Walter Nichols
Hawthorn Building
Altoona, PA

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Note: * indicates that this topic has changed since the original proposal

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Executive Summary

The Hawthorn Building at Penn State presented many design challenges when attempting to provided a decent building system while meeting codes and design criteria. Each building system was designed to solve the problems of the space in a tasteful way while meeting the requirements of the codes and criteria. The lighting redesign of the Hawthorn Building includes the following spaces: the Main Corridor, the Pechter Family Music Room, the Lecture Hall classroom, and the Computer Classroom.

This report includes an in-depth analysis of the design criteria, design concerns and goals, schematic design, and finally the lighting calculation values for the lighting systems. Energy efficient lamps, appropriate power density calculations, and control systems were also included in the lighting design of the spaces.

The electrical depth of my report focuses on the checking the sizing of the new lighting system, making sure the panel boards can safely handle the new loading, sizing the panel boards, and doing the same for the emergency electrical system. This depth study is different than what was originally purposed. After speaking with my contact at Penn State Altoona as well as Dr. Mistrick, I felt that this depth study was more appropriate than the one originally purposed.

For my first breadth study, I wanted to elaborate more on the idea of energy saving lamps and how much could be saved if a construction management cost analysis was done. After designing my lighting systems for the building, I went back and checked different possibilities for lamps that could be used. A detailed spreadsheet with energy savings, kilowatt usage, and rate charges was created o see how much money per year could be saved by using energy efficient lamps.

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My second breadth study was an acoustical design in the Pechter Family Music Room. Since I would be changing the existing lighting system, which in turn would change the existing acoustical system, I decided that I should design an appropriate acoustical system for the room with the new lighting system. Different types of wall panels, ceiling pyramids, and architectural materials were analyzed to create an appropriate acoustical system for the room.

In conclusion, the systems chosen for the different spaces show how all of the different architectural systems work together with each other. It also shows how making changes to certain parts of a system will affect the other systems. All of these things come together to form the complete building system.

Background

The Hawthorn Building was substantially completed in January of 2004. Before then, the existing library and computer lab shared the same building. As the campus continued to grow, it was soon realized that each would need its own building. The Hawthorn Building was built to replace the old computer labs, and the library took over where the computer labs once where. The project was a design-bid-build, and took just over a year to complete. The architect for the project was WTW Architects of Pittsburgh and the contractor was Lawruk Builders, Inc. of Altoona.

I mainly chose this building because it is located 10 minutes outside my home and a close friend of my family works there. This allowed me to easily visit the building relatively whenever I needed, as well as gave me a personal another personal contact if I needed additional information on the building. The spaces of this building are also multipurpose, which created some problems when designing the building systems, but also allowed me to be more creative in my design.

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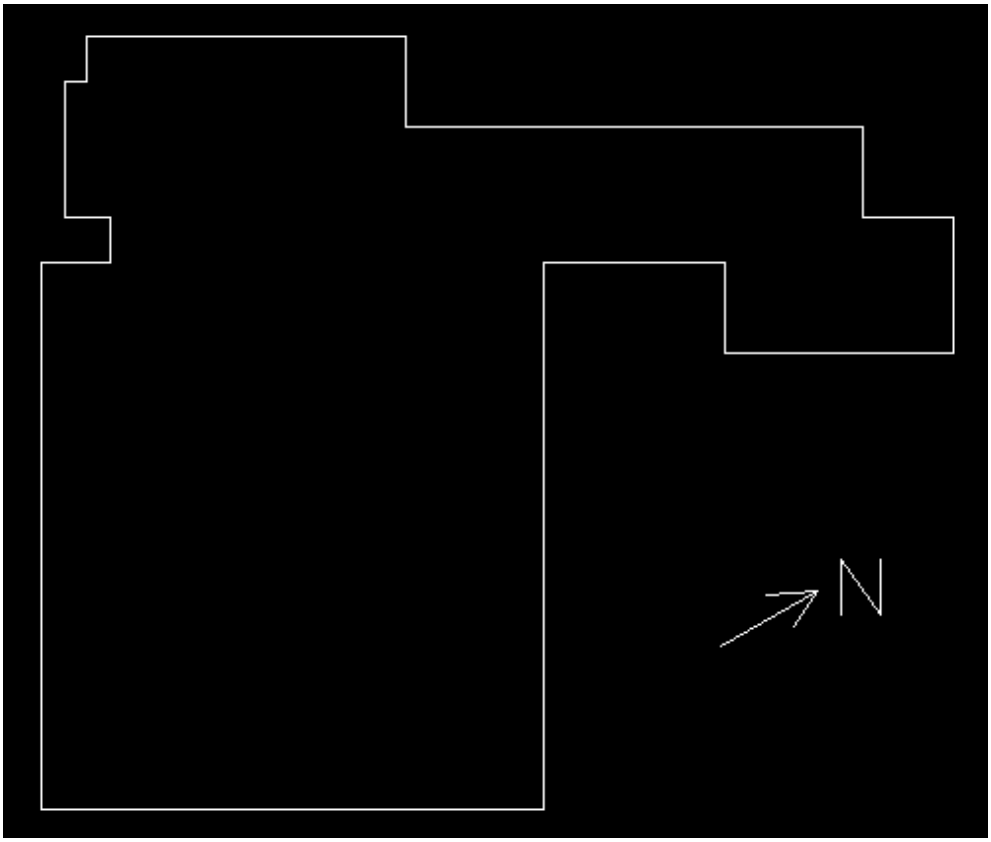
Architecture

The Hawthorn Building is just less than 59,000 sq. ft. in area. Its architectural style is similar to the other Penn State buildings on the Altoona Campus, in that it is relatively rectangular in shape, uses a steel structural system, and has a red brick façade. Grass and trees surround the building. It is 2 stories high, and is designed to allow for lots of circulation and gathering points inside.

Site Plan



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Lighting Depth

Introduction

Four spaces of the Hawthorn Building will be analyzed in this lighting redesign. They are: the Main Corridor, the Pechter Family Music Room, the Lecture Hall classroom, and the Computer Classroom. Each space has it's own function and feeling to it, and was addressed in the lighting redesign.

Problem Statement

The major challenge of the lighting redesign was to meet the multiple needs of each space. Since every room in the building is used for more than 1 activity, it was difficult finding solutions that were flexible to the multiple needs of the spaces. Another key consideration was making sure that all the spaces in the building meet ASHREA 90.1 electrical code.

Design Criteria

Besides meeting the ASHREA 90.1 electrical code, there were other criteria that needed to be taken into consideration when doing the lighting design for the Hawthorn Building. Glare (reflected and direct), lighting distributions, color temperature, color rendering, and luminiare appearance were also issues to consider. Design criteria for each space will be gone over in more detail in each space's section later in the report. All models were built in AutoCAD, and lighting calculations were performed in AGI32.

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Main Corridor

Design Concept

The purpose of this space is to act as a major circulation point in the building. The space has white walls and ceilings, and an intricate tile pattern on the floor. My main design concept was to try and create a cove lighting feel to the space, without changing the architecture of the space. I did this by using a wall mounted 95% uplight fixture at 7.5 feet. Since the space is a major circulation space, I felt that facial recognition was important. The "cove" would help bring the light up onto people's faces, but wouldn't be harsh because the light is mostly uplight. By lighting the walls and the ceiling, it would give the space a wider and larger feel that what it really is as well. To make sure enough light reached the ground in the middle of the corridor, I also used small 4" downlights to provide the extra needed light on the floor. The same size downlights were also used above the doorways in the corridor to make the entrances to the rooms easier to see.

Design Criteria

System Control and Flexibility

The lighting system will need to be on all the time when the building is active at full output because there is very little daylight entering this space. Because of this, I chose to run the lighting system off of standard, non-dimming electrical ballasts with switching at both ends of the corridor.

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Appearance of Space

The appearance of this space is important because it is the first and last thing you see when you enter and leave the space. This is where you get your first impression of the building, almost like a lobby area. This should draw people into the building from the outside, as well as make them feel comfortable when they get inside.

Surface Characteristics

The corridor has standard, white walls on both sides, and the doors are made of a lighter colored wood. The main architectural feature to this space is the intricate floor-tiling pattern. This pattern stands out and is highlighted by the downlights that run through the middle of the space.

Atmosphere

As stated before, this space is primarily for circulation, so the atmosphere is fairly fast paced and smooth.

IES Criteria:

Horizontal:
Simple visual tasks (walking): 10 FC

Vertical:
Simple Orientation: 5 FC

Because of the fast paced environment, the need for facial rendering, and the need to act as a main entering point, I wanted to get levels higher than the recommended by IES.

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Power Allowances from ASHREA 90.1:

0.5-1.6 w/ft^2

Table 9-B – Common Space Types for Space-by-Space Method

Space Type	*W/ft² Range*	*Space Type*	*W/ft² Range*
Office, enclosed	1.5	Dining area	1.0 to 2.2
Office, open	1.3	Foot preparation	2.2
Conference, meeting, multipurpose	1.5	Restrooms	1.0
Classroom, lecture , training	1.4 to 1.6	Corridor, transition	0.5 to 1.6
Audience, seating area	0.5 to 3.2	Stairs, active	0.9
Lobby	0.8 to 1.8	Storage, active	1.1 to 2.9
Atrium, first three floors	1.3	Storage, inactive	0.3 to 1.4
Atrium, each additional floor	0.2	Electrical, mechanical	1.3
Lounge, recreation	1.4		

Fixture Schedule (see appendices for cut sheets and light loss factors):

Type	Description	Lamps	Voltage	Wattage	Ballast	Quantity
A1	Downlight	(1) 18w CFT	277	20	Electric	18
A2	Wall mounted fixture	(1) 28w T5	277	33	Electric	27

Calculations:

27 wallmount fixtures * 33 watts/fixture = 891 watts @ 277v

18 downlight fixtures * 20 watts/fixture = 360 watts @ 277v

Power density = 2050 watts / 1400 ft^2 = 1.46 watts/ft^2

Therefore, power density is ok.

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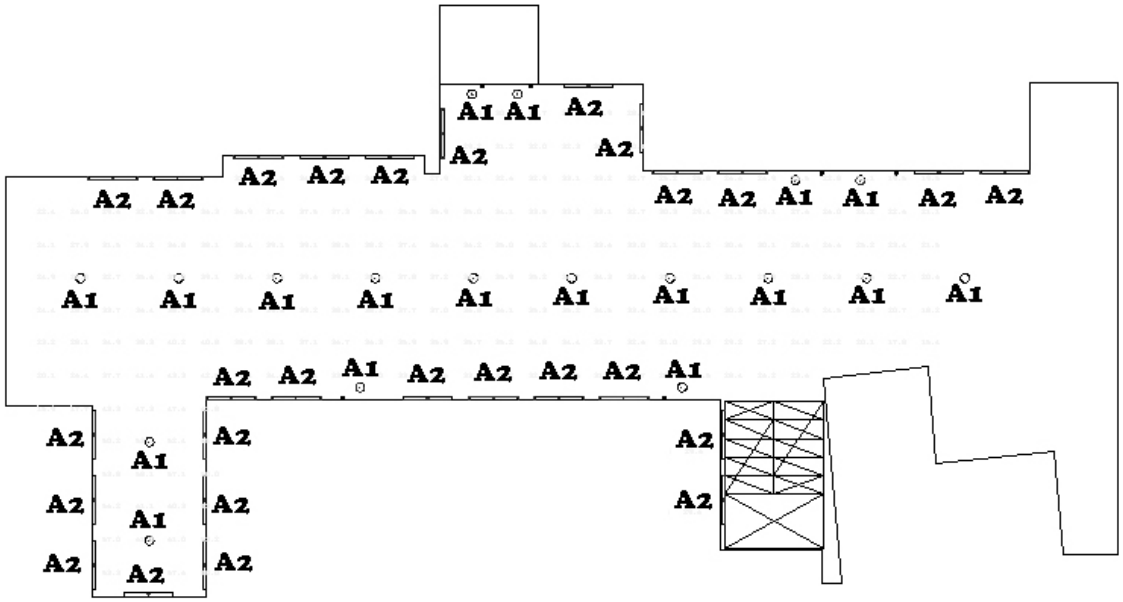
Lighting Plan



Note: Both A1 and A2 go to Panel HV1

10 of A1 go to emergency Panel NEH

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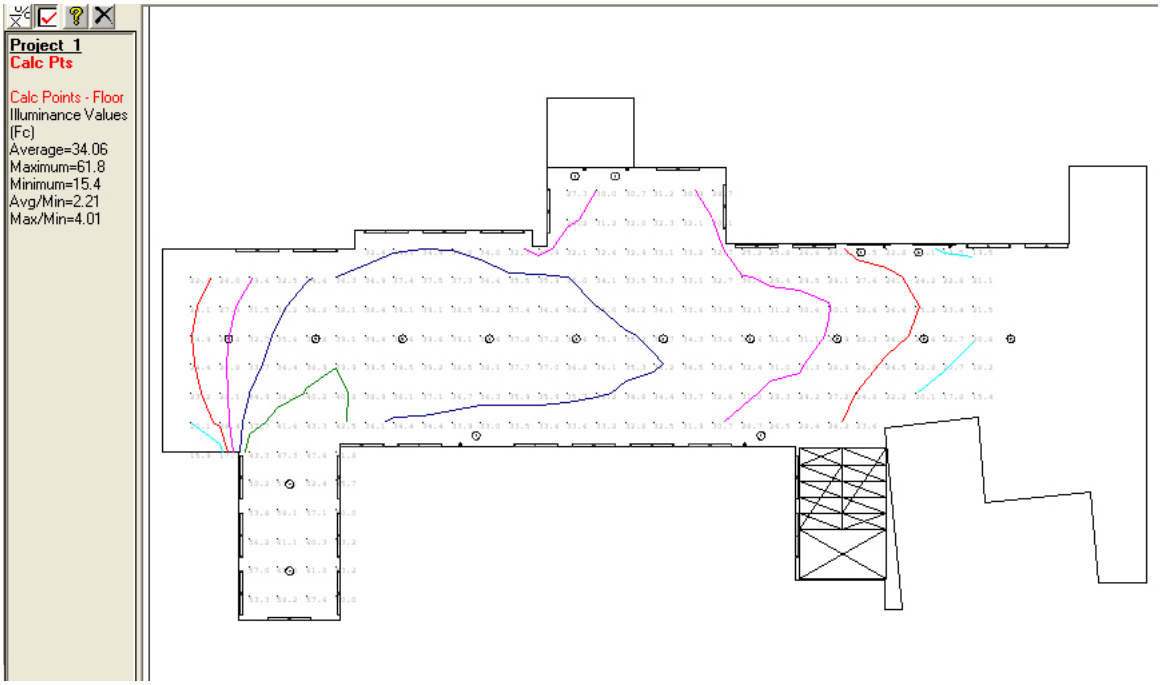

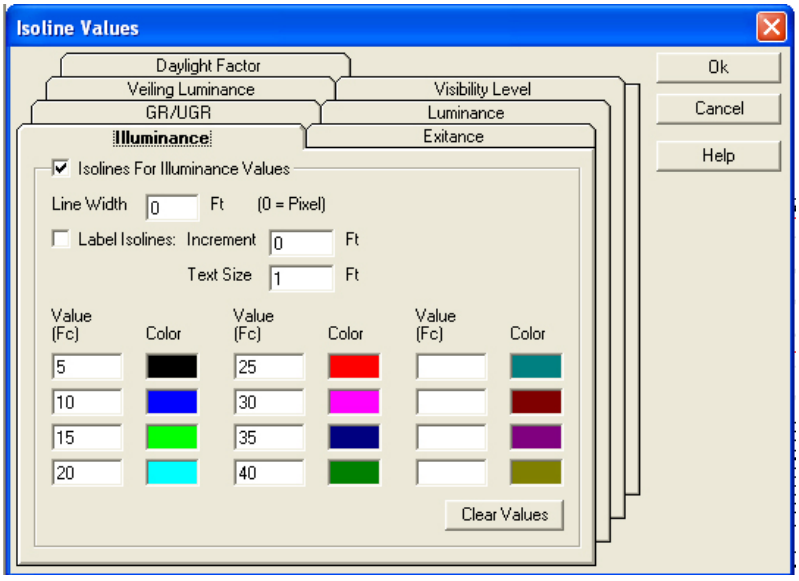

Conclusion

The main corridor provides a lighting solution that provides more than enough light into the space, but also does it in a way the compliments the functions of the space. The main source of light for the space is the wall mounted fixtures, but the downlights help to add the extra punch needed to get more light onto the floor, as well as makes the tile pattern on the floor stand out more than the wall mounted fixtures would do alone.

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Music Room

Design Concept

The purpose of this space is to act as both a classroom as well as a place to practice music and singing. The music room has 2 ceilings in it. The first is a 10' high ceiling the is suspended over the front part of the classroom, while the second ceiling is 15' high and covers the entire ceiling. The walls in this space are white with brown acoustical panels from my breadth study (more on this topic later). The 10' ceiling is white acoustical pyramids (more on this topic later as well), while the 15' ceiling is painted black and hidden behind mechanical equipment. The rear walls also have large windows that allow a decent amount of daylight into the space.

My main design concept for this space was to light the space in a way that wasn't standard of other spaces. Since this room is for more artistic uses, I wanted to use more artistic fixtures in it. Since the 10' ceiling is already divided into 2'x2' grids via acoustical ceiling pyramids, I decided to use a 2'x2' recessed indirect system. Most of the classroom activities take place over the 10' ceiling, so this system should provide decent light over the space while looking different that standard 2'x2' parabolics. Along the outside edge of the classroom, I decided to use a suspended 5-bowl cloud pendant to add a nice artistic touch, as well as provide the lighting for the outer edges. The rear of the room also has a 5-bowl cloud pendant suspended above it, as well as the windows in the rear providing a lot of daylight into the space.

Picture of the Cloud Pendant

Design Criteria

System Control and Flexibility

The lighting system won't need to be on all the time because of the large windows in the rear, as well as the rear of the classroom not always being in use. Because of this, I chose to switch the pendants and 2'x2' recessed indirect fixtures separately so the pendants can be turned off when they aren't needed.

Appearance of Space

Generally speaking, people involved in the arts, music, and theater (students and teachers alike) major tend to have a finer appreciation for artistic and aesthetic things. Because of this, I feel that the appearance of this room is very important. I think this room should be lit in a way that isn't standard. The suspended pendants are a nice approach to this. Also, the 2'x2' recessed indirect fixtures provide light in a common way, but with an uncommon look. The daylight also gives this room a nice, welcoming feel to it.

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Surface Characteristics

The walls of this space are covered in acoustical panels that are painted brown. Because these walls are somewhat far away from the front middle section of the classroom where most of the teaching is done, they don't play a large role in making sure enough light gets onto the music stand workplane.

Accent Issues

All of the walls in this space have acoustical panels on them, so there is little need for accent lighting the walls. In the front of the room however, there is a staffed (musical lines) backboard. The front row of 2'x2' recessed indirect fixtures are close enough to the front blackboard, that they act as a wallwash on the board, as well as provide light onto the workplane for the students.

IES Criteria:

Horizontal:
Note taking: 30 FC
General Art Room Requirements: 30 FC
Reading 10 pt. Font: 50 FC

Vertical:
Reading off of a blackboard: 50 FC

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Power Allowances from ASHREA 90.1:

1.4-1.6 w/ft^2

Table 9-B – Common Space Types for Space-by-Space Method

Space Type	*W/ft² Range*	*Space Type*	*W/ft² Range*
Office, enclosed	1.5	Dining area	1.0 to 2.2
Office, open	1.3	Foot preparation	2.2
Conference, meeting, multipurpose	1.5	Restrooms	1.0
Classroom, lecture , training	1.4 to 1.6	Corridor, transition	0.5 to 1.6
Audience, seating area	0.5 to 3.2	Stairs, active	0.9
Lobby	0.8 to 1.8	Storage, active	1.1 to 2.9
Atrium, first three floors	1.3	Storage, inactive	0.3 to 1.4
Atrium, each additional floor	0.2	Electrical, mechanical	1.3
Lounge, recreation	1.4		

Fixture Schedule (see appendices for cut sheets and light loss factors):

Type	Description	Lamps	Voltage	Wattage	Ballast	Quantity
B1	2'x2' recessed indirect	(2) 21w T5	277	48	Electric	16
B2	Cloud Pendant	(5) 60w Halogen Quartz	120	300	NA	3

Calculations:

16 2x2 fixtures * 48 watts/fixture = 768 watts @ 277v
3 pendant fixtures * 300 watts/fixture = 900 watts @120v
Power density = 1686 watts / 2250 ft^2 = 0.75 watts/ft^2

Therefore, power density is ok.

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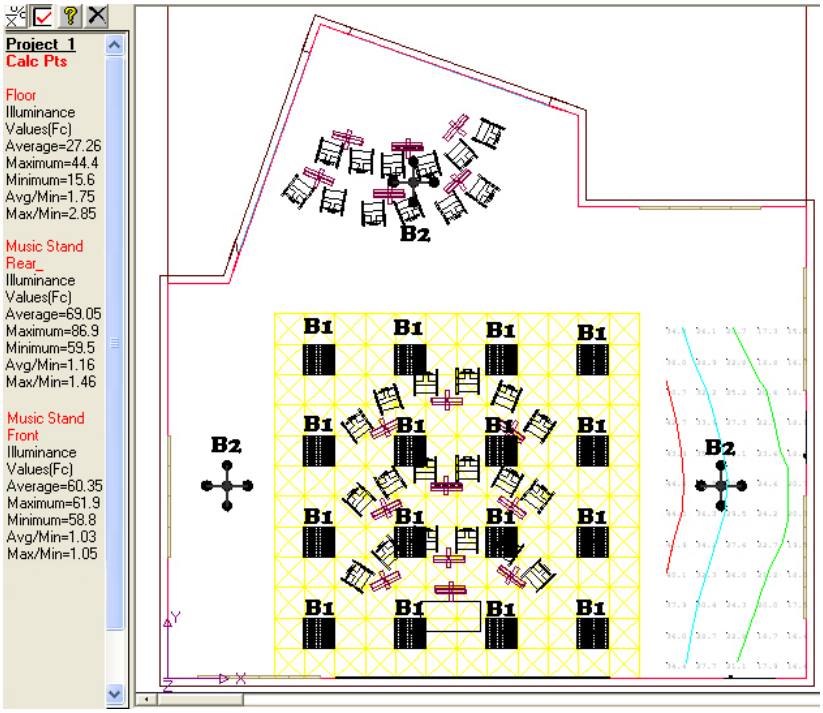
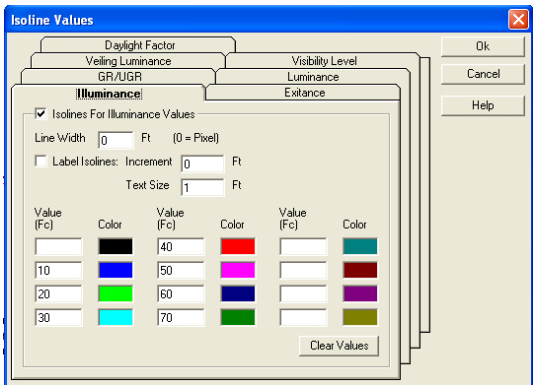
Lighting Plan





Note: Both A1 and A2 go to Panel HV2

3 of B1 go to emergency Panel NEH

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Renderings

Conclusion

The music room provides a lighting solution that supplies enough light into the space while having a certain esthetic appeal to the space. The main source of light for the space is the 2'x2' recessed indirect fixtures, but the pendants provided the needed light to the floor around the perimeter, as well as the sidewalls.

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Auditorium Classroom/Video Conferencing Room

Design Concept

The original purpose of this space was to act as both a classroom as well as a place to hold video conferencing via a web cam and net meeting for students to take the class online. After talking with my contact at Penn State Altoona, I was told that this room was no longer going to be used for video conferencing via net meeting. A classroom upstairs was going to take over the responsibility if it was needed. I designed the space so it would be ok to do video conferencing via net meeting before I found this information out, but since it won't be used for that purpose anymore, I will not be going into depth about it.

The space has a 15' high ceiling, and the seating is raked to a total of 2.5' higher in the rear than the front. Since the room was fairly large and its uses were wide spread, I wanted to keep my lighting design for this space simple and able to function well under multiple scenarios. For that reason, I decided to use 2'x4' lensed troffers for my main light source. Lensed troffers are efficient, supply a decent amount of light, and work well for most scenarios. Along the outer perimeter, I also have recessed wall washers. The wall washers serve two purposes. They make the room seem larger, and they also help to guide you around the room. Finally, I also have two track-mounted spotlights in the front aimed onto the teacher's podium. This was for the original plans of video conferencing, but can still be used if some extra punch is needed. The fixtures are adjustable as well, so they could potentially be aimed at something else if that was wanted.

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Design Criteria

System Control and Flexibility

The lighting system was originally designed with video conferencing in mind, so the control system was taken into consideration. There is a dimming panel located inside the room with all of the fixtures hooked up to it. The panel has multiple programmable scene selections, as well as the ability to dim all of the lighting in the room.

Appearance of Space

My goal for appearance of the space was to keep it simple and multifunctional. The 2'x4' troffers and recessed wallwashers do that. The ceiling is white, and the troffers are lensed with a somewhat stained white lense, so the ceiling should look relatively clean and smooth.

Accent Issues

Since the space is so large, accenting the walls with wallwashers is important to help lead you around the room and down the steps since the floor is raked. The wallwashers in the front also help to illuminate the front blackboard so reading and taking notes is easier.

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IES Criteria:

Horizontal:
Note taking: 30 FC
Reading 10 VDT screens: 3 FC

Vertical:
Reading off of a blackboard: 50 FC
Facial Rendering: 50 FC

Power Allowances from ASHREA 90.1:

1.4-1.6 w/ft^2

Table 9-B – Common Space Types for Space-by-Space Method

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Classroom, lecture , training	1.4 to 1.6	Corridor, transition	0.5 to 1.6
Audience, seating area	0.5 to 3.2	Stairs, active	0.9
Lobby	0.8 to 1.8	Storage, active	1.1 to 2.9
Atrium, first three floors	1.3	Storage, inactive	0.3 to 1.4
Atrium, each additional floor	0.2	Electrical, mechanical	1.3
Lounge, recreation	1.4		

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Fixture Schedule (see appendices for cut sheets and light loss factors):

Type	Description	Lamps	Voltage	Wattage	Ballast	Quantity
C1	2'x4' lensed troffer	(2) 32w T8	277	59	Electric	16
C2	Recessed wallwasher	(1) 54w T5HO	277	62	Electric	13
C3	Track mounted spot	(1) A65 150 Incandescent	277	150	NA	2

16 2x4 fixtures * 59 watts/fixture = 944 watts @ 277v
13 wallwasher fixtures * 62 watts/fixture = 806 watts @ 277v
2 spotlight fixtures * 150 watts/fixture = 300 watts @ 277v
Power density = 2050 watts / 1560 ft^2 = 1.31 watts/ft^2

Therefore, power density is ok.

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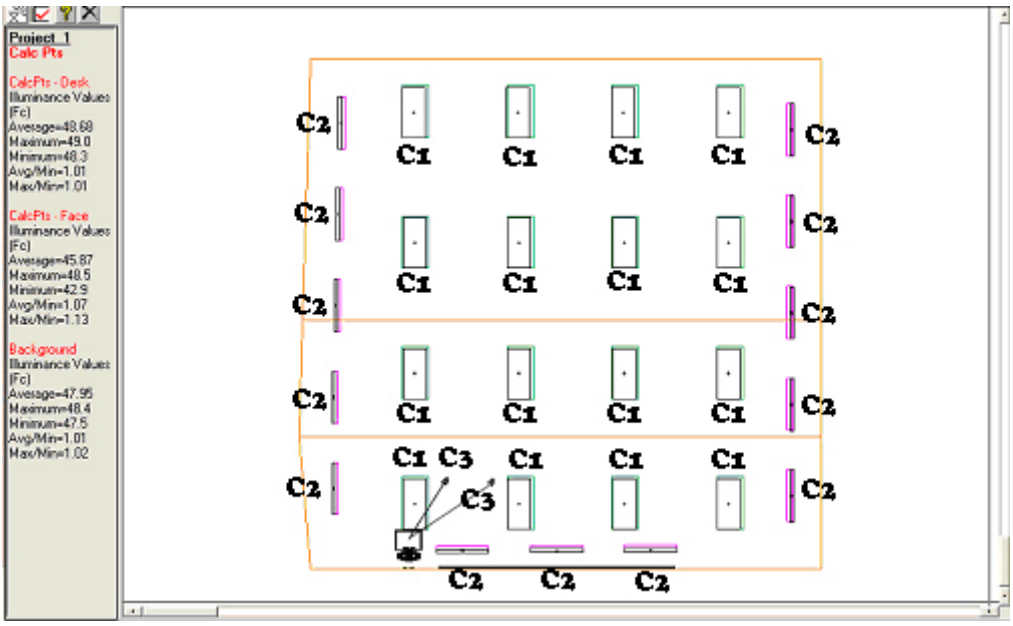
Lighting Plan



Note: C1, C2, and C3 go to Panel SD

10 of C2 go to emergency Panel NEH

Conclusion

The lecture hall provides a lighting solution that supplies enough light into the space while having the ability to customizable by the user via the dimming panel. The solution is relatively simple, but the possibilities are complex and close too endless.

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Computer Classroom

Design Concepts

The purpose of this space is to act as a classroom to computer based classes. Its secondary function is to act as a small computer lab for students to use when there aren't any classes going on in it at that time. The space has a ceiling height of 15'. For my design concept, I wanted to use an indirect/direct system for a few reasons. The first, and most important, is a system with primarily uplight won't cause direct glare on computer screens very easily. Since the ceiling is 15' high, indirect glare shouldn't be a big issue either. The other reason I wanted to use a primarily uplight system is because students are usually looking down at their illuminated computer screen when working in this room, which means the uplight isn't really wasted by going to the ceiling instead of the workplane. I also want the system to run on dimming ballasts so that when the teacher is teaching from their computer (PowerPoint for example), the lights can be dimmed down to a comfortable level instead of turning them all off or leaving them on.

Design Criteria

System Control and Flexibility

As stated above, I want the system to run on dimming ballasts. This will allow the teacher or students to set the correct level for what is going on in the classroom space at that time.

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Appearance of Space

The appearance of this space isn't very important in my opinion. Most of the time, students will have their heads down involved in whatever is happening on their computer screens, so they are going to pay little attention to their surroundings.

Glare

Glare is a large consideration for this space. Indirect/direct lighting is being used to prevent as much direct glare as possible, and the 15' ceiling will help to prevent indirect glare coming back down from the ceiling onto the computer screens.

Atmosphere

The atmosphere for this space is fairly quiet and self-contained. Most of the time, students are doing work by themselves at the computers, but occasionally there will be people doing group work in the space.

IES Criteria:

Horizontal:
Reading VDT screen: 10 FC
Reading paper/taking notes w/ #2 pencil: 40 FC
Keyboard reading: 30 FC

Vertical:
Educational: 5 FC

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Power Allowances from ASHREA 90.1:

1.4-1.6 w/ft^2

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Space Type	*W/ft² Range*	*Space Type*	*W/ft² Range*
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Audience, seating area	0.5 to 3.2	Stairs, active	0.9
Lobby	0.8 to 1.8	Storage, active	1.1 to 2.9
Atrium, first three floors	1.3	Storage, inactive	0.3 to 1.4
Atrium, each additional floor	0.2	Electrical, mechanical	1.3
Lounge, recreation	1.4		

Fixture Schedule (see appendices for cut sheets and light loss factors):

Type	Description	Lamps	Voltage	Wattage	Ballast	Quantity
D1	Indirect/direct pendant	(2) 54w T5HO	277	118	Dimming	16

16 indirect/direct * 118 watts/fixture = 1888 watts @ 277v
Power density = 1888 watts / 1280 ft^2 = 1.48 watts/ft^2

Therefore, power density is ok.

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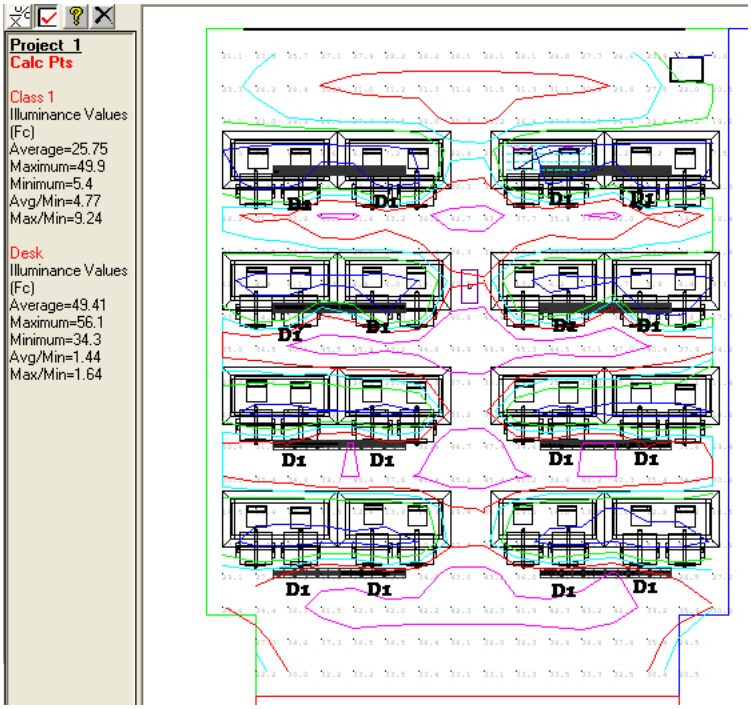
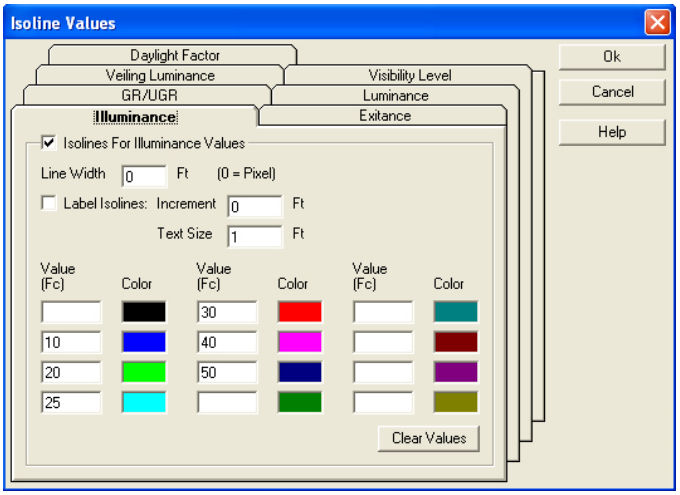
Lighting Plan





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Note: D1 go to Panel HV5

2 of D1 go to emergency Panel NEH

Renderings

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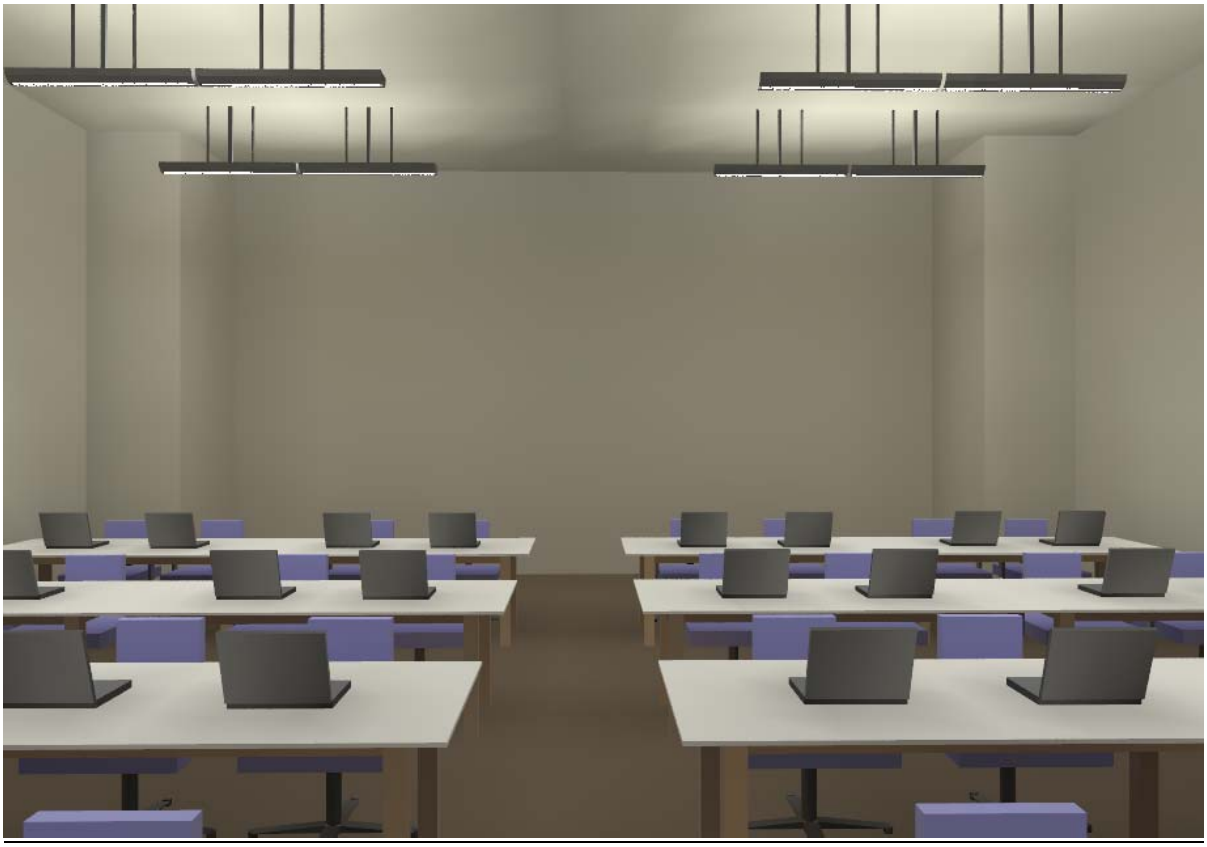

Conclusion

The computer classroom provides a lighting solution that supplies enough light into the space while preventing glare and creating a comfortable and non-distracting environment for the people working in the space. Also, the dimming ballasts allow for custom light levels that match the needs of the people in the space.

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Electrical Depth

Introduction

The electrical depth of my report focuses on the checking the sizing of the new lighting system, making sure the panel boards can safely handle the new loading, sizing the panel boards, and doing the same for the emergency electrical system. This depth study is different than what was originally purposed. After speaking with my contact at Penn State Altoona as well as Dr. Mistrick, I felt that this depth study was more appropriate than the one originally purposed.

Problem Statement

The major challenge of the electrical redesign was to go back after the lighting redesign was done and make sure that everything works out to be electrically ok. After that was done, I would have to check the emergency system to make sure that it was sized ok as well.

Design Criteria

Design criteria were taken from various charts in the NEC 2002 codebook. The criteria include: wire sizing, circuit breaker sizing, conduit sizing, etc, panel board sizing, etc. Panel boards that were resized include: HV1, HV2, HV5, dimming panel SD, and emergency panel NEH.

Short Circuit Rating:	22,000 A		**Panel:**	HV1		**Bus Amp:**	100		
Amps Main Breaker:	60		**Mounting:**	Recessed		**Phase:**	3	**Wire:**	4
Voltage:	277/480 V								

		Breaker		Load (W)			Wire		
CKT	**Description**	**Amp**	**P**	**A**	**B**	**C**	**No.**	**Size**	**Cond**
1	Lighting	20	1	2304			3	12	1/2
3	Lighting	20	1		2816		3	12	1/2
5	Lighting	20	1			2304	3	12	1/2
7	Lighting (Corridor)	20	1	2050			3	12	1/2
9	Spare	20	1	-	-	-	-	-	-
11	Space	-	-	-	-	-	-	-	-
13	Space	-	-	-	-	-	-	-	-
15	Space	-	-	-	-	-	-	-	-
17	Space	-	-	-	-	-	-	-	-

		Breaker		Load (W)			Wire		
CKT	**Description**	**Amp**	**P**	**A**	**B**	**C**	**No.**	**Size**	**Cond**
2	Lighting	20	1	1056			3	12	1/2
4	Lighting	20	1		2034		3	12	1/2
6	Lighting	20	1			960	3	12	1/2
8	Spare	20	1	-	-	-	-	-	-
10	Spare	20	1	-	-	-	-	-	-
12	Space	-	-	-	-	-	-	-	-
14	Space	-	-	-	-	-	-	-	-
16	Space	-	-	-	-	-	-	-	-
18	Space	-	-	-	-	-	-	-	-

Signifies a change from original

Short Circuit Rating:	14,000 A		**Panel:**	HV2		**Bus Amp:**	100		
Amps Main Breaker:	60		**Mounting:**	Recessed		**Phase:**	3	**Wire:**	4
Voltage:	277/480 V								

		Breaker		Load (W)			Wire		
CKT	**Description**	**Amp**	**P**	**A**	**B**	**C**	**No.**	**Size**	**Cond**
1	Lighting	20	1	1344			3	12	1/2
3	Lighting	20	1		2304		3	12	1/2
5	Lighting	20	1			1056	3	12	1/2
7	Lighting (Music)	20	1	1524			3	12	1/2
9	Spare	20	1	-	-	-	-	-	-
11	Space	-	-	-	-	-	-	-	-
13	Space	-	-	-	-	-	-	-	-
15	Space	-	-	-	-	-	-	-	-
17	Space	-	-	-	-	-	-	-	-

		Breaker		Load (W)			Wire		
CKT	**Description**	**Amp**	**P**	**A**	**B**	**C**	**No.**	**Size**	**Cond**
2	Lighting	20	1	2304			3	12	1/2
4	Lighting	20	1		2112		3	12	1/2
6	Lighting	20	1			1344	3	12	1/2
8	Exterior Lighting	20	1	160	-	-	3	12	1/2
10	Spare	20	1	-	-	-	-	-	-
12	Space	-	-	-	-	-	-	-	-
14	Space	-	-	-	-	-	-	-	-
16	Space	-	-	-	-	-	-	-	-
18	Space	-	-	-	-	-	-	-	-

Signifies a change from original

Short Circuit Rating:	14,000 A	**Panel:**	HV5	**Bus Amp:**	100		
Amps Main Breaker:	60	**Mounting:**	Recessed	**Phase:**	3	**Wire:**	4
Voltage:	277/480 V						

		Breaker		Load (W)			Wire		
CKT	**Description**	**Amp**	**P**	**A**	**B**	**C**	**No.**	**Size**	**Cond**
1	Lighting	20	1	1920			3	12	1/2
3	Lighting	20	1		2016		3	12	1/2
5	Lighting	20	1			2304	3	12	1/2
7	Lighting	20	1	960			3	12	1/2
9	Spare	20	1	-	-	-	-	-	-
11	Space	-	-	-	-	-	-	-	-
13	Space	-	-	-	-	-	-	-	-
15	Space	-	-	-	-	-	-	-	-
17	Space	-	-	-	-	-	-	-	-

		Breaker		Load (W)			Wire		
CKT	**Description**	**Amp**	**P**	**A**	**B**	**C**	**No.**	**Size**	**Cond**
2	Lighting	20	1	1728			3	12	1/2
4	Lighting	20	1		3168		3	12	1/2
6	Lighting (Comp)	20	1			1770	3	12	1/2
8	Spare	20	1	-	-	-	3	12	1/2
10	Spare	20	1	-	-	-	-	-	-
12	Space	-	-	-	-	-	-	-	-
14	Space	-	-	-	-	-	-	-	-
16	Space	-	-	-	-	-	-	-	-
18	Space	-	-	-	-	-	-	-	-

Signifies a change from original

Short Circuit Rating:	10,000 A	**Panel:**	SD	**Bus Amp:**	150		
Voltage:	208/120			**Phase:**	3	**Wire:**	4

		Breaker		Dimmer			
CKT	**Serves**	**Amp**	**P**	**Size**	**Type**	**Feeder**	**Notes**
1	House Lights	20	1	2.0 KW	Flourescent	2 #12 & 1 #12 Grd - 3/4" Cond.	Fed From Panel NEL
2	House Lights	20	1	2.0 KW	Flourescent	2 #12 & 1 #12 Grd - 3/4" Cond.	-
3	House Lights	20	1	2.0 KW	Flourescent	2 #12 & 1 #12 Grd - 3/4" Cond.	-
4	House Lights	20	1	2.0 KW	Flourescent	2 #12 & 1 #12 Grd - 3/4" Cond.	-
5	House Lights	20	1	2.0 KW	Flourescent	2 #12 & 1 #12 Grd - 3/4" Cond.	-
6	Spot Lights	20	1	2.0 KW	Incandescent	2 #12 & 1 #12 Grd - 3/4" Cond.	-
7	Spot Lights	20	1	2.0 KW	Incandescent	2 #12 & 1 #12 Grd - 3/4" Cond.	-
8	Spot Lights	20	1	2.0 KW	Incandescent	2 #12 & 1 #12 Grd - 3/4" Cond.	-
9	Spot Lights	20	1	2.0 KW	Incandescent	2 #12 & 1 #12 Grd - 3/4" Cond.	-
10	Spot Lights	20	1	2.0 KW	Incandescent	2 #12 & 1 #12 Grd - 3/4" Cond.	-
11	Spot Lights	20	1	2.0 KW	Incandescent	2 #12 & 1 #12 Grd - 3/4" Cond.	-
12	Spare	20	1	2.0 KW	Flourescent	-	-
13	Spare	20	1	2.0 KW	Incandescent	-	-
14	Spare	20	1	2.0 KW	Incandescent	-	-

Signifies a change from original

Short Circuit Rating:	14,000 A		**Panel:**	NEH		**Bus Amp:**	100	
Amps Main Breaker:	60		**Mounting:**	Surface		**Phase:**	3	**Wire:** 4
Voltage:	277/480 V							

		Breaker		Load (W)			Wire		
CKT	**Description**	**Amp**	**P**	**A**	**B**	**C**	**No.**	**Size**	**Cond**
1	Emergency Lighting	20	1	384			3	12	1/2
3	Emergency Lighting	20	1		576		3	12	1/2
5	Emergency Lighting	20	1			576	3	12	1/2
7	Emergency Lighting (corridor and music)	20	1	324			3	12	1/2
9	Stair Tower Lighting	20	1		512		3	12	1/2
11	Emergency Lighting	20	1			384	3	12	1/2
13	Transformer TE	30	3	3333			-	-	-
15	Transformer TE	30	3		3333		-	-	-
17	Transformer TE	30	3			3333	-	-	-
19	Emergency Lighting (lecture)	20	1	620			3	12	1/2
21	Space	-	-	-	-	-	-	-	-
23	Space	-	-	-	-	-	-	-	-

		Breaker		Load (W)			Wire		
CKT	**Description**	**Amp**	**P**	**A**	**B**	**C**	**No.**	**Size**	**Cond**
2	Emergency Lighting	20	1	448			3	12	1/2
4	Emergency Lighting	20	1		384		3	12	1/2
6	Stair Tower Lighting	20	1			512	3	12	1/2
8	Emergency Lighting	20	1	576			3	12	1/2
10	Emergency Lighting	20	1		448		3	12	1/2
12	Emergency Lighting (comp)	20	1			236	3	12	1/2
14	Spare	20	1	-	-	-	-	-	-
16	Spare	20	1	-	-	-	-	-	-
18	Spare	20	1	-	-	-	-	-	-
20	Space								
22	Space								
24	Space								

Signifies a change from original

Signifies all 3 as same thing

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Altoona, PA

Construction Management Breadth

Introduction

For my first breadth study, I wanted to elaborate more on the idea of energy saving lamps and how much could be saved if a construction management cost analysis was done. After designing my lighting systems for the building, I went back and checked different possibilities for lamps that could be used. A detailed spreadsheet with energy savings, kilowatt usage, and rate charges was created to see how much money per year using energy efficient lamps could save.

Problem Statement

The major challenge of the construction management cost analysis was to go back after the lighting redesign was done and find equivalent lamps to the ones I used in my lighting depth, and then run calculations to see how many kilowatt hours could be saved using the optimal system.

Design Criteria

Design criteria were chosen at will by me. I looked at different types of lamps from different manufactures to see which ones were "energy efficient." From here, I compared them all against each other to see which had the best lumen outputs as well as lowest wattage used. I then chose the ones I thought would be the optimal system, and ran a cost analysis on them, strictly for kilowatt hour usage. Relamping was not taking into account in this study.

Lamp Comparison

Note: All lamps from Philips Lighting unless noted otherwise in lamp description

Note: All ballasts taken from Advance Transformer

Space	Fixture	Lamp Description	Design Lumens	Watts (w/o ballast)	Watts (w/ ballast)
Computer Class	Indirect/direct	(1) 54w T5HO	4740	54	62
	Indirect/direct	(2) 28w T5	5500	56	63
Corridor	Wall mount	(1) 28w T5	2750	28	33
	Wall mount	(1) 34w Cold Cathode (by American Cathode)	2836	34	34
Corridor	Downlight	(1) 18w CFT	1100	18	20
	Downlight	(1) 75w Incan.	1030	75	75
Music Room	2x2 indirect	(2) 21w T5	4000	42	48
	2x2 indirect	(1) 39w T5HO	3320	39	40
Music Room	Cloud Pendant	(5) 60w Halogen Quartz	4600	300	300
	Cloud Pendant	(5) 50w Incan.	4125	250	250
Lecture Hall	2x4 Troffer	(2) 32W T8	5420	64	79
	2x4 Troffer	(2) 32w T8 Ultramax (by GE)	5170	56	71
	2x4 Troffer	(2) 32w T8 Alto energy advantage (by Philips)	5500	60	75
Lecture Hall	Wallwasher	(1) 54w T5HO	4740	54	62
	Wallwasher	(2) 42w CFT	5440	84	91
Lecture Hall	Spot	(1) 150w Incan.	2850	150	150
	Spot	(1) 120w Par38	1200	120	120

Space	Fixture	Lamp Type	Watts Saved per lum.	# of Lums.	Total Watts Saved
Computer Class	Indirect/direct	(1) 54w T5HO	1	16	16
	Indirect/direct	(2) 28w T5			
Corridor	Wall mount	(1) 28w T5	1	27	27
	Wall mount	(1) 34w Cold Cathode			
Corridor	Downlight	(1) 18w CFT	55	18	990
	Downlight	(1) 75w Incan.			
Music Room	2x2 indirect	(2) 21w T5			
	2x2 indirect	(1) 39w T5HO	8	16	128
Music Room	Cloud Pendant	(5) 60w Halogen Quartz			
	Cloud Pendant	(5) 50w Incan.	50	3	150
Lecture Hall	2x4 Troffer	(2) 32W T8			
	2x4 Troffer	(2) 32w T8 Ultramax (by GE)	8	16	128
	2x4 Troffer	(2) 32w T8 Alto energy advantage (by Philips)			
Lecture Hall	Wallwasher	(1) 54w T5HO	29	13	377
	Wallwasher	(2) 42w CFT			
Lecture Hall	Spot	(1) 150w Incan.			
	Spot	(1) 120w Par38	30	2	60
				Total Kwatts =	**1.876**

Building use in hours/year =	**2376**	**(KW*hours)/year =**	**4457.376**
Building rate plan = $0.06/kwh			
Total savings/year =	**267.44256**		

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Mechanical Breadth

Introduction

For my second breadth study, I wanted to redesign the acoustical system in my music room to get acceptable reverberation times. I chose to do this because when I altered the lighting system in the 10' ceiling, I changed the existing system. For this study, I went to multiple manufactures websites looking at ceiling pyramids, wall panels, etc, and tried to design a system that was optimal for the multipurpose band room space.

Problem Statement

The major challenge of the acoustical study was trying to find a reverberation time that would be decent for all the different types of musical and singing activities that go on in the room. Since the range of activities varies so much, I chose to average the reverberation time between these activities and try to get a reverberation time that falls close to the average.

Design Criteria

For my acoustical study, design criteria were taken from my AE 458 note, the AE 458 handout packet, and the AE309 book by Egan. I went to manufactures websites to find absorption coefficients for ceiling pyramids and wall panels, but I used the absorption coefficients off of the charts in my books for the rest of the architectural materials.

Walter Nichols **Music Room T60 Calcs**

Surface	Material	Area (ft^2)	125 Hz α	250 Hz α	500 Hz α	1000 Hz α	2000 Hz α	4000 Hz α
10' Ceiling Below	Foam Pyramid 2" thick	512	0.07	0.25	0.6	0.94	0.97	1.08
Walls	Gypsum board -1 layer @ 5/8"	1742	0.55	0.14	0.08	0.04	0.12	0.11
	Painted Foam Panels 2" think	160	0.05	0.31	0.81	1.01	0.99	0.95
Windows	Heavy Glass	300	0.18	0.06	0.04	0.03	0.02	0.02
Doors	Steel Doors	48	0.05	0.1	0.1	0.1	0.07	0.02
Floor	Glazed Tile	1441	0.01	0.01	0.01	0.01	0.02	0.02
15' Ceiling	Plaster on Lath	1441	0.14	0.1	0.06	0.05	0.04	0.03

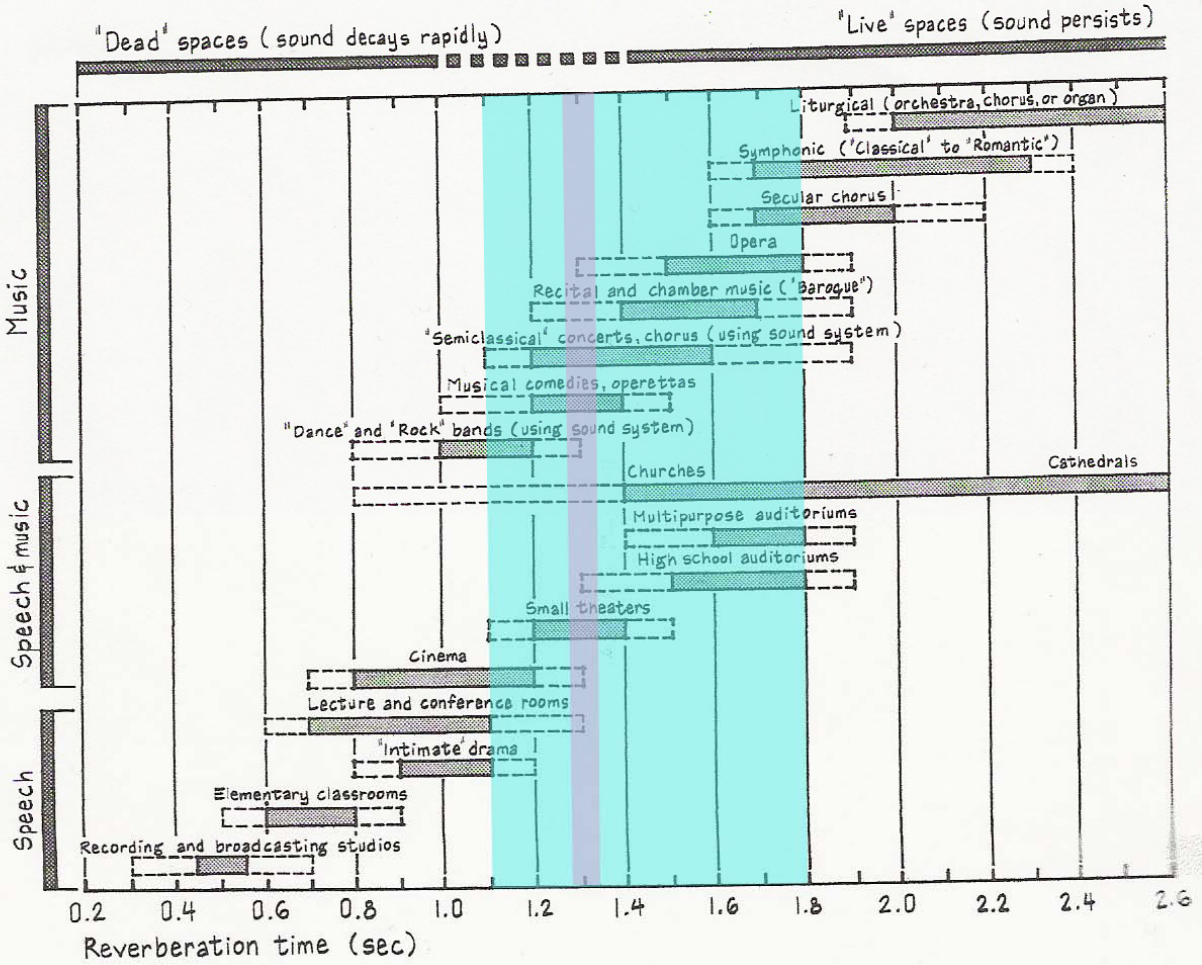
Surface	Material	Area (ft^2)	125 Hz Sα	250 Hz Sα	500 Hz Sα	1000 Hz Sα	2000 Hz Sα	4000 Hz Sα
10' Ceiling Below	Foam Pyramid 2" thick	512	35.84	128	307.2	481.28	496.64	552.96
Walls	Gypsum board -1 layer @ 5/8"	1742	958.1	243.88	139.36	69.68	209.04	191.62
	Painted Foam Panels 2" think	160	8	49.6	129.6	161.6	158.4	152
Windows	Heavy Glass	300	54	18	12	9	6	6
Doors	Steel Doors	48	2.4	4.8	4.8	4.8	3.36	0.96
Floor	Glazed Tile	1441	14.41	14.41	14.41	14.41	28.82	28.82
15' Ceiling	Plaster on Lath	1441	201.74	144.1	86.46	72.05	57.64	43.23
		ΣSα =	1274.49	602.79	693.83	812.82	959.9	975.59

Volume (ft^3) = 21615

T60=	0.847986	1.79291	1.55766	1.32963	1.1259	1.107791
Ave. T60=	1.293646					

OPTIMUM REVERBERATION TIME

The preferred ranges of reverberation time at mid-frequency (average of reverberation at 500 and 1000 Hz) for a variety of activities are given on the bar graph below. The ranges, based on the experience of normal-hearing listeners in completed spaces, are extended by dashed sections at the ends of the bars to indicate the extreme limits of acceptability. Satisfactory listening conditions can be achieved in auditoriums which have different reverberation times within the preferred range, provided other important acoustical needs are fulfilled. In general, large rooms should be nearer the upper end of the reverberation time ranges than smaller rooms of the same type (see Chap. 3). For example, liturgical organ music is composed for church- or cathedral-sized rooms; chamber music is intended for small rooms.



Note: Long reverberation times degrade speech perception of hearing-impaired persons far more than normal-hearing persons. For hearing-impaired and elderly listeners, reverberation times should be well below most of the values in the graph (e.g., < 0.5 s for satisfactory speech perception).

Reference

R. B. Newman, "Acoustics" in J. H. Callender (ed.), *Time-Saver Standards for Architectural Design Data*, McGraw-Hill, New York, 1974, p. 696.

Conclusions

Overall, I feel that my goal to redesign the architectural engineering systems of the Hawthorn Building was successful. I was able to achieve the lighting systems I wanted the way I wanted them while meeting ASHREA 90.1 as well as the IES guidelines. I was also able to optimize the lighting system by selecting the most efficient lamps that I could find, saving money, but more importantly, saving energy. After changing the lighting system in the music room, I was then able to do an acoustical analysis to make sure that the changes I made to the lighting as well as the acoustics were ok for the room and it's activities. Finally, I was able to resize the electrical system according to NEC 2002 to make sure my changes to the lighting system were ok. Though this thesis project, I was able redesign 4 building systems to my liking, and then prove that I did the changes correctly. Because of these reasons, I feel the project was a success.

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Finally, I want to thank my roommates for keeping me positive when I couldn't stand thesis anymore. The moral support was appreciated greatly.

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Appendix A

FEATURES

OPTICAL SYSTEM

- Reflector - Self-flanged, specular clear or semi-diffuse reflector. Fluted vertical upper section works in conjunction with Bounding Ray Optical Principle to provide lamp before lamp image and smooth transition from top of reflector to bottom. Minimum flange matches reflector finish. White painted flange optional.
- Baffle/cone - Specular clear upper reflector. Microgroove baffle with white painted flange or specular black cone with flange that matches cone finish.
- Hinged lampdoor seals upper trim for optimal fixture efficiency and the reduction of stray light in the plenum.

MECHANICAL

- 16-gauge galvanized steel mounting/plaster frame with integral yoke to retain optical system. Maximum 1-1/2" ceiling thickness.
- Mounting bars are 16-gauge galvanized steel with continuous 4" vertical adjustment, held in place with toolless, integral cam-action locking system. Post installation adjustment possible without the use of tools from above or below the ceiling. Shipped pre-installed.
- Galvanized steel junction box with bottom-hinged access covers and spring latches. Two combination 1/2"–3/4" and three 1/2" knockouts for straight-through conduit runs. Capacity: 8 (4 in, 4 out) No. 12 AWG conductors, rated for 90°C.

ELECTRICAL SYSTEM

- Horizontally-mounted, four-pin, positive-latch, thermoplastic socket.
- Class P, thermally-protected high power factor electronic ballast mounted to the junction box (CP and EL ballast mounted on ballast tray).

LISTING

- Fixtures are UL listed for thru-branch wiring, recessed mounting and damp locations. Listed and labeled to comply with Canadian Standards (see Options).

ENERGY

LER.DOL	Annual Energy Cost	Lamps	Lamp Lumens	Ballast Factor	Input Watts
41	$5.83	1/26TRT	1800	0.98	27

Calculated in accordance with NEMA standard LE-5.

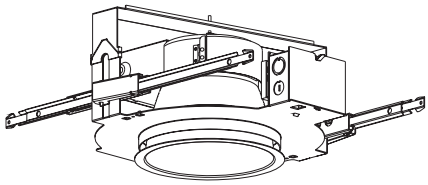
Type Catalog number

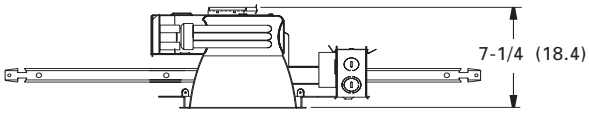
Compact Fluorescent Downlights

6" AF

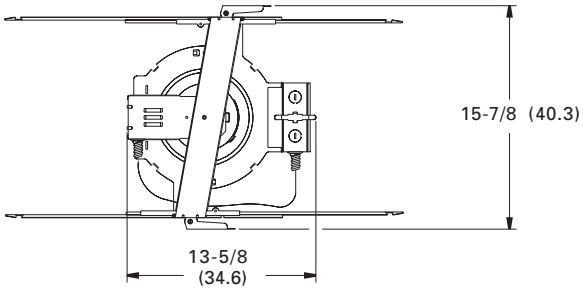
Open Reflector

Horizontal Lamp
Triple-Tube





Aperture: 6-1/4 (15.9)
Ceiling Opening: 7-1/8 (18.1)
Overlap Trim: 7-1/2 (19.1)



All dimensions are inches (centimeters).

ORDERING INFORMATION

Example: AF 1/26TRT 6AR MVOLT

Choose the boldface catalog nomenclature that best suits your needs and write it on the appropriate line. Order accessories as separate catalog number (shipped separately).

AF

Series	Wattage/Lamp	Reflector/Color	Finish	Voltage	Ballast	Options
AF	1/18TRT	6AR Clear	(blank) Specular low iridescent	MVOLT[4]	(blank) GEB10 standard. Electronic ballast.	WLP With 35°K lamp (shipped separately).
	1/26TRT	6PR Pewter	LD Semi-diffuse low iridescent	120	DMHL[5] Lutron Hi-Lume electronic dimming ballast	TRW White flange.
	1/32TRT	6UBR Umber		277	ADEZ[5] Advance Mark X electronic dimming ballast.	EL[6] Emergency battery pack. Integral test switch provided.
	1/42TRT	6WTR Wheat		347		ELR Emergency battery pack. Remote test switch provided.
		6CR Champagne Gold[1]				GMF Single, slow-blow fuse (not available with MVOLT).
		6GR Gold[1]				RIF Radio Interference Filter.
		6MB Black Baffle[2,3]				LRC Provides compatibility with Lithonia Reloc System. Reloc System can be installed less this option with connectors provided by others. Access above ceiling required. For compatible Reloc Systems, see options and accessories tab.
		6BC Black Cone[2]				QDS Quick Disconnect for easy ballast replacement. Not available with EL or ELR option.
						CP Chicago Plenum (consult factory).
						CSA CSA Certified.

NOTES:

1 Not recommended for use with compact fluorescent lamp. Consult factory.
2 Not available with finishes.
3 White flange standard.
4 Multi-volt electronic ballast capable of operating on any line voltage between 120-277 volt.
5 Consult factory for specific availability.
6 Not available with black cone.

Accessories

Order as separate catalog number.

SC6FL Sloped ceiling adaptor. Degree of slope must be specified (10D, 15D, 20D, 25D, 30D). Ex: SC6FL 10D

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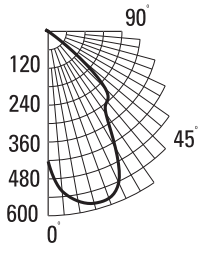
6" AF Open Reflector

Distribution curve | Distribution data | Output data | Coefficient of utilization | Illuminance Data at 30" Above Floor for a Single Luminaire

AF 1/18TRT 6AR, (1) CF18DT/E/IN/835, 1200 lumens per lamp, 1.3 s/mh, test no. LTL9404



From 0°	cp.	Lumens
0°	423	
5°	522	41
15°	579	123
25°	543	187
35°	328	175
45°	263	150
55°	12	17
65°	1	1
75°	1	1
85°	0	0
90°	0	

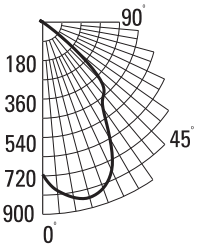
Zone	Lumens	%lamp
0°-30°	351.8	29.3
0°-40°	526.7	43.9
0°-60°	693.5	57.8
0°-90°	695.4	58.0
90°-180°	0.0	0.0
0°-180°	695.4	58.0*

*Efficiency

ρf	80%		20%		50%	
ρc	80%		70%		50%	
ρw	50%	30%	50%	30%	50%	30%
1	63	62	62	61	60	59
2	58	56	57	55	55	53
3	53	50	53	49	51	48
4	49	45	48	45	47	44
5	45	41	44	41	43	40
6	42	38	41	37	40	37
7	38	34	38	34	37	34
8	36	32	35	31	35	31
9	33	29	33	29	32	29
10	31	27	31	27	30	27

Mount height	Initial fc at beam center	50% beam angle 60.9° Beam diameter	50% beam angle 60.9° fc at beam edge	10% beam angle 94.1° Beam diameter	10% beam angle 94.1° fc at beam edge
8'	14.0	6.5	7.0	11.8	1.4
10'	7.5	8.8	3.8	16.1	0.8
12'	4.7	11.2	2.3	20.4	0.5
14'	3.2	13.5	1.6	24.7	0.3
16'	2.3	15.9	1.2	29.0	0.2

AF 1/26TRT 6AR, (1) CF26DT/E/IN/835, 1800 lumens per lamp, 1.2 s/mh, test no. LTL9391



From 0°	cp.	Lumens
0°	713	
5°	792	72
15°	850	206
25°	765	307
35°	493	282
45°	383	232
55°	15	27
65°	1	2
75°	0	1
85°	0	0
90°	0	

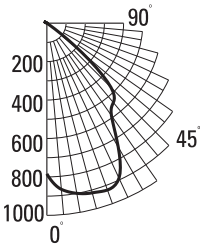
Zone	Lumens	%lamp
0°-30°	584.2	32.5
0°-40°	866.2	48.1
0°-60°	1125.1	62.5
0°-90°	1127.4	62.6
90°-180°	0.0	0.0
0°-180°	1127.4	62.6*

*Efficiency

ρf	80%		20%		50%	
ρc	80%		70%		50%	
ρw	50%	30%	50%	30%	50%	30%
1	69	67	67	66	65	64
2	63	60	62	59	60	58
3	58	54	57	54	55	52
4	53	49	52	49	51	48
5	49	45	48	44	47	44
6	45	41	45	41	44	40
7	42	37	41	37	40	37
8	39	34	38	34	38	34
9	36	32	36	32	35	31
10	34	30	33	29	33	29

Mount height	Initial fc at beam center	50% beam angle 59.9° Beam diameter	50% beam angle 59.9° fc at beam edge	10% beam angle 93.8° Beam diameter	10% beam angle 93.8° fc at beam edge
8'	23.6	6.3	11.8	11.8	2.4
10'	12.7	8.6	6.3	16.0	1.3
12'	7.9	11.0	4.0	20.3	0.8
14'	5.4	13.3	2.7	24.6	0.5
16'	3.9	15.6	2.0	28.8	0.4

AF 1/32TRT 6AR, (1) CF32DT/E/IN/835, 2400 lumens per lamp, 1.3 s/mh, test no. LTL9390



From 0°	cp.	Lumens
0°	784	
5°	868	79
15°	914	230
25°	890	354
35°	587	332
45°	473	273
55°	22	31
65°	2	3
75°	1	2
85°	1	1
90°	0	

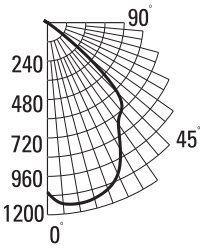
Zone	Lumens	%lamp
0°-30°	663.0	27.6
0°-40°	995.2	41.5
0°-60°	1299.6	54.2
0°-90°	1304.8	54.4
90°-180°	0.0	0.0
0°-180°	1304.8	54.4*

*Efficiency

ρf	80%		20%		50%	
ρc	80%		70%		50%	
ρw	50%	30%	50%	30%	50%	30%
1	60	58	58	57	56	55
2	55	52	54	51	52	50
3	50	47	49	46	48	45
4	46	43	45	42	44	41
5	42	39	42	38	41	38
6	39	35	39	35	38	35
7	36	32	36	32	35	32
8	33	30	33	29	32	29
9	31	27	31	27	30	27
10	29	25	29	25	28	25

Mount height	Initial fc at beam center	50% beam angle 62.0° Beam diameter	50% beam angle 62.0° fc at beam edge	10% beam angle 94.1° Beam diameter	10% beam angle 94.1° fc at beam edge
8'	25.9	6.6	13.0	11.8	2.6
10'	13.9	9.0	7.0	16.1	1.4
12'	8.7	11.4	4.3	20.4	0.9
14'	5.9	13.8	3.0	24.7	0.6
16'	4.3	16.2	2.2	29.0	0.4

AF 1/42TRT 6AR, (1) CF42DT/E/IN/835, 3200 lumens per lamp, 1.3 s/mh, test no. LTL9521



From 0°	cp.	Lumens
0°	1058	
5°	1135	107
15°	1136	323
25°	1043	487
35°	774	473
45°	622	374
55°	26	41
65°	2	2
75°	1	1
85°	0	0
90°	0	

Zone	Lumens	%lamp
0°-30°	916.8	28.6
0°-40°	1390.1	43.4
0°-60°	1805.1	56.4
0°-90°	1808.4	56.5
90°-180°	0.0	0.0
0°-180°	1808.4	56.5*

*Efficiency

ρf	80%		20%		50%	
ρc	80%		70%		50%	
ρw	50%	30%	50%	30%	50%	30%
1	62	60	61	59	58	57
2	57	54	56	53	54	52
3	52	49	51	48	50	47
4	48	44	47	44	46	43
5	44	40	43	40	42	39
6	41	37	40	36	39	36
7	38	34	37	33	36	33
8	35	31	34	31	34	30
9	32	28	32	28	31	28
10	30	26	30	26	29	26

Mount height	Initial fc at beam center	50% beam angle 62.5° Beam diameter	50% beam angle 62.5° fc at beam edge	10% beam angle 94.2° Beam diameter	10% beam angle 94.2° fc at beam edge
8'	35.0	6.7	17.5	11.8	3.5
10'	18.8	9.1	9.4	16.1	1.9
12'	11.7	11.5	5.9	20.4	1.2
14'	8.0	14.0	4.0	24.7	0.8
16'	5.8	16.4	2.9	29.0	0.6

NOTES:

1 For electrical characteristics, refer to electrical data tab.

2 Tested to current IES and NEMA standards under stabilized laboratory conditions. Various operating factors can cause differences between laboratory data and actual field measurements. Dimensions and specifications are based on the most current available data and are subject to change without notice.

3 Consult factory or IES file for microgroove baffle, black cone and other photometric reports.

gotham

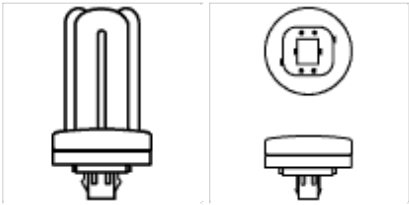
An AcuityBrands Company

GOTHAM ARCHITECTURAL DOWNLIGHTING
A DIVISION OF ACUITY LIGHTING GROUP, INC.
1400 Lester Road Conyers Georgia 30012
P 800 315 4982 F 770 860 3129
www.gothamlighting.com

Print Close

GE Consumer & Industrial
Lighting

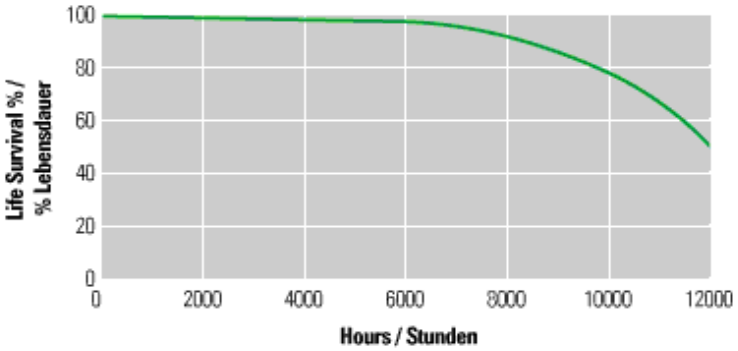
Lighting Specification Bulletin

Plug-in 4-Pin Triple Biax® **Product Code:** 34396 **Description:** TU F18TBX/SPX30/830/A/4P GX24Q-2 GE MI	

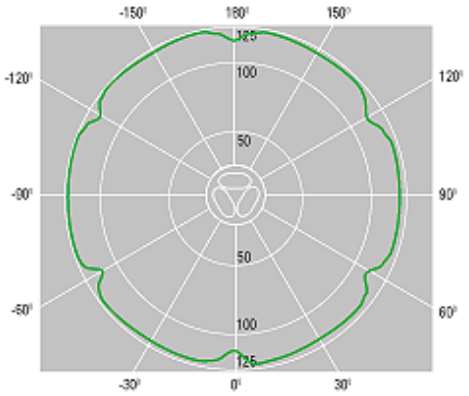
Specification:
Firm Name :
Job Name :

General	
Product Code	34396
Description	F18TBX/SPX30/A/4
Subcategory	Plug-in 4-Pin Triple Biax®
Physical	
Bulb Type	BiaxT (T4)
Base Type	GX24q-2
Max Overall Length (In.)	4.8
Max Overall Length (mm)	122
Nominal Length (In.)	4.80
Nominal Length (mm)	122
Width of Lamp in inches	1.7
Depth of Lamp in inches	1.7
Base Face to Top of Lamp (In.)	4.25
Photometric	
Average Rated Life	12000
Lumens (Initial)	1200
Lumens (Mean)	1010
Color Temperature (K)	3000
Color Rendering Index (Ra) CRI	82
Nominal Efficacy (Lumens/Watt)	67
Electrical	
Watts	18
Minimum Starting Temp (deg F)	32
Nominal Lamp Operating Frequency (Hz)	60
Cold Cathode Resistance (Rc)	6.05
Max Cathode Resistance Ratio (Rh/Rc)	5.25
Min Cathode Resistance Ratio (Rh/Rc)	4.25
Ballast-related information	
Maximum Ballast OCV During	250

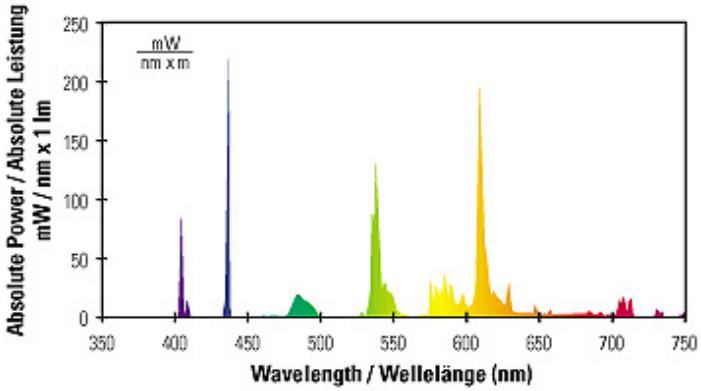
Lamp Mortality



Radial Luminous Intensity Distribution



Spectral Power Distribution Graphs



Preheating (Vrms) (HF Operation)	
Minimum Ballast OCV After Preheating (Vrms) (-15 degC) (HF Operation)	550
Minimum Ballast OCV After Preheating (10 degC)	550
Minimum OCV Across Starter (Vrms) (LF Operation)	198
Miscellaneous	
Additional Information	NEMA Generic Designation: CFTR18W/GX24q/830, EOL protection
Footnotes	Fluorescent lamp lumens decline during life.Based on 60Hz reference circuit.4-Pin lamp minimum starting temperature is a function of the ballast. Most ballasts are rated with a minimum starting temperature of 50° F (10° C). Ballasts are also available that provide reliable starting to 0° F (-18° C) and -20° F (-29° C).Amalgam product experience stable brightness over a wider temperature range and in various operating positions.

Reduced Wattage LSB Data Available

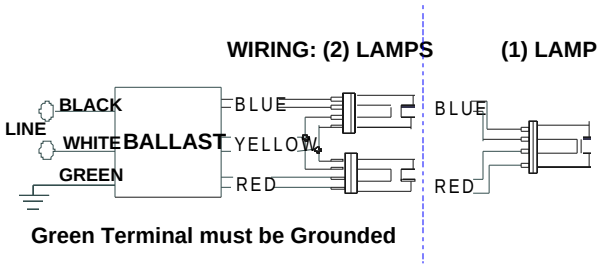
ICF-2S18-H1-LD@277

Brand Name	SMARTMATE
Ballast Type	Electronic
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 (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
* CFM18W/GX24Q	1	18	0/-18	0.08	20	1.05	10	0.97	1.5	5.25
CFM18W/GX24q	2	18	0/-18	0.14	39	1.05	10	0.99	1.5	2.69
CFQ18W/G24q	1	18	0/-18	0.07	19	1.00	10	0.97	1.5	5.26
CFQ18W/G24q	2	18	0/-18	0.13	35	0.95	10	0.99	1.5	2.71
CFS16W/GR10q	2	16	0/-18	0.13	37	1.00	09	0.99	1.5	2.70
CFS21W/GR10q	1	21	0/-18	0.07	20	0.90	13	0.97	1.5	4.50
CFS21W/GR10q	2	21	0/-18	0.14	40	0.91	08	0.99	1.5	2.28

Wiring Diagram



Green Terminal must be Grounded

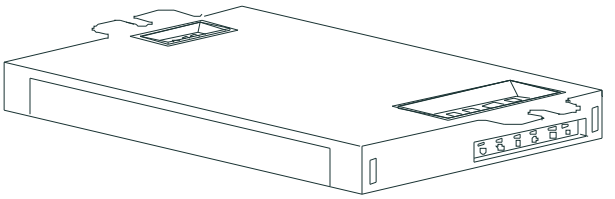
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0.0	
White	0.0	
Blue	0.0	
Red	0.0	
Yellow	0	
Gray		
Violet		

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

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
4.98 "	2.4 "	1.0 "	4.6 "
4 49/50	2 2/5	1	4 3/5
12.6 cm	6.1 cm	2.5 cm	11.7 cm

Revised 09/02/2004

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 TRANSFORMER CO.
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

ICF-2S18-H1-LD@277	
Brand Name	SMARTMATE
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Notes:

Section I - Physical Characteristics

1.1 Ballast shall be physically interchangeable with standard electromagnetic or standard electronic ballasts, where applicable.

1.2 Ballast shall be available in a plastic/metal can or all metal can construction to meet all plenum requirements.

1.3 Ballast shall be provided with poke-in wire trap connectors color coded per ANSI C82.11.

Section II - Performance Requirements

2.1 Ballast shall be Programmed Start except for ballasts with -QS suffix, which shall be Rapid Start.

2.2 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.

2.3 Ballast shall operate from 50/60 Hz input source of 120V through 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the IntelliVolt ballast. RCF models shall operate from 60 Hz input source of 120V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

2.4 Ballast shall be high frequency electronic type and operate lamps at a frequency above 42 kHz to avoid interference with infrared devices and eliminate visible flicker.

2.5 Ballast shall have a Power Factor greater than 0.98 for primary lamp.

2.6 Ballast shall have a minimum ballast factor of 1.00 for primary lamp application.

2.7 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

2.8 Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when operated at nominal line voltage with primary lamp.

2.9 Ballast shall have a Class A sound rating.

2.10 Ballast shall have a minimum starting temperature of -18C (0F) for primary lamp. Ballasts for PL-H lamps shall have a minimum starting temperature of -30C (-20F) for primary lamp.

2.11 Ballast shall provide Lamp EOL Protection Circuit which meets NEMA recommendations.

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

Section III - Regulatory Requirements

3.1 Ballast shall not contain any Polychlorinated Biphenyl (PCB).

3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable.

3.3 Ballast shall be Underwriters Laboratories (UL) rated for use in air-handling spaces.

3.4 Ballast shall comply with ANSI C62.41 Category A for Transient protection.

3.5 Ballast shall comply with ANSI C82.11 where applicable.

3.6 Ballast shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated) except for RCF models which shall be Consumer (Class B).

Section IV - Other

4.1 Ballast shall be manufactured in a factory certified to ISO 9001:2000 Quality System Standards.

4.2 Ballast shall carry a five-year warranty from date of manufacture against defects in material or workmanship, including replacement, for operation at a maximum case temperature of 75C and three-years for a maximum case temperature of 85C (90C 3year warranty for ICF1H120-XX-XX, ICF2S70-XX-XX and ICF2S4290C-XX-XX modesls).

4.3 Manufacturer shall have a fifteen-year history of producing electronic ballasts for the North American market.

4.4 Ballast shall be Advance Transformer part # _____ or approved equal.

Revised 09/02/2004

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 TRANSFORMER CO.
O'HARE INTERNATIONAL CENTER - 10275 WEST HIGGINS ROAD
ROSEMONT, ILLINOIS 60018
TELEPHONE: (847) 390-5000 FAX: (847) 390-5109

Corelite™

Description

Corelite's Iridium Perf Wall Mount is a semi-indirect fluorescent luminaire that features elegant styling with a sleek profile and end caps. The engineered optical system provides an asymmetric forward throw distribution. The Iridium Perf Wall may be mounted over standard 2"x4" J-Boxes for individual or continuous configurations using 4'and 8' modular sections. The Iridium Perf Wall is suited for open office perimeters, private offices, conference rooms, corridors and public spaces.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

A ... Construction
Housing is one piece die-formed cold rolled steel, forming a 7"x 2-1/2" architectural profile. Standard 4'-0" and 8'-0" fixture lengths combine for continuous runs.

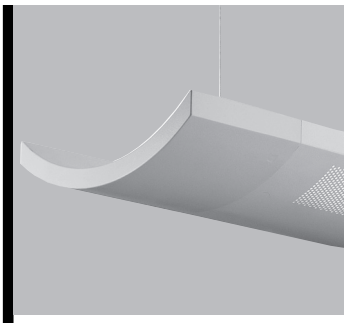
B ... End Caps
Standard Straight and optional Beveled end caps are precision die-cast aluminum mechanically attached without exposed fasteners.

C ... Reflectors
Die-formed reflectors are highly specular anodized aluminum.

D ... Electrical
Fixtures are prewired with quick wire connectors and use UL listed Class P, T5HO program rapid start universal voltage electronic ballasts. Power factor of 97% with less than 10% THD. Fixtures and electrical components certified to UL and CUL standards.

E ... Finish
Fixture housings are standard white using electrostatically applied polyester powder coat paint.

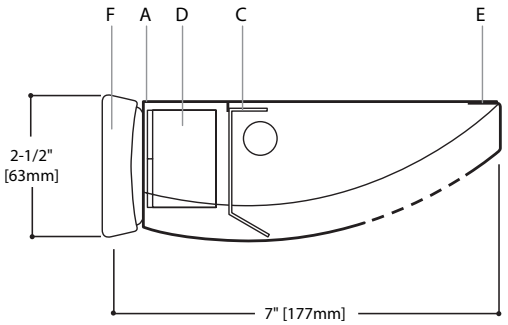
F ... Mounting
Fixture mounts directly to existing structure over a 2" x 4" standard electrical box mounted horizontally into the wall. Refer to installation section for details.



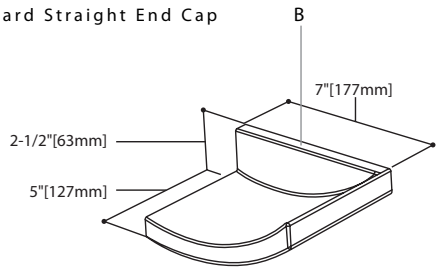
Iridium

PERF WALL
1T5HO

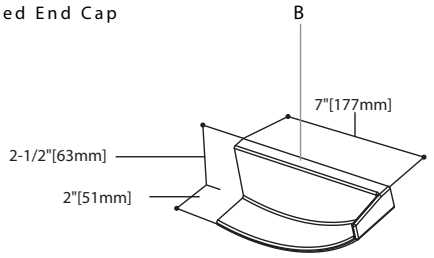
WALL MOUNT
SEMI - INDIRECT



Standard Straight End Cap



Beveled End Cap



Light Distribution

Indirect - 94.6%
Direct - 5.4%

MODULES AND DIMENSIONS*

48" [1219mm]

96" [2438mm]

*Dimensions do not include end caps.

ORDERING INFORMATION

Sample Number: IW-SP-1T5-1D-120-SU-WA-68

Series
IW= Iridium Perf Wall Mount

Optics Up
S= Specular

Optics Down
P= Round Perf

Number of Lamps
1= 1 Lamp

Lamp Type
T5= 54W T5 HO (4' unit)

Number of Circuits [1]
1= 1 Circuit

Wiring [1]
C= Standard Circuit
D= Dimming
E= Emergency
B= Battery Pack
T= Nightlight
Y= Daylight

Voltage [1]
120= 120V
277= 277V
347= 347V
UNV= Universal

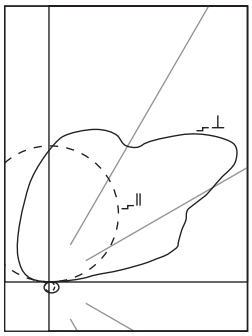
Suspension
SU-WA= Surface/Wall Mount

Run Length
Individually Mounted
Luminaires may be 4' or 8' in length
Continuously Mounted
Standard row configurations over 8' consist of 4' and 8' sections

Options
ES= Straight End Cap (Provided if none specified)
EB= Beveled End Cap

Notes: 1 Not all options available. Please consult your Cooper Lighting Representative for availability. Specifications and dimensions subject to change without notice.

PHOTOMETRICS



IW-SP-1T5
(1) FP54/841/HO
4500 Lumens

Efficiency 73.5%

Test Report
#LSI16233

Coefficients of Utilization

Effective floor cavity reflectance																				
rc	80%				70%				50%			30%			10%			0%		
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0		
RCR																				
0	71	71	71	71	61	61	61	61	43	43	43	26	26	26	11	11	11	04		
1	64	62	59	56	56	53	51	48	37	36	35	23	22	22	10	10	09	03		
2	59	53	49	46	50	46	43	40	33	31	29	20	19	18	09	08	08	03		
3	53	47	42	38	46	41	37	33	29	26	24	18	17	15	08	07	07	02		
4	49	41	36	32	42	36	31	28	25	23	20	16	14	13	07	06	06	02		
5	45	36	31	27	38	32	27	24	23	20	17	14	12	11	06	05	05	02		
6	41	33	27	23	35	28	24	20	20	17	15	13	11	09	05	05	04	01		
7	38	29	24	20	32	25	21	18	18	15	13	11	09	08	05	04	04	01		
8	35	26	21	17	30	23	18	15	16	13	11	10	08	07	04	04	03	01		
9	32	24	19	15	27	21	16	13	15	12	10	09	07	06	04	03	03	01		
10	30	21	17	13	26	19	15	12	13	11	09	08	07	05	04	03	02	01		

Candela

Angle	Along ∥	45°	Across ⊥
0	59	59	59
5	58	61	63
15	55	66	72
25	51	68	77
35	42	63	80
45	35	63	76
55	23	54	68
65	12	45	58
75	5	30	46
85	0	14	26
90	0	9	18
95	35	160	82
105	188	582	815
115	347	991	920
125	487	1023	1412
135	606	915	1309
145	702	912	1073
155	776	968	1011
165	826	947	988
175	851	900	918
180	842	842	842

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0-30	46	1.03	1.40
0-40	75	1.68	2.28
0-60	133	2.97	4.05
0-90	179	36.99	5.43
40-90	104	2.32	3.15
60-90	45	1.02	1.39
90-180	3126	69.48	94.57
0-180	3306	73.47	100.00

Luminance Data

Angle in Deg	0-Deg cd/sm	45-Deg cd/sm	90-Deg cd/sm
45	871	1190	1296
55	706	1121	1285
65	500	1125	1232
75	640	913	1126
85	0	559	784

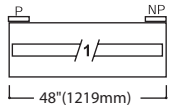
COMMON CIRCUIT CONFIGURATIONS FOR ONE LAMP WALL MOUNT FIXTURES

1C =Single circuit luminaire
1E =Single circuit luminaire with emergency circuit
1B =Single circuit luminaire with battery pack

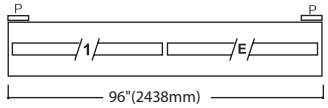
/1/ =Circuit 1
/E/ =Emergency Circuit
/B/ =Battery Circuit

P =Power Mount
NP =Non-Power Mount

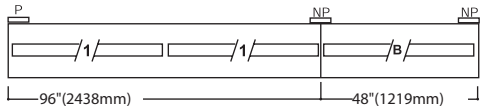
1C



1E



1B



STANDARD ROW CONFIGURATIONS

FIXTURE LENGTH	4'	8'	12'	16'	20'	24'	28'	32'	36'	40'	44'	48'	52'	56'	60'	64'	68'	72'	76'	80'	84'	88'	92'	96'	100'	104'	108'
4'	1		1		1		1		1		1		1		1		1		1		1		1		1		1
8'		1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13

Print Close

GE Consumer & Industrial
Lighting

Lighting Specification Bulletin

T5 Starcoat High Efficiency **Product Code:** 46704 **Description:** F28W/T5/830/ECO	

Specification:
Firm Name :
Job Name :

General	
Product Code	46704
Description	F28W/T5/830/ECO
Subcategory	T5 Starcoat High Efficiency
Physical	
Bulb Type	T5
Base Type	Miniature BiPin (G5)
Bulb Material	Soft Glass
Nominal Length (In.)	45.20
Nominal Length (mm)	1150
Max Overall Length (In.)	45.795
Bulb Nominal Diameter in inches	.625
Max bulb diameter	.67
Max Face to End of Opposing Pin (B)	45.42
Min Face to End of Opposing Pin (B)	45.42
Photometric	
Lumens (Initial)	2900
Lumens (Mean)	2726
Color Temperature (K)	3000
Nominal Efficacy (Lumens/Watt)	104
Electrical	
Average Rated Life	20000
Watts	28
Nominal Lamp Volts	167
Nominal Lamp Operating Frequency (Hz)	20000
Minimum Starting Temp (deg F)	5
Min. Terminal to Terminal Starting Lamp Voltage (Vrms)- Instant Start at 15°C	530
Min. Terminal to Terminal Starting Lamp Voltage (Vrms)- Rapid Start at 10°C	425
Max Cathode Resistance Ratio (Rh/Rc)	6.5
Min Cathode Resistance Ratio (Rh/Rc)	4.25
Miscellaneous	
TCLP Regulated	Y
Additional Information	S/P Ratio: 1.3 Lumen Ratings at 35C. At 25C, Initial Lumens are 2640.

All values are design values or typical values when measured under laboratory conditions.Information provided is subject to change without notice. Where applicable, values are based on guidelines published in ANSI. For more information see Terms and Conditions in the link below.

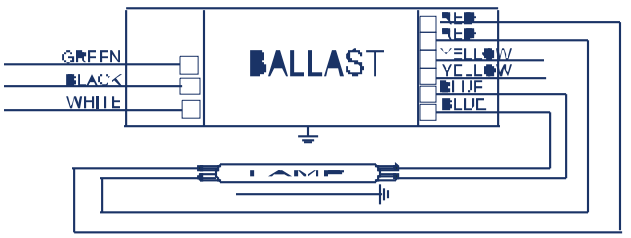
ICN-2S28@277

Brand Name	CENTIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
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.
F14T5	1	14	0/-18	0.07	19	1.07	20	0.90	1.7	5.63
F14T5	2	14	0/-18	0.13	34	1.06	10	0.98	1.7	3.12
F21T5	1	21	0/-18	0.10	26	1.03	15	0.95	1.7	3.96
F21T5	2	21	0/-18	0.17	48	1.02	10	0.98	1.7	2.13
* F28T5	1	28	0/-18	0.12	33	1.04	10	0.98	1.7	3.15
F28T5	2	28	0/-18	0.23	63	1.03	10	0.99	1.7	1.63
F35T5	1	35	0/-18	0.15	41	1.01	10	0.98	1.7	2.46
F35T5	2	35	0/-18	0.28	77	1.00	10	0.99	1.7	1.30

Wiring Diagram



For 1 lamp operation, do not use yellow leads

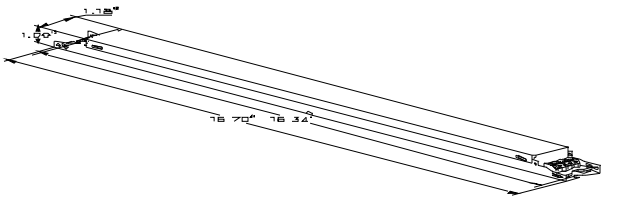
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow	0	0
Gray	0	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)
16.70 "	1.18 "	1.00 "	16.34 "
16 7/10	1 9/50	1	16 17/50
42.4 cm	3 cm	2.5 cm	41.5 cm

Revised 09/01/2004

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 TRANSFORMER CO.
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

ICN-2S28@277	
Brand Name	CENTIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Notes:

Section I - Physical Characteristics

1.1 Ballast shall be physically interchangeable with standard electromagnetic or standard electronic ballasts, where applicable.

1.2 Ballast shall be provided with integral leads color-coded per ANSI C82.11.

Section II - Performance Requirements

2.1 Ballast shall be Programmed Start.

2.2 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.

2.3 Ballast shall operate from 50/60 Hz input source of _____ (120V through 277V or 347V through 480V) with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

2.4 Ballast shall be high frequency electronic type and operate lamps at a frequency above 42 kHz to avoid interference with infrared devices and eliminate visible flicker.

2.5 Ballast shall have a Power Factor greater than 0.98 for primary lamp.

2.6 Ballast shall have a minimum ballast factor of 1.00 for primary lamp application.

2.7 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

2.8 Ballast input current shall have Total Harmonic Distortion (THD) of less than 20% for Standard models and THD of less than 10% for Centium models when operated at nominal line voltage with primary lamp.

2.9 Ballast shall have a Class A sound rating.

2.10 Ballast shall have a minimum starting temperature of -18C (0F) or -28C (-20F) for primary lamp. Consult lamp manufacturer for temperature versus lamp characteristics.

2.11 Ballast shall provide Lamp EOL Protection Circuit.

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

2.13 Ballast shall have a hi-low switching option when operating (4) F54T5/HO lamps to allow switching from 4-2 lamps, 3-2 lamps or 3-1 lamp.

2.14 Four lamp ballast shall have semi-independent lamp operation.

Section III - Regulatory Requirements

3.1 Ballast shall not contain any Polychlorinated Biphenyl (PCB).

3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable.

3.3 Ballast shall comply with ANSI C62.41 Category A for Transient protection.

3.4 Ballast shall comply with ANSI C82.11 where applicable.

3.5 Ballast shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

Section IV - Other

4.1 Ballast shall be manufactured in a factory certified to ISO 9001:2000 Quality System Standards.

4.2 Ballast shall carry a five-year warranty from date of manufacture against defects in material or workmanship, including replacement, for operation at a maximum case temperature of 70C. Ballasts with a "90C" designation in their catalog number shall also carry a three-year warranty at a maximum case temperature of 90C.

4.3 Manufacturer shall have a fifteen-year history of producing electronic ballasts for the North American market.

4.4 Ballast shall be Advance Transformer part # _____ or approved equal.

Revised 09/01/2004

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 TRANSFORMER CO.
O'HARE INTERNATIONAL CENTER - 10275 WEST HIGGINS ROAD
ROSEMONT, ILLINOIS 60018
TELEPHONE: (847) 390-5000 FAX: (847) 390-5109

Walter Nichols
Hawthorn Building
Altoona, PA

Appendix B

luna® 2x2

Covered by U.S. Patent No. D395,727.

FEATURES

2'x2' recessed indirect with perforated center basket.

Reflector and end caps form seamless one-piece housing.

High reflectance, low gloss Matte White finish controls glare and provides high efficiency.

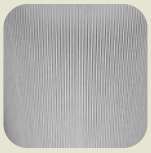
Perforated shields snap out for easy relamping.

Optional radial blade louver offers a distinct look that highlights interior architecture.

All luminaire combinations may be continuously row mounted.

Luna® provides high angle uniform distribution ideal for general illumination.

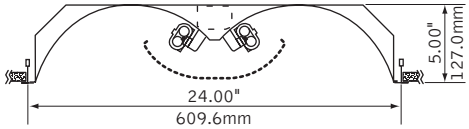
shielding options & details



perforated

radial blade louver

DIMENSIONAL DATA



lamping options

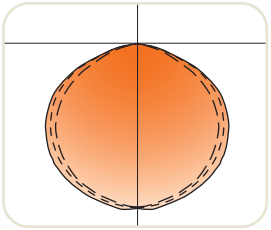
BIAX LAMPS

T8 U–BEND LAMPS

T8 LAMPS

T5/T5HO LAMPS

PERFORMANCE



2–Lamp 40W Biax
70% Efficiency
1598 cd @ 5°

See **Photometric** section for additional performance data.

september 2005

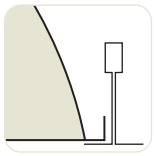
fixture type:

project name:

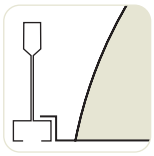
DETAILS

mounting

specify "G" for flat 9/16" and 15/16" tee or "ST" for 9/16" slot tee grid types.



"G" flat tee

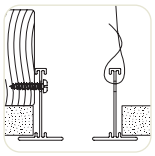


"ST" slot tee

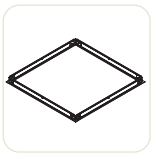
Luminaires cannot be installed in T-bar ceiling systems over 1.5" high in T8 lamp configurations.

drywall frame kit

specify "DF" Drywall Frame Kit for drywall ceiling conditions.



Use tie–wire or screws to secure frame kit.



cut out dimensions:
2': Min: 24.125"
Max: 24.563"

SPECIFICATIONS

construction

One-piece 20 Ga. steel reflector and housing.

20 Ga. steel ends form finished housing.

Lamps are shielded by detachable 22 Ga. steel perforated lamp shield with acrylic lens insert.

Optional radial blade louver: .75"H x 1" frequency fabricated of 20 Ga. steel with acrylic lens insert.

Top access 20 Ga. steel ballast compartment.

Weight: 20 lbs

optic

One-piece 20 Ga. steel reflectors finished in Matte Satin White powder coat.

electrical

Electronic ballasts are thermally protected and have a Class "P" rating.

Optional DALI and other dimming ballasts available.

Consult factory for dimming specifications and availability.

UL and cUL listed.

emergency

Emergency battery packs provide 90 minutes of illumination.

Initial lumen output for lamp types are as follows:

Biax Lamps:	Up to 650 lumens
T8 Lamps:	Up to 450 lumens
T5 Lamps:	Up to 375 lumens
T5HO Lamps:	Up to 450 lumens
T831 Lamps:	Up to 475 lumens

Battery pack requires unswitched hot from same branch circuit as AC ballast.

finish

Polyester powder coat applied over a 5-stage pre–treatment.

Standard luminaire housing finished in Matte Satin White.

ORDERING

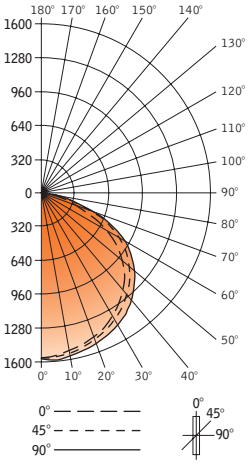
luminaire series		FLU
Luna	FLU	
nominal size		22
2' x 2'	22	
distribution		B
Bi-Directional	B	
lamp quantity		
2 Lamps	2	
3 Lamps	3	
lamp type		
40 Watt Biax	BX40	
50 Watt Biax	BX50	
55 Watt Biax	BX55	
F31/T8U (two lamp only)	T831	
T8	T8	
T5	T5	
T5HO	T5HO	
ballast		
Electronic Instant Start <20% THD	E	
Electronic Program Start <10% THD	S	
Electronic Dimming Ballast (consult factory for dimming availability)	D	
voltage		
120 Volt	120	
277 Volt	277	
347 Volt (Consult factory for availability)	347	
mounting		
Grid	G	
Slot Tee	ST	
shielding		
Perforated Shield	PS	
Radial Blade Louver	RLP	
factory options		
Air Return	AR	
Chicago Plenum	CP	
Dust Cover	DC	
Drywall Frame Kit (Cut out dimensions: Min: 24.125"/Max: 24.563")	DF	
Emergency Battery Pack	EM	
Earthquake Clip	EQ	
HLR/GLR Fuse	FU	
Flex Whip	FW	
Include 3000K Lamp	L830	
Include 3500K Lamp	L835	
Include 4100K Lamp	L841	
Separate Circuit	SC	
finish		WH
Matte Satin White	WH	

Focal Point L.L.C. 4201 South Pulaski Rd, Chicago, Illinois 60632 | T: 773.247.9494 | F: 773.247.8484 | info@focalpointlights.com | www.focalpointlights.com

luna® 2x2

Filename: FLU222BX40PS.IES
Catalog #: FLU-22-B-2-BX40-E-120-G-PS-WH
Efficiency: 70%
Test #: 11020.0

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	1595	1595	1595	1595	1595	
5°	1581	1583	1583	1596	1598	152
15°	1505	1515	1521	1543	1550	433
25°	1370	1386	1416	1451	1467	656
35°	1184	1209	1262	1320	1341	794
45°	944	981	1065	1140	1172	822
55°	676	731	837	913	940	738
65°	408	477	570	587	592	530
75°	183	224	230	259	271	249
85°	29	34	44	43	48	44
90°	0	0	0	0	0	
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	

Spacing 1.2
Criterion: 1.3

LUMEN SUMMARY

	Zone	Lumens	% Lamp	% Fixt
	0°-30°	1241	19.7	28.1
	0°-40°	2034	32.3	46.1
	0°-60°	3594	57.0	81.4
	0°-90°	4415	70.1	100.0
Total Luminaire	0°-180°	4415	70	100.0

LUMINANCE DATA (CD/M²)

Vertical Angle	0°	45°	90°
45°	3924	4427	4872
55°	3464	4289	4817
65°	2838	3965	4118
75°	2078	2612	3078
85°	978	1484	1619

CO–EFFICIENTS OF UTILIZATION

Floor													
Ceiling	80				70			20		50		30	
Wall	70	50	30	10	70	50	10	50	10	50	10	50	10	00
RCR 0	83	83	83	83	81	81	81	78	78	75	75	72	72	70
1	77	74	71	69	75	73	68	70	66	67	64	64	62	61
2	71	66	61	57	69	64	57	62	56	60	54	58	53	52
3	65	58	53	49	63	57	48	55	47	53	47	51	46	44
4	60	52	46	42	58	51	41	49	41	48	40	46	40	38
5	54	46	40	35	53	45	35	44	35	42	34	41	34	32
6	50	41	35	30	49	40	30	39	30	38	30	37	30	28
7	46	37	31	26	45	36	26	35	26	34	26	33	26	24
8	42	33	27	23	41	32	23	31	23	31	23	30	22	21
9	39	29	24	20	38	29	20	28	20	27	19	27	19	18
10	36	27	21	17	35	26	17	26	17	25	17	24	17	16

Numbers indicate percentage values of reflectivity.

Go to www.focalpointlights.com for additional photometric data.

PHILIPS

21W/830 Min Bipin T5 UNP

PRODUCT DATA

Product Number	230813
Full product name	21W/830 Min Bipin T5 UNP
Ordering Code	F21T5/830/ALTO
Pack type	Unpacked
Pieces per pack	1
Packs per case	40
Pack UPC	046677230814
EAN2US	-
Case Bar Code	50046677230819
Successor Product number	-
Wattage[W]	21W
Color Code	830 [CCT of 3000K]
Base	Min Bipin [Miniature Bipin]
Bulb	T5 [16mm]
Special packing	ALTO
Packing Type	UNP [Unpacked]
System Description	High Efficiency
Base Information	Green[Green Base]
Packing Configuration	40
Rated Avg. Life[hr]	24000
Dimmable	Yes
Mercury (Hg) Content[mg]	-
Color Rendering Index[Ra8]	85
Color Temperature[K]	3000
Initial Lumens[Lm]	-
Overall Length C[mm]	863.2
Diameter D[mm]	17

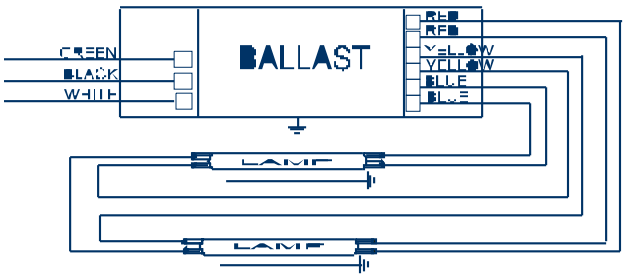
ICN-2S28@277

Brand Name	CENTIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
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.
F14T5	1	14	0/-18	0.07	19	1.07	20	0.90	1.7	5.63
F14T5	2	14	0/-18	0.13	34	1.06	10	0.98	1.7	3.12
F21T5	1	21	0/-18	0.10	26	1.03	15	0.95	1.7	3.96
* F21T5	2	21	0/-18	0.17	48	1.02	10	0.98	1.7	2.13
F28T5	1	28	0/-18	0.12	33	1.04	10	0.98	1.7	3.15
F28T5	2	28	0/-18	0.23	63	1.03	10	0.99	1.7	1.63
F35T5	1	35	0/-18	0.15	41	1.01	10	0.98	1.7	2.46
F35T5	2	35	0/-18	0.28	77	1.00	10	0.99	1.7	1.30

Wiring Diagram



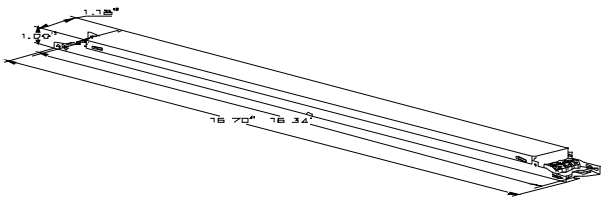
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow	0	0
Gray	0	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)
16.70 "	1.18 "	1.00 "	16.34 "
16 7/10	1 9/50	1	16 17/50
42.4 cm	3 cm	2.5 cm	41.5 cm

Revised 09/01/2004

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 TRANSFORMER CO.
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

ICN-2S28@277	
Brand Name	CENTIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Notes:

Section I - Physical Characteristics

1.1 Ballast shall be physically interchangeable with standard electromagnetic or standard electronic ballasts, where applicable.

1.2 Ballast shall be provided with integral leads color-coded per ANSI C82.11.

Section II - Performance Requirements

2.1 Ballast shall be Programmed Start.

2.2 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.

2.3 Ballast shall operate from 50/60 Hz input source of _____ (120V through 277V or 347V through 480V) with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

2.4 Ballast shall be high frequency electronic type and operate lamps at a frequency above 42 kHz to avoid interference with infrared devices and eliminate visible flicker.

2.5 Ballast shall have a Power Factor greater than 0.98 for primary lamp.

2.6 Ballast shall have a minimum ballast factor of 1.00 for primary lamp application.

2.7 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

2.8 Ballast input current shall have Total Harmonic Distortion (THD) of less than 20% for Standard models and THD of less than 10% for Centium models when operated at nominal line voltage with primary lamp.

2.9 Ballast shall have a Class A sound rating.

2.10 Ballast shall have a minimum starting temperature of -18C (0F) or -28C (-20F) for primary lamp. Consult lamp manufacturer for temperature versus lamp characteristics.

2.11 Ballast shall provide Lamp EOL Protection Circuit.

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

2.13 Ballast shall have a hi-low switching option when operating (4) F54T5/HO lamps to allow switching from 4-2 lamps, 3-2 lamps or 3-1 lamp.

2.14 Four lamp ballast shall have semi-independent lamp operation.

Section III - Regulatory Requirements

3.1 Ballast shall not contain any Polychlorinated Biphenyl (PCB).

3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable.

3.3 Ballast shall comply with ANSI C62.41 Category A for Transient protection.

3.4 Ballast shall comply with ANSI C82.11 where applicable.

3.5 Ballast shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

Section IV - Other

4.1 Ballast shall be manufactured in a factory certified to ISO 9001:2000 Quality System Standards.

4.2 Ballast shall carry a five-year warranty from date of manufacture against defects in material or workmanship, including replacement, for operation at a maximum case temperature of 70C. Ballasts with a "90C" designation in their catalog number shall also carry a three-year warranty at a maximum case temperature of 90C.

4.3 Manufacturer shall have a fifteen-year history of producing electronic ballasts for the North American market.

4.4 Ballast shall be Advance Transformer part # _____ or approved equal.

Revised 09/01/2004

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 TRANSFORMER CO.
O'HARE INTERNATIONAL CENTER - 10275 WEST HIGGINS ROAD
ROSEMONT, ILLINOIS 60018
TELEPHONE: (847) 390-5000 FAX: (847) 390-5109

Description

308 Features a Center Luminous Glass Bowl surrounded by Four Perched Glass Bowls. Available with various glass colors and texture options.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Material/Mounting
Brass, copper, steel or aluminum stems, trim and ball.

Quad-Pod with Decorative Rings: Four 3/8" stems with decorative ring attachment. Standard hang height of 48" (OA). Minimum overall hang height is 30" (OA). Maximum overall hang height is 8' (OA). Contact factory for lengths above 8'. Specify SCA for sloped ceilings up to 0-45°. 1/4" Architectural (light green glass) or Starfire (white glass) available in various textures and colors.

Finish
Standard: Unlacquered Natural Aluminum (NA) [Sustainable Design].
Premium: Matte White (MW), Lacquered Satin Aluminum (SAL), Satin Chrome (SC), Polished Chrome (PC), Satin Brass (SB), Polished Brass (PB), Satin Copper (SCP), Polished Copper (PCP), Satin Nickel (SN), Polished Nickel (PN), Satin Zinc (SZ), Gun Metal (GNM), Oxidized Brass (OBRS), Oxidized Copper (OCP) or Custom Colors (CC).

Glass Finish
Standard: Glass Architectural White (GAW).
Premium:
Colors - Glass Architectural Celadon (GAC), Glass Architectural Parchment (GAP), Glass Architectural Coral (GAL), Glass Starfire White (GSA), Glass Starfire Celadon (GSC), Glass Starfire Parchment (GSP) or Glass Starfire Coral (GSL).
Faux - Glass Architectural Marble White (GAMW), Glass Architectural Marble Celadon (GAMC), Glass Architectural Marble Parchment (GAMP), Glass Architectural Marble Coral (GAML), Glass Starfire Marble White (GSMW), Glass Starfire Marble Celadon (GSMC), Glass Starfire Marble Parchment (GSMP), Glass Starfire Marble Coral (GSML), Glass Architectural Sand Granite (GASG) or Glass Starfire Sand Granite (GSSG). Contact factory for additional colors and faux patterns.
Textured: Glass Architectural Oscuro (GAO), Glass Starfire Oscuro (GSO) or Glass Architectural Opal Ice (GAI).

Optics
Refer to www.shaperlighting.com for complete photometrics.

Lamp/Socket
One (1) 50W T-5 (mini-can) 120V Xelogen lamp (5000hrs, 2900K) or 60W (G9) pinched quartz 120V halogen lamp (2000hrs, 2800K). Note: Six lamps total per fixture. Lamps furnished by others.

Installation
Supplied with either a circle strap mounting canopy or bar strap that mounts to a 4" J-box or plaster ring. Integral safety cable provided.

Options
Center Stem with Ball (CSB), Sloped Ceiling Adaptor (SCA). Contact the factory for alternative mounting options and multi-bowls.

Labels
U.L. and C.U.L. listed.

Modifications
Shaper's skilled craftspeople with their depth of experience offer the designer the flexibility to modify standard pendant luminaires for project specific solutions. Contact the factory regarding scale options, unique finishes, mounting, additional materials/colors, or decorative detailing.

308
Cloud
Interior Pendant

Features a Center Luminous Glass Bowl surrounded by Four Perched Glass Bowls

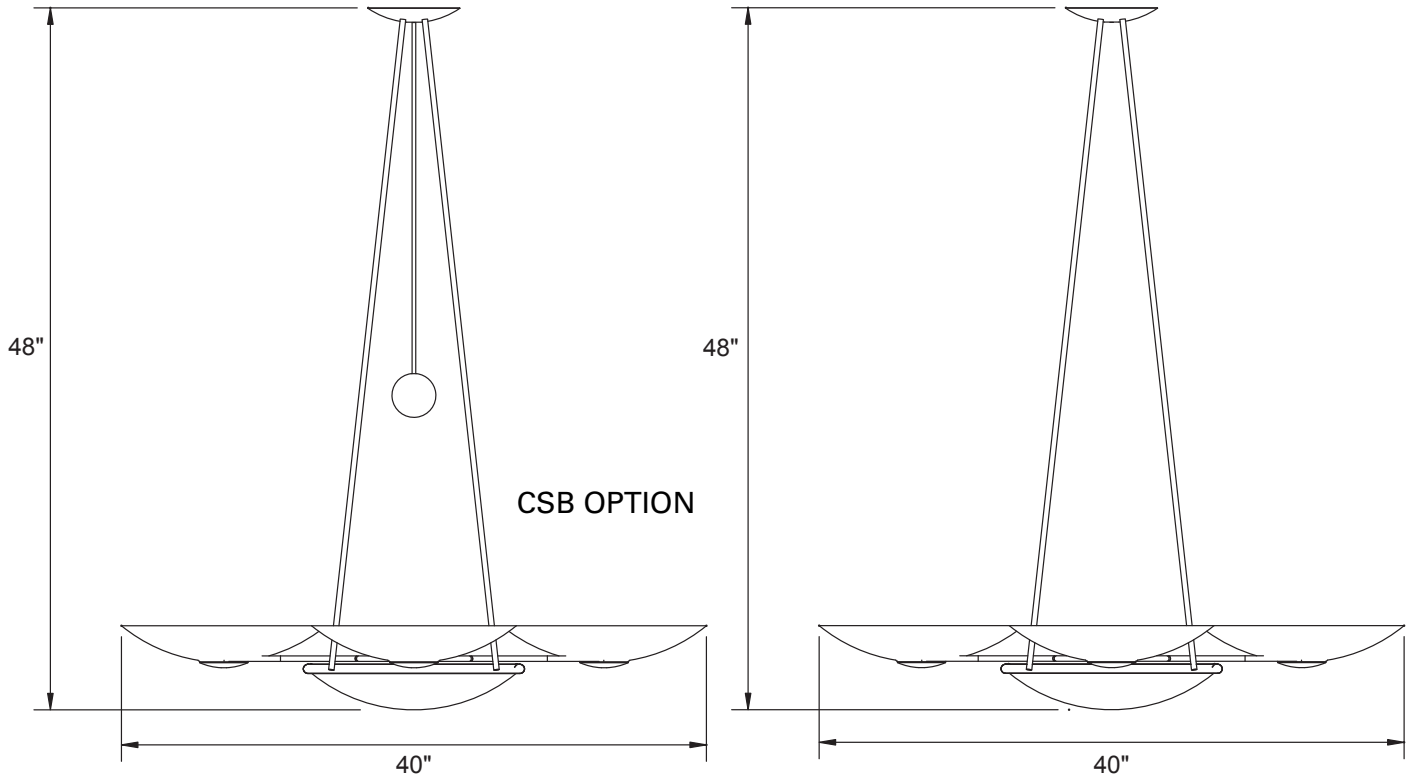
ORDERING EXAMPLE 308-XEL/3/50 + XEL/8/50-120V-GOA-NZ-42

SERIES	LAMP	VOLTAGE	GLASS FINISH	TRIM FINISH	OPTIONS	OA
308	XEL/3/50 + XEL/8/50 (11 total) HAL/3/60 + HAL/8/60 (11 total)	120V (only)	GAW, GAC, GAP, GAL, GSA, GSC, GSP, GSL, GAMW, GAMC, GAMP, GAML, GSMW, GSMC, GSMP, GSML, GASG, GSSG, GAO, GSO, GAI	NA, MW, SAL, SB, PB, SC, PC, SCP, PCP, SN, PN, SZ, GNM, OBRS, OCP or CC	CSB, SCA	48" OA or Specify

[Sustainable Design] Shaper's NA finish supports the goals for sustainable projects. Refer to the Icon Legend Link on shaperlighting.com.

Specifications and Dimensions subject to change without notice.
Consult your representative for additional options and finishes.

DIMENSIONS



Specifications and Dimensions subject to change without notice.

Shaper Lighting • 1141 Marina Way South • Richmond, CA 94804 • ph 510.234.2370 • fax 510.234.2371

Halogená Classic 60W Med 120V BT15 CL 1BC

Product family description
The long life alternative to standard incandescent that offers superior light quality, less maintenance and energy savings.

Features/Benefits

- Long life means less hassle and lower maintenance for the consumer.
- Superior Light Quality - Provides a crisp white light. Maintains a high light quality when dimmed.
- Dimmable - Greater design flexibility. Saves energy. Increases life - uses less electricity when dimmed.
- Direct Replacement - Compact size and a medium base to replace standard incandescent lamps.
- Full Line - Available in a variety of shapes, wattages and bases.

Applications

- Ideal for table lamps, hanging pendants, ceiling fixtures, enclosed outdoor lighting, commercial downlights, or any hard-to-reach fixture.

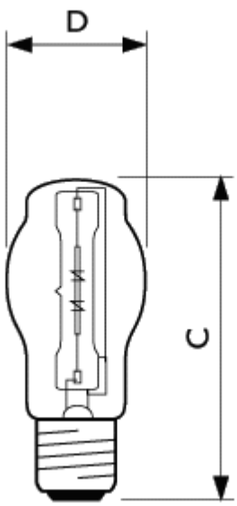
Notes

- Operating Instructions: Do not use lamp in close proximity to combustile materials. If used outdoors, use in an enclosed fixture only. If used indoors, no additional shield is required. Can be operated in all positions. CAUTION: Read operating instructions before use. If outer glass breaks, turn power off immediately and avoid touching any metal components. To avoid potential burn and electrical shock during lamp replacement, always turn power off and let lamp cool before replacing bulb. Lasts 2 years based on 4 hours average usage per day/7 days per week. (96)
- Rated average life is the length of operation (in hours) at which point an average of 50% of the lamps will still be operational and 50% will not. (93)

Product data	
Product Number	249243
Full product name	Halogená Classic 60W Med 120V BT15 CL 1BC
Ordering Code	BC60BT15/HAL/CL
Pack type	1 Lamp in a Blister Card
Pieces per pack	1
Packs per case	10
Pack UPC	046677249243
EAN2US	
Case Bar Code	50046677249248
Successor Product number	
Wattage[W]	60W
Base	Med [Medium]
Voltage[V]	120V
Bulb	BT15 [Diameter 1.875 inch]
Bulb Finish	CL [Clear]
Packing Type	1BC [1 Lamp in a Blister Card]

PHILIPS

Product data	
Packing Configuration	10
Operating Position	Universal[Any or Universal (U)]
Rated Avg. Life[hr]	
Color Rendering Index[Ra8]	100
Color Temperature[K]	2900
Initial Lumens[Lm]	920
Overall Length C[mm]	106
Diameter D[mm]	47.3



Data not (yet) available

HalA E27/Medium BT15

Walter Nichols
Hawthorn Building
Altoona, PA

Appendix C

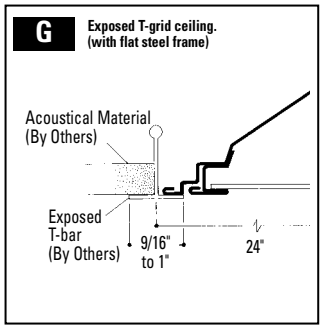
XP/XA 2' x 4' Lens Recessed Fluorescent **XP/XA332**

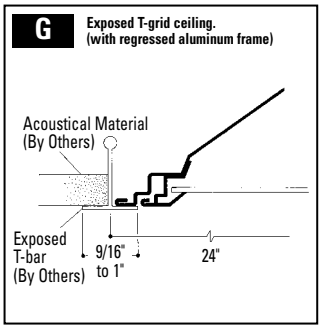
Static, Flat Steel or Regressed Aluminum Lens Frame, 3 Lamp, T8

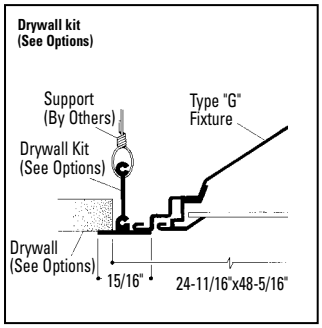
Features

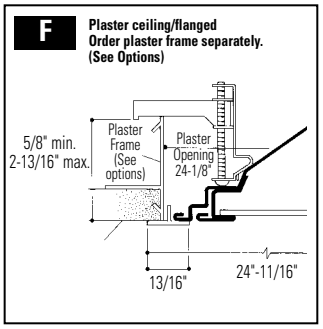
- Efficiency 85.0%.
- Shallow 3" deep housing.
- Ribbed housing for strength and stability.
- Ends of housing formed inward for safe handling.
- Built-in earthquake clips.
- Hemmed-over side rails for safe handling.
- Ends have screw dimples for installation to T-bar (no fixture or ceiling distortion).
- Flat steel or regressed aluminum lens frame with mitered corners.
- Edges of steel door frame hemmed-over for safe handling.
- No light leak.
- Internal "T" hinges – easy installation and maintenance.
- Rooster head spring latches.
- Meets code 30 requirements in New England.

Mounting Methods

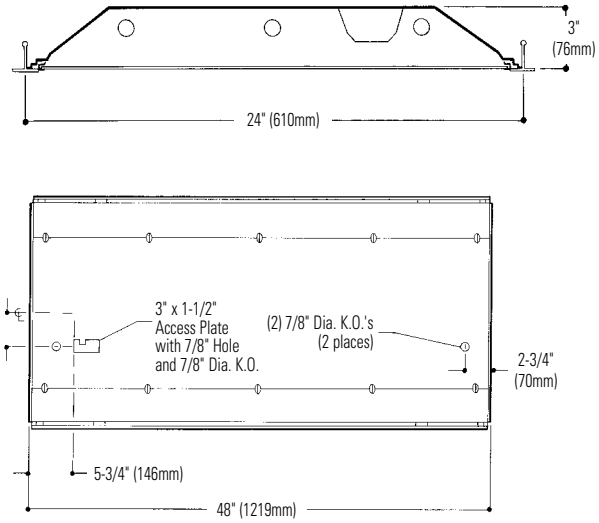








Dimensions



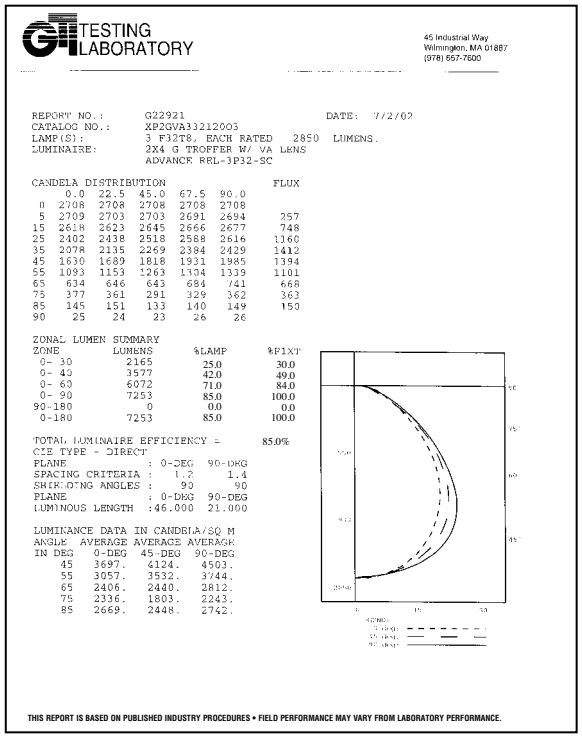
Job Information	**Type:**
Job Name:	
Cat. No.:	
Lamp(s):	
Volts/Ballast:	

Lightolier a Genlyte Thomas Company www.lightolier.com
Technical Information: (978) 657-7600 • Fax (978) 658-0595
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

Photometry

Model No. XP2GVA33212003



GL TESTING LABORATORY

45 Industrial Way
Wilmington, MA 01887
(978) 657-7600

REPORT NO.: G22921 DATE: 7/2/02
CATALOG NO.: XP2GVA33212003
LAMP(S): 3 F32T8, EACH RATED 2850 LUMENS.
LUMINAIRE: 2X4 G TROFFER W/ VA LENS
ADVANCE REL-3P32-SC

CANDELA DISTRIBUTION

	0.0	22.5	45.0	67.5	90.0	FLUX
0	2708	2708	2708	2708	2708	
5	2709	2703	2703	2691	2694	257
15	2618	2623	2645	2666	2677	748
25	2402	2438	2518	2588	2616	1160
35	2078	2135	2269	2384	2429	1412
45	1630	1689	1818	1931	1985	1394
55	1093	1153	1263	1334	1339	1101
65	634	646	643	684	741	668
75	377	361	291	329	362	363
85	145	151	133	140	149	150
90	25	24	23	26	26	

ZONAL LUMEN SUMMARY

ZONE	LUMENS	%LAMP	%FIXT
0- 30	2165	25.0	30.0
0- 40	3577	42.0	49.0
0- 60	6072	71.0	84.0
0- 90	7253	85.0	100.0
90-180	0	0.0	0.0
0-180	7253	85.0	100.0

TOTAL LUMINAIRE EFFICIENCY = 85.0%
CIE TYPE - DIRECT

PLANE	: 0-DEG	90-DEG
SPACING CRITERIA	: 1.2	1.4
SHIELDING ANGLES	: 90	90
PLANE	: 0-DEG	90-DEG
LUMINOUS LENGTH	:46.000	21.000

LUMINANCE DATA IN CANDELA/SQ M

ANGLE IN DEG	AVERAGE 0-DEG	AVERAGE 45-DEG	AVERAGE 90-DEG
45	3697.	4124.	4503.
55	3057.	3532.	3744.
65	2406.	2440.	2812.
75	2336.	1803.	2243.
85	2669.	2448.	2742.

THIS REPORT IS BASED ON PUBLISHED INDUSTRY PROCEDURES • FIELD PERFORMANCE MAY VARY FROM LABORATORY PERFORMANCE.

LER = FL - 75.2 IW - 85 BF - 0.88
Comparative yearly lighting energy cost per 1000 lumens = $3.19

coefficients of utilization — zonal cavity method (effective floor cavity reflectance 0.20)

RF	20			20			20		
RC	80			50			30		
RW	70	50	30	50	30	10	50	30	10
room cavity ratio 1	93	89	85	83	81	78	80	78	76
2	85	78	73	74	69	66	71	67	64
3	78	69	63	65	60	56	63	59	55
4	71	62	54	58	53	48	56	51	47
5	66	55	48	53	46	42	51	46	41
6	61	50	43	48	41	37	46	41	36
7	56	45	38	43	37	33	42	37	32
8	53	41	34	40	34	29	39	33	29
9	49	38	31	37	31	26	35	30	26
10	46	35	28	34	28	24	33	28	24

visual comfort probability (rated lumens per lamp 2850.)

room size		luminaries lengthwise	ceiling height				luminaries crosswise	ceiling height			
W	L		8.5	10.0	13.0	16.0		8.5	10.0	13.0	16.0
20	20		60	65	73	81		59	63	69	78
20	30		52	57	63	71		53	56	60	67
20	40		48	52	58	63		50	52	56	60
20	60		44	48	52	58		46	49	52	56
30	20		62	66	72	79		61	65	69	76
30	30		53	58	62	68		54	57	60	65
30	40		48	52	56	61		50	53	55	58
30	60		44	47	50	55		46	49	50	54
30	80		42	45	46	51		44	46	48	51
40	20		64	68	72	78		63	66	70	76
40	30		55	59	63	67		56	59	61	65
40	40		49	53	56	60		51	54	56	58
40	60		45	48	50	54		46	49	51	53
40	80		42	45	46	50		44	46	48	50
40	100		41	43	44	47		43	45	46	48
60	30		56	60	64	68		57	60	62	66
60	40		50	54	57	60		52	55	56	59
60	60		45	48	50	54		47	50	51	54
60	80		42	45	46	49		44	46	47	50
60	100		41	43	43	46		43	44	45	48
100	40		54	57	59	63		54	57	59	62
100	60		48	51	52	56		49	52	53	56
100	80		45	47	47	51		46	48	49	52
100	100		43	44	44	47		44	46	46	48

Ordering Information

Explanation of Catalog Number. Example: XP2GVA33212003GLR

[ ]	2	[ ]	VA	3	32	[ ]	[ ]	[ ]
XP = Recessed Fluorescent with Flat Steel Lens Frame **XA** = Recessed Fluorescent with Regressed Aluminum Lens Frame	**Fixture Width**	**Ceiling Type:** **G** = Grid (lay-in) T-bar **F** = Flanged (overlap) Z spline and plaster frame	**Lens Shielding Type:** **VA** = Virgin Acrylic (standard) see options and consult factory	**Lamp Quantity:** (By others) **3** = 3-Lamp	**Lamp Fixture Length:** **32**=T8, 4' Length	**Voltage:** 120 or 277	**Ballast:**	**Options:** Add appropriate suffix to catalog no, ie: (GLR)

Ballast:

	<20THD	<10THD
1 & 2 Lamp Elec. (T8)	**SO***	**HI***
1-3 Lamp Elec. (T8)	**O3***	**H3***
LOL Dimming (T8)	**PS**	

*Instant Start Standard
Other dimming options. Consult factory.

Options/Accessories

Special Lens: Substitute VI for **.125"** nominal pattern. For other lenses, consult factory.

Access Plates: Top wiring access plate is shipped with fixture as standard. When access plates are required in advance for wiring convenience, specify separately. Order Catalog number: **ACPX CSP**.

Electrical Wiring Options: Consult factory.

Fusing: Internal fast-blow fusing. Suffix: **GLR**.
Internal slow-blow fusing. Suffix: **GMF**.

Radio Interference Filter: 120 or 277 volt, 50 or 60 Hz. One per fixture: Suffix: **R**. One per ballast: Suffix: **B**.

Drywall Kit: Order Catalog Number: **FK92x4** (Request Folio OA30-10).

Specifications

Performance: In an installation of 3 lamps 32 W luminaires in a room cavity of 1, with reflectance of 80% ceiling, 50% walls, 20% floor, the C.U. shall not be less than .89. To control veiling reflections, luminaire output in the 30°-90° zone shall be not less than 70%.

Materials: Chassis parts are die-formed code gauge cold rolled steel.

Housing is embossed for added strength and rigidity with all edges turned over for safe handling. **Lens frames**—(**XP**) flat full-size steel frame, (**XA**) regressed full-size aluminum frame.

Finish: Chassis exterior—white baked polyester enamel. **Cavity**—white baked polyester enamel minimum 86% reflectance. Phosphate undercoating.

Specifications (continued)

Lens: Extruded virgin acrylic 3/16" square based female cones, running 45° to the panel edge. .095" nominal thickness (similar to pattern 12).

Electrical: Thermally protected class "P" ballast C.B.M. approved, non PCB. If K.O. is within 3" of ballast, use wire suitable for at least 90°.

Labels: I.B.E.W./UL and ULc Listed.

Job Information **Type:**

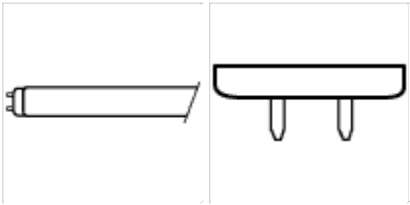
Lightolier a Genlyte Thomas Company www.lightolier.com
Technical Information: (978) 657-7600 • Fax (978) 658-0595
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

Print Close

GE Consumer & Industrial
Lighting

Lighting Specification Bulletin

T8 ULTRA Watt-Miser (4', 8', XL) w/ Starcoat **Product Code:** 48277 **Description:** F32T8SP30ISWMECO	

Specification:
Firm Name :
Job Name :

General	
Product Code	48277
Description	F32T8SP30ISWMECO
Subcategory	T8 ULTRA Watt-Miser (4', 8', XL) w/ Starcoat
Physical	
Bulb Type	T8
Base Type	Medium BiPin (G13)
Nominal Length (In.)	48.00
Nominal Length (mm)	1220
Max Overall Length (In.)	47.78
Bulb Nominal Diameter in inches	1
Max bulb diameter	1.1
Min bulb diameter	.94
Photometric	
Lumens (Initial)	2875
Lumens (Mean)	2700
Color Temperature (K)	3000
Electrical	
Average Rated Life	20000
Watts	30
Nominal Lamp Volts	129
Minimum Starting Temp (deg F)	59
Miscellaneous	
TCLP Regulated	Y
Additional Information	S/P Ratio: 1.3
Footnotes	Watt-Miser ¨ , Watt-Miser ¨ Plus, F28T8/UMX and Energy Efficient (/EE) lamps are intended for use where ambient temperatures are 60 F (16 C) or higher and where the lamp surface is protected from strong air drafts. Failure to protect the lamp surface may result in reduced life, poor starting or erratic operation, such as flickering

	or spiraling. All T12 Watt-Miser ¨ lamps are intended for use on two-lamp, indoor, lead, high power factor ballasts and are not recommended for use with dimming or reduced current systems. The use of T12 Watt-Miser ¨ lamps on single lamp ballasts may shorten lamp life. T12 Rapid Start Watt-Miser ¨ lamps are intended for use only with Rapid Start Ballasts. F40 Rapid Start Watt-Miser ¨ lamps on high frequency electronic systems may display erratic starting before end of life. T8 Watt-Miser ¨ lamps are intended for use only with instant start ballasts. F28T8/UMX lamps are designed for use on UltraMax ballasts.	

All values are design values or typical values when measured under laboratory conditions.Information provided is subject to change without notice. Where applicable, values are based on guidelines published in ANSI. For more information see Terms and Conditions in the link below.

Reduced Wattage Ⓔ Meets Federal Minimum Efficiency Standards

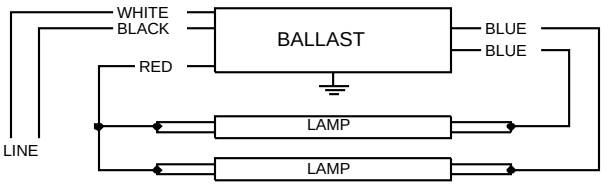
VCN-2M32-MC

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

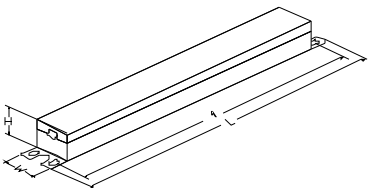
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

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

ADVANCE TRANSFORMER CO.
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

Notes:

Section I - Physical Characteristics

1.1 Ballast shall be physically interchangeable with standard electromagnetic or standard electronic ballasts, where applicable.

1.2 Ballast shall be provided with integral leads color-coded per ANSI C82.11.

Section II - Performance Requirements

2.1 Ballast shall be Instant Start.

2.2 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.

2.3 Ballast shall operate from 50/60 Hz input source of 120V or 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast. IntelliVolt models shall operate from 50/60 Hz input source of 120V through 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

2.4 Ballast shall be high frequency electronic type and operate lamps at a frequency above 42 kHz to avoid interference with infrared devices and eliminate visible flicker.

2.5 Ballast shall have a Power Factor greater than 0.98 for primary lamp.

2.6 Ballast shall have a minimum ballast factor for primary lamp application as follows: 0.75 for Low Watt, 0.85 for Normal Light Output, and 1.20 for High Light.

2.7 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

2.8 Ballast input current shall have Total Harmonic Distortion (THD) of less than 20% for Standard models and THD of less than 10% for Centium models when operated at nominal line voltage with primary lamp.

2.9 Ballast shall have a Class A sound rating.

2.10 Ballast shall have a minimum starting temperature of -18C (0F) for standard T8 lamps and 16C (60F) for energy-saving T8 lamps.

2.11 Ballast shall provide Lamp EOL Protection Circuit.

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

Section III - Regulatory Requirements

3.1 Ballast shall not contain any Polychlorinated Biphenyl (PCB).

3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable.

3.3 Ballast shall comply with ANSI C62.41 Category A for Transient protection.

3.4 Ballast shall comply with ANSI C82.11 where applicable.

3.5 Ballast shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

Section IV - Other

4.1 Ballast shall be manufactured in a factory certified to ISO 9001:2000 Quality System Standards.

4.2 Ballast shall carry a five-year warranty from date of manufacture against defects in material or workmanship, including replacement, for operation at a maximum case temperature of 70C.

4.3 Manufacturer shall have a fifteen-year history of producing electronic ballasts for the North American market.

4.4 Ballast shall be Advance Transformer part # _____ or approved equal.

4.5 All products except Optanium 2.0 (IOP) models may experience lamp striations when operating 25W, 28W, or 30W energy saving T8 lamps.

4.6 Only the Optanium 2.0 (IOP) models are suitable for tandem-wiring applications operating 25W, 28W, or 30W energy saving T8 lamps.

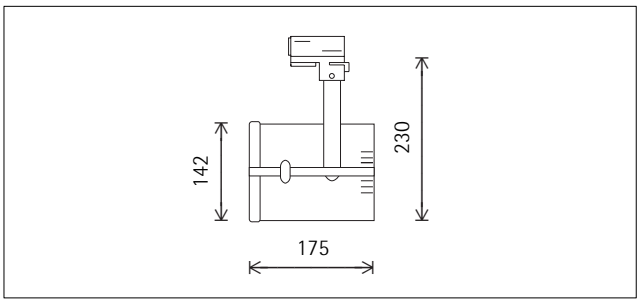
Revised 07/23/2004

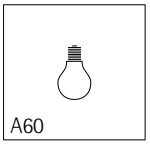
ADVANCE TRANSFORMER CO.
O'HARE INTERNATIONAL CENTER - 10275 WEST HIGGINS ROAD
ROSEMONT, ILLINOIS 60018
TELEPHONE: (847) 390-5000 FAX: (847) 390-5109

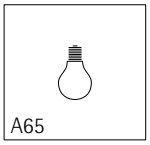
ERCO

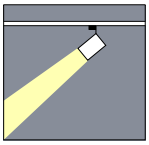
TM Spotlight

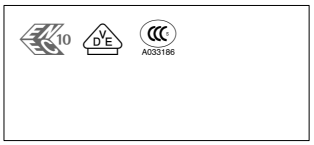
for PAR lamps and general service lamps





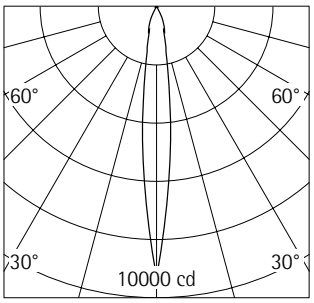






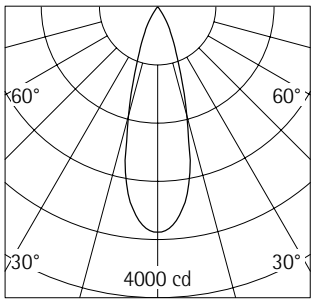
77461.000 White (RAL9002)
PAR38 120W 230V E27 12°
PAR38 120W 230V E27 30°
A60 100W/m 230V E27 1380lm
A65 150W/m 230V E27 2220lm

Product description
Housing: cast aluminium, powder-coated. 0°-90° tilt. Lateral guides for accessories. Bracket on 3-circuit adapter rotatable through 360°. ERCO 3-circuit adapter: plastic. A60 100W/m or A65 150W/m with reflector 70555.000.
Weight 1.50kg



PAR38 120W 230V E27 12°

h(m)	E(lx)	D(m) 12°
1	9300	0.21
2	2325	0.42
3	1033	0.63
4	581	0.84
5	372	1.05



PAR38 120W 230V E27 30°

h(m)	E(lx)	D(m) 30°
1	3100	0.54
2	775	1.07
3	344	1.61
4	194	2.14
5	124	2.68

Mounting
ERCO 3-circuit track
Hi-trac track
Monopoll track
1-circuit singlet

ERCO Leuchten GmbH
Postfach 24 60
58505 Lüdenscheid
Germany
Tel.:+49 2351 551-0
Fax.:+49 2351 551-300
info@erco.com

Technical Region: 230V/50Hz
Edition: December 16, 2005
Please download the current version from
www.erco.com/77461.000

LIGHTLINE™ WALL WASH

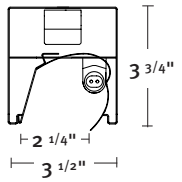
PEERLESS®

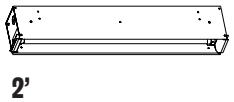
2 1/4" Aperture

Recessed Mount Wall Wash

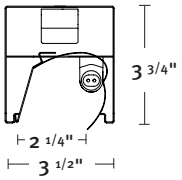
SPECIFICATIONS

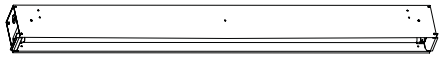
AVAILABLE FIXTURE





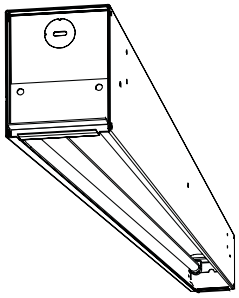
LWR9 2' T5HO/T5





LWR9 4' T5HO/T5

SPECIFICATIONS



CONSTRUCTION

Housing is formed from painted cold-rolled steel. Five-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with high-gloss baked enamel.

REFLECTORS

Specular asymmetric reflector system.
Black metal diffuser with round holes.

ELECTRICAL

Specify 120 volt , 277 volt, or 347 volt. Non EL versions damp location labeled. UL and C-UL listed and labeled.
For special circuiting, consult factory.

FIXTURE SIZE

Nominal 2" aperture. 2' and 4' lengths available.

ORDERING LOGIC

Quantity	Fixture	Ceiling Type	# of Lamps in Cross Section	Lamp Type	Reflector/Shielding	Nominal Length	Voltage	Ballast Type	Emergency Options	Lamp Color	Options
		G	1								

LWR9 – Asymmetric recessed

24T5HO – 24W 2' T5HO
54T5HO – 54W 4' T5HO
28T5 – 28W 4' T5
14T5 – 14W 2' T5

HOL – Black Metal Diffuser with Round Holes

U2 – 2'
U4 – 4'

120
277
347
MVOLT[3]

GEB10 – 10% THD Ballast

Dimming Ballasts Available
ADEZ – Advance Mark 10[1]
ADZT – Advance Mark 7[1]
ECO10 – Lutron ECO 10
DMHL – Lutron Hi-Lume (FDB) - Purchased [1]
OSDIM – Osram 0-10V[1]

EL – Emergency Battery Pack (390-700 lumens) [2]

L/LP – No Lamp
LP830 3000k 80+ CRI
LP835 3500k 80+ CRI
LP841 4100k 80+ CRI

GLR – Fast Blow Fuse
GMF – Slow Blow Fuse
CP – Chicago Plenum

Accessories (order separately)
DHSGS2 - Gyp-board Flange Kit 2'
DHSGS4 - Gyp-board Flange Kit 4'

1 Only available with 54T5HO
2 Only available with 28T5 & 54T5HO
3 Not for use when specifying battery pack

EXAMPLE:

Qty	Fixture section
4	LWR9 G 1 54T5HO HOL U4 120 GEB10 L/LP
1	LWR9 G 1 14T5 HOL U2 277 GEB10 LP835

PEERLESS LIGHTING Box 2556, Berkeley, CA 94702-0556 510.845-2760 Fax 510.845-2776 www.peerless-lighting.com

ITEM #: _____

LIGHTLINE™ WALL WASH

PEERLESS®

2 1/4" Aperture

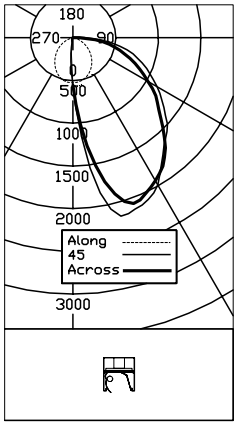
Recessed Mount Wall Wash

PHOTOMETRICS

1-LAMP 54W T5 HIGH-OUTPUT

FAR-FIELD PHOTOMETRY
DATE: 12-12-2005
REPORT NUMBER: 6893

CATALOG NUMBER: LWR9-1-54T5HO
LUMINAIRE: 3 1/2"W X 3 3/4"H RECESSED WALL WASH WITH ASYMMETRIC-THROW SPECULAR REFLECTOR AND PERF. BLACK TRIM
LAMP(S): FP54/835/HO RATED @ 5000 LUMENS
BALLAST: QTP-1X54HO/UNV PSN
MOUNTING:
LUMEN TO CANDELA RATIO USED = 9.15
TOTAL INPUT WATTS = 60.9 AT 120.0 VOLTS
THE 0 DEGREE PLANE IS PERPENDICULAR TO THE LAMPS.



CANDELA DISTRIBUTION						FLUX
	0.0	45.0	90.0	135.0	180.0	
0	558	558	558	558	558	
5	1183	1020	564	276	180	65
15	2163	1895	543	48	40	254
25	2091	2010	501	32	27	429
35	1809	1832	439	22	23	532
45	1559	1488	356	20	22	549
55	1274	1184	262	17	15	505
65	990	863	160	8	5	403
75	728	570	67	0	1	278
85	343	263	4	0	0	124
90	132	77	0	0	0	

ZONAL LUMEN SUMMARY			
ZONE	LUMENS	%LAMP	%FIXT
0- 30	748	15.0	23.8
0- 40	1279	25.6	40.8
0- 60	2333	46.7	74.4
0- 90	3138	62.8	100.0
90-180	0	0.0	0.0
0-180	3138	62.8	100.0

TOTAL LUMINAIRE EFFICIENCY = 62.8 %
CIE TYPE - DIRECT

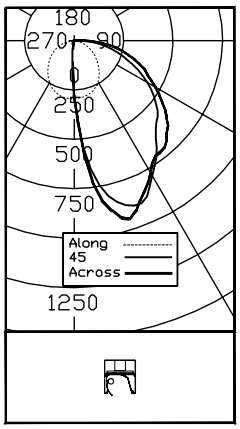
APPROVED BY:

BARE LAMP LUMEN VALUE IS RATED AT LAMP OPERATING TEMPERATURE INSIDE THE LUMINAIRE.
FOR DETAIL EXPLANATIONS, PLEASE SEE PEERLESS PUBLICATION # A62

1-LAMP 28W T5 HIGH-OUTPUT

FAR-FIELD PHOTOMETRY
DATE: 12-12-2005
REPORT NUMBER: 6932

CATALOG NUMBER: LWR9-1-24T5HO
LUMINAIRE: 3 1/2"W X 3 3/4"H RECESSED WALL WASH WITH ASYMMETRIC-THROW SPECULAR REFLECTOR AND PERF. BLACK TRIM
LAMP(S): FP24/835/HO RATED @ 2200 LUMENS
BALLAST: QTP2X39-24T5HO/UNV PSN
MOUNTING:
LUMEN TO CANDELA RATIO USED = 9.15
TOTAL INPUT WATTS = 26.6 AT 120.0 VOLTS
THE 0 DEGREE PLANE IS PERPENDICULAR TO THE LAMPS.



CANDELA DISTRIBUTION						FLUX
	0.0	45.0	90.0	135.0	180.0	
0	279	279	279	279	279	
5	580	543	296	106	43	32
15	927	845	283	19	16	115
25	845	871	261	13	11	184
35	718	723	226	9	8	219
45	662	588	178	7	7	230
55	543	493	125	7	5	209
65	409	358	69	2	2	164
75	286	226	22	0	0	107
85	134	93	0	0	0	44
90	49	20	0	0	0	

ZONAL LUMEN SUMMARY			
ZONE	LUMENS	%LAMP	%FIXT
0- 30	331	15.0	25.4
0- 40	550	25.0	42.2
0- 60	988	44.9	75.8
0- 90	1303	59.2	100.0
90-180	0	0.0	0.0
0-180	1303	59.2	100.0

TOTAL LUMINAIRE EFFICIENCY = 59.2 %
CIE TYPE - DIRECT

APPROVED BY:

BARE LAMP LUMEN VALUE IS RATED AT LAMP OPERATING TEMPERATURE INSIDE THE LUMINAIRE.
FOR DETAIL EXPLANATIONS, PLEASE SEE PEERLESS PUBLICATION # A62

PEERLESS LIGHTING Box 2556, Berkeley, CA 94702-0556 510.845-2760 Fax 510.845-2776 www.peerless-lighting.com

ITEM #: _____

GE Consumer & Industrial Lighting

Lighting Specification Bulletin

T5 Starcoat High Output

Product Code: 46760
Description: F54W/T5/835/ECO

Specification:
Firm Name :
Job Name :

General	
Product Code	46760
Description	F54W/T5/835/ECO
Subcategory	T5 Starcoat High Output
Physical	
Bulb Type	T5
Base Type	Miniature BiPin (G5)
Bulb Material	Soft Glass
Nominal Length (In.)	45.20
Nominal Length (mm)	1150
Max Overall Length (In.)	45.795
Bulb Nominal Diameter in inches	.625
Max bulb diameter	.67
Max Face to End of Opposing Pin (B)	45.52
Min Face to End of Opposing Pin (B)	45.42
Photometric	
Lumens (Initial)	5000
Lumens (Mean)	4700
Color Temperature (K)	3500
Nominal Efficacy (Lumens/Watt)	93
Electrical	
Average Rated Life	20000
Watts	54
Nominal Lamp Volts	117
Nominal Lamp Operating Frequency (Hz)	20000
Minimum Starting Temp (deg F)	5
Min. Terminal to Terminal Starting Lamp Voltage (Vrms)- Instant Start at 15°C	620
Min. Terminal to Terminal	520

Starting Lamp Voltage (Vrms)- Rapid Start at 10° C	
Max Cathode Resistance Ratio (Rh/Rc)	6.5
Min Cathode Resistance Ratio (Rh/Rc)	4.25
Miscellaneous	
TCLP Regulated	Y
Additional Information	S/P Ratio: 1.5 Lumen Ratings at 35C. At 25C, Initial Lumens are 4460.

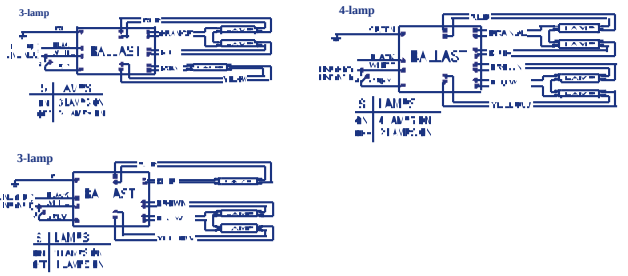
ICN4S5490C2LS@277

Brand Name	CENTIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series/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.
* F54T5/HO	1	54	0/-18	0.24	62	0.99	30	0.90	1.7	1.60
F54T5/HO	2	54	0/-18	0.43	117	0.99	10	0.98	1.7	0.85
F54T5/HO	3	54	0/-18	0.66	179	1.00	10	0.98	1.7	0.56
F54T5/HO	4	54	0/-18	0.86	234	1.00	10	0.98	1.7	0.43

Wiring Diagram



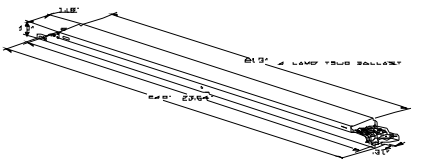
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow	0	0
Gray	0	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)
24 "	1.18 "	1 "	23.64 "
24	1 9/50	1	23 16/25
61 cm	3 cm	2.5 cm	60 cm

Revised 10/04/2005

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 TRANSFORMER CO.
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

ICN4S5490C2LS@277	
Brand Name	CENTIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series/Parallel
Input Voltage	277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Notes:

Section I - Physical Characteristics

1.1 Ballast shall be physically interchangeable with standard electromagnetic or standard electronic ballasts, where applicable.

1.2 Ballast shall be provided with integral leads color-coded per ANSI C82.11.

Section II - Performance Requirements

2.1 Ballast shall be Programmed Start.

2.2 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.

2.3 Ballast shall operate from 50/60 Hz input source of _____ (120V through 277V or 347V through 480V) with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

2.4 Ballast shall be high frequency electronic type and operate lamps at a frequency above 42 kHz to avoid interference with infrared devices and eliminate visible flicker.

2.5 Ballast shall have a Power Factor greater than 0.98 for primary lamp.

2.6 Ballast shall have a minimum ballast factor of 1.00 for primary lamp application.

2.7 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

2.8 Ballast input current shall have Total Harmonic Distortion (THD) of less than 20% for Standard models and THD of less than 10% for Centium models when operated at nominal line voltage with primary lamp.

2.9 Ballast shall have a Class A sound rating.

2.10 Ballast shall have a minimum starting temperature of -18C (0F) or -28C (-20F) for primary lamp. Consult lamp manufacturer for temperature versus lamp characteristics.

2.11 Ballast shall provide Lamp EOL Protection Circuit.

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

2.13 Ballast shall have a hi-low switching option when operating (4) F54T5/HO lamps to allow switching from 4-2 lamps, 3-2 lamps or 3-1 lamp.

2.14 Four lamp ballast shall have semi-independent lamp operation.

Section III - Regulatory Requirements

3.1 Ballast shall not contain any Polychlorinated Biphenyl (PCB).

3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable.

3.3 Ballast shall comply with ANSI C62.41 Category A for Transient protection.

3.4 Ballast shall comply with ANSI C82.11 where applicable.

3.5 Ballast shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

Section IV - Other

4.1 Ballast shall be manufactured in a factory certified to ISO 9001:2000 Quality System Standards.

4.2 Ballast shall carry a five-year warranty from date of manufacture against defects in material or workmanship, including replacement, for operation at a maximum case temperature of 70C. Ballasts with a "90C" designation in their catalog number shall also carry a three-year warranty at a maximum case temperature of 90C.

4.3 Manufacturer shall have a fifteen-year history of producing electronic ballasts for the North American market.

4.4 Ballast shall be Advance Transformer part # _____ or approved equal.

Revised 10/04/2005

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 TRANSFORMER CO.
O'HARE INTERNATIONAL CENTER - 10275 WEST HIGGINS ROAD
ROSEMONT, ILLINOIS 60018
TELEPHONE: (847) 390-5000 FAX: (847) 390-5109

Walter Nichols
Hawthorn Building
Altoona, PA

Appendix D

LIGHTEDGE®

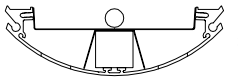
PEERLESS®

7" X 2 1/4" Deep Curved

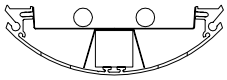
Pendant Mount - Modular

SPECIFICATIONS

AVAILABLE FIXTURES



EGCM1 1 T5/T5HO INDIRECT
EGCM2 1 T5/T5HO INDIRECT/OPEN



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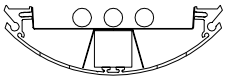
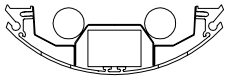
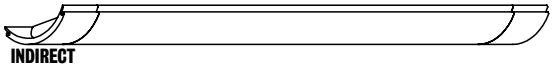
EGCM2 2 T5/T5HO INDIRECT/OPEN



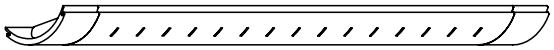
EGCM1 3 T5/T5HO INDIRECT
EGCM2 3 T5/T5HO INDIRECT/OPEN



EGCM1 2 T8 INDIRECT
EGCM2 2 T8 INDIRECT/OPEN



INDIRECT



INDIRECT/OPEN

CONSTRUCTION
Housing and endcap AA 6063 T6 extruded aluminum forming a 7" x 2 1/4" curvilinear channel.

REFLECTORS
Die-formed reflectors combine with baked white enamel finish (nominal reflectance 90%). T5HO/T5 with hammertone specular aluminum.

FINISH
Satin anodized standard; custom colors available.

ELECTRICAL
Specify 120 volt, 277 volt, or 347 volt. UL and C-UL listed and labeled. For special circuiting, consult factory.

FIXTURE LENGTH
4', 8' and 12' lengths in a single section for exact suspension spacing of 4', 8' and 12.' For total fixture length add 4" for each end-cap. Using internal joiners, 4', 8' and 12' sections can be joined to form longer-length fixtures.

ORDERING LOGIC

Use guide below to order complete fixture runs from four feet to three-hundred feet in increments of four feet.

Quantity	Fixture	# of Lamps in Cross Section	Lamp Type	Nominal Row Length (Must be in 4' increments)	Maximum Section Length	Voltage	Ballast Type	# of Emergency Sections (sections per run)(optional)	Emergency Type (optional)***	Switching	Lamp Color	Mounting Type	Feed/Overall Suspension	Finish	Options
				FT								/			
	EGCM1 **EGCM2**	**1*** **2** **3***	**54T5HO-** 54W 4' T5HO **28T5-** 28W 4' T5 **32-** 32W 4' T8		**R4-** 4' section **R8-** 8' section **R12-** 12'section	**120** **277** **347**	T5/T5HO **GEB10-** <10% THD Ballast T8 **GEB-** Electronic Ballast **GEB10-** <10% THD Ballast	**EL-** Emrgncy Battery Pack **EC-** Emergency Night Light/Circuit **EN-** Emergency Battery Pack w/ Night Light Circuit	**1SE-** 1 section **2SE-** 2 sections **XSE-** X sections	**SCT-** Single Circuit **DCT-** Dual Circuit	T5/T5HO/ T8 **L/LP-** No lamp **LP830-** 3000K 80 + CRI **LP835-** 3500K 80 + CRI **LP841-** 4100K 80 + CRI	**F1-** T-bar Ceiling **F2-** Hard Ceiling Horizontal J-box **F4A-** Grid Ceiling IDS 15/16" **F4B-** Grid Ceiling IDS 9/16" **F4C-** Grid Ceiling IDS Screw Slot	**12-** 12" overall **15-** 15" overall **18-** 18" overall **21-** 21" overall **24-** 24" overall **XX-** XX" overall	**C100-** Satin Anodized Finish (Standard) **C099-** Custom Color (consult factory)	**ACG-** Adjustable Cable Grippers **GLR-** Fast Blow Fuse **GMF-** Slow Blow Fuse **ELH-** EM Through Wire Harness **ELS-** EM Through Wire Harness With Single Feed **CMG-** White Cord Manager **APF-** Alternate Power Feed (F4X mounting only) **AEC-** Accent End Cover

*1 and 3 lamp not available in T8.
***EL, EN and EC not available with DCT in 4' sections.

EXAMPLE:

Qty Fixture section
1 EGCM1 3 54T5HO 12FT R12 277 GEB10 DCT L/LP F2/15 C100 ACG

PEERLESS LIGHTING Box 2556, Berkeley, CA 94702-0556 510.845-2760 Fax 510.845-2776 www.peerless-lighting.com

ITEM #: _____

LIGHTEDGE®

PEERLESS®

7” X 2 1/4” Deep Curved

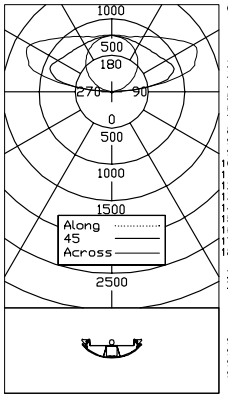
Pendant Mount - Modular

PHOTOMETRICS

1-LAMP T5 HIGH-OUTPUT

FAR-FIELD PHOTOMETRY
DATE: 11-15-2001
REPORT NUMBER: 5495

CATALOG NUMBER: EGCM2-1-54T5HO
LUMINAIRE: 7"W X 2 1/4"H ALUMINUM INDIRECT/OPEN LIGHT WITH WHITE PAINTED AND HAMMERTONE REFLECTOR AND SLOTS
LAMP(S): 1-FP54/835/HO RATED @ 5000 LUMENS
BALLAST: QT 1X54/120PHO
MOUNTING:
LUMEN TO CANDELA RATIO USED = 9.15
TOTAL INPUT WATTS = 60.1 AT 12.0 VOLTS
THE 0 DEGREE PLANE IS PARALLEL WITH THE LAMPS.



CANDELA DISTRIBUTION

	0.0	22.5	45.0	67.5	90.0	FLUX
0	5	5	5	5	5	
5	8	6	6	5	5	1
15	5	5	6	6	6	2
25	5	5	7	6	7	3
35	4	6	6	7	6	4
45	4	5	6	5	6	4
55	2	4	4	5	5	4
65	2	3	3	4	4	3
75	2	2	3	3	4	3
85	2	1	2	2	3	2
90	2	4	3	4	4	
95	17	243	297	294	292	270
105	123	446	822	1060	1117	764
115	254	478	900	1214	1299	831
125	384	521	824	1100	1207	728
135	500	583	782	972	1044	603
145	602	649	763	879	926	480
155	681	703	759	814	835	351
165	736	744	762	779	785	216
175	766	770	773	777	778	74
180	776	776	776	776	776	

ZONAL LUMEN SUMMARY

ZONE	LUMENS	%LAMP	%FIXT
0- 30	5	0.1	0.1
0- 40	9	0.2	0.2
0- 60	17	0.3	0.4
0- 90	26	0.5	0.6
90-120	1865	37.3	42.9
90-130	2593	51.9	59.7
90-150	3675	73.5	84.7
90-180	4316	86.3	99.4
0-180	4341	86.8	100.0

LUMINANCE DATA IN FOOTLAMBERTS

ANGLE IN DEG	AVERAGE 0-DEG	AVERAGE 45-DEG	AVERAGE 90-DEG
45	220.	323.	378.
55	178.	320.	355.
65	229.	286.	339.
75	367.	367.	400.
85	420.	420.	389.

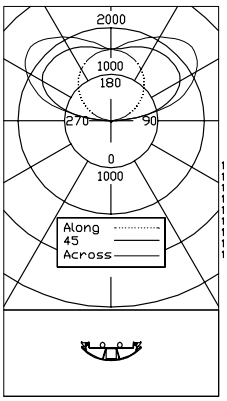
TOTAL LUMINAIRE EFFICIENCY = 86.8 %
CIE TYPE - INDIRECT
APPROVED BY:

TESTED IN ACCORDANCE WITH IES PROCEDURES, TEST DISTANCE EXCEEDS 25.0 FEET
NEAR-FIELD PHOTOMETRY AND CU TABLE AVAILABLE UPON REQUEST

2-LAMP T5 HIGH-OUTPUT

FAR-FIELD PHOTOMETRY
DATE: 11-15-2001
REPORT NUMBER: 5494

CATALOG NUMBER: EGCM2-2-54T5HO
LUMINAIRE: 7"W X 2 1/4"H ALUMINUM INDIRECT/OPEN LIGHT WITH WHITE PAINTED AND HAMMERTONE REFLECTOR AND SLOTS
LAMP(S): 2-FP54/835/HO RATED @ 5000 LUMENS
BALLAST: QT 2X54/120PHO
MOUNTING:
LUMEN TO CANDELA RATIO USED = 9.15
TOTAL INPUT WATTS =120.5 AT 12.0 VOLTS
THE 0 DEGREE PLANE IS PARALLEL WITH THE LAMPS.



CANDELA DISTRIBUTION

	0.0	22.5	45.0	67.5	90.0	FLUX
0	15	15	15	15	15	
5	17	16	16	15	14	1
15	15	15	15	18	17	5
25	13	14	19	18	19	8
35	12	15	16	17	17	10
45	10	13	13	14	15	10
55	9	11	11	13	13	10
65	7	8	9	10	10	9
75	6	6	7	7	8	7
85	4	3	4	4	6	4
90	4	4	5	5	7	
95	35	277	312	301	298	300
105	250	786	1135	1287	1312	1041
115	507	1032	1575	1825	1908	1394
125	760	1199	1779	2144	2246	1480
135	992	1353	1815	2201	2339	1359
145	1194	1455	1803	2074	2175	1101
155	1350	1503	1738	1917	1979	789
165	1460	1526	1638	1727	1760	462
175	1517	1533	1553	1574	1582	149
180	1538	1538	1538	1538	1538	

ZONAL LUMEN SUMMARY

ZONE	LUMENS	%LAMP	%FIXT
0- 30	14	0.1	0.2
0- 40	23	0.2	0.3
0- 60	43	0.4	0.5
0- 90	63	0.6	0.8
90-120	2735	27.3	33.6
90-130	4215	42.2	51.8
90-150	6676	66.8	82.0
90-180	8076	80.8	99.2
0-180	8139	81.4	100.0

LUMINANCE DATA IN FOOTLAMBERTS

ANGLE IN DEG	AVERAGE 0-DEG	AVERAGE 45-DEG	AVERAGE 90-DEG
45	563.	796.	966.
55	654.	818.	981.
65	657.	811.	910.
75	901.	876.	871.
85	858.	858.	795.

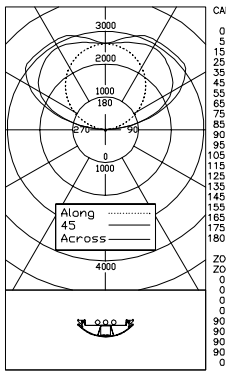
TOTAL LUMINAIRE EFFICIENCY = 81.4 %
CIE TYPE - INDIRECT
APPROVED BY:

TESTED IN ACCORDANCE WITH IES PROCEDURES, TEST DISTANCE EXCEEDS 25.0 FEET
NEAR-FIELD PHOTOMETRY AND CU TABLE AVAILABLE UPON REQUEST

3-LAMP T5 HIGH-OUTPUT

FAR-FIELD PHOTOMETRY
DATE: 11-15-2001
REPORT NUMBER: 5493

CATALOG NUMBER: EGCM2-3-54T5HO
LUMINAIRE: 7"W X 2 1/4"H ALUMINUM INDIRECT/OPEN LIGHT WITH WHITE PAINTED AND HAMMERTONE REFLECTOR AND SLOTS
LAMP(S): 3-FP54/835/HO RATED @ 5000 LUMENS
BALLAST: QT 1X54/120PHO & QT 2X54/120PHO
MOUNTING:
LUMEN TO CANDELA RATIO USED = 9.15
TOTAL INPUT WATTS =179.6 AT 12.0 VOLTS
THE 0 DEGREE PLANE IS PARALLEL WITH THE LAMPS.



CANDELA DISTRIBUTION

	0.0	22.5	45.0	67.5	90.0	FLUX
0	22	22	22	22	22	
5	24	22	21	21	20	2
15	21	20	22	26	26	7
25	20	20	27	27	28	12
35	18	23	25	25	25	14
45	14	20	20	21	21	15
55	12	16	16	17	18	14
65	10	12	12	13	15	12
75	8	9	9	10	11	10
85	6	6	6	6	8	8
90	6	6	6	6	8	
95	61	287	309	294	289	311
105	450	1047	1306	1369	1378	1217
115	902	1544	2062	2298	2354	1856
125	1332	1923	2501	2867	2966	2108
135	1720	2230	2725	3111	3118	2025
145	2057	2428	2881	3118	3118	1727
155	2315	2533	2864	3097	3117	1295
165	2501	2596	2753	2875	2922	777
175	2596	2619	2650	2682	2693	254
180	2630	2630	2630	2630	2630	

ZONAL LUMEN SUMMARY

ZONE	LUMENS	%LAMP	%FIXT
0- 30	21	0.1	0.2
0- 40	35	0.2	0.3
0- 60	65	0.4	0.6
0- 90	95	0.6	0.8
90-120	3384	22.6	29.0
90-130	5492	36.6	47.1
90-150	9245	61.6	79.2
90-180	11570	77.1	99.2
0-180	11666	77.8	100.0

LUMINANCE DATA IN FOOTLAMBERTS

ANGLE IN DEG	AVERAGE 0-DEG	AVERAGE 45-DEG	AVERAGE 90-DEG
45	796.	1200.	1380.
55	850.	1204.	1345.
65	915.	1098.	1266.
75	1244.	1189.	1147.
85	1254.	1202.	1033.

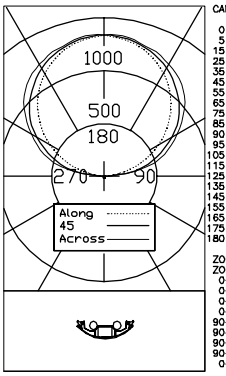
TOTAL LUMINAIRE EFFICIENCY = 77.8 %
CIE TYPE - INDIRECT
APPROVED BY:

TESTED IN ACCORDANCE WITH IES PROCEDURES, TEST DISTANCE EXCEEDS 25.0 FEET
NEAR-FIELD PHOTOMETRY AND CU TABLE AVAILABLE UPON REQUEST

2-LAMP T8

FAR-FIELD PHOTOMETRY
DATE: 11-15-2001
REPORT NUMBER: 5511

CATALOG NUMBER: EGCM2-2-32
LUMINAIRE: 7"W X 2 1/2"H ALUMINUM INDIRECT/OPEN LIGHT WITH WHITE PAINTED REFLECTOR AND SLOT
LAMP(S): 2-F32/SP35 RATED @ 2850 LUMENS
BALLAST: REL-2P32-SC
MOUNTING:
LUMEN TO CANDELA RATIO USED = 9.15
TOTAL INPUT WATTS = 56.2 AT 12.0 VOLTS
THE 0 DEGREE PLANE IS PARALLEL WITH THE LAMPS.



CANDELA DISTRIBUTION

	0.0	22.5	45.0	67.5	90.0	FLUX
0	13	13	13	13	13	
5	14	13	14	14	13	1
15	13	13	14	16	16	4
25	13	13	16	16	16	7
35	9	12	13	13	14	8
45	7	10	10	10	11	9
55	7	9	9	9	10	8
65	5	7	7	7	8	6
75	3	5	5	5	6	5
85	3	3	4	4	4	4
90	2	7	15	22	24	
95	39	109	124	126	125	123
105	255	329	428	480	495	421
115	481	552	630	684	701	610
125	699	751	840	885	898	731
135	892	936	1000	1061	1076	767
145	1056	1089	1126	1170	1188	706
155	1183	1207	1227	1254	1260	566
165	1272	1290	1294	1304	1305	367
175	1319	1335	1332	1341	1342	127
180	1340	1340	1340	1340	1340	

ZONAL LUMEN SUMMARY

ZONE	LUMENS	%LAMP	%FIXT
0- 30	12	0.2	0.3
0- 40	21	0.4	0.5
0- 60	37	0.7	0.8
0- 90	53	0.9	1.2
90-120	1154	20.2	25.8
90-130	1885	33.1	42.2
90-150	3359	58.9	75.1
90-180	4419	77.5	98.8
0-180	4472	78.5	100.0

LUMINANCE DATA IN FOOTLAMBERTS

ANGLE IN DEG	AVERAGE 0-DEG	AVERAGE 45-DEG	AVERAGE 90-DEG
45	149.	205.	184.
55	181.	213.	215.
65	166.	225.	222.
75	130.	228.	280.
85	186.	242.	260.

TOTAL LUMINAIRE EFFICIENCY = 78.5 %
CIE TYPE - INDIRECT
APPROVED BY:

TESTED IN ACCORDANCE WITH IES PROCEDURES, TEST DISTANCE EXCEEDS 25.0 FEET
NEAR-FIELD PHOTOMETRY AND CU TABLE AVAILABLE UPON REQUEST

PEERLESS LIGHTING Box 2556, Berkeley, CA 94702-0556 510.845-2760 Fax 510.845-2776 www.peerless-lighting.com

ITEM #: _____

GE Consumer & Industrial Lighting

Lighting Specification Bulletin

T5 Starcoat High Output

Product Code: 46760
Description: F54W/T5/835/ECO

Specification:
Firm Name :
Job Name :

General	
Product Code	46760
Description	F54W/T5/835/ECO
Subcategory	T5 Starcoat High Output
Physical	
Bulb Type	T5
Base Type	Miniature BiPin (G5)
Bulb Material	Soft Glass
Nominal Length (In.)	45.20
Nominal Length (mm)	1150
Max Overall Length (In.)	45.795
Bulb Nominal Diameter in inches	.625
Max bulb diameter	.67
Max Face to End of Opposing Pin (B)	45.52
Min Face to End of Opposing Pin (B)	45.42
Photometric	
Lumens (Initial)	5000
Lumens (Mean)	4700
Color Temperature (K)	3500
Nominal Efficacy (Lumens/Watt)	93
Electrical	
Average Rated Life	20000
Watts	54
Nominal Lamp Volts	117
Nominal Lamp Operating Frequency (Hz)	20000
Minimum Starting Temp (deg F)	5
Min. Terminal to Terminal Starting Lamp Voltage (Vrms)- Instant Start at 15°C	620
Min. Terminal to Terminal	520

Starting Lamp Voltage (Vrms)- Rapid Start at 10° C	
Max Cathode Resistance Ratio (Rh/Rc)	6.5
Min Cathode Resistance Ratio (Rh/Rc)	4.25
Miscellaneous	
TCLP Regulated	Y
Additional Information	S/P Ratio: 1.5 Lumen Ratings at 35C. At 25C, Initial Lumens are 4460.

Hi-lume Overview

Hi-lume architectural electronic dimming ballasts are designed to meet the most demanding lighting requirements. By providing industry-leading performance with true full-range 100% to 1% fluorescent dimming, Hi-lume ballasts enable you to provide the ideal visual environment for any application.

Hi-lume, case type A
3.00"w (76mm) x 1.00"h (25mm) x 4.90"l (124mm)

Hi-lume, case type C
1.18"w (30mm) x 1.00"h (25mm) x 18.00"l (457mm)

Hi-lume, case type F
2.38"w (60mm) x 1.50"h (38mm) x 9.50"l (241mm)

Features

- Continuous, flicker-free dimming from 100% to 1%
- Standard 3-wire line-voltage phase-control technology for consistent fixture-to-fixture dimming performance
- Models available for T4 triple-tube compact, T5-HO linear, and T8 lamps
- Programmed rapid start design preheats lamp cathodes before applying full arc voltage
- Lamps turn on to any dimmed level without flashing to full brightness
- Low harmonic distortion throughout the entire dimming range maintains power quality
- Frequency of operation ensures that ballast does not interfere with infrared devices operating between 38 and 42 kHz
- Inrush current limiting circuitry eliminates circuit breaker tripping, switch arcing, and relay failure
- End-of-lamp-life protection circuitry (for T4 and T5-HO models) ensures safe operation throughout entire lamp life cycle
- For linear lamps, ballasts maintain consistent light output for different lamp lengths, ensuring fixture uniformity
- Ultra-quiet operation
- Protected from miswires of any input power to control lead, or from lamp leads to each other and/or ground
- 100% compatible with all Lutron 3-wire fluorescent controls
- 100% performance tested at factory
- Designed and assembled in the USA
- 5-year limited warranty with Lutron field service commissioning (3-year standard warranty) from date of purchase

Specifications

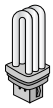
Performance

- Dimming Range: 100% to 1% measured relative light output (RLO)
- Lamp Starting: programmed rapid start
- Minimum Lamp Starting Temperature: 10°C (50°F)
- Ambient Temperature Operating Range: 10°C (50°F) to 60°C (140°F)
- Relative Humidity: maximum 90% non-condensing
- Operating Voltage: 120V or 277V at 60Hz
- Lamp Current Crest Factor: less than 1.7
- Lamp Flicker: none visible
- Light Output Variation: constant ±2% light output for line voltage variations of ±10%
- Lamp Life: average lamp life meets or exceeds rating of lamp manufacturer
- Ballast Factor: greater than .85 for T8 lamps, greater than .95 for T4 lamps, equal to 1.0 for T5-HO lamps
- Power Factor: greater than .95
- Total Harmonic Distortion (THD): less than 10%
- Maximum Inrush Current: 7 amps per ballast at 120V, 3 amps per ballast at 277V
- Sound Rating: Inaudible in a 27dBa ambient
- Maximum Ballast Case Temperature: 75°C (167°F)

Standards

- UL Listed (evaluated to the requirements of UL935)
- CSA certified (evaluated to the requirements of C22.2 No. 74)
- Class P thermally protected
- Meets ANSI C82.11 High Frequency Ballast Standard
- Meets FCC Part 18 Non-Consumer requirements for EMI/RFI emissions
- T4 and T5-HO ballasts are MIL Std. 461E compliant (meets the requirements of CE101, RE101 and RE102)
- Meets ANSI C62.41 Category A surge protection standards up to and including 6kV
- Manufacturing facilities employ ESD reduction practices that comply with the requirements of ANSI/ESD S20.20
- Lutron Quality Systems registered to ISO 9001.2000

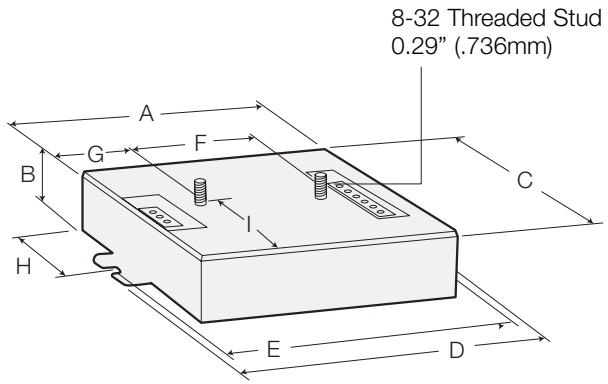
Hi-lume Ballast Models

Lamp Type	Lamp Watts (length)	Lamps per ballast	Case Type	120 VOLTS Ballast Current (amps)	120 VOLTS **Hi-lume** Model Number [1]	277 VOLTS Ballast Current (amps)	277 VOLTS **Hi-lume** Model Number [1]
T4 triple-tube 4-pin  1/2" diameter	26W	1	A	.26	HL3-T426-120-1-S	.12	HL3-T426-277-1-S
	32W	1	A	.31	HL3-T432-120-1-S	.13	HL3-T432-277-1-S
T5-HO linear high output  5/8" diameter	24W (21.5")	1 2	C C	.26 .45	FDB-T524-120-1 FDB-T524-120-2	.13 .20	FDB-T524-277-1 FDB-T524-277-2
	39W (33.4")	1 2	C C	.38 .76	FDB-T539-120-1 FDB-T539-120-2	.17 .31	FDB-T539-277-1 FDB-T539-277-2
	54W (45.3")	1 2	C C	.58 1.1	FDB-T554-120-1 FDB-T554-120-2	.25 .45	FDB-T554-277-1 FDB-T554-277-2
T8 linear and U-bent  1" diameter	17W (24")	1 2 3	F F F	.19 .31 .43	FDB-2427-120-1 FDB-2427-120-2 FDB-2427-120-3	.08 .15 .20	FDB-2427-277-1 FDB-2427-277-2 FDB-2427-277-3
	25W (36")	1 2 3	F F F	.24 .43 .62	FDB-3627-120-1 FDB-3627-120-2 FDB-3627-120-3	.12 .19 .28	FDB-3627-277-1 FDB-3627-277-2 FDB-3627-277-3
	32W (48")	1 2 3	F F F	.30 .57 .82	FDB-4827-120-1 FDB-4827-120-2 FDB-4827-120-3	.14 .25 .35	FDB-4827-277-1 FDB-4827-277-2 FDB-4827-277-3
	40W (60")	1 2	F F	.36 .64	FDB-6027-120-1 FDB-6027-120-2	.16 .30	FDB-6027-277-1 FDB-6027-277-2
T12 linear HO (800ma)  1½" diameter	85W (72")	1	F	.75	FDB-7280-120-1	- -	- -
	95W (84")	1	F	.83	FDB-8480-120-1	- -	- -
	110W (96")	1	F	.88	FDB-9680-120-1	- -	- -

[1] Mounting studs standard for T4 ballasts. Delete suffix -S in the model number if mounting studs not needed.

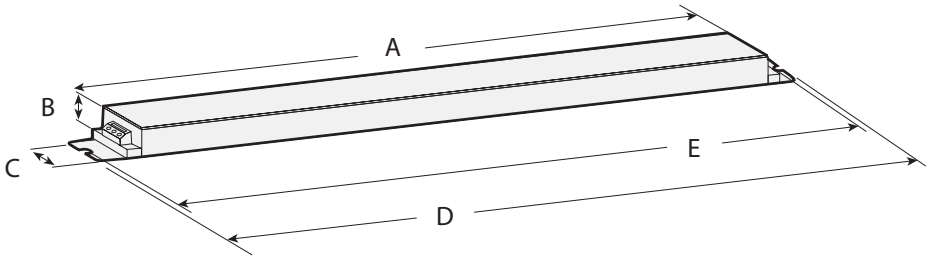
Case Dimensions

A [1]



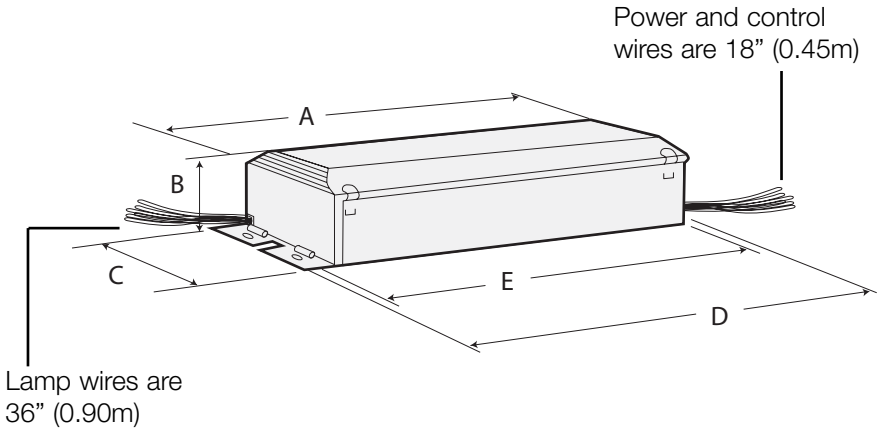
A	4.20"	(107 mm)
B	1.00"	(25 mm)
C	3.00"	(76 mm)
D	4.90"	(124 mm)
E	4.60"	(117 mm) (mounting centers)
F	2.00"	(51 mm)
G	1.08"	(27 mm)
H	1.60"	(41 mm)
I	1.39"	(35 mm)

C



A	16.12"	(409 mm)
B	1.00"	(25 mm)
C	1.18"	(30 mm)
D	18.00"	(457 mm)
E	17.70"	(450 mm) (mounting centers)

F



A	8.30"	(211 mm)
B	1.50"	(38 mm)
C	2.38"	(60 mm)
D	9.50"	(241 mm)
E	8.91"	(226 mm) (slot mounting centers)

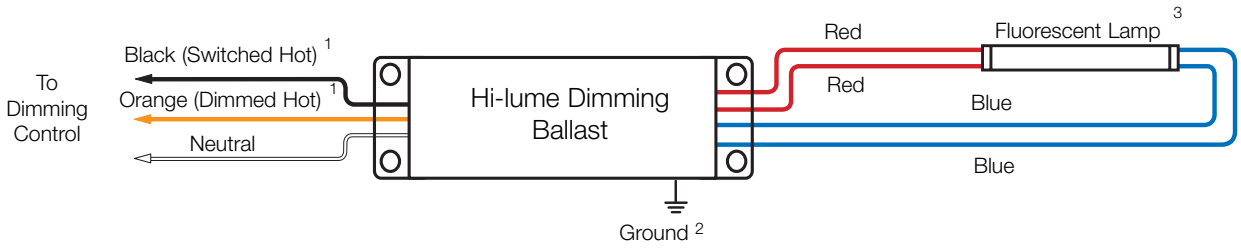
If using four hole mount, mounting centers are 9.21" (234 mm) x 1.70" (43 mm).

[1] Mounting studs standard. When ordering, delete suffix -S in the ballast model number if mounting studs not needed.

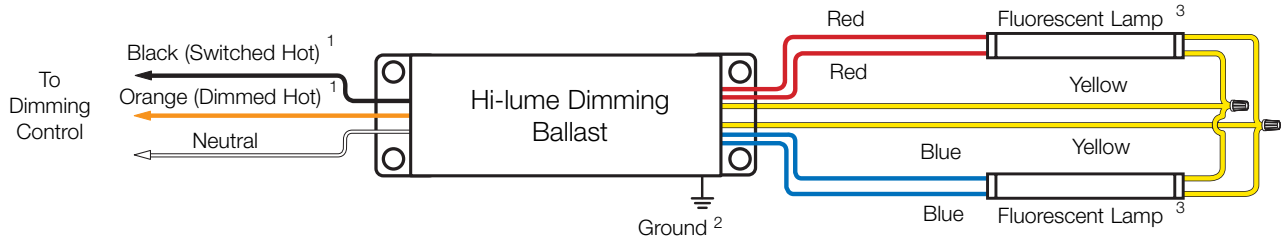
Job Name:	Model Numbers:	
Job Number:		

Hi-lume Wiring Diagrams

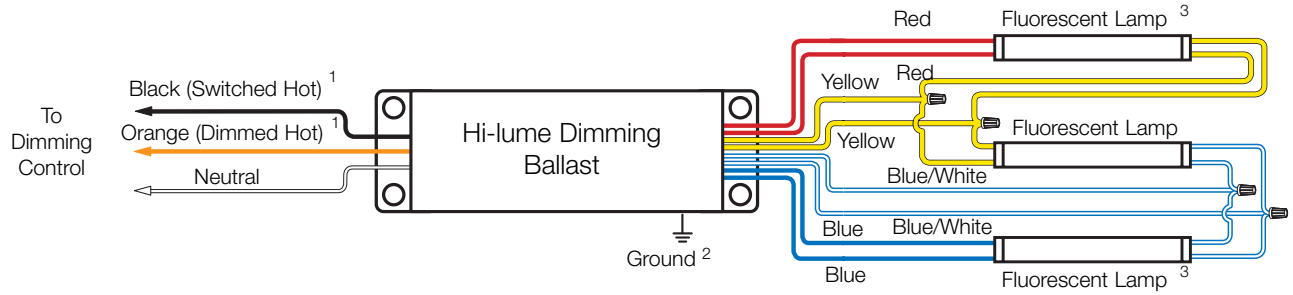
One T5-HO or T8 lamp



Two T5-HO or T8 lamps



Three T8 lamps



[1] Dimming control wire colors do not necessarily match ballast wire colors (e.g. control 'dimmed hot' may be yellow, and ballast 'dimmed hot' may be orange. Wire colors shown are for Lutron ballasts and controls only.
[2] Ballast and lighting fixture must be effectively grounded.
[3] Includes 6" T8 U-bent lamps

Note: For T5-HO and T8 lamps, maximum lamp-to-ballast wire length is 7 feet (2m).

Job Name:	Model Numbers:	
Job Number:		

Walter Nichols
Hawthorn Building
Altoona, PA

Appendix E

Light Loss Factors

Space	Luminaire	Maint. Category	Degree of Dirt	Monthly Cleaing	LDD	LLD	BF
Computer Classroom	Indirect/direct pendant	2	Clean	12	0.95	0.94	1
Corridor	Wall mount	2	Clean	12	0.95	0.94	1.04
Corridor	4" Downlight	4	Clean	12	0.88	0.84	1.05
Lecture Hall	2'x4' Troffer	4	Clean	12	0.88	0.94	0.88
Lecture Hall	Recessed wallwasher	4	Clean	12	0.88	0.94	0.99
Lecture Hall	Trackmounted spot	4	Clean	12	0.88	1	1
Music Room	2'x2' Recessed indirect	4	Clean	12	0.88	0.94	1.02
Music Room	Cloud Pendant	3	Clean	12	0.9	1	1

Sum of Losses
0.893
0.92872
0.77616
0.727936
0.818928
0.88
0.843744
0.9

Light Loss Factors

Space	Luminaire	Maint. Category	Degree of Dirt	Monthly Cleaing	LDD	LLD	BF	Sum
Computer Classroom	Indirect/direct pendant	2	Clean	12	0.95	0.94	1	0.893
Corridor	Wall mount	2	Clean	12	0.95	0.94	1.04	0.9287
Corridor	4" Downlight	4	Clean	12	0.88	0.84	1.05	0.7761
Lecture Hall	2'x4' Troffer	4	Clean	12	0.88	0.94	0.88	0.72793
Lecture Hall	Recessed wallwasher	4	Clean	12	0.88	0.94	0.99	0.81892
Lecture Hall	Trackmounted spot	4	Clean	12	0.88	1	1	0.88
Music Room	2'x2' Recessed indirect	4	Clean	12	0.88	0.94	1.02	0.84374
Music Room	Cloud Pendant	3	Clean	12	0.9	1	1	0.9