.3′	2.0′	4′	6.9′	137	2.9′	1.4′
				16′	68	2.8′	2.8′	13′	7.5′	67	3.0′	2.6′	5′	8.7′	88	3.6′	1.7′
				20′	44	3.5′	3.5′	16′	9.2′	44	3.7′	3.2′	6′	10.4′	61	4.3′	2.1′
60W PAR38 FL	30°	3200	3000	6′	89	3.2′	3.2′	5′	2.9′	83	3.7′	3.1′	2′	3.5′	100	5.5′	2.1′
				8′	50	4.3′	4.3′	7′	4.0′	42	5.1′	4.3′	3′	5.2′	44	8.2′	3.2′
				10′	32	5.4′	5.4′	9′	5.2′	26	6.6′	5.6′	4′	6.9′	25	10.9′	4.3′
				12′	22	6.4′	6.4′	11′	6.4′	17	8.1′	6.8′	5′	8.7′	16	13.7′	5.4′
60W PAR38 WFL (HIR)	53°	1250	3000	3′	139	3.0′	3.0′	3′	1.7′	90	4.3′	3.5′	1′	1.7′	156	15.7′	2.0′
				5′	50	5.0′	5.0′	5′	2.9′	32	7.2′	5.6′	2′	3.5′	39	31.4′	4.0′
				7′	26	7.0′	7.0′	7′	4.0′	17	10.1′	8.1′	3′	5.2′	17	47.1′	6.0′
				9′	15	9.0′	9.0′	9′	5.2′	10	13.0′	10.4′	4′	6.9′	10	62.8′	8.0′
90W PAR38 NSP	9°	19500	2500	10′	195	1.6′	1.6′	8′	4.6′	198	1.7′	1.5′	4′	6.9′	152	2.6′	1.3′
				15′	87	2.4′	2.4′	12′	6.9′	88	2.5′	2.2′	6′	10.4′	60	3.8′	1.9′
				20′	49	2.4′	2.4′	16′	9.2′	49	3.4′	2.9′	8′	13.9′	38	5.1′	2.5′
				25′	31	3.9′	3.9′	20′	11.5′	32	4.2′	3.6′	10′	17.3′	24	6.4′	3.1′
90W PAR38 SP	12°	14500	2500	8′	227	1.7′	1.7′	7′	4.0′	192	2.0′	1.7′	3′	5.2′	201	2.6′	1.3′
				12′	101	2.5′	2.5′	10′	5.8′	94	2.8′	2.4′	4′	6.9′	113	3.5′	1.7′
				16′	57	3.4′	3.4′	13′	7.5′	56	3.7′	3.2′	5′	8.7′	73	4.3′	2.1′
				20′	36	4.2′	4.2′	16′	9.2′	37	4.5′	3.9′	6′	10.4′	50	5.2′	2.5′
90W PAR38 FL	28°	4500	2500	6′	125	3.0′	3.0′	5′	2.9′	117	3.4′	2.9′	2′	3.5′	141	4.9′	2.0′
				8′	70	4.0′	4.0′	7′	4.0	60	4.8′	4.0′	3′	5.2′	63	7.4′	3.0′
				10′	45	5.0′	5.0′	9′	5.2′	36	6.1′	5.2′	4′	6.9′	35	9.8′	4.0′
				12′	31	6.0′	6.0′	11′	6.4′	24	7.5′	6.3′	5′	6.7′	23	12.3′	5.0′
90W PAR38 WFL	60°	1300	2500	3′	144	3.5′	3.5′	3′	1.7′	94	5.2′	4.0′	1′	1.7′	163	*	2.3′
				5′	52	5.6′	5.6′	5′	2.9′	34	6.7′	6.7′	2′	3.5′	41	*	4.6′
				7′	27	8.1′	8.1′	7′	4.0′	17	12.1′	9.3′	3′	5.2′	16	*	6.9′
				9′	16	10.4′	10.4′	9′	5.2′	10	15.6′	12.0′	4′	6.9′	10	*	9.2′
100W PAR38 SP (HIR)	10°	29000	2500	10′	290	1.7′	1.7′	8′	4.6′	294	1.9′	1.6′	4′	6.9′	227	2.9′	1.4′
				15′	129	2.6′	2.6′	12′	6.9′	131	2.8′	2.4′	6′	10.4′	101	4.3′	2.1′
				20′	73	3.5′	3.5′	16′	9.2′	74	3.7′	3.2′	8′	13.9′	57	5.7′	2.8′
				25′	46	4.4′	4.4′	20′	11.5′	47	4.7′	4.0′	10′	17.3′	36	7.2′	3.5′
100W PAR38 NFL (HIR)	27°	7500	3000	7′	153	3.4′	3.4′	6′	3.5′	135	3.9′	3.3′	2′	3.5′	234	4.6′	1.9′
				10′	75	4.8′	4.8′	9′	5.2′	60	5.9′	5.0′	3′	5.2′	104	7.0′	2.9′
				13′	44	6.2′	6.2′	12′	6.9′	34	7.8′	6.7′	4′	6.9′	59	9.3′	3.6′
				16′	29	7.7′	7.7′	15′	8.7′	22	9.8′	8.3′	5′	8.7′	38	11.6′	4.8′
100W PAR38 FL (HIR)	40°	3400	3000	6′	94	4.4′	4.4′	5′	2.9′	88	5.1′	4.2′	2′	3.5′	106	9.7′	2.9′
				8′	53	5.8′	5.8′	7′	4.0′	45	7.1′	5.9′	3′	5.2′	47	14.5′	4.4′
				10′	34	7.3′	7.3′	9′	5.2′	27	9.1′	7.8′	4′	6.9′	27	19.3′	5.8′
				12′	24	8.7′	8.7′	11′	6.4′	18	11.2′	9.2′	5′	8.7′	17	24.2′	7.3′
120W PAR38 NSP	10°	25000	3000	10′	250	1.7′	1.7′	8′	4.6′	254	1.9′	1.6′	4′	6.9′	195	2.9′	1.4′
				15′	111	2.6′	2.6′	12′	6.9′	113	2.8′	2.4′	6′	10.4′	87	4.3′	2.1′
				20′	63	3.5′	3.5′	16′	9.2′	63	3.7′	3.2′	8′	13.9′	49	5.7′	2.8′
				25′	40	4.4′	4.4′	20′	11.5′	41	4.7′	4.0′	10′	17.3′	31	7.2′	3.5′
120W PAR38 FL	30°	5000	3000	6′	139	3.2′	3.2′	5′	2.9′	130	3.7′	3.1′	2′	3.5′	156	5.5′	2.1′
				8′	78	4.3′	4.3′	7′	4.0′	66	5.1′	4.3′	3′	5.2′	69	6.2′	3.2′
				10′	50	5.4′	5.4′	9′	5.2′	40	6.6′	5.6′	4′	6.9′	39	10.9′	4.3′
				12′	35	6.4′	6.4′	11′	6.4′	27	8.1′	6.8′	5′	8.7′	25	13.7′	5.4′
120W PAR38 WFL	50°	2000	3000	4′	125	3.7′	3.7′	3′	1.7′	144	4.0′	3.2′	1′	1.7′	250	10.7′	1.9′
				6′	56	5.6′	5.6′	5′	2.9′	52	6.7′	5.4′	2′	3.5′	63	21.5′	3.7′
				8′	31	7.5′	7.5′	7′	4.0′	27	9.4′	7.5′	3′	5.2′	28	32.2′	5.6′
				10′	20	9.3′	9.3′	9′	5.2′	16	12.1′	9.7′	4′	6.9′	16	42.9′	7.5′

Accent Lighting Performance Data

(FC) is initial footcandles at center of beam. Beam length **(L)** and beam width **(W)** are to where the candlepower is reduced to 50% of the center beam candlepower.

CBCP is center beam candlepower. **(C)** is distance to the center of the beam.

Lamp data shown is typical, and is based on bare lamp photometrics. Contact lamp manufacturers for availability and performance.

Job Information **Type:**

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LIGHTOLIER®

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WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE
WILLIAMSTOWN, MA

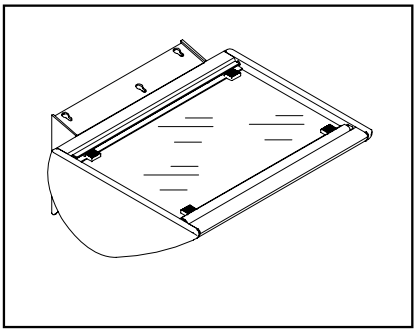
TYPE: HL-22
AUTH: DMM
DATE: 04/12/07

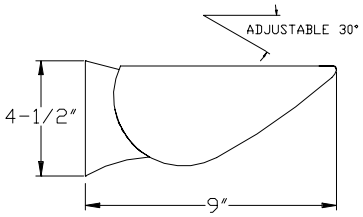
INDOOR ARCHITECTURAL LUMINAIRES

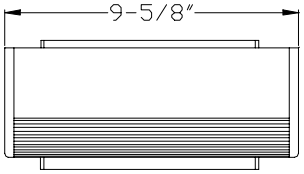
TIEMPO TM5

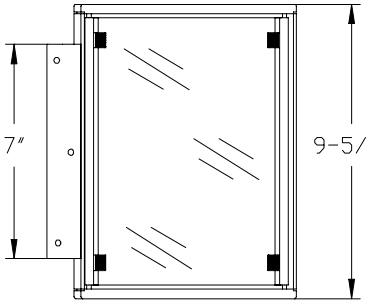
SURFACE MOUNT REMOTE BALLAST

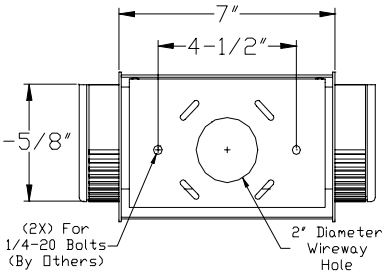
QUARTZ HALOGEN, CERAMIC METAL HALIDE AND METAL HALIDE











ORDERING

FIXTURE	MOUNTING	REFLECTOR	VOLTS	FINISH	OPTIONS
Quartz Halogen **TM501** 500W Max Mini-Can **Ceramic Metal Halide** **TM517** 35W/39W CMH (T6, G12 Base) **TM522** 70W CMH (T6, G12 Base) **TM523** 100W CMH (T6, G12 Base) **TM527** 150W CMH (T6, G12 Base) **Metal Halide** **TM540** 70W MH (E17, Med Base) **TM541** 100W MH (E17, Med Base) **TM542** 150/175W MH (E17, Med Base) (Specify Wattage)	**RCB** Surface Mount Remote Ballast	**(1)** Asymmetric Indirect **(2)** Asymmetric Wallwash	**1**=120V **2**=277V **7**=347V Quartz Halogen Available in 120V Only	**W** Semi-Gloss White **BL** Semi-Gloss Black **BR** Semi-Gloss Bronze **N** Semi-Gloss Natural **S** Semi-Gloss Satin **G** Semi-Gloss Graphite **SF** Specify Finish (See Color Chart) **CC** Custom Color (Contact Factory)	**VS** Solid Cutoff Visor **VP** Perforated Cutoff Visor **GS** External Louvered Visor **AL** Adjustable Shutter **SS** Adjustable Back Sawtooth Shield **CF** "Fade Not" Visored Color Lens **CDF** Dichroic Visored Color Lens **UV** UV Filter **F** HLR Fuseholder **QEM** Quartz Emergency Socket # **QL** Quartz Restrike—Hot/Cold Relay # **CM-X** Column Mount (X=Column Diameter)* # DC Bayonet Lamp, 50W Maximum. Available With TM517, TM522, TM523, TM527 Only. * Consult Factory For Minimum Column Dia.
ORDERING EXAMPLE: TM517 / WCB / (1) / 1 / W / GS					

SPECIFICATIONS

Housing Extruded aluminum housing with die cast end plates secured to mounting bracket with a single fastener. Fastener is hidden inside of lamp housing allowing for no visible hardware.
Lens Clear prismatic tempered glass lens. Lens is secured to an anodized extruded aluminum frame. Lamp is maintained by a tool-less doorframe with die cast aluminum latches that hinge in either direction for ease of lamping and maintenance.
Reflector Die formed highly efficient unitized reflector systems constructed of 95% specular anodized peened aluminum. Reflector can be easily adjusted in field by hand rotating lamp housing to desired position while illuminated.
Wall Bracket: The wall bracket mounts to a standard 4-0 j-box (by others). Additional structural support is required (by others).
Electrical Quartz Halogen is available in 120V only. All Metal Halide ballasts are remote, high power factor, encased & potted, thermally protected, class 'B' sound rated, and supplied with j-box for thru wiring. Butterfly brackets supplied for T-bar ceiling mounting.
Labels Underwriters Laboratories and Canadian

FIXTURE	MOUNTING TYPE	REFLECTOR	VOLTS	FINISH	OPTIONS
TM5_____	RCB				

APPROVED: _____

JOB NAME: _____

TYPE: _____

INSIGHT

TEL: 505 345-0888 FAX: 505 345-3838
www.insightlighting.com

Ustudio

WILLIAMS COLLEGE
'62 CENTER FOR THEATRE & DANCE

WILLIAMSTOWN, MA

TYPE: HL-23

AUTH: DMM

DATE: 04/12/07

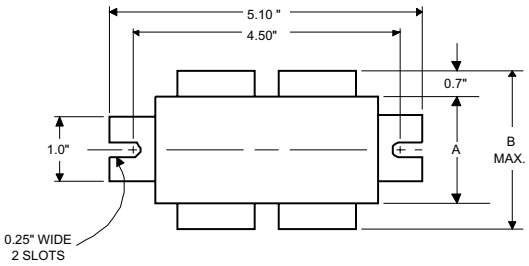
ADVANCE™

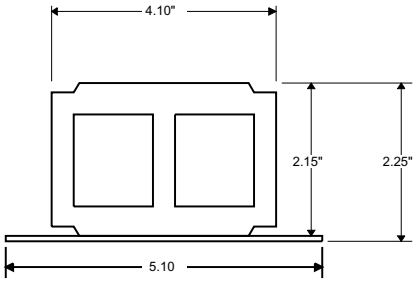
Metal Halide Lamp Ballast

Catalog Number 71A5005P
For 35/39W M130
60 Hz HX-HPF
Status: Active

DIMENSIONS AND DATA

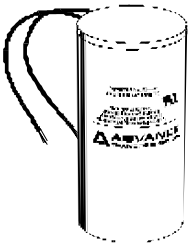
2 X 4 CORE





INPUT VOLTS		120				
CIRCUIT TYPE	HX-HPF					
POWER FACTOR (min)	90%					
REGULATION						
Line Volts	±5%					
Lamp Watts	±10%					
LINE CURRENT (Amps)						
Operating.....		0.50				
Open Circuit.....		1.10				
Starting.....		0.45				
UL TEMPERATURE RATINGS						
Insulation Class	H(180°C)					
Coil Temperature Code	1029	A				
MIN. AMBIENT STARTING TEMP.	-20°F or -30°C					
NOM. OPEN CIRCUIT VOLTAGE	230					
INPUT VOLTAGE AT LAMP DROPOUT.....		100				
INPUT WATTS	55					
RECOMMENDED FUSE (Amps).....		3				
CORE and COIL						
Dimension (A)	0.83					
Dimension (B)	1.70					
Weight (lbs.)	2					
Lead Lengths	12"					
CAPACITOR REQUIREMENT						
Microfarads	28.0					
Volts (min.)	120					
Fault Current Withstand (amps)						
60 Hz TEST PROCEDURES (Refer to Advance Test Procedure for HID Ballasts - Form 1270)						
High Potential Test (Volts)						
1 minute	2000					
2 seconds	2500					
Open Circuit Voltage Test (Volts)	205-255					
Short-Circuit Current Test (Amps)						
Secondary Current	0.60-0.75					
Input Current.....		0.30 0.50	-	-	-	-

Capacitor: 7C280M12



Capacitance: 28
Dia/Oval Dim: 1.5
Height: 2.9
Temp Rating: 105°C

Ignitor: LI533-H4

Ballast to Lamp Distance (BTL) = 15 feet
Temp Rating: 105°C

Wiring Diagram:

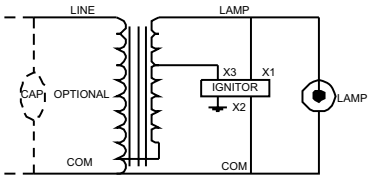


Fig. F

U.L. RECOGNIZED

Typical Ordering Information

(please call Advance for suffix availability)

Order Suffix	Description
500D.	Ballast With Ignitor and Dry Film Capacitor
510D.	Ballast w/Welded Bracket, Ignitor, & Dry Film Capacitor
600.	Ballast and Ignitor, No Capacitor
610.	Ballast with Welded Bracket and Ignitor, No Capacitor

Data is based upon tests performed by Advance Transformer in a controlled environment and representitive of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice

ADVANCE
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06/22/00