

The School of Forest Resources Building
University Park, Pennsylvania



Chris Hoyman
Lighting/Electrical Option

Senior Thesis
Final Report
Spring 2006

Dr. Richard Mistrick, Faculty Advisor

THE SCHOOL OF FOREST RESOURCES BUILDING

UNIVERSITY PARK, PENNSYLVANIA

CHRIS HOYMAN

LIGHTING/ELECTRICAL

PROJECT TEAM

- OWNER: THE PENNSYLVANIA STATE UNIVERSITY
- CONSTRUCTION MANAGER: GILBANE BUILDING COMPANY
- ARCHITECT: BOWER LEWIS THROWER ARCHITECTS
- STRUCTURAL AND CIVIL ENGINEER: GANNETT FLEMING
- MEP: BARD, RAO, AND ATHANAS

CONSTRUCTION INFORMATION

- TIMELINE: OCTOBER 2004 TO MAY 2006
- TOTAL PROJECT COST: \$27,000,000
- DELIVERY: DESIGN-BID-BUILD WITH MULTIPLE PRIMES

STRUCTURAL

- STEEL FRAME CONSTRUCTION
- 5-1/2" SLAB ON METAL DECK FLOOR SYSTEM
- BEAM SIZES INCLUDE W12X22, W16X31, AND W16X36
- TYPICAL BAY SIZE: 20' X 36'
- MULTIPLE WALL SYSTEMS INCLUDING CURTAIN AND MASONRY WALLS

LIGHTING

- TYPICALLY 277V FLUORESCENT
- 2' X 2' AND LINEAR PENDANT FLUORESCENT FIXTURES COMMON
- RECESSED DOWNLIGHTS USED AS ACCENTS
- OFFICES EQUIPPED WITH OCCUPANCY SENSORS



ELECTRICAL

- ONE 480Y/277V 2000A 50 KAIC MAIN DISTRIBUTION SWITCHGEAR (MDS)
- TWO AUTOMATIC TRANSFER SWITCHES FEEDING LIFE SAFETY AND EMERGENCY LAB EQUIPMENT LOADS
- TWO 480/277V PANEL BOARDS FED DIRECTLY BY MDS WHICH PROVIDE POWER TO ALL OTHER PANELS
- TEN STEP-DOWN TRANSFORMERS TO FEED 208/120V LOADS

MECHANICAL

- UTILIZES PENN STATE UNIVERSITY CAMPUS CHILLED WATER AND STEAM SYSTEMS FOR COOLING AND HEATING
- RADIANT PANEL AND ENCLOSED FIN TUBE RADIATORS PROVIDE HEAT
- ONE 54,000 CFM AIRHANDLER SERVES LAB AREAS OF BUILDING, TWO 40,000 CFM AIRHANDLERS SERVE REMAINDER OF BUILDING
- MAIN BUILDING EXHAUST FANS LOCATED IN THE ATRIUM PULL 22,500 CFM EACH



[HTTP://WWW.ARCH.E.PSU.EDU/THESIS/EPORTFOLIO/CURRENT/PORTFOLIOS/CAH280/](http://www.arche.psu.edu/thesis/eportfolio/current/portfolios/cah280/)

Table of Contents

Executive Summary	1
Building Statistics	2
Lighting Depth Work	
Lighting Overview	3
Atrium	
Overview	4
New Design Concepts	5
Luminaire Schedule	6
Controls	6
Reflected Ceiling Plan	7
Power Density	11
Illuminance Values and Renderings	12
Analysis	17
Videoconference Room	
Overview	19
New Design Concepts	20
Luminaire Schedule	23
Controls	23
Reflected Ceiling Plan	24
Power Density	25
Illuminance Values and Renderings	26
Analysis	30

Aquaculture Lab	
Overview_____	32
New Design Concepts_____	32
Luminaire Schedule_____	33
Controls_____	33
Reflected Ceiling Plan_____	34
Power Density_____	35
Illuminance Values and Renderings_____	36
Analysis_____	39
Meadow	
Overview_____	40
New Design Concepts_____	40
Luminaire Schedule_____	41
Controls_____	41
Power Density_____	42
Illuminance Values and Renderings_____	43
Analysis_____	44
Electrical Depth Work	
Existing Conditions_____	45
Impact of New Lighting Design_____	46
Analysis_____	51
Breadth Work	
Introduction_____	54
Videoconference Reverberation Times_____	55

Atrium Structural Design	58
Conclusions	61
Appendix	63

Executive Summary

The following report is a comprehensive collection of the work done during the spring semester for Senior Thesis. For the lighting portion of this thesis, four spaces were analyzed and new designs were applied. These spaces include the Atrium, the Videoconference Room, the Aquaculture Laboratory, and the Meadow outside the front of the building. The primary goal of these new designs was to improve the performance of the spaces over the original in terms of lighting levels, lighting quality, system flexibility, and efficiency. Criteria were set forth in all locations and met, creating quality lighting systems while maintaining acceptable power densities.

For the electrical section of this thesis, analyses of the impacts of the new lighting systems were performed. An effort was made to curtail increased power consumption in the new designs. As such, the impact on the electrical distribution systems was minimal. In addition to providing enough distribution capacity in the system, the voltage drop along the longest circuit was checked to ensure code requirements were met. The short-circuit capacity of the wires in the building was also checked. Finally, the main building feeder size was increased to more easily allow growth in the system in the future.

Two breadth design topics flowed from the new lighting designs. The first was a new steel beam across the atrium to allow for suspended lighting fixtures in that space. While the load on the beam was found to be minimal, design considerations such as construction loading and unbraced length forced the beam size up. The second breadth topic was an acoustical analysis in the Videoconference room. Reverberation time for the space was calculated to ensure a high level of speech-intelligibility during conferences. Combined with the new lighting system, this breadth topic helped improve the quality and functionality of the space dramatically.

Building Statistics

Building Name: The School of Forest Resources Building

Location and Site: The Pennsylvania State University, University Park, Pennsylvania

Building Occupant Name: Penn State School of Forest Resources

Occupancy: Multi-use building, including classrooms, offices, administration, laboratories, and an auditorium

Size: 92,000 gross square feet

Stories: 4 usable stories above ground plus a penthouse for mechanical spaces on roof, 1 basement level, 6 total levels

Construction Dates: October 29, 2004 - May 2006

Total Project Cost: \$27,000,000

Project Delivery: Design-Bid-Build

Architecture: The School of Forest Resources building along with the new Smeal business building works to create an architectural border along Park Avenue. The two buildings frame a large open pedestrian area which welcomes people into the University. The defining feature of the buildings exterior is the large atrium area, enclosed by a glass wall on the Park Avenue side.

Construction: The School of Forest Resources building was constructed according to PA Labor and Industry 50.11 Fire Resistive construction codes. The building is located on the site of a former parking lot, so no major demolition was required. Contracts were bid out to multiple primes companies on an individual system basis. Gilbane, the construction manager, acts as an extension of the University and manages all companies. 15 individual contracts were given out for the building, slated for completion in May 2006.

Lighting Overview

This building will serve as a headquarters for the School of Forest Resources on campus. It is a multi-use facility accommodating a variety of needs for the entire department. Four unique areas were chosen for new designs during this thesis:

- Atrium
- Videoconference Room
- Aquaculture Lab
- Front Meadow

Each of these spaces has a unique function and as such has unique criteria to achieving a good lighting design. The atrium serves as one of the main vertical transportation routes through the central core of the building. It is the main architectural feature of the structure, rising four levels and topping off with a hardwood ceiling. The videoconference room provides a unique virtual meeting space in the building. It presents a challenging environment for lighting: the needs of the conference participants and also the camera viewing the scene must be considered together. The aquaculture lab is an area for research on aquatic life, and a space where functionality of lighting is most important. Finally, the exterior lighting serves the paths that frame the campus on the north side and fills the meadow between the School of Forest Resources Building and the nearby Smeal Building.

Atrium

Overview

Room Surfaces:

- White Painted Gypsum Walls- reflectance 0.76
- White Painted Gypsum Ceiling- reflectance 0.76
- Wood Panel Walls- reflectance 0.51
- Hardwood Ceiling- reflectance 0.51
- Terrazzo Floor- reflectance 0.20

Tasks:

- Walking
- Facial Recognition
- Personal Interaction

Goals:

- Provide an inviting main entrance to the building
- Create an environment that will induce people to admire the space
- Highlight the natural wood portions of the space
- Utilize natural theme in lighting

Recommended Illuminances:

Horizontal- 10 fc

Vertical- 3 fc

Considerations: **Space and luminaire appearance-** As the main architectural feature, the appearance of this space is critical to forming a good impression of the building.

Direct Glare- Creates an uncomfortable environment that will hinder peoples' experience of the space.

Color Appearance- An important part of personal interaction, good color rendering is important for the natural finishes in the atrium.

Modeling of Faces- Another important part of personal interaction, good facial modeling enhances communication between the occupants.

Light Distribution on Surfaces- Distribution of light on surfaces can be used to highlight portions of the space, making them stand out and catch attention. Providing too much light can make a surface distracting.

New Design Concept

For the new atrium design, the space was looked at as two different sections. The front section was the four floor open area with the hardwood ceiling. The original design featured wall mounted fixtures that left the central area darker and did not highlight the ceiling in any way. For the new design, suspended fixtures were chosen to help bring more light into the central area. The fixtures selected (Louis Poulsen “Artichoke”) used metal halide lamps with a “leafy” shroud around them, creating a very organic feel and hiding the bright lamps from direct view. Suspension length issues as well as relamping concerns made it impossible to hang these fixtures directly from the ceiling, and so a small beam was added across the atrium on the third level (see structural breadth for more information). The beam provided a convenient place to mount fixtures to uplight the hardwood ceiling as well. Care was taken to shield the luminaires from the view of people on the floor above. A 3000K lamp was used to provide warm illumination on the wood.

The back section of the space was the corridor area located on each floor. The bottom two levels are open to the front atrium section, while the upper two floors are behind a glass wall. The original design utilized compact fluorescent fixtures which threw most of the light straight down. Walking through a space, a person would pass through varying areas of light and darkness, providing poor facial rendering. The new design for the area featured recessed parabolic fixtures that threw more light sideways but also shielded the lamps from view.

Luminaire Schedule

Designation	Fixture	Lamp	Ballast	Voltage	Wattage	Number
A	Metalux 2P2GAX2U6T8	FB32T8/6 TL841	Electronic 2 lamp	277	54	40
B	Louis Poulsen Artichoke	CDM150/T6/830	Electronic	277	173	3
C	Winona Wallwasher	CDM35/T6/830	Electronic	277	48	3

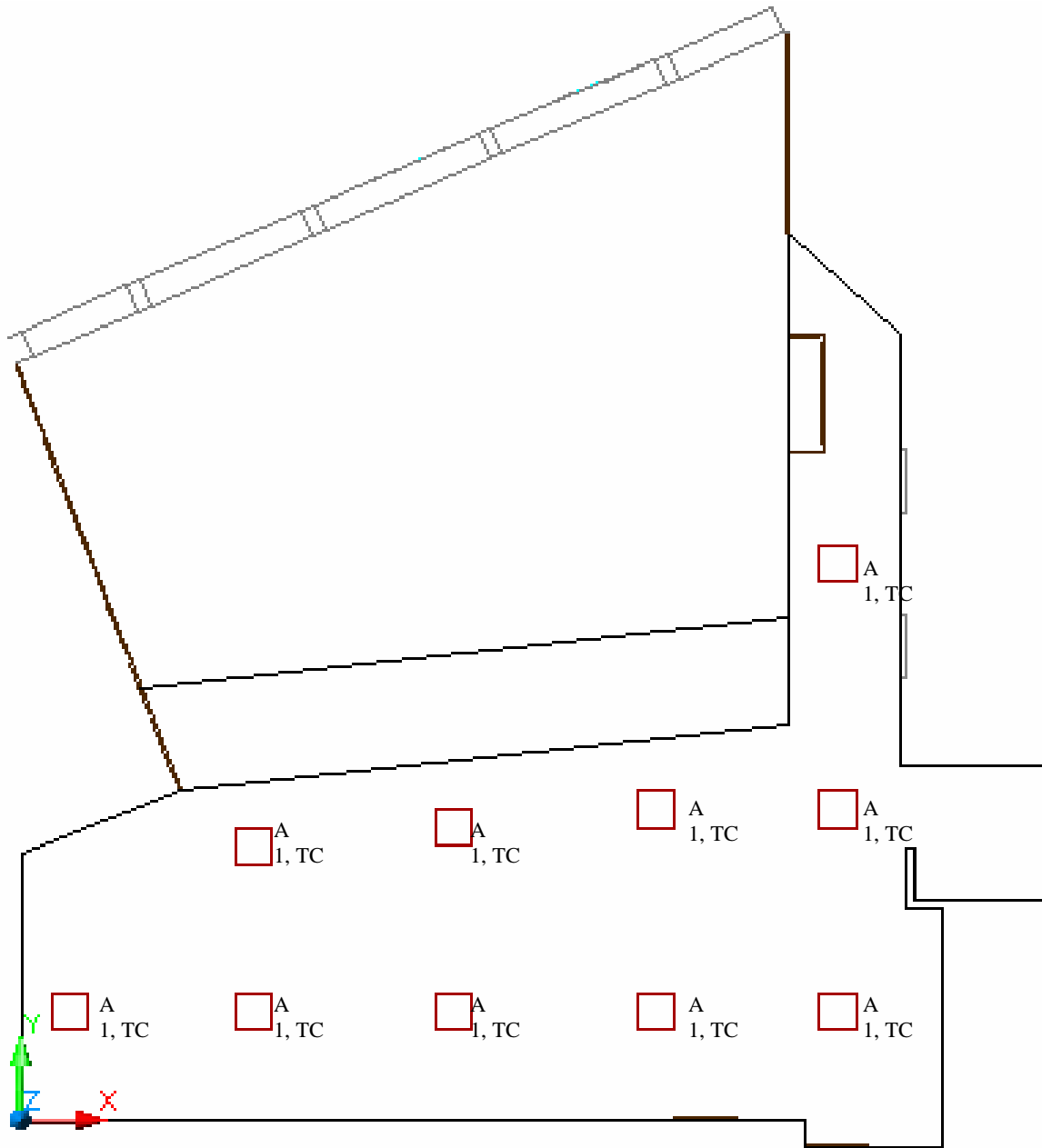
See Appendix for all cutsheets

Controls

ASHRAE 90.1 Section 9.2.1.1 states that areas greater than 250 sq. ft. in buildings larger than 5000 sq. ft. must be controlled by automatic shutoff. This area will be connected to a time clock system for control. Areas in the back section of the atrium will operate in the morning, evening, and night. The front area suspended fixtures and accent lights will only be on at night. There will be sufficient natural light in this space through the day to turn the lights off and save energy, since both the front and the back walls are glass.

The exception is the back area on the ground floor, where there is no back glass wall (see bottom floor rendering page 17). Fixtures on the bottom level in the back will need to be on at all times since sunlight penetration deep into the space will be minimal.

The lighting for the front part of the atrium is fed from the third floor. Since it will operate on a different time clock setting (night only) than the rest of the floor these fixtures were moved to a separate circuit from the back of the atrium (which operates morning, evening, and night). See the Third Floor Lighting Plan for more information.

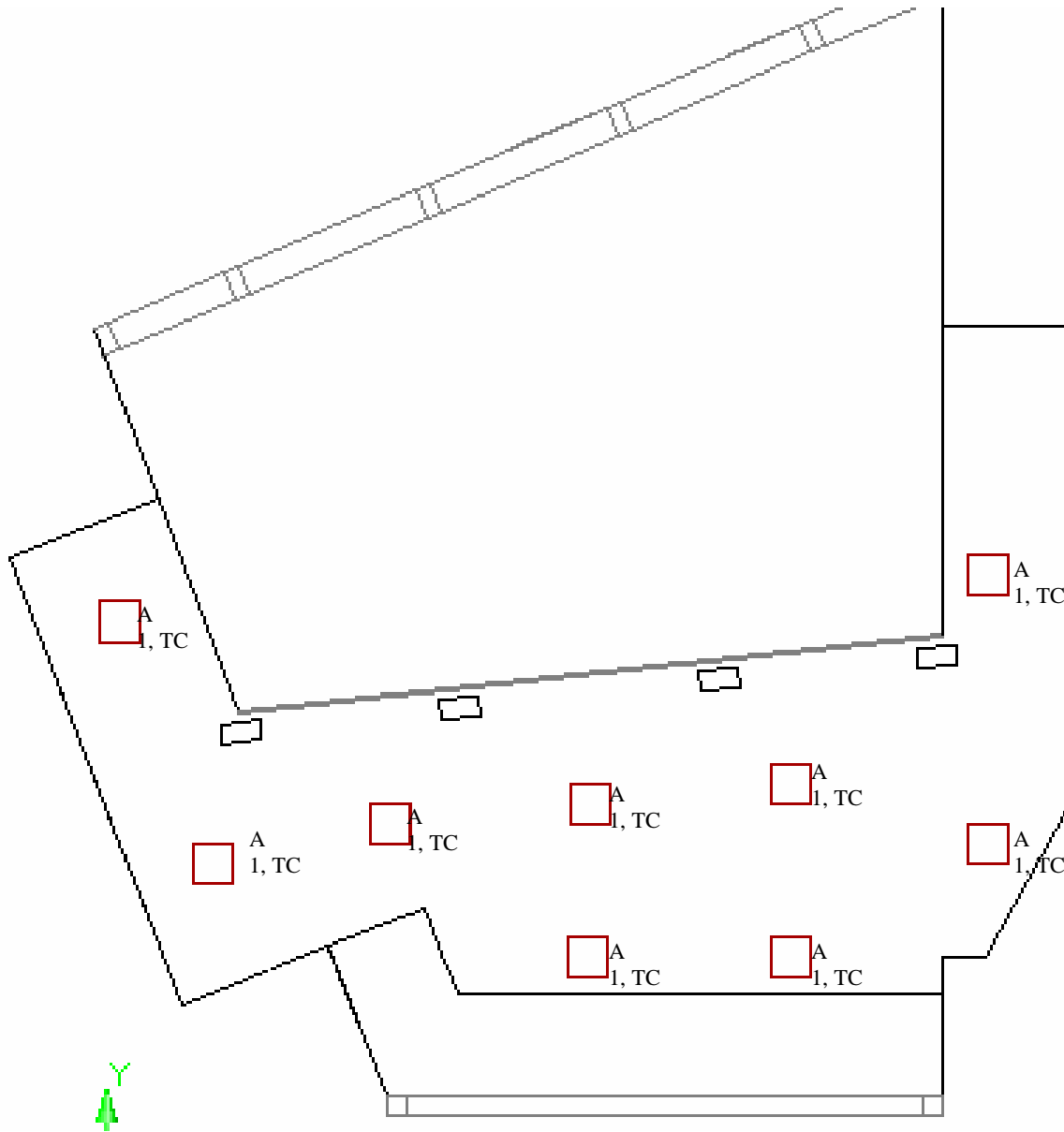


Atrium First Floor Lighting Plan

A- Fixture Type- 2'x2' Recessed Parabolic

1- Circuit Designation- Served by LP-41, circuit 12

TC- Controlled by time clock with manual override in nearby electrical room

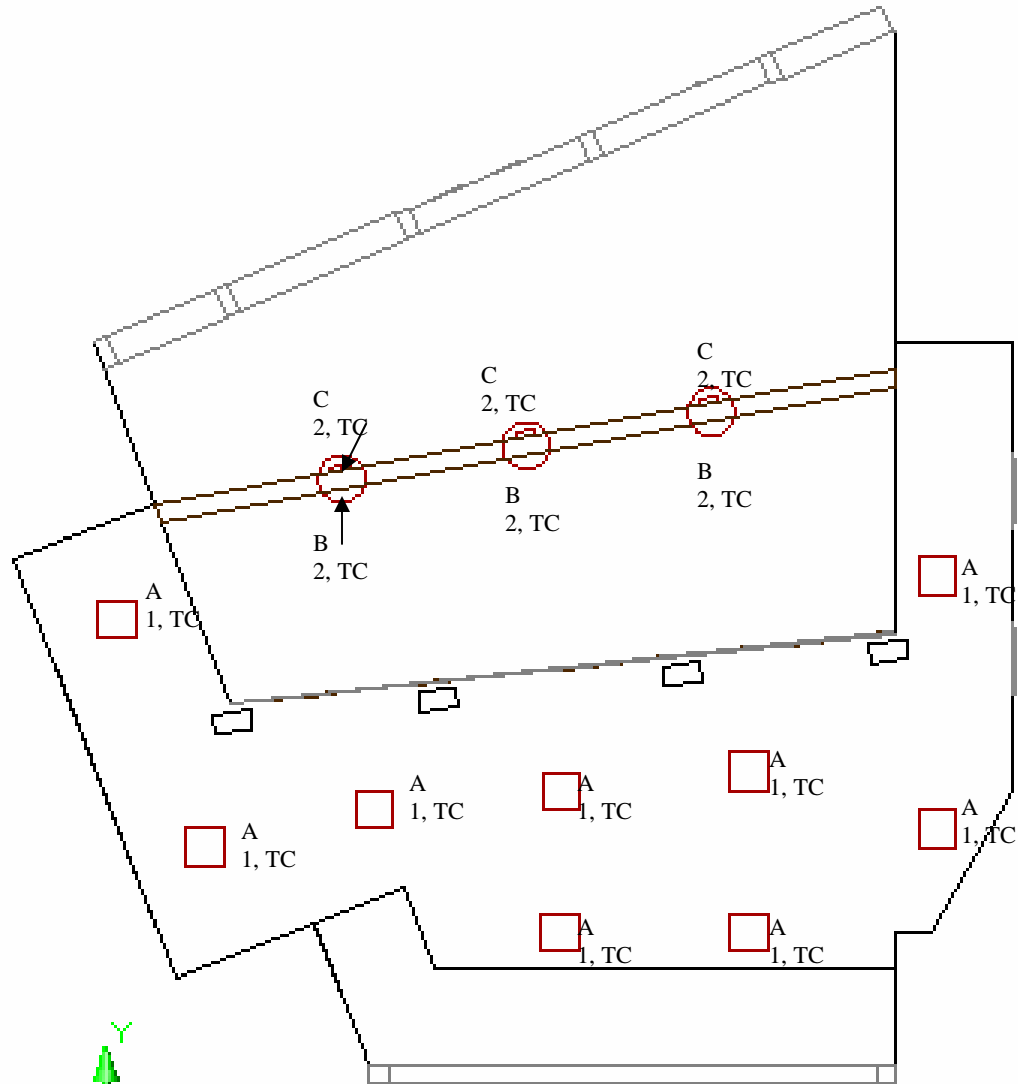


Atrium Second Floor Lighting Plan

A- Fixture Type- 2'x2' Recessed Parabolic

1- Circuit Designation- Served by LP-42, circuit 11

TC- Controlled by time clock with manual override in nearby electrical room



Atrium Third Floor Lighting Plan

A- Fixture Type- 2'x2' Recessed Parabolic

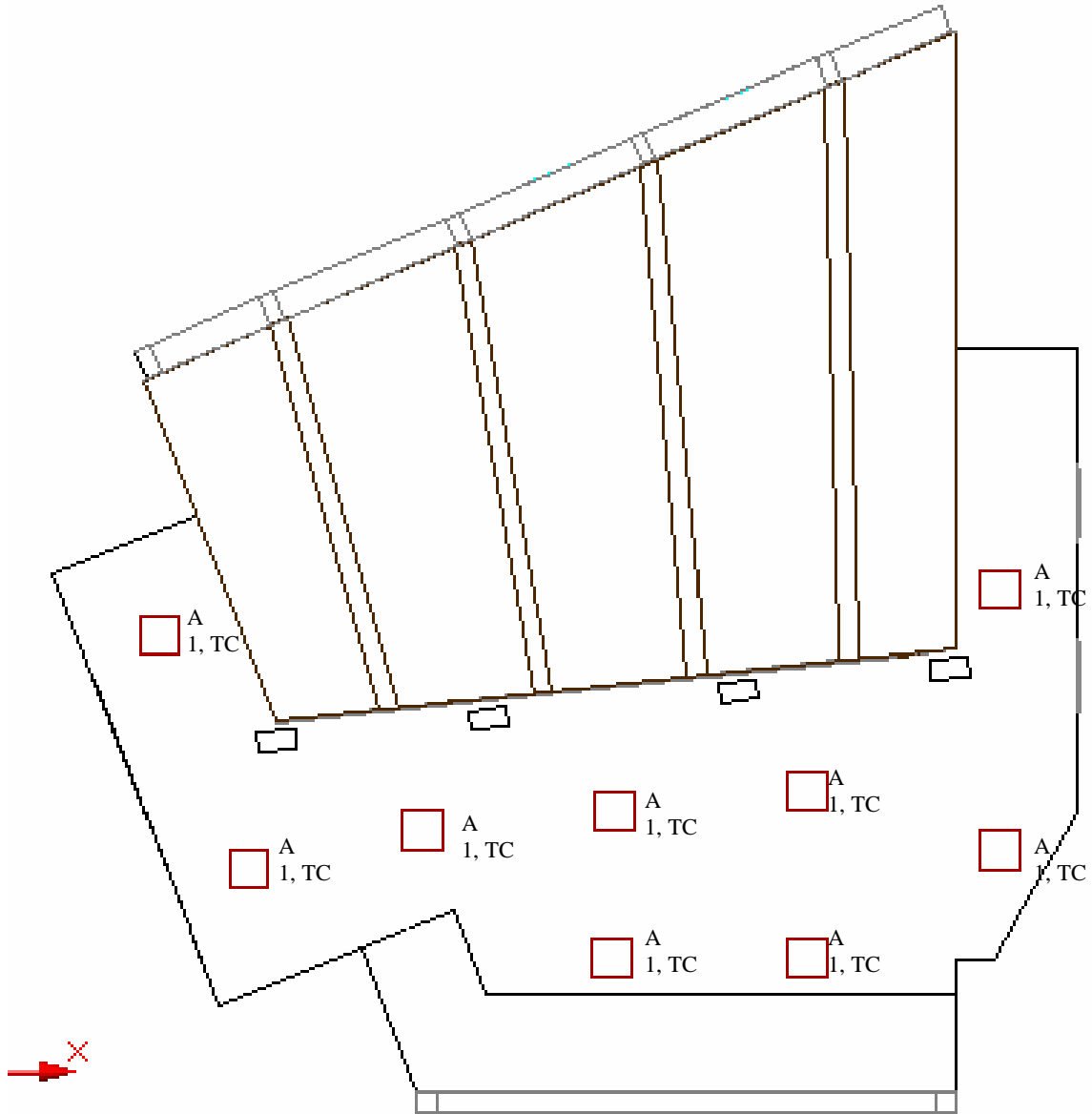
B- Fixture Type- Suspended Atrium Fixture

C- Fixture Type- Ceiling Accent Lights

1- Circuit Designation- Served by LP-43, circuit 9

2- Circuit Designation- Served by LP-43, circuit 12

TC- Controlled by time clock with manual override in nearby electrical room



Atrium Fourth Floor Lighting Plan

A- Fixture Type- 2'x2' Recessed Parabolic

1- Circuit Designation- Served by LP-44, circuit 10

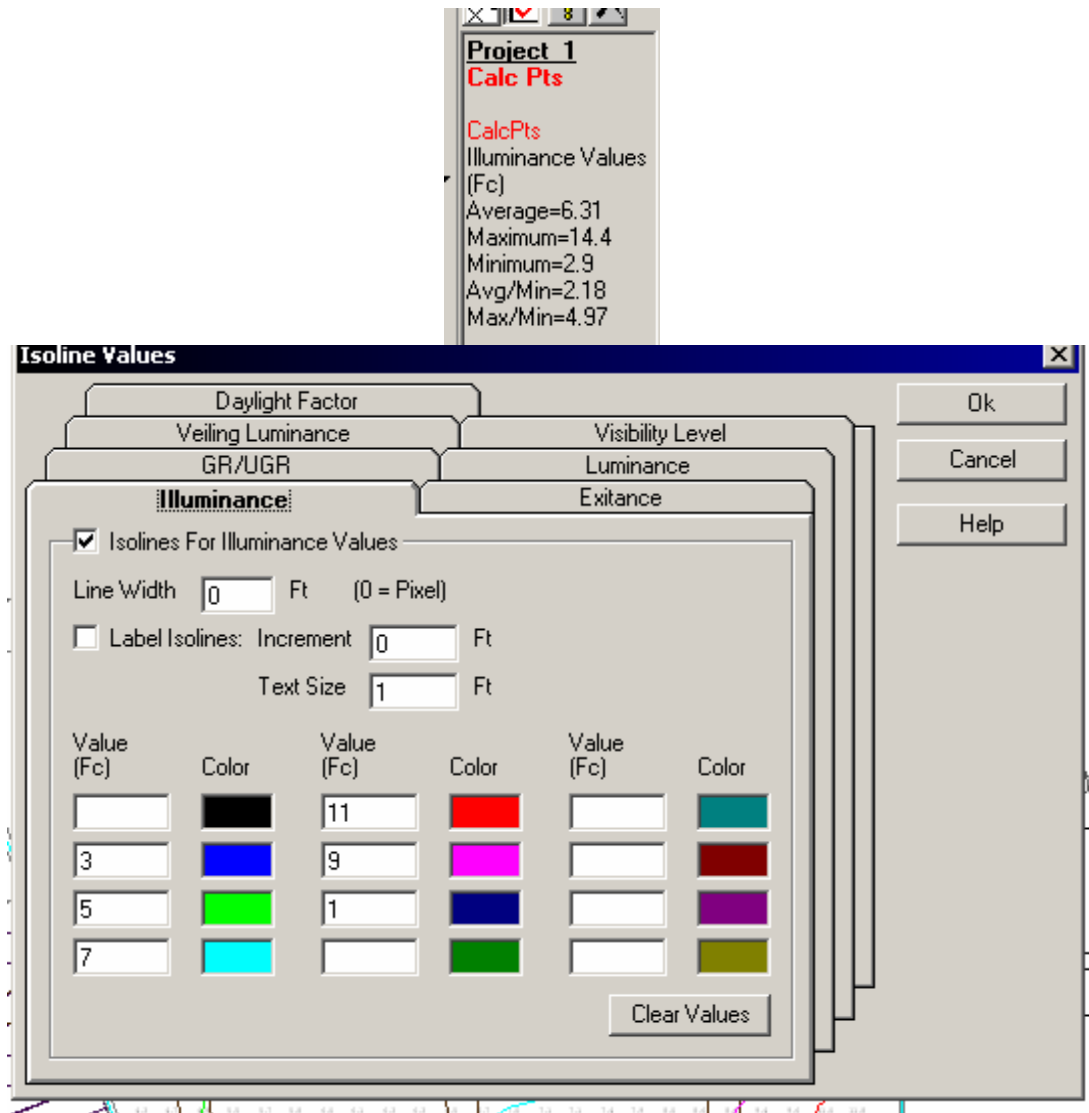
TC- Controlled by time clock with manual override in nearby electrical room

Luminaire	Maintenance Category	Cleaning Interval	Ballast Factor	RSDD	LLD	LDD	Total LLF
A	IV	24m Very Clean	0.85	0.98	0.90	0.90	0.67
B	III	24m Very Clean	0.90	0.95	0.70	0.85	0.51
C	V	24m Very Clean	0.90	0.95	0.78	0.87	0.58

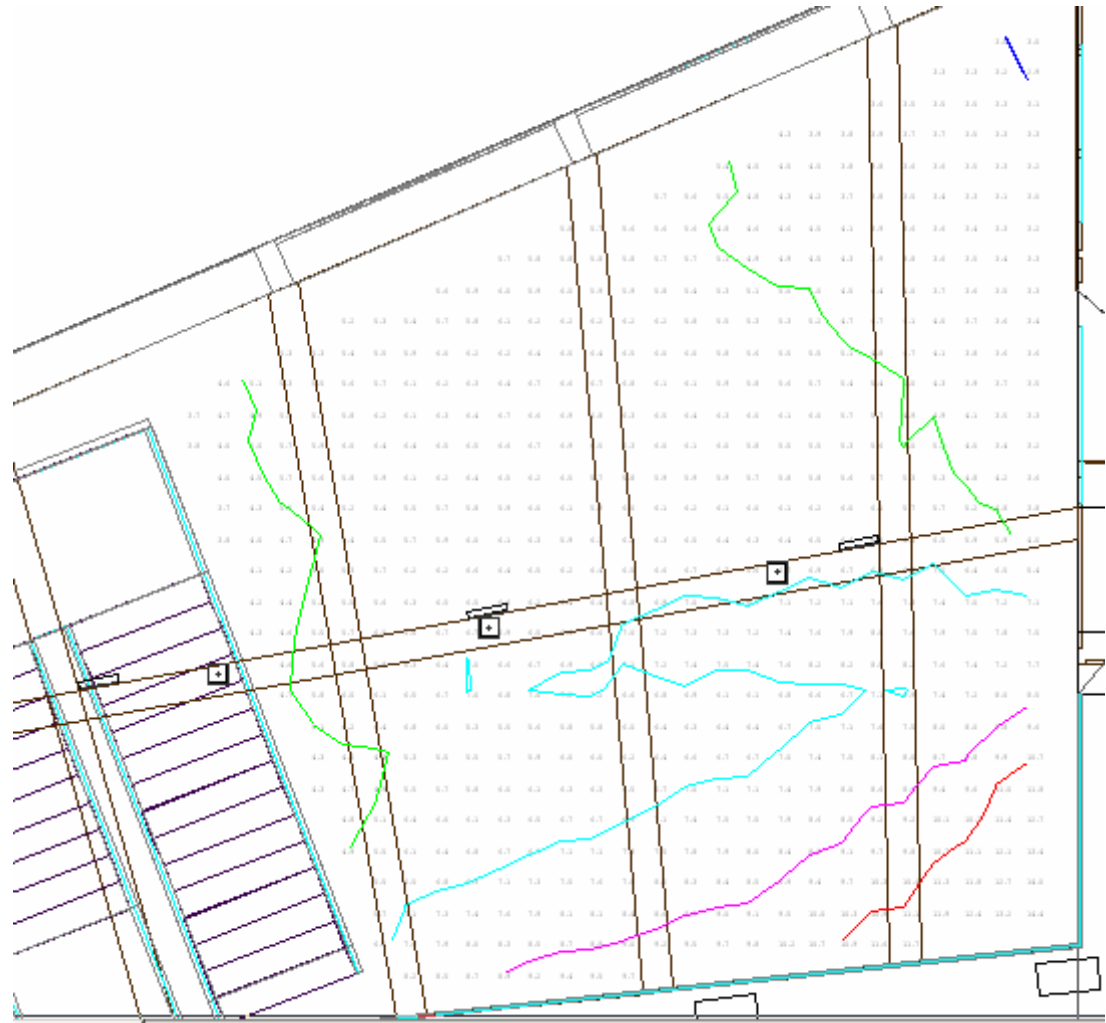
Power Density

ASHRAE 90.1 specifies a power density of 0.60 W/sq.ft. for the first three floors of an atrium, and 0.2 W/sq.ft. for each additional floor. The total power use in the new design is 2823 W, spread over $(2380 + 3*(850)) = 4930$ sq. ft. The total power density is then 0.57 W/sq. ft. This is under the value for only a single floor and easily meets the requirements.

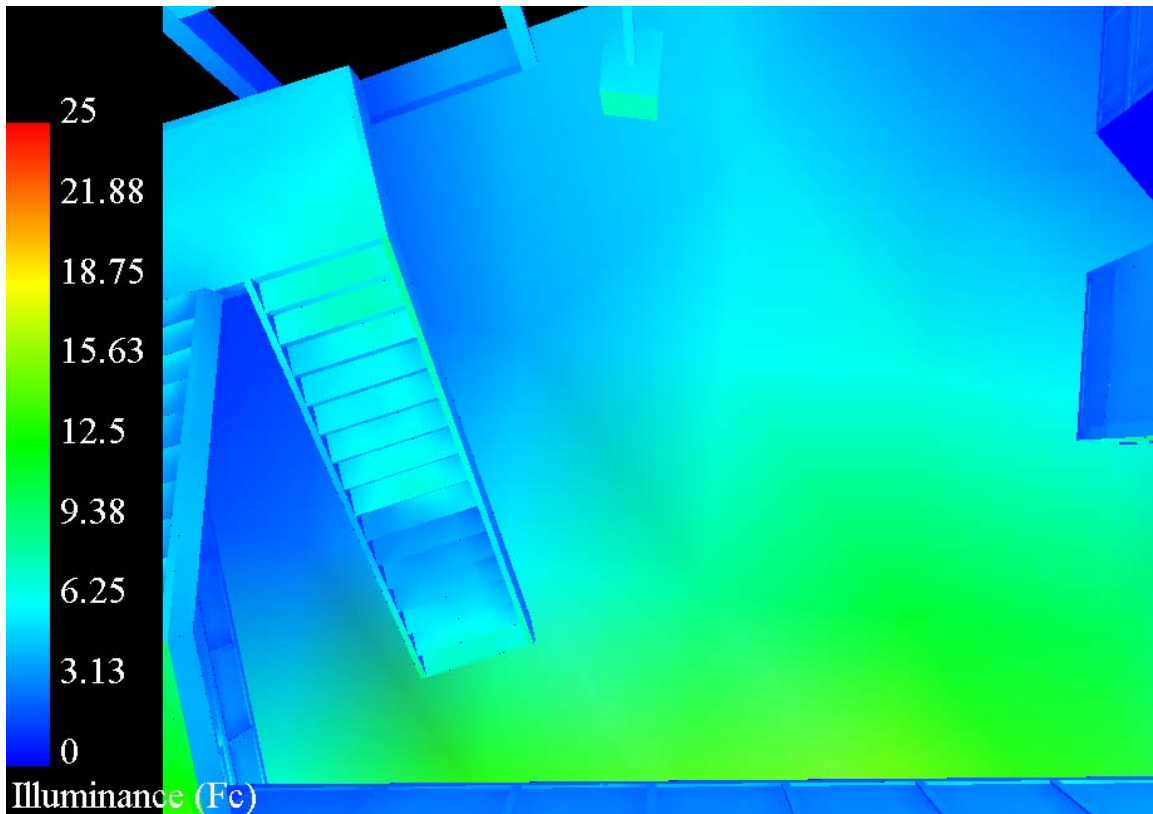
Illuminance Values and Renderings



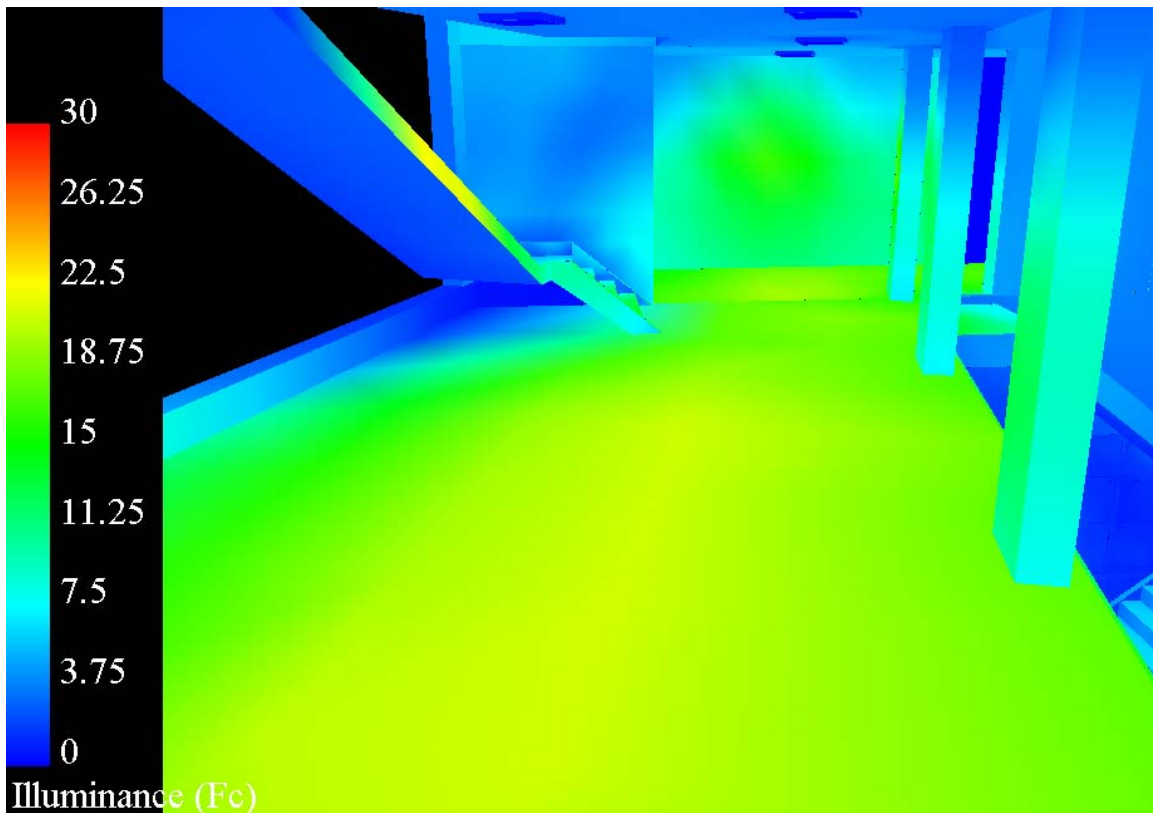
Contour Values



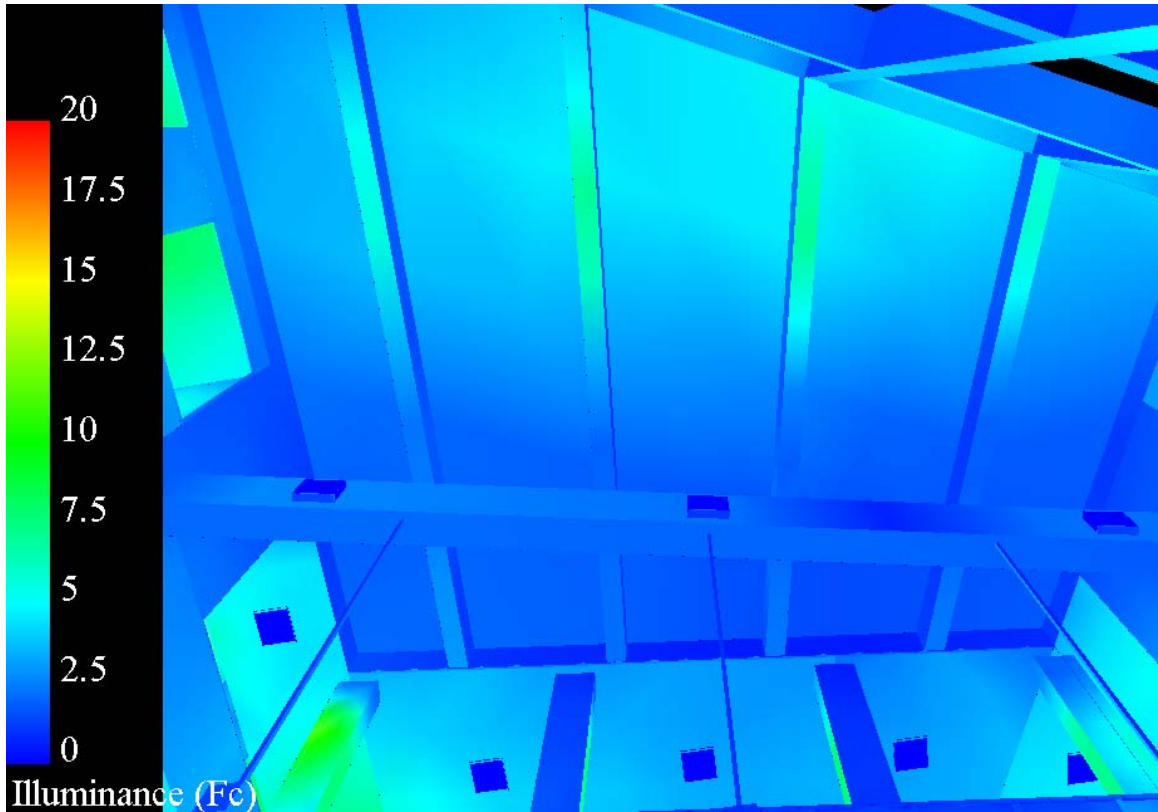
Atrium Floor Illuminance Values



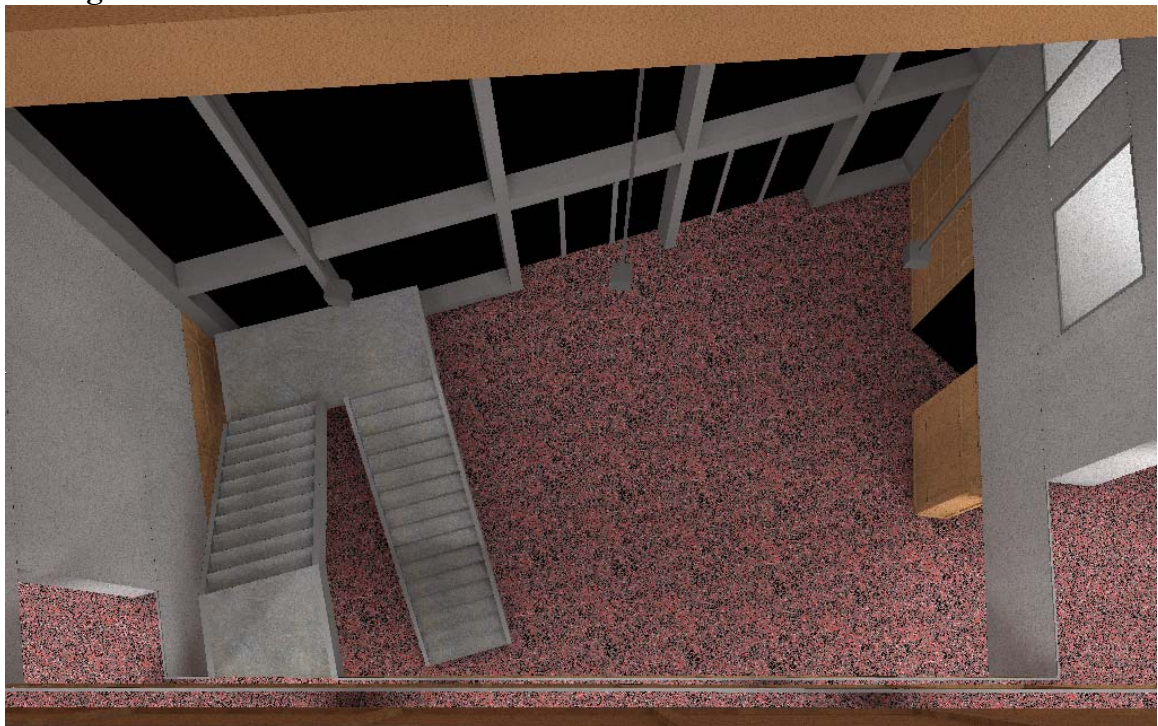
Illuminance (Fc)
Atrium Floor Pseudocolor Illuminance Values



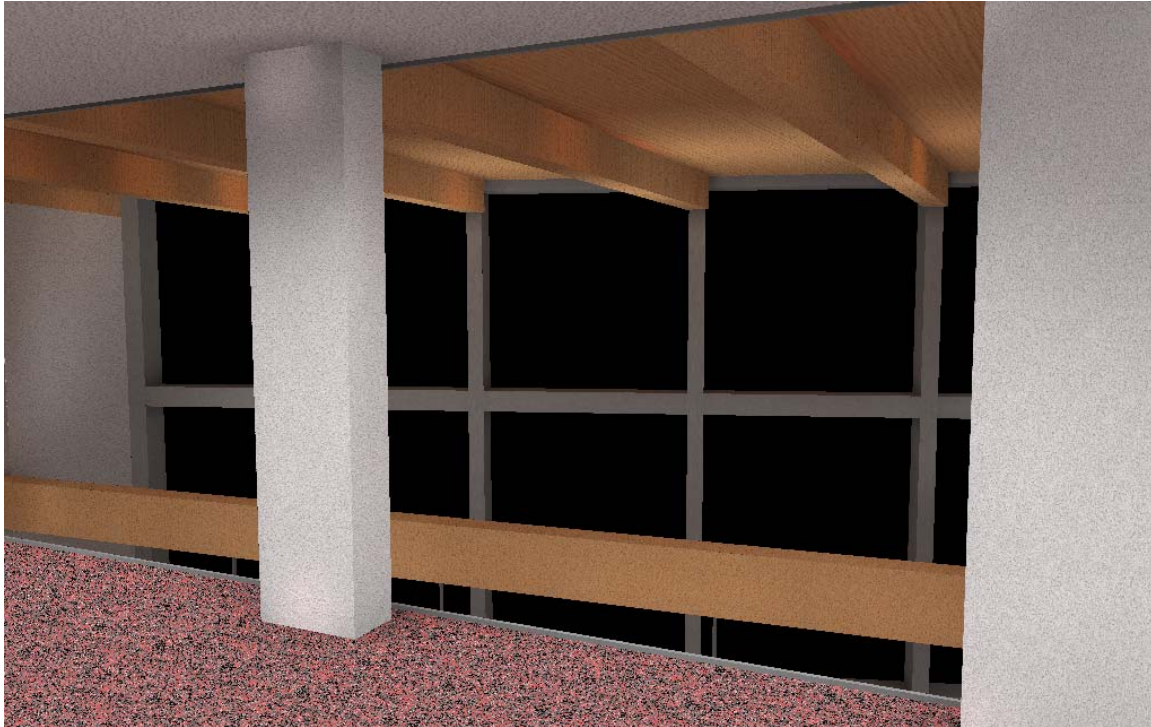
Illuminance (Fc)
Second Floor Pseudocolor Illuminance Values



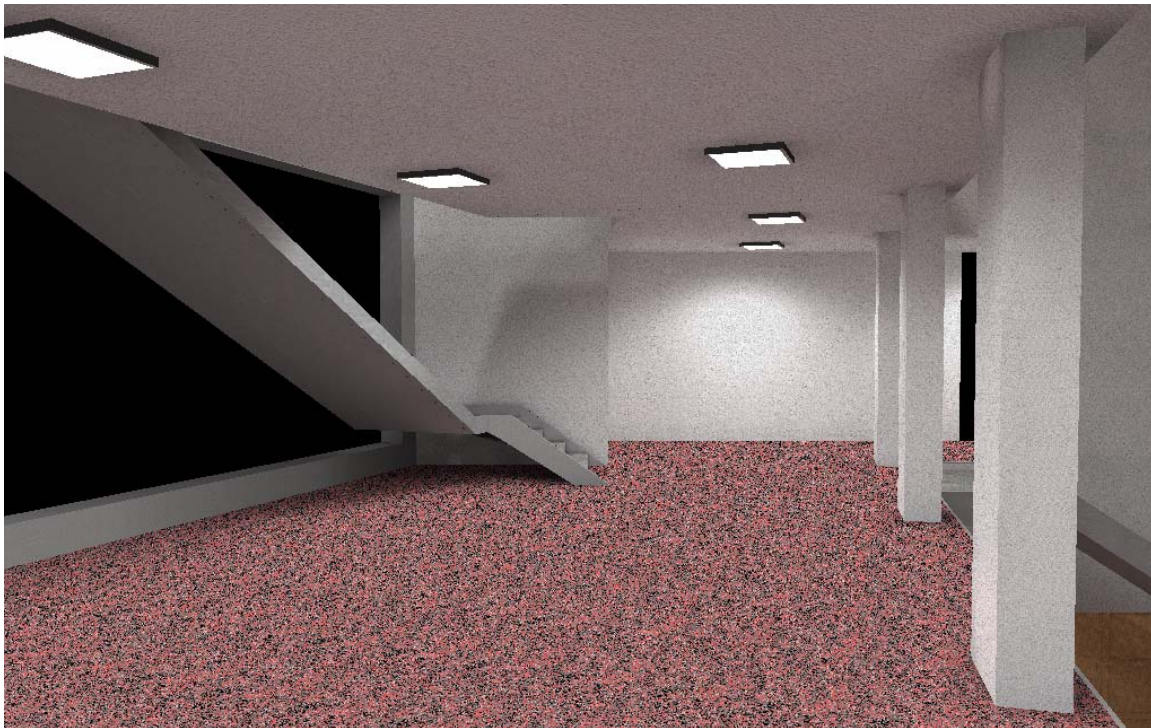
Ceiling Pseudocolor Illuminance Values



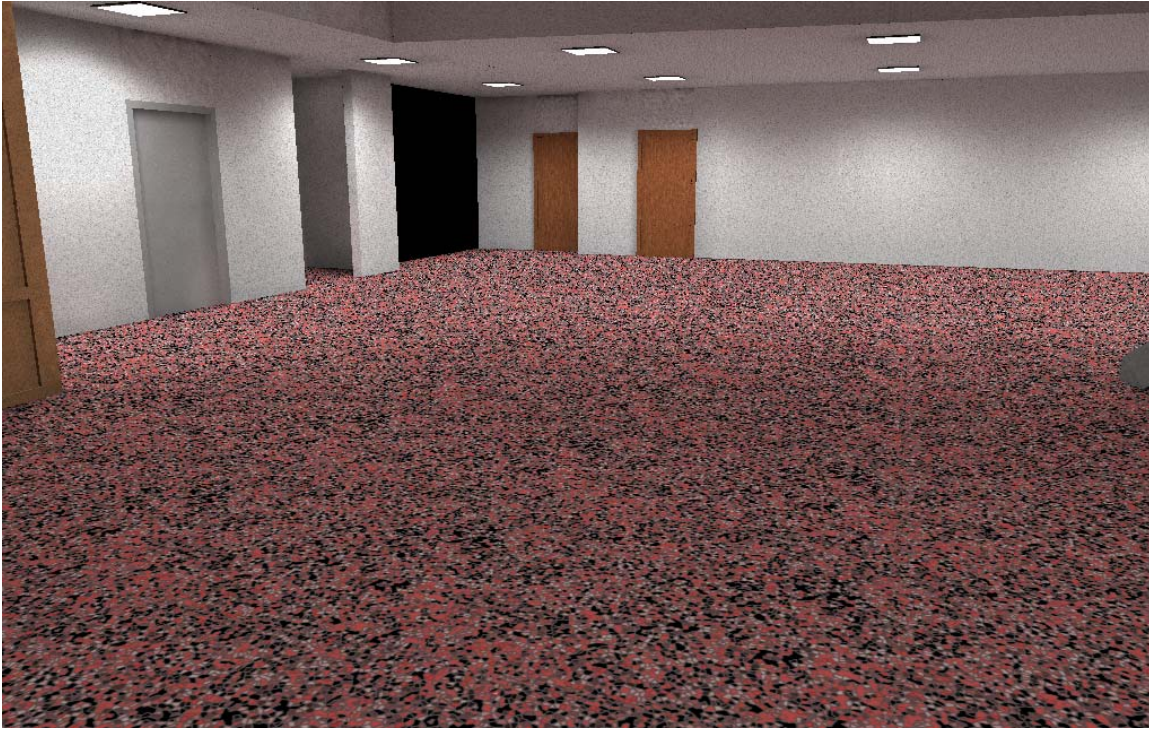
Rendering from the Fourth Floor Looking Down



Rendering from the Fourth Floor Looking Out at the Ceiling



Rendering of the Second Floor



Rendering of the Back Section of the First Floor

Analysis

The appearance of the atrium is very important to the building since it is the main architectural feature. The Louis Poulsen fixtures suspended from the beam have an organic appearance and fit with a natural theme. Also, their large size (28" deep) will make them noticeable features in the high atrium. The accent uplights provide a soft warm illumination on the ceiling and highlight the hardwood. The mounting location also effectively shields them from view from the fourth floor. An average illuminance of 6.31 fc was provided in the front area of the atrium. This is slightly under the recommended value of 10 fc. Adding an extra Louis Poulsen fixture to the beam added more illumination in the area, however due to spacing issues the end fixtures on the beam ended up close to the walls, leaving unattractive patterns of light there. Based on this, three fixtures were kept and the lower illuminance accepted. The illuminance in the back section of the atrium was between 15 and

20 fc and was evenly distributed, as indicated in the pseudocolor rendering. Additionally, the use of the parabolic fixtures throws more light sideways, eliminating the areas of light and darkness caused by downlights as well as improving facial rendering. The reflectors on the parabolic fixtures will help reduce view of the lamps when walking through the hall, which will lessen direct glare levels. Power density for the new design was much less than the maximum allowed by ASHRAE, resulting in energy savings.

Video Conference Room

Overview

Room Surfaces:

- White Painted Gypsum Walls- reflectance 0.76
- Acoustic Tile Ceiling- reflectance 0.80
- Wood Panel Walls- reflectance 0.51
- Hardwood Table- reflectance 0.44
- Carpet- reflectance 0.20
- Shades- reflectance 0.48

Tasks:

- Regular Conferencing
- Video Conferencing
- Presentations
- Facial Recognition
- Personal Interaction

Goals:

- Provide a video conference lighting system that responds to camera needs
- Increase the performance of the videoconference lighting settings
- Create a general lighting system for other room uses

Considerations and Requirements

The lighting in a videoconference room must be designed with consideration of the needs of the camera. Design based on illuminance values alone will not create a good videoconferencing environment. Rather the camera requires certain luminance ratios between the participants and their surrounds, as well as good vertical illumination on the faces of those participants. The people within the room require a visually comfortable space that is free of glare and has adequate illumination. Listed below are some of the criteria for designing a good videoconferencing room:

- Lamp CCT 3000-3500 K- improves skin tone for camera
- Optimal Camera Performance at 10-15 feet
- Camera has 60° horizontal field of view, keeping participants at relatively the same distance across the field minimizes camera adjustments
- Use of a curved table can help keep constant focal distance
- Ideal room dimensions: 20'-25' x 25'-30'
- Camera should be located around eye level
- Ceiling should be out of the view of the camera, along with luminaires
- Minimize patterns within the view of the camera: simple rooms scenes have less information to interpret

Recommended Reflectances:

Ceiling- 70-80%
Area behind participants- 40-60%
Table- 40-60%
Floor- 20% minimum

Recommended Illuminance Values:

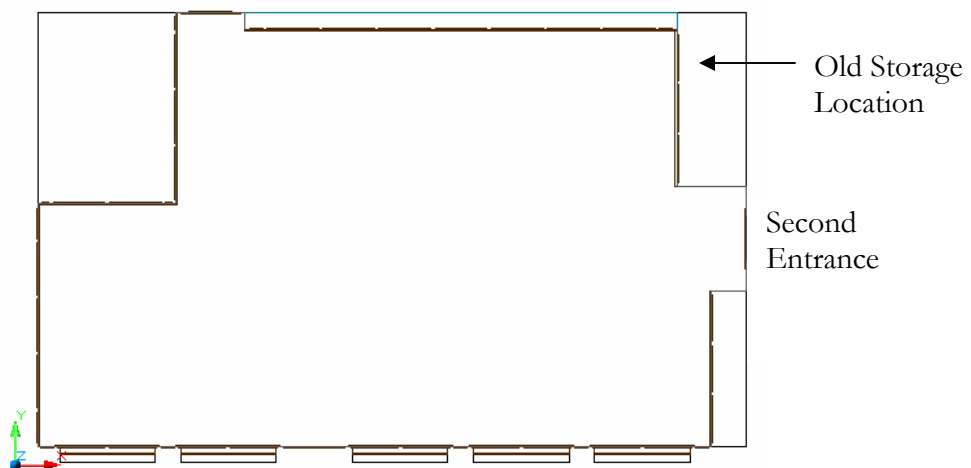
Table- 30-100 horizontal fc
Face- 30-90 vertical fc
Back wall- 10-75 fc

Recommended Luminance Ratios:

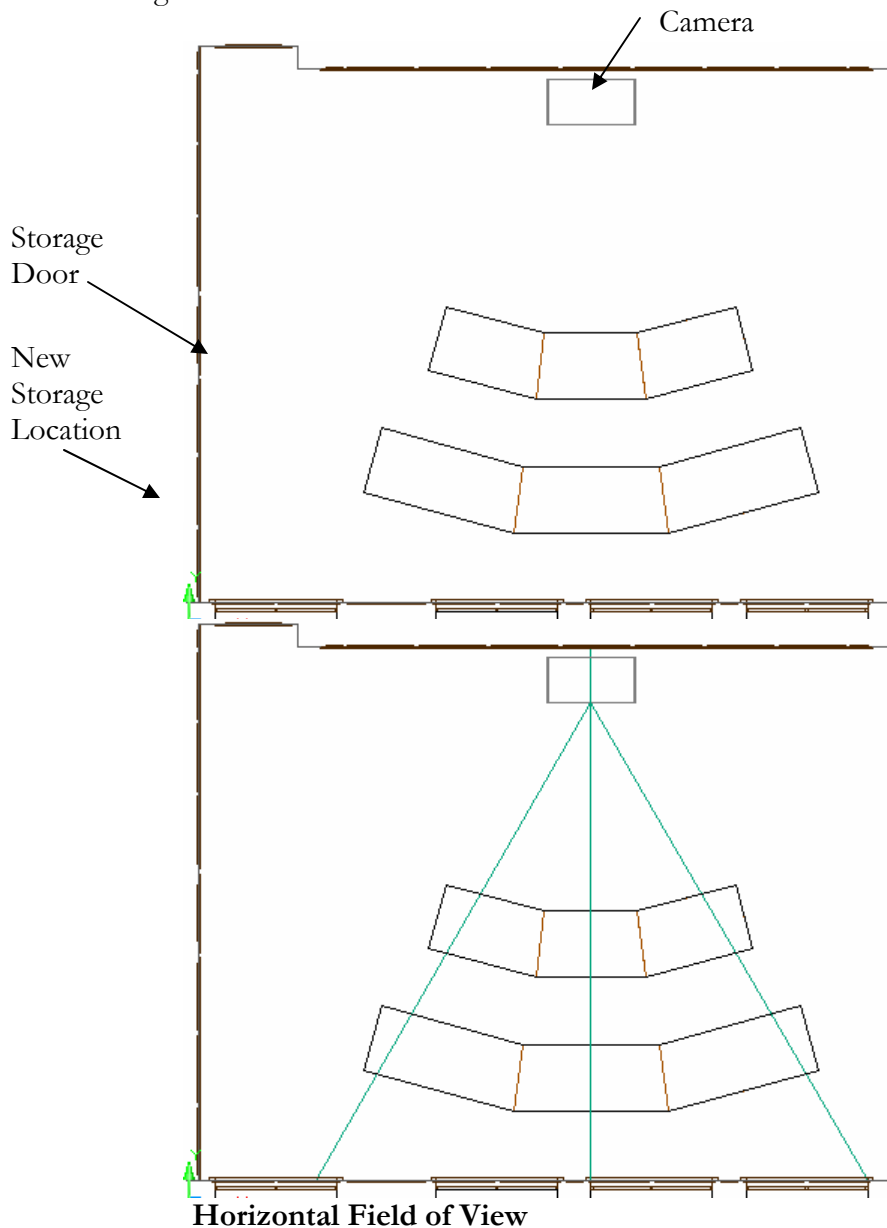
Face to background- 3:1
Maximum in space- 20:1

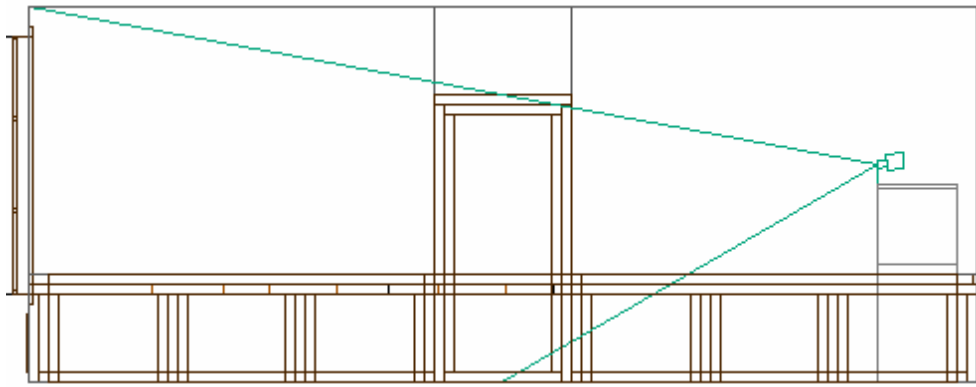
New Design Concept

The goal for the new design in the videoconference room was to create two lighting systems: one for videoconferencing settings and one for other uses, such as presentations. The original design featured an oddly shaped room with uneven lighting that did not address the requirements set forth above. In the new design, a storage closet in the room was moved to create a rectangular space measuring 24' x 30', which is within the range suggested.



The second entrance to the space was also eliminated due to relocation of the tables. In the original design, one large U-shaped table sat in the middle of the room, with the camera looking towards the window. This large table was so wide that not everyone seated could be seen by the camera. A new table layout was chosen, using two separate curved tables in a stadium seating-like arrangement. This proved useful by allowing everyone to sit within the 60° horizontal field of view of the camera, and also helped keep everyone at a closer focal length.





Vertical Camera Field of View (Ceiling Excluded from View)

To provide lighting for a videoconference, special fixtures were selected to shine directional light onto the faces of the participants. These luminaires were designed to minimize direct glare and provide even illumination for the participants and the camera. A second fixture type was also positioned above the tables to provide fill and key light on the participants. Wall washers were used behind the participants to light the background. Finally, recessed parabolic fixtures were used throughout the space to create a second lighting system for general illumination if needed during regular conferences or presentations at the front of the room.

One other special consideration in this space was the four windows behind the participants and in the field of view of the camera. There was a need to stop outside light from entering the room during a videoconference. However, when used for regular conferences and even some presentations, having natural light in the space could be desirable. Blackout shades in the windows were chosen to eliminate natural light penetration during videoconference sessions. During one of these sessions, the shades would be in view of the camera. An unsaturated beige color of reflectance 0.48 was selected. This matches the recommended reflectance value for the area behind the participants as specified above.

The use of solid shades would create large areas of uniform pattern within the view of the camera, reducing the amount of information it has to interpret.

Luminaire Schedule

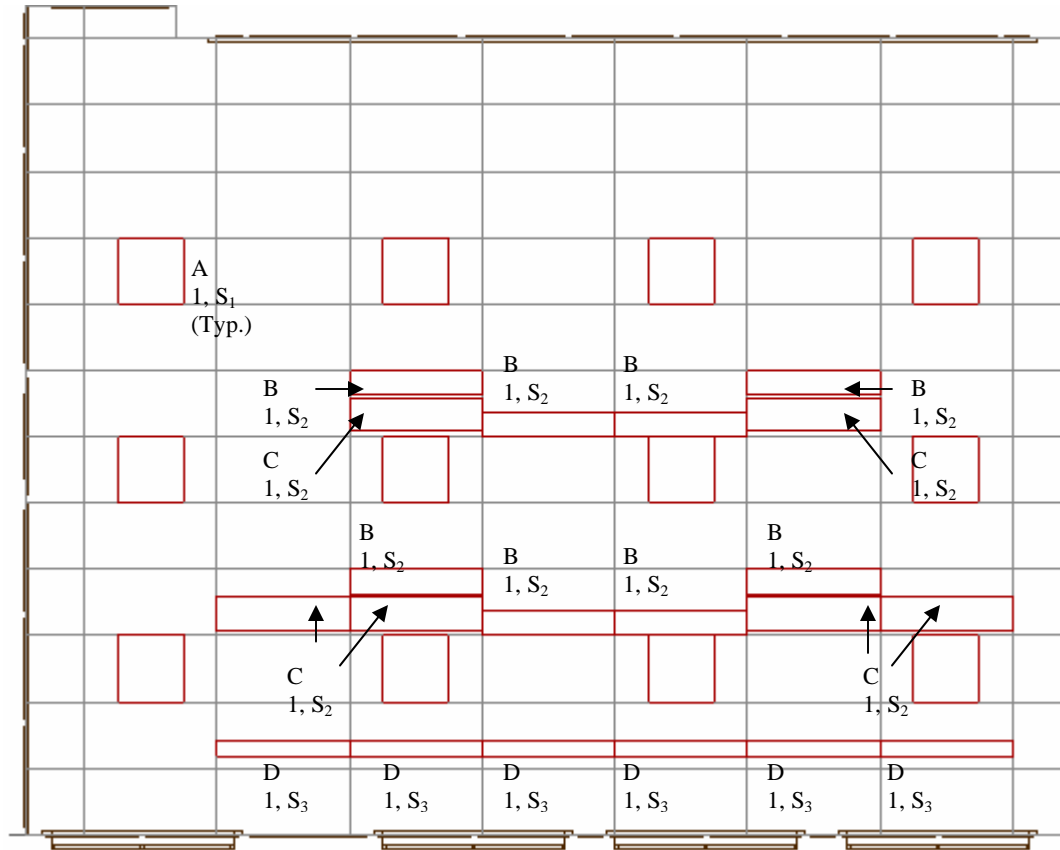
Designation	Fixture	Lamp	Ballast	Voltage	Wattage	Number
A	Metalux 2P2GAX2U6T8	FB32T8/6 TL841	Electronic 2 lamp	277	54	12
B	Focal Point Vision VC	F54T5/835/HO/ALTO	Electronic 2 lamp	277	122	8
C	Lightolier 1x4 Parabolic	F32T8/ADV835/ALTO	Electronic 1, 2 lamp	277	36,71	2,4
D	Focal Point Avenue A WW	F28T5/835	Electronic 2 lamp	277	63	6

See Appendix for all cutsheets

Note: Fixture A is two-lamp, with a two-lamp ballast. Fixture B is one-lamp, with two fixtures wired in tandem with a two-lamp ballast per ASHRAE 90.1. Fixture C is one-lamp, with four of the fixtures wired with two two-lamp ballasts and two of the fixtures with one one-lamp ballast since they are 10 ft apart center to center (allowed by ASHRAE 90.1). Fixture D is one-lamp, with two fixtures wired in tandem by a two-lamp ballast.

Controls

ASHRAE 90.1 Section 9.2.1.1 dictates areas greater than 250 sq. ft. in buildings larger than 5000 sq. ft. must be controlled by automatic shutoff. This area will be connected to an occupancy sensor for automatic shutoff. Manual control will be from a control panel at the front of the room near the door (similar to Lutron GraphikEye). Using the control panel preset scenes for videoconferencing (blinds down, with fixtures B, C, and D on) can be selected and customized (e.g. for increased dimming on the wallwashers in the back). This system also allows for rapid switching to the general lighting scene (blinds up with fixture A on).



Video Conference Room Lighting Plan

A- Fixture Type- 2'x2' Recessed Parabolic

B- Fixture Type- Recessed Video Conference Fixture

C- Fixture Type- 1'x4' Recessed Parabolic

D- Fixture Type- Wall Washer

1- Circuit Designation- Served by LP-42, circuit 4

S_{1,2,3}- Controlled manually by a control panel at the entrance, also equipped with automatic shutoff per ASHRAE 9.2.1.1

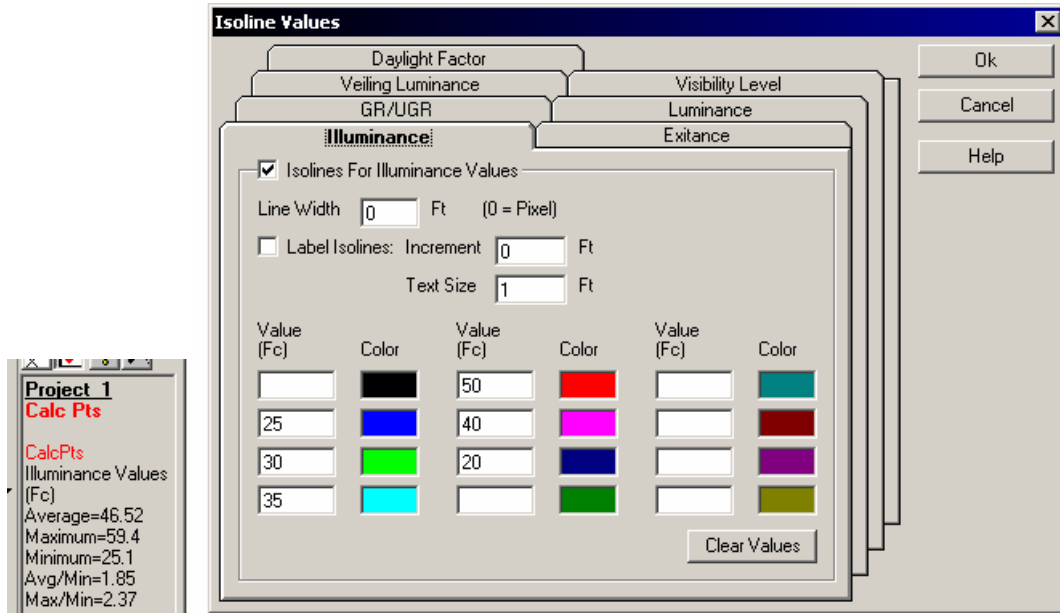
Luminaire	Maintenance Category	Cleaning Interval	Ballast Factor	RSDD	LLD	LDD	Total LLF
A	IV	24m Very Clean	0.85	0.98	0.90	0.90	0.67
B	IV	24m Very Clean	0.95	0.98	0.95	0.90	0.79
C	IV	24m Very Clean	1.0	0.98	0.95	0.90	0.84
D	IV	24m Very Clean	0.95	0.98	0.95	0.90	0.79

Power Density

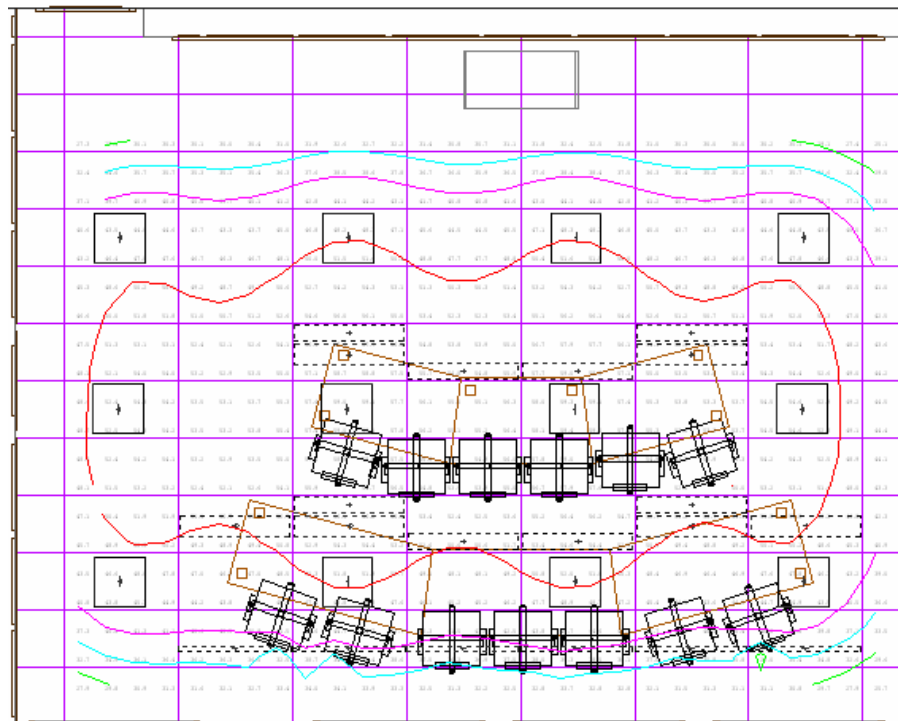
ASHRAE 90.1 specifies a power density of 1.3 W/sq.ft. for conference rooms. The total power use for the space was calculated to be 1539W over an area of 720 sq. ft. This yields a power density of 2.13 W/sq. ft. This high number is due to the two lighting systems contained in the room (videoconferencing and general). ASHRAE allows for tradeoffs between spaces to enable higher densities in some spaces if it can be offset elsewhere.

ASHRAE specifies a power density of 1.1 W/sq.ft. in offices. There are 66 offices in the School of Forest Resources Building that use two 59W fixtures (2 T8 lamps each). The total power use is 118W over 165 sq. ft., or a power density of 0.72 W/ sq. ft. This is a savings of 0.38 W/sq. ft. per office, which at 66 offices means 25W/ sq. ft. was saved. This easily offsets the increase in power density in the videoconference room.

Illuminance Values and Rendering



General Lighting Setting at Table Level



General Lighting Setting Illuminance Values



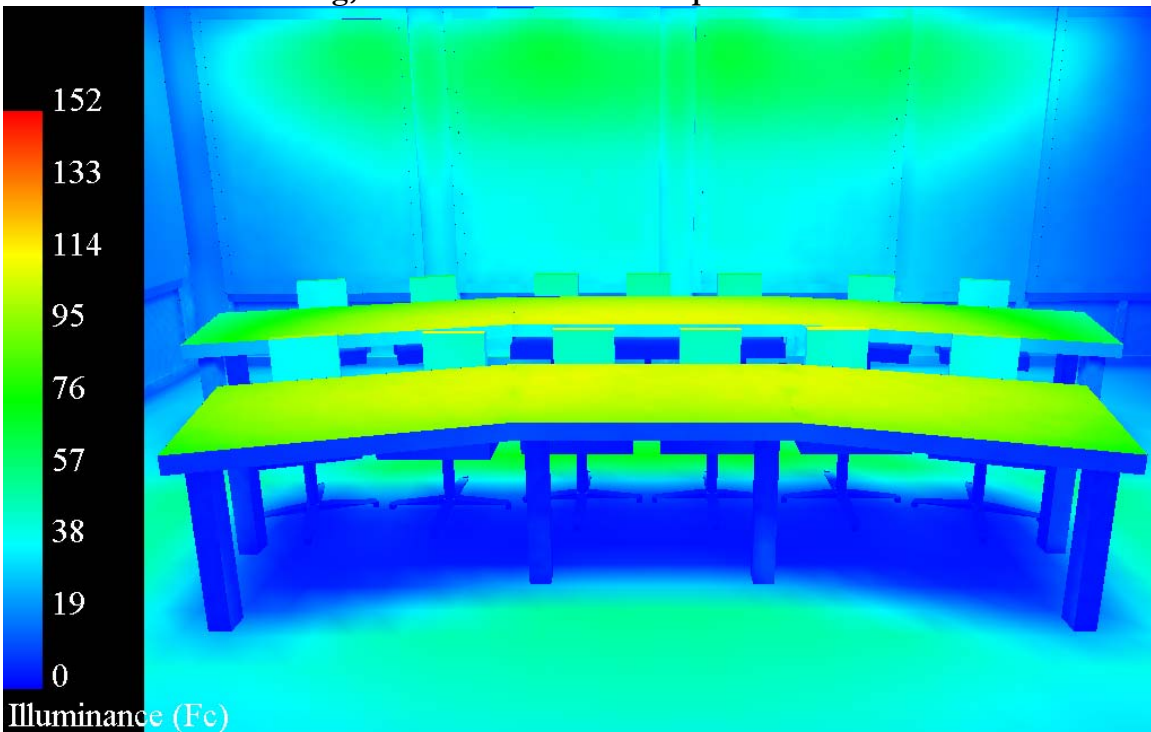
General Lighting View



General Lighting View

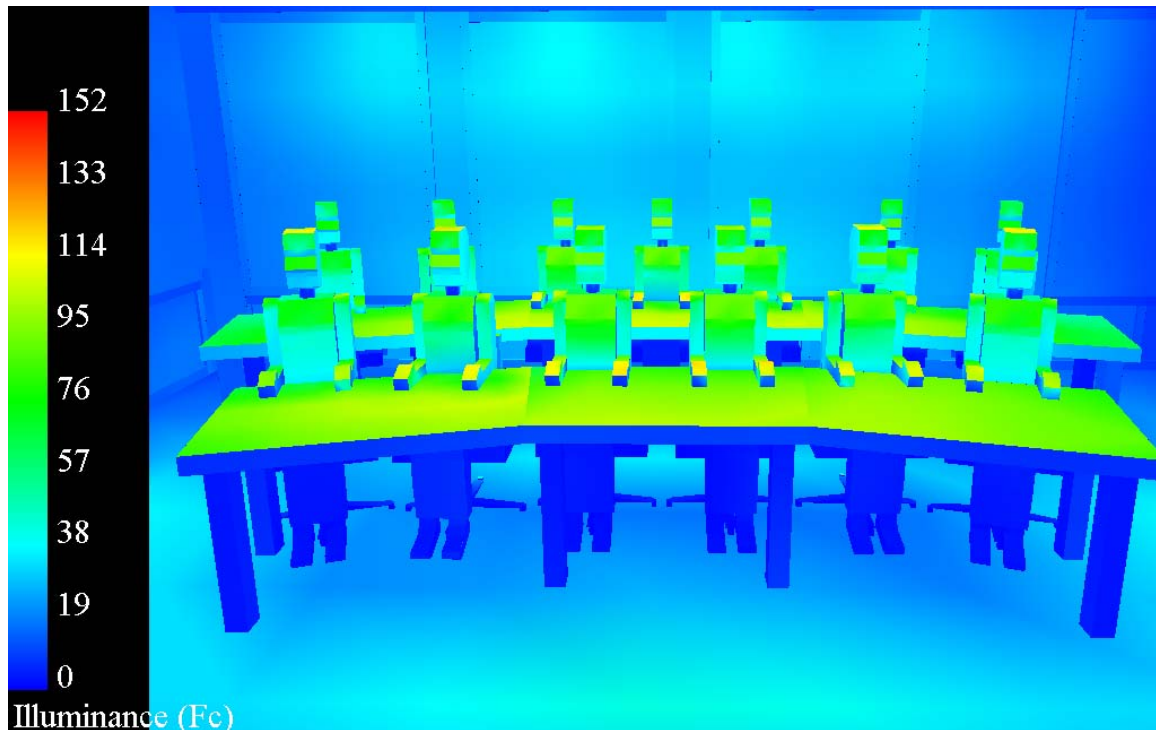


Video Conference Setting, From the Camera's Perspective



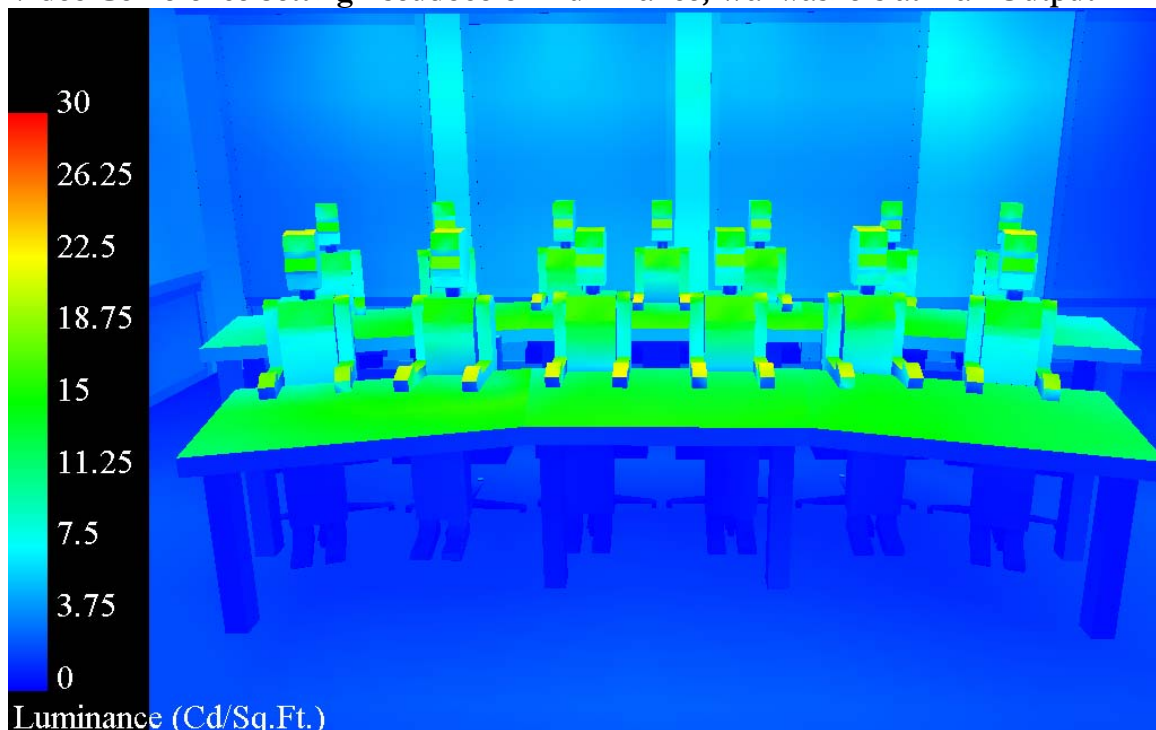
Illuminance (Fc)

Video Conference Setting Pseudocolor Illuminance, Wallwashers at Full Output



Illuminance (Fc)

Video Conference Setting Pseudocolor Illuminance, Wallwashers at Half Output



Luminance (Cd/Sq.Ft.)

Video Conference Setting Pseudocolor Luminance, Wallwashers at Half Output



Video Conference Setting, Wallwashers at Half Output

Analysis

The new design for the videoconference room allows for increased flexibility in the uses for the space as well as a dramatic increase in performance for videoconferencing over the original. The new table layout allows for all members of the conference to be seen by the camera at once. In the old design, more people could be seated at the table, however the camera was required to rotate, which could lead to a back and forth rotation scenario and diminish the effectiveness of the videoconference session (for original lighting design information see Technical Assignment 1). Also, the new furniture layout brings everyone at each table to a relatively similar focal length from the camera requiring fewer focusing adjustments during a meeting. The camera is near eye level for a natural feel, and the ceiling is excluded from view along with the luminaires. Almost all of the side walls were eliminated from camera view, limiting the amount of information the camera needs to process. A

fluorescent lamp CCT of 3500K provides the warm tones necessary for proper skin appearance.

In the general lighting scenario, an average of 46 fc is provided over the room, very close to the IES recommended value of 50 fc. The materials selected for the room fit with the criteria laid out for videoconference design. These material reflectances combined with the lighting design deliver the following output:

Recommended Illuminance Values:

Table- 30-100 horizontal fc-	90-100 fc achieved
Face- 30-90 vertical fc-	60-70 fc achieved
Back wall- 10-75 fc	35-45 fc achieved with wallwashers at 50% output

Recommended Luminance Ratios:

Face to background- 3:1	2-3:1 with wallwashers at 50%
-------------------------	-------------------------------

Using a dimmed setting on the wallwashers (and on the videoconference fixture if desired) helped achieve values within the guidelines for illuminance and luminance and also saves energy.

The addition of the new control system will allow for quick changes between videoconference and general scenes, increasing the flexibility of the room to accommodate different tasks.

Aquaculture Lab

Overview

- Room Surfaces:**
- White Painted Gypsum Walls- reflectance 0.76
 - Acoustic Tile Ceiling- reflectance 0.86
 - Concrete Floor- reflectance 0.35
 - Tanks- modeled as reflectance 0.30
- Tasks:**
- Observation of Tanks
 - Experiments
 - Personal Interaction
- Goals:**
- Provide adequate lighting levels for the space at an acceptable power density
- Recommended Illuminances:**
- Horizontal- 50 fc
 - Vertical- 30 fc
- Considerations:**
- Direct Glare-** Creates an uncomfortable environment that will hinder occupants' ability to work well.
 - Color Appearance-** Important for proper color rendering during observations in tanks (fish/plant health) or any other experiment.
 - Light Distribution on Surfaces-** Light should be distributed evenly over horizontal and vertical elements for uniform observation conditions
 - Reflected Glare-** Important due to the glass aquariums in the space, along with improper source/task/eye geometry, reflected glare could hinder observations

New Design Concept

The focus of the new aquaculture lab design was to increase the performance of the system by increasing the levels of light and decreasing energy consumption. One element of the original design that decreased performance was the exposed piping in the ceiling. The network of pipes above the room diminished the amount of useful light reflections in the

space. In the new design, an acoustic tile drop ceiling was added to increase these reflections and eliminate the loss of light in the pipe network. Two systems were analyzed originally: a recessed linear fluorescent system and a suspended linear fluorescent system. The suspended system offered greater uniformity at a fractional increase in energy consumption, so it was chosen for the final design.

Luminaire Schedule

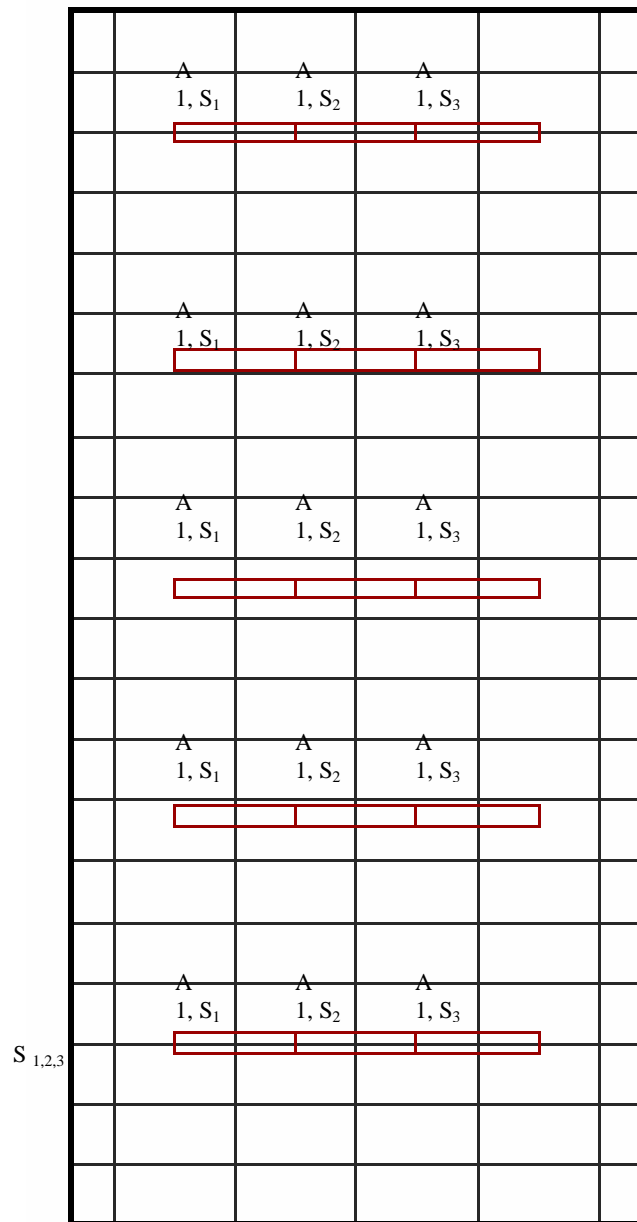
Designation	Fixture	Lamp	Ballast	Voltage	Wattage	Number
A	Lightolier Agili-T Direct/Indirect	F28T5/835	Electronic 2 lamp	277	63	15

See Appendix for all cutsheets

Note: This is a two-lamp fixture with a two-lamp ballast

Controls

ASHRAE 90.1 Section 9.2.1.1 states areas greater than 250 sq. ft. in buildings larger than 5000 sq. ft. must be controlled by automatic shutoff. This area will be connected to an occupancy sensor for automatic shutoff. Manual controls will be located at the door, and will switch the luminaires in three different zones. This will allow for some flexibility in light levels.



Aquaculture Laboratory Lighting Plan

A- Fixture Type- Pendant Mounted Direct/Indirect

1- Circuit Designation- Served by L4-BB, circuit 5

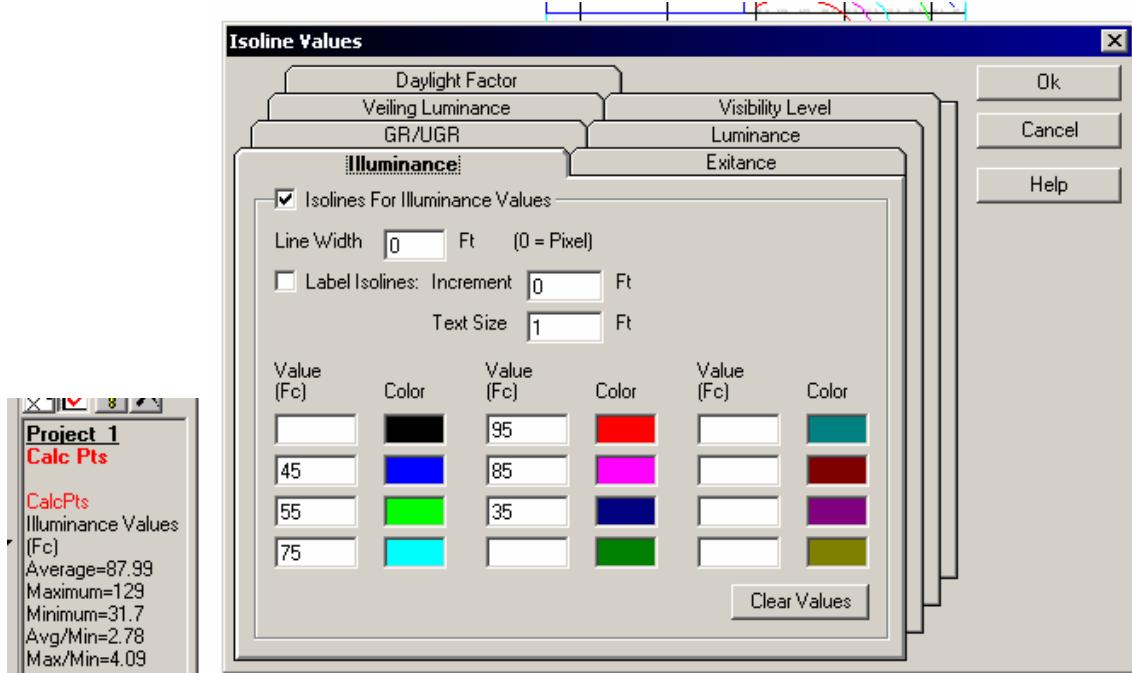
S_{1,2,3} – Controlled manually by switches at the entrance, equipped with automatic shutoff per ASHRAE 9.2.1.1

Luminaire	Maintenance Category	Cleaning Interval	Ballast Factor	RSDD	LLD	LDD	Total LLF
A	II	12m Very Clean	1.03	0.94	0.93	0.97	0.87

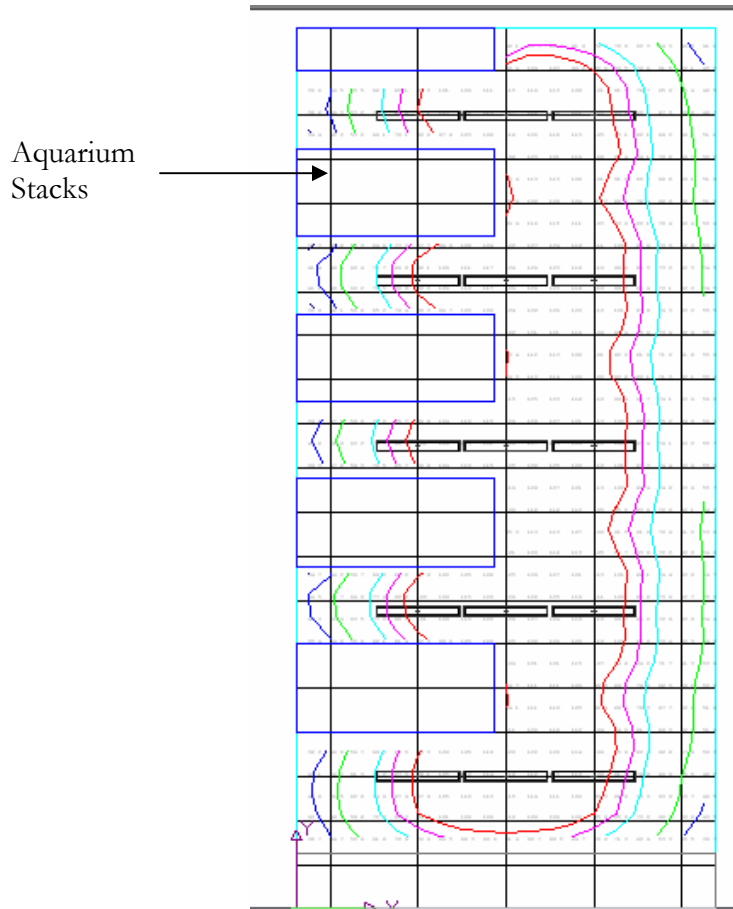
Power Density

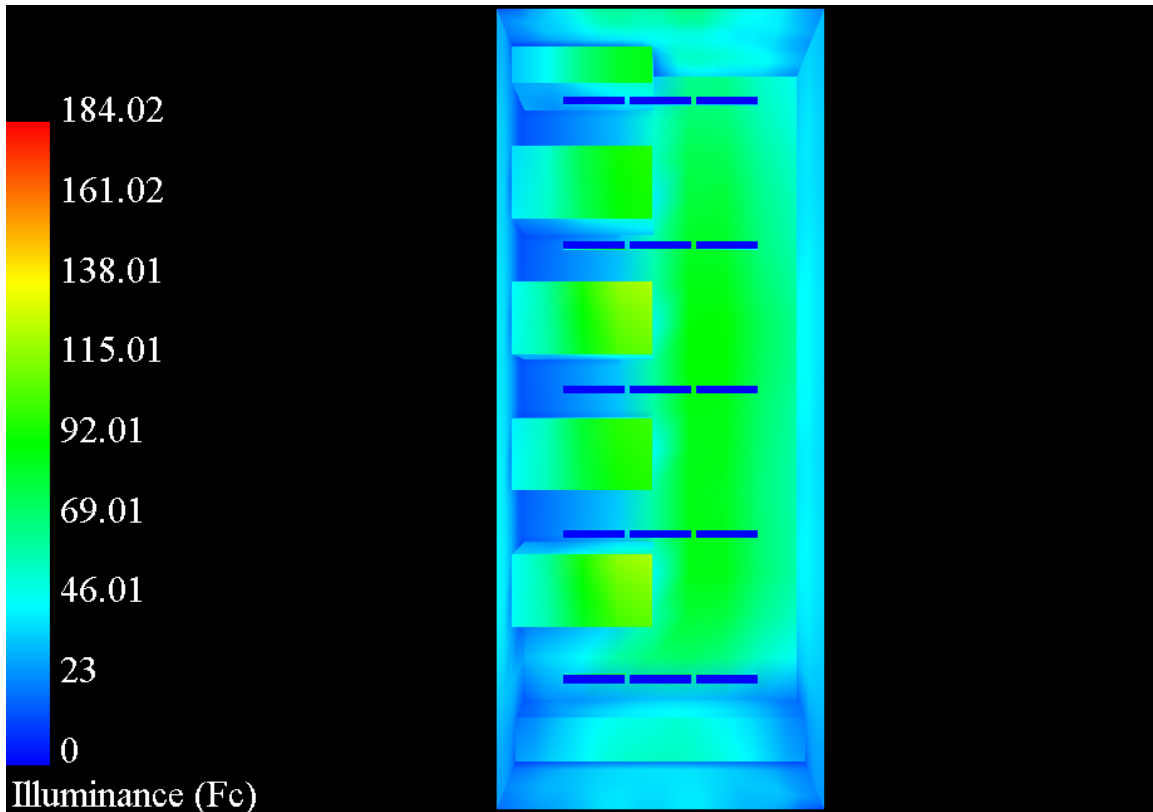
ASHRAE 90.1 specifies a power density of 1.4 W/sq.ft. for laboratories. The total power use for the space was calculated to be 945W over an area of 760 sq. ft. This yields a power density of 1.24 W/sq. ft., which is below the maximum for this type of space.

Illuminance Values and Rendering



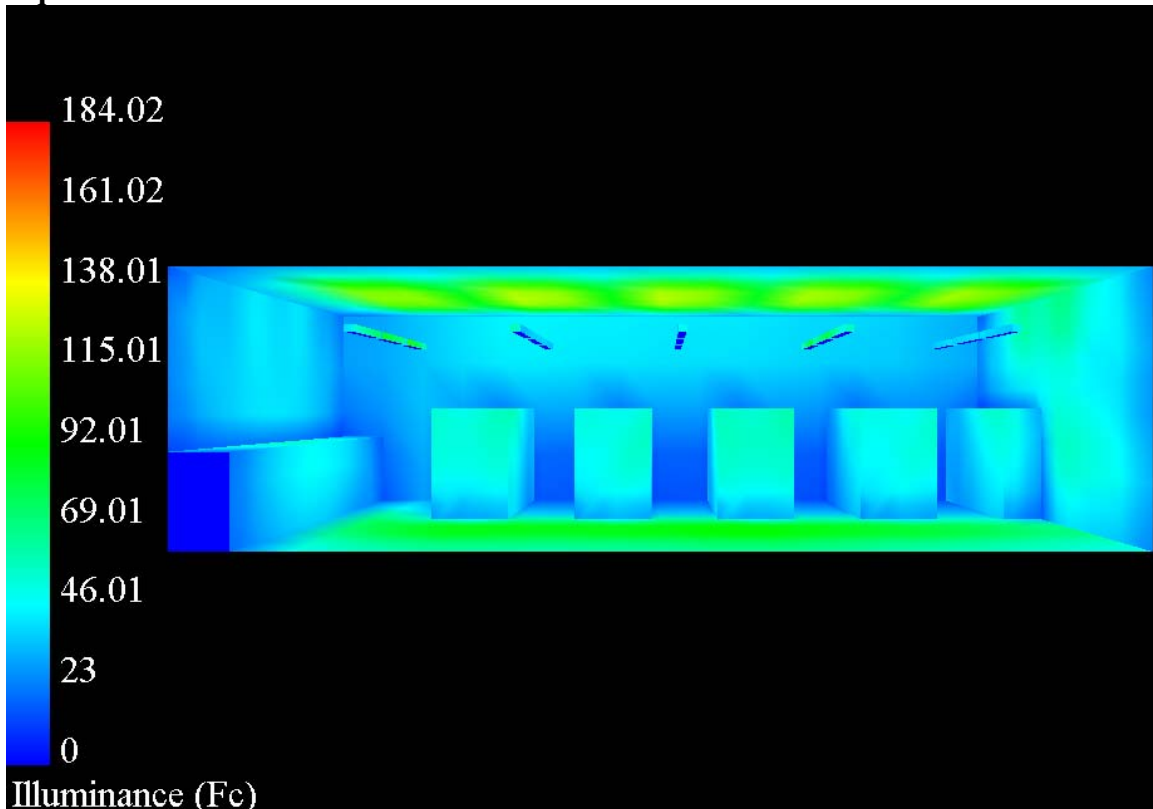
Calculation grid at 3.5'





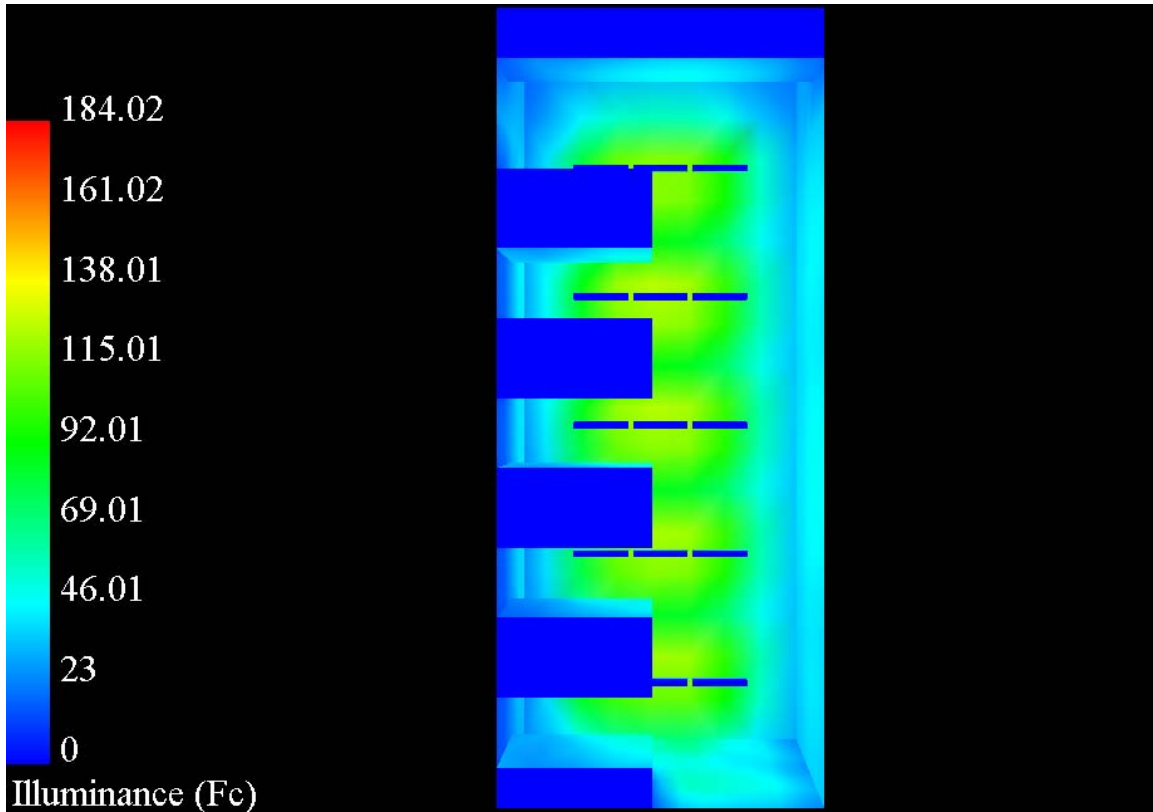
Illuminance (Fc)

Aquaculture Lab Floor Illuminance Pseudocolor

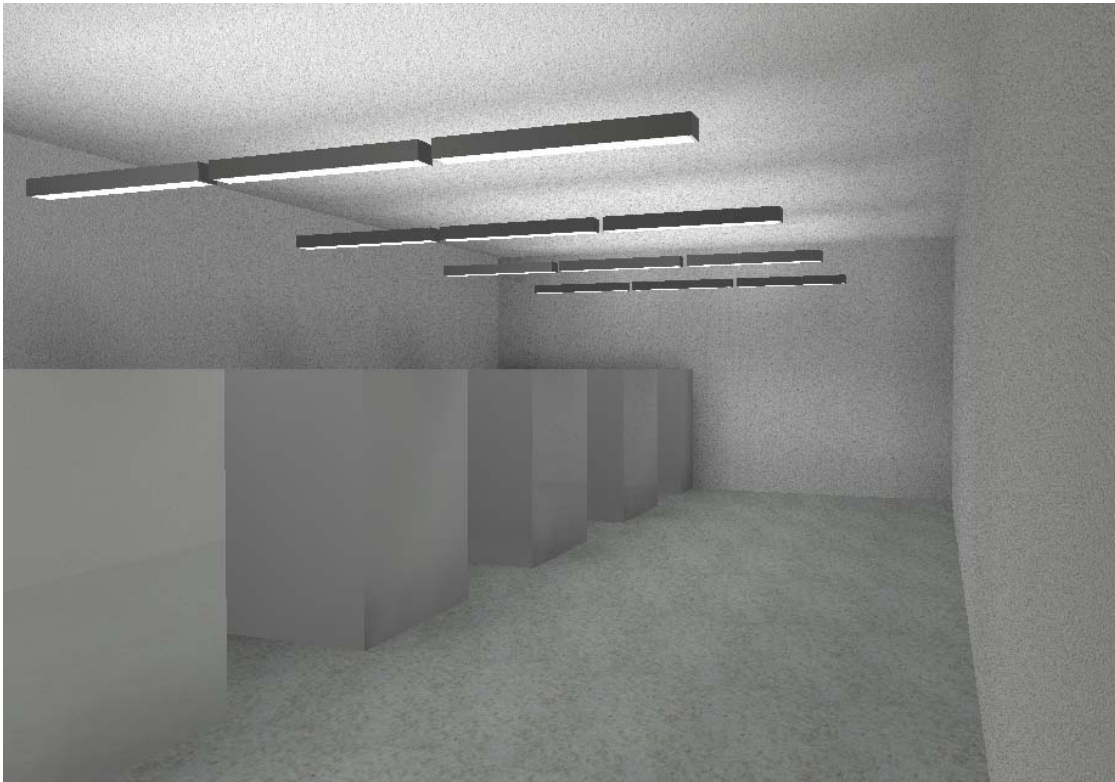


Illuminance (Fc)

Aquaculture Lab Illuminance Pseudocolor View from Side



Aquaculture Lab Ceiling Illuminance Pseudocolor



Aquaculture Lab Rendering

Analysis

The new lighting design for the Aquaculture Lab performed very well, providing an average of 87 fc on the workplane and around 70 fc on the floor. This is well above the recommended level, which is still acceptable since it allows the system to be dimmed (saving energy). Alternatively, not all of the zones need to be on at one time. Power density requirements were met, and less energy was used in the new design than in the old. The fixtures chosen are baffled at the bottom, reducing direct glare. Due to the location of the fixtures directly between the tanks, any incident light should reflect towards the floor, minimizing reflected glare. Illuminance on the floor, walls, and ceiling has an acceptable uniformity.

Front Meadow

Overview

Tasks:

- Walking
- Facial Recognition
- Safety

Goals: -Provide adequate lighting levels for the meadow pathways at an acceptable power density while creating an aesthetically pleasing design

Target Illuminance:

Minimum 0.1 horizontal fc over all path areas

Considerations: **Direct Glare-** Glare coming directly from the fixtures can impair the ability to see and may inhibit safety.

Light Distribution on Surfaces- While uniformity is not a major concern, ensuring at least a small amount of light covers all pathways is important.

Reflected Glare- Important due to the glass aquariums in the space, along with improper source/task/eye geometry, reflected glare could hinder observations.

Facial Recognition- Critical for recognition and perception of possible threats

Light Pollution/Trespass- selection of a cutoff fixture will help reduce light pollution. Light trespass is not a major concern since the University owns all the property surrounding the building.

New Design Concept

The primary goal of the new meadow design was to increase the amount of light on the pathways. As shown in Technical Assignment 1, there were large path areas that have no illumination. The illuminance on the paths needed to be increased while maintaining an acceptable power density. Another concern for the new design was the choice of luminaires. A pole mounted fixture was chosen to match the new campus style (Louis Poulsen “Kipp”

Post Top). In the original concept, bollards (matching the “Kipp” Post Top fixtures) were to be used along one path to provide illumination. After several layout analyses, it was determined too many bollards would be needed to be practical. The final design featured a layout entirely of post-mounted luminaires.

Luminaire Schedule

Designation	Fixture	Lamp	Ballast	Voltage	Wattage	Number
A	Louis Poulsen Kipp Post Top	CDM150/T6/830	Electronic	277	173	19

See Appendix for all cutsheets

Note: 19 Fixtures will be fed from the School of Forest Resources Building with the rest being fed from the Smeal Building. Fixtures were laid out for the entire meadow during the lighting calculations.

Controls

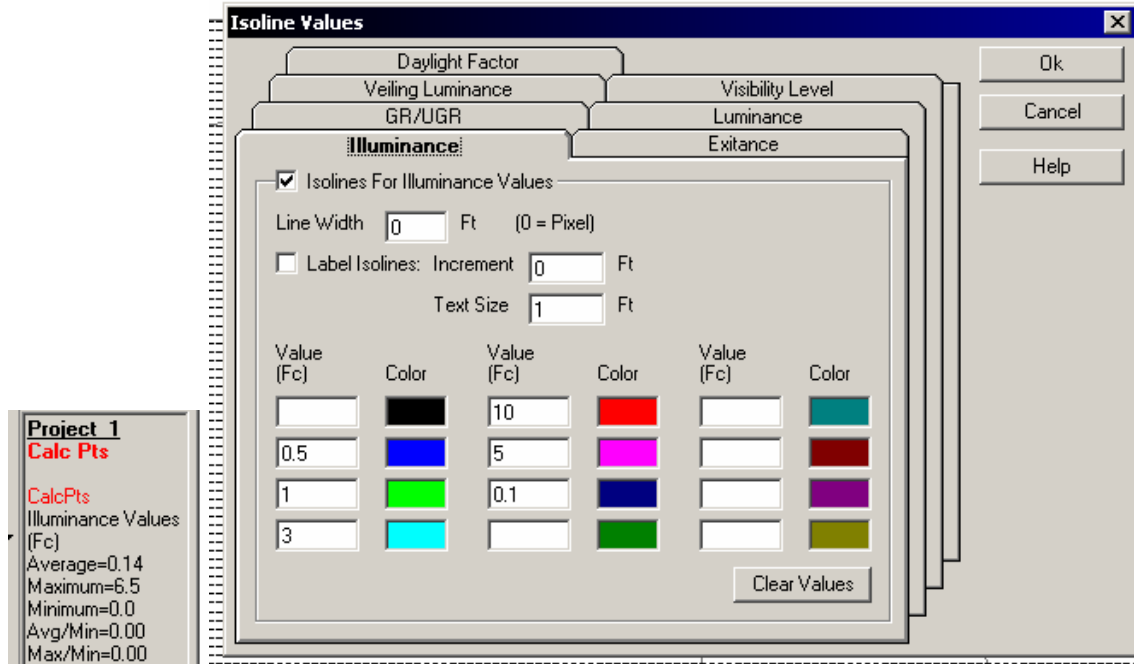
ASHRAE 90.1 states that lighting for exterior applications should have automatic controls capable of turning off exterior lighting when sufficient daylight is available or when the lighting is not required during nighttime hours. The exterior lighting will be linked to a photosensor which will automatically turn the lights on and off when needed.

Luminaire	Maintenance Category	Cleaning Interval	Ballast Factor	RSDD	LLD	LDD	Total LLF
A	---	---	0.90	---	0.70	0.90	0.57

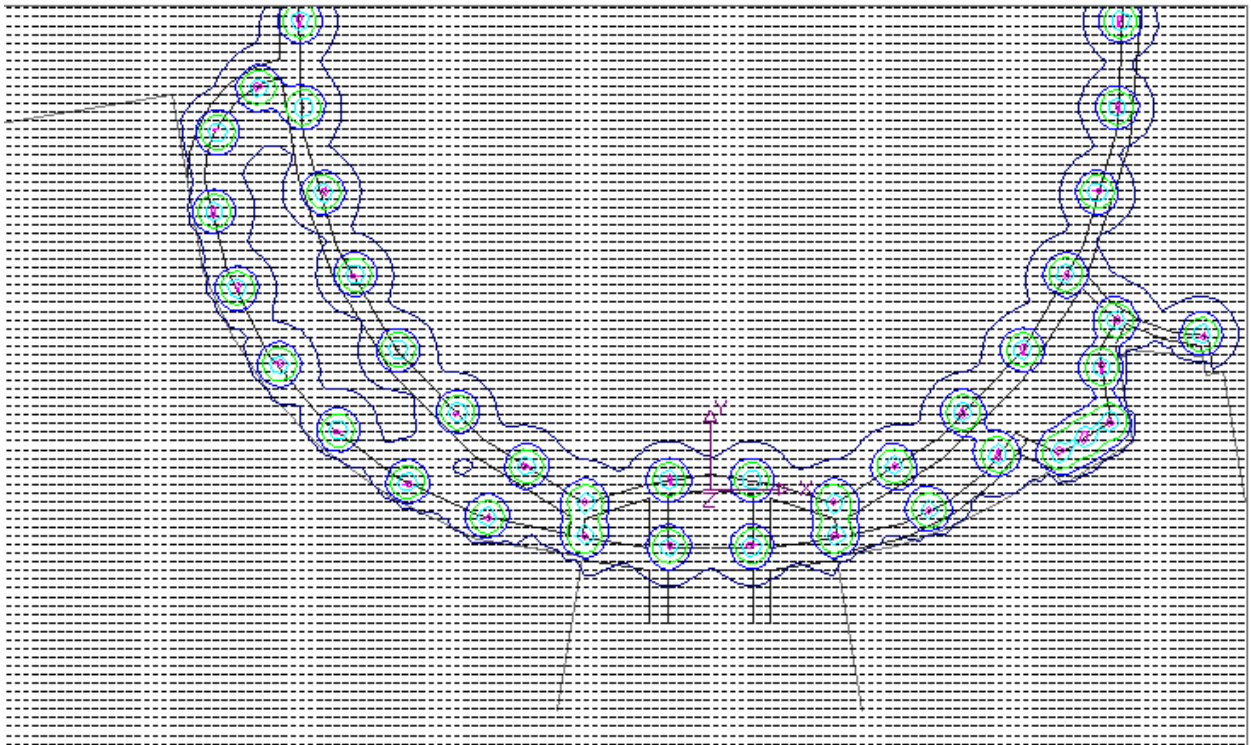
Power Density

ASHRAE 90.1 specifies a power density of 1 W/linear foot for paths 5 feet wide or less in Table 9.4.5. The total length of path for the School of Forest Resources Building section of the lighting is 3588 feet, allowing for a total of 3588W to be used. Each of the nineteen luminaires uses 173W, for a total of 3287W. This is an acceptable power density.

Illuminance Values and Layout

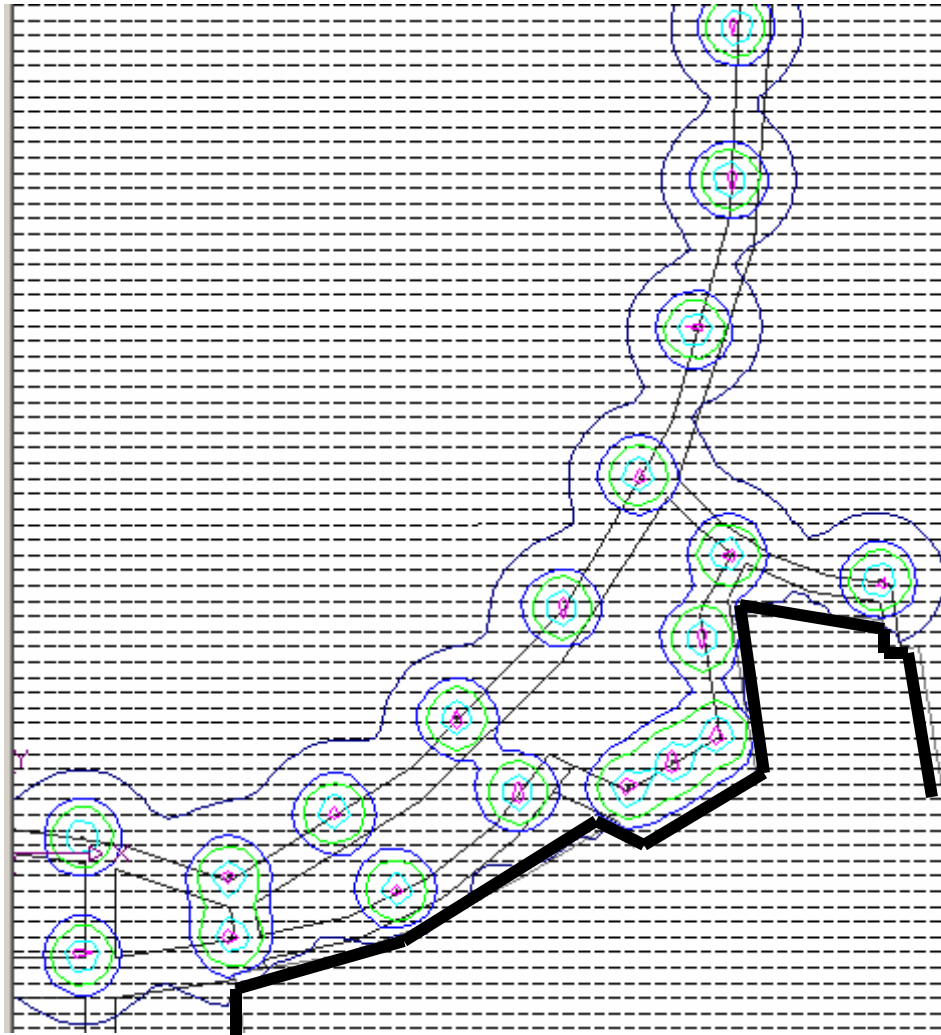


Illuminance Values for the Layouts



Entire Meadow Lighting Layout and Illuminance Levels

Note: Most path fixtures are 100' apart



The Forest Resources Building Section of Meadow Lighting

Analysis

The new design for the meadow path lighting provides a minimum of 0.1 fc over the entire path, which is an adequate level of light. ASHRAE requirements for power density were met, so the system performs well from an energy standpoint. The choice of luminaire matches the campus style and connects the meadow to the rest of the university.

Additionally, the luminaire is equipped with internal diffuser to help eliminate glare, one of the concerns for safety.

Electrical Design and Analysis

Existing Conditions

The School of Forest Resources building is fed from an electric service provided by the user (PSU-OPP). The utility feeders connect to a delta-wye configuration step-down transformer which provides the building utilization voltage of 480/277V.

In the original design, four sets of (4) 600 MCM wires feed the 480Y/277V, 2000A, 50 KAIC, 3 phase Main Distribution Switchgear (MDS). The building's power use is monitored by the customer via a metering section in the MDS.

Ten delta-wye configuration step-down transformers are used to provide 208/120V service to distribution panels. These supply power to various loads including receptacles, fire-alarm panels, fumehoods, and a small amount of incandescent lighting.

In the case of an emergency, two automatic transfer switches are feed from two 5 kV feeders. The first ATS is connected to emergency/standby power feeds downstream of a 4160V/480-277V, dry-type, 45 kVA, delta-wye configuration transformer. This ATS is 480/277V, 200A and feeds the Life Safety Panel. This panel feeds all life safety loads in the building for emergencies, including fire alarm panels and emergency lighting. Emergency lighting fixtures operate at 277V and utilize fluorescent lamps (U-tube, linear, and compact varieties depending on location). The second ATS is downstream of a 4160V/480-277V, dry-type, 112.5 kVA, delta-wye configuration transformer connected to emergency/standby power feeds. This ATS powers a lab equipment load emergency panel as well as the elevators.

Circuit breakers are used for overcurrent protection in the building. Circuit breakers are required to provide overcurrent protection with inverse time and instantaneous tripping characteristics. A main circuit breaker with a 1600A trip rating protects the MDS.

Additionally, the MDS is equipped with a transient voltage surge suppression system.

Within the MDS, 10 circuit breakers ranging from 150 to 800A trip ratings protect feeders to distribution panels located throughout the building. The automatic transfer switches are protected by 5Kv fused switches, as well as circuit breakers downstream of their respective transformers. Two bus ducts in the building each serve multiple feeders that are protected by circuit breakers. The smaller distribution panels scattered throughout the building are each protected via a main circuit breaker or are main lugs only. Individual loads from these panels are also protected via breakers.

The Main Distribution Switchgear is located is located in an electrical room in the basement of the building. Adjacent to this room is an additional electrical room housing the main transformer, automatic transfer switches, and utility entrance to the building. The building contains two motor control panels, one located in the basement mechanical room and one in the penthouse. Small electrical rooms are located on each floor of the building and house many of the distribution panels. Additional panels are found throughout the building recessed in the walls. The penthouse level contains two machine rooms which house the controls for the elevators.

Impact of New Lighting Design

After the changes to the lighting systems in several spaces in the building, an examination of the distribution systems was performed to ensure everything was adequately sized for the new loads. Note that all lighting operates on 277V.

Atrium

Existing Lighting Circuits

Level	Panelboard	Circuit	Breaker Size	Wire Size
1 st Floor	LP 41	12	20A	#12
2 nd Floor	LP 42	11	20A	#12
3 rd Floor	LP 43	9	20A	#12
4 th Floor	LP44	10	20A	#12

Original Lighting Loads

Level	Fixture Number	Ballast Watts	Power Factor	Total VA
1 st Floor	22	36	0.98	808
2 nd Floor	17	36	0.98	625
	6	6	0.90	667
3 rd Floor	17	36	0.98	625
4 th Floor	21	36	0.98	772

New Lighting Loads

Level	Fixture Number	Ballast Watts	Power Factor	Total VA
1 st Floor	10	54	0.98	551
2 nd Floor	10	54	0.98	551
3 rd Floor	10	54	0.98	551
	3*	48	0.90	160
	3*	173	0.90	577
4 th Floor	10	54	0.98	551

Change in Lighting Load

Level	Original VA	New VA	Change in VA
1 st Floor	808	551	-257
2 nd Floor	1292	551	-741
3 rd Floor	625	1288	663
4 th Floor	772	551	-221

*In the new design, these six fixtures were placed on a second 20A circuit fed from the same panel (LP 43) to accommodate a different time clock setting from the other fixtures on this floor of the atrium

Video Conference

Existing Lighting Circuits

Panelboard	Circuit	Breaker Size	Wire Size
LP 42	4	20A	#12

Old Lighting Loads

Fixture	Number	Ballast Watts	Power Factor	Total VA
2x2 Parabolic (2 lamp)	13	59	0.99	775

New Lighting Loads

Fixture	Number	Ballast Watts	Power Factor	Total VA
2x2 Parabolic (2 lamp)	12	54	0.98	661
Video Fixture (1 lamp)	8	122 (1 for 2 fixtures)	0.98	498
1x4 (1 lamp)	2	36	0.99	73
	2	71 (1 for 2 fixtures)	0.99	143
Wall Wash (1 lamp)	6	63 (1 for 2 fixtures)	0.98	193

Change in Lighting Load

Original VA	New VA	Change in VA
775	1568	793

Aquaculture Lab

Existing Lighting Circuits

Panelboard	Circuit	Breaker Size	Wire Size
L4 BB	5	20A	#12

Old Lighting Loads

Fixture	Number	Ballast Watts	Power Factor	Total VA
Suspended Direct (2 lamp)	18	59	0.99	1073

New Lighting Loads

Fixture	Number	Ballast Watts	Power Factor	Total VA
Suspended Direct/Indirect (2 lamp)	15	63	0.99	954

Change in Lighting Load

Original VA	New VA	Change in VA
1073	954	-119

Exterior Meadow

Existing Lighting Circuits

Panelboard	Circuit	Breaker Size	Wire Size
L4 BB	11	20A	#12

Old Lighting Loads

Fixture	Number	Ballast Watts	Power Factor	Total VA
Metal Halide Pole	11	173	0.90	2114

New Lighting Loads

Fixture	Number	Ballast Watts	Power Factor	Total VA
Metal Halide Pole	19	173	0.90	3652

Change in Lighting Load

Original VA	New VA	Change in VA
2114	3652	1538

Note: In the new lighting layout for the meadow, half the fixtures will be fed from the School of Forest Resources Building, and half from the Smeal Building, as in the original design.

Analysis

The entire lighting system in the School of Forest resources building operates on 277 volts. The panels that feed the lighting system are all 100A and contain room for growth. The changes in volt-amperes created by the new lighting systems are not enough to impact the sizing of the electrical distribution systems in the building (i.e., all lighting circuits are still below the 16 Amp limit).

The exterior lighting load of 3652 VA (13.18 Amperes) was originally placed on a 20 amp circuit with #12 wire. While the wire is adequate to carry the load (16 Amp maximum), an analysis of the voltage drop was performed to ensure code requirements were met:

NEC: 3% maximum voltage drop on a branch circuit

Total distance of meadow run for the Forest Resources Building portion of the lighting is 1545 feet.

Amp feet = $13.18\text{A} \times 1545\text{ft} = 20.36 \times 1000$ Amp-feet

From Voltage drop table:

#12 wire, PVC conduit (as in original design), PF=0.90,
VD per 1000 Amp-feet = 1.749

Multiple x 2 due to single phase load:
VD per 1000 Amp-feet = 3.498

$20.36 \times 3.498 = 71.22$ Volts

$71.22\text{v}/277\text{v} \times 100 = 25\%$ Voltage drop, well over the maximum

Try #4 wire:

Table Value = $0.3 \times 2 = 0.6$

$20.36 \times 0.6 = 12.22$ Volts

$12.22\text{v}/277\text{v} \times 100 = 4.4\%$

Try #2 wire:

Table Value = $0.196 \times 2 = 0.392$

$20.36 \times 0.392 = 7.98$ Volts

$$7.98\text{v}/277\text{v} \times 100 = 2.8\%$$

The wire for the exterior meadow lighting will be sized up to #2 to account for the high voltage drop that occurred with the original #12 wire.

Analyses of the maximum symmetrical short-circuit ratings of the conductors used in the building were also performed:

System Voltage <1000, circuit breaker clearing time= 2 cycles, $K_0 = 1.3$

Wire Size	Amps Asymmetric	Amps Symmetric (A_{sym}/K_0)
#12	2000	1539
#10	2000	1539
#8	4800	3692
#4	12000	9231
#1	24000	18462
1/0	30000	23077
2/0	40000	30769
3/0	49000	37692
4/0	60000	46154
250 MCM	70000	53846
350 MCM	100000	76923
400 MCM	110000	84615
500 MCM	120000	92307

During the analysis of the existing electrical distribution system in Technical Assignment 2, the total building demand load was calculated to be close to the maximum allowable. To allow for expansion of the electrical system, the original distribution system included an extra conduit through the basement wall near the existing incoming feeders. In this design, new feeder would have to be run from the utility lines outside into the building through this conduit.

To accommodate the existing loads and more easily allow for the expansion of the electrical system in the future, the incoming feeders will be resized based on the demand

loads calculated in Technical Assignment 2 (the lighting loads from the new designs will be included as well).

The original lighting load was calculated to be 155,085 VA. The original load in the spaces examined for this thesis was 7,459 VA. The new load for these spaces totaled 9,115 VA. This brings the total building lighting load to 156,741 VA. Applying the continuous load multiplier of 1.25 to this lighting load brings the total building lighting demand load to 195,926 VA. The total building mechanical system and receptacle load was calculated to be 1,352,597 VA in Technical Assignment 2. This brings the total building demand load to 1,548,523 VA. From this building feeders can be sized:

$$1,548,523 \text{ VA Demand} / (3 \times 277\text{V}) = 1863 \text{ Amps}$$

Original Feeder Size: 4 sets of (4) 600 MCM wire, 90 degree C rating as stated in the project specifications.

Original Ampacity: 475A each * 4 sets = 1900 Amps

New feeder size: allow for 1.25 percent growth in VA demand.

New demand: $1,548,523 \times 1.25 = 1,935,654 \text{ VA} / (3 \times 277) = 2330 \text{ Amps}$

Use 5 sets of (4) 600 MCM wire, 90 degree C rating in (4) 4 inch conduits

New Ampacity: 475A * 5 sets = 2375 Amps

The increase in feeder size now will eliminate the need to connect to the utility and run a new feeder later, when system expansion becomes an issue.

Breadth Design

The topics for breadth design originally proposed both involved the addition of new skylights in the atrium. After some preliminary analyses, those skylights were deemed to be unnecessary additions. Consequently the original breadth topics were no longer applicable. Two new topics were chosen however, and both relate directly to the newly designed spaces in the depth section.

The first was an acoustic analysis for reverberation times in the videoconference room. The goal was to improve the performance of the space as a conference room by improving the reverberation time, which increases the level of speech intelligibility.

The second directly involved the new suspended fixtures in the atrium of the building. Mounting the fixtures on the ceiling would have placed them too high in the space for easy relamping, while increasing the suspension length was limited by how far the ballast could be from the lamp. The solution was to add a low-profile beam across the center of the space and mount the luminaires from there, allowing for easy relamping and eliminating the suspension length problems.

Video Conference Reverberation Times

Reverberation times are important in any space where speech intelligibility is critical. The videoconference room is such a space. Having a reverberation time that is too high can cause echoing and decrease intelligibility. Similarly, having a reverberation time that is too low can cause a space to seem dead. A good reverberation time for conference rooms is 0.7-1.2 seconds at all frequencies. The analysis of the space is as follows:

Surface Areas: Floor-760 sq. ft.

Wood paneling- 475.5 sq. ft. total

Painted Walls- 445 sq. ft.

Ceiling- 760 sq. ft.

Windows- 143 sq. ft.

Space Volume: $V = 760 \times 9.5 = 7225$ sq. ft.

$$T_{60} = 0.161 (V / (\Sigma S\alpha))$$

Absorption Coefficients

Surface	Material	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Floor	Carpet on Concrete	0.02	0.06	0.14	0.37	0.60	0.65
Wood	1" Paneling	0.19	0.14	0.09	0.06	0.06	0.05
Ceiling	Acoustic Board	0.76	0.93	0.83	0.99	0.99	0.94
Wall	Gypsum	0.55	0.14	0.08	0.04	0.12	0.11
Glass	Glass	0.35	0.25	0.18	0.12	0.07	0.04

T₆₀ Calculation

Frequency	Swall α_w	Scac	Swall α_w	Sf α_f	Sg α_g	$\Sigma S\alpha$	T ₆₀
125 Hz	90.35	577.9	244.75	15.21	15.21	978.71	1.18
250 Hz	66.57	707.27	62.3	45.63	35.75	911.52	1.27
500 Hz	42.79	631.22	35.6	106.47	25.74	841.82	1.38
1000 Hz	28.53	752.89	17.8	281.39	17.16	1097.77	1.05
2000 Hz	28.53	752.89	53.4	456.3	10.01	1301.13	0.89
4000 Hz	23.78	714.87	48.95	494.33	5.72	1287.85	0.903

All the reverberation times are relatively close to the target range. Reverberation time could be slightly decreased by adding panels of fibrous material behind a perforated facing:

Surface	Material	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Absorption	Fibrous Panel with Facing	0.60	0.75	0.82	0.80	0.60	0.38

Try two 5' x 10' panels on the side walls (100 sq. ft. of fibrous panel, 345 sq. ft. painted wall area after adding paneling).

Frequency	Swall α_w	Spanels α_p	$\Sigma S\alpha$	T ₆₀
125 Hz	189.75	60	983.7	1.18
250 Hz	48.3	75	978.5	1.18
500 Hz	27.6	82	905.8	1.28
1000 Hz	13.8	80	1173.7	0.99
2000 Hz	41.4	60	1349.1	0.86
4000 Hz	37.95	38	1314.7	0.88

The reverberation time still needs to be lowered at 500 Hz. Try two 6' x 10' panels on the left wall and one 6' x 12' panel on the right wall (192 sq. ft. of fibrous panel, 253 sq. ft. of wall).

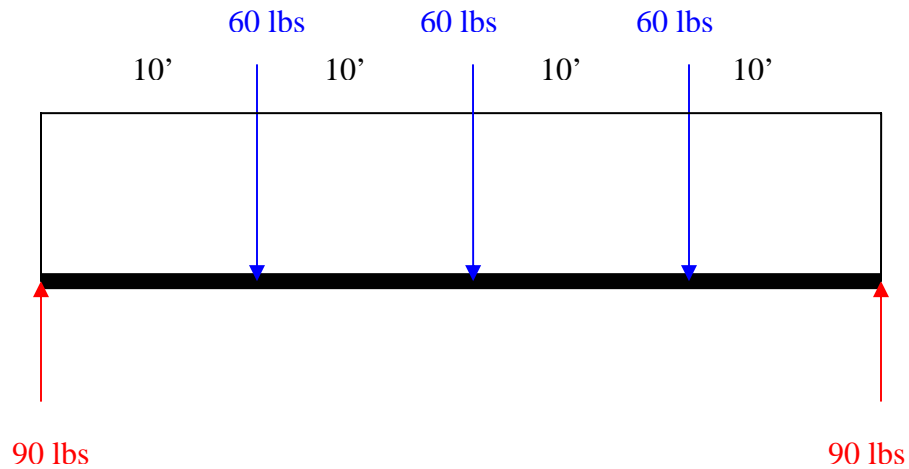
Frequency	Swall α_w	Spanels α_p	$\Sigma S\alpha$	T ₆₀
125 Hz	139.35	115.2	988.3	1.17
250 Hz	35.42	144	1034.6	1.12
500 Hz	20.24	157.44	973.9	1.19
1000 Hz	10.12	153.6	1243.7	0.94
2000 Hz	30.36	115.2	1393.3	0.83
4000 Hz	27.83	72.96	1339.5	0.87

By dropping the reverberation times to within the 0.7-1.2 second range at all frequencies, the speech intelligibility of the space will be increased, if only slightly. Understandable speech is critical for all of the room's functions, especially videoconferencing, where microphones will be used to pick up sound.

Atrium Beam Design

An analysis of the new beam in the atrium was performed to ensure proper sizing. While the loading on the beam is relatively small, other factors, such as construction loading and unbraced length, may force the beam size up.

Reaction due to Suspended Luminaires



From this loading the maximum moment of 1200 ft-lbs was calculated

$$M_u = 1200 \times 1.2 = 1440 \text{ ft-lbs}$$

This loading is very small, and nearly any beam size picked could support this.

Check Deflection:

Dead load- Steel self weight, assume 50 plf

Wood paneling, 10 plf

$W_u = (50 + 10) 1.2 = 72$ plf factored dead load

Assume a factored light and construction loading of 60 plf over the length of the beam (this is unlikely, but conservative given long beam length).

Total load= 132 plf

Total load deflection is $(1/240)L$ where L is the beam length. Live load deflection is $(1/360)L$ and provides the more conservative measure which will be used.

Solving deflection equation for I :

$I = (5 * (132 \text{plf}/12)(480^4)) / (384 * (29 \times 10^6)(1.33)$ where $1.33 = 480''/360$

$I = 197 \text{ in}^4$

From the AISC Manual, pg 5-41

W14x22 has the I value needed

Looking at the beam design moments on page 5-101, a W14x22 beam will not perform adequately at the unbraced length of 40', even though it can easily support the 1.44 ft-kip moment. By examining the charts, a W18x86 beam was selected through extrapolation. The design moment is approximately 290 ft-kip at the unbraced length of 40', which is more than enough to carry the loading.

This new beam will directly connect into existing columns E2 (W14x90) and F6 (W14x283).

E2- effective length=32', axial compression strength= 512k

F6- effective length=28', axial compression strength= 2200k

Given the total factored beam load is $(132 + 86 - 50) = 168$ plf (50 subtracted since assumed initially)

$168 \text{ plf} * 40' = 6720$ lbs, which due to symmetric loading means each column supports an additional 3.36k, a negligible increase given their large capacities.

Conclusions

The goals set forth for this thesis have been met. The new lighting designs provided adequate illumination to meet requirements in all spaces. Other design criteria relating to performance have been addressed and implemented in the solution. The result is an effective lighting design that fulfills the needs of the spaces.

Electrical checks ensuring that the distribution system can supply the necessary power were performed. Systems were correctly sized given load requirements and voltage drop. All new lighting systems have been shown to meet power density requirements (with some tradeoff in other spaces). The initial increase in feeder size will save time and money in the future when system growth is addressed.

Acoustically, the reverberation time was improved slightly to help increase speech intelligibility, a major concern in conference spaces.

Finally, the new structural member added has been shown adequate to carry the load and perform well with regards to deflection and unbraced length.

Acknowledgments

-I would like to thank all those who have supported me throughout the process of completing this thesis, both friends and family.

-Special thank you to Richard Riccardo for providing all the drawings and specifications as well as arranging a tour of the building.

-Dr. Richard Mistrick my thesis advisor, for all the lighting and electrical help.

-Dr. Kevin Parfitt, for assisting on my structural work.

Thanks!

Appendix

Resources

Rea, Mark S., ed. *The IESNA Lighting Handbook: Reference & Application*. New York: Illuminating Engineering Society of North America, 2000.

Hughes, S. David. *Electrical Systems in Buildings*. Albany: Delmar Publishers Inc., 1988.

2002 National Electric Code. National Fire Protection Association, 2002.

ASHRAE Standard 90.1-2004. N.p.: ASHRAE, 2004.

Beldecos, Andrew. *Lighting for Videoconferencing Today*. As presented at Lightfair International 2004 Seminar #22.

Egan, M. David. *Architectural Acoustics*. New York, NY: McGraw-Hill, Inc.

DESCRIPTION

The Paralux II Series features recessed aesthetics and the latest in energy efficient technology. The luminaire incorporates a 2" precision cell louver into a nominal 4-1/2" deep para-contoured fixture housing. This combination creates a total low profile parabolic optical assembly for optimum performance. The series is compatible with all of today's popular ceiling systems and is available with a number of options and accessories for application versatility.

APPLICATION

The low profile luminaire is designed to offer the market-place a parabolic choice when economics and shallow plenum space are factors. The Paralux II series is an excellent choice for commercial office spaces, schools, hospitals or retail merchandising areas.

SPECIFICATION FEATURES

A... Construction

Nominal 4-1/2" deep, para-contoured housing, die formed code gauge, prime cold rolled steel. Full length die formed stiffeners for added strength. Contoured ballast/wireway cover, easily removed without tools. Die formed captive lampholder bracket fully encloses lampholder wiring permitting easy lampholder replacement. Heavy end plates, securely attached with interlocking tabs and screws. Four auxiliary fixture end suspension points provided. KOs for continuous row wiring. End plates have integral Grid-Lock feature for safety and convenience. Housing features enable fixture to be converted from Grid to T-option or vice versa in the field.*

B... Electrical**

Ballasts are CBM/ETL Class "P" and are positively secured by mounting bolts. Pressure lock lampholders. UL/CUL listed. Suitable for damp locations.

C... Finish

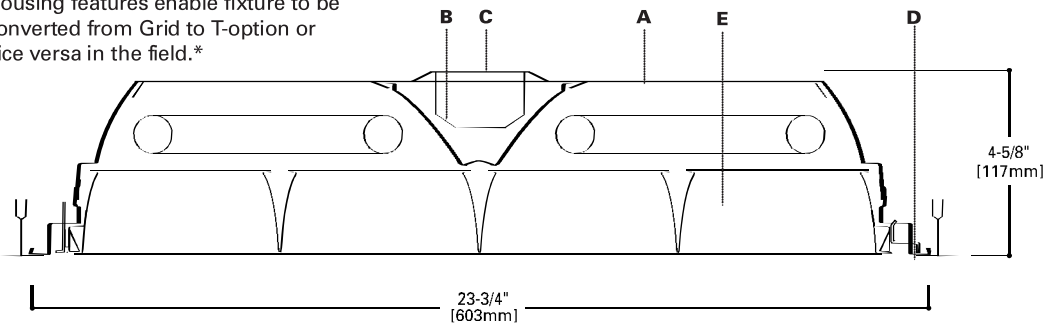
Lighting grade, baked white enamel finish. Multistage, iron phosphate pretreatment ensures maximum bonding and rust inhibition.

D... Hinging/Latching

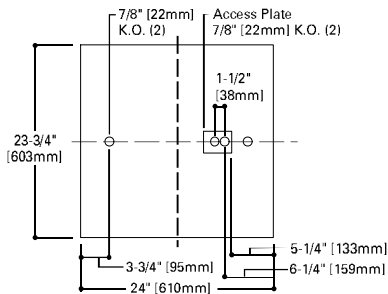
Positive cam action spring loaded, self locking, black steel latches. Safety lock T-hinges allow hinging and latching either side.

E... Louver

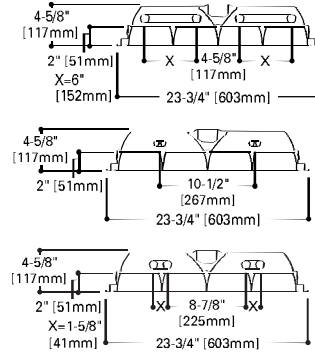
Die formed of semi-specular aluminum. Finish is anodic oxide coating. Accurate precision parabolic cells are held in place by interlocking feature. True-cut mitered corners. Black reveal with mechanical light seal around entire perimeter of louver. Louver protected by polyethylene cover.



MOUNTING DATA



LAMP CONFIGURATIONS



CEILING COMPATIBILITY

G
Grid/Lay-in
Standard

T
Concealed T

T
Slot Grid

F
Flange Trim
With Supporting
Swing Gates

MZ
Modular Trim
With Supporting
Swing Gates

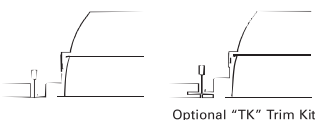
**Ceiling
Type**

Exposed Grid
Concealed T
Slot Grid
Flange
Concealed Spine
Metal Pan

**Trim
Type**

G
G or T
G or T
F
MZ
MZ

(Verify compatibility/ consult Pre Sales Technical Support.)



COOPER LIGHTING

Catalog #	Type
Project	
Comments	
Prepared by	Date



2P2GAX2U6
2U6T8
2U1-5/8
2BX40

16 Cell

**2' X 2' PARABOLIC
2 LAMP
SEMI-SPECULAR LOUVER**

Paralux II
Recessed Air Supply
Troffer

ENERGY DATA

Input Watts:
EB Ballast & STD Lamps
2U6 (72)
2U6T8 (61)
2U1-5/8 (61)
2BX40 (67)

ES Ballast & STD Lamps

2U6 (86)
2U6T8 (71)
2U1-5/8 (71)

STD Ballast & STD Lamps

2BX40 (82)

Luminaire Efficacy Rating

LER = FP-54

Catalog Number: 2P2GAX-2U6T8

**Yearly Cost of 1000 lumens,
3000 hrs at .08 KWH = \$4.43**

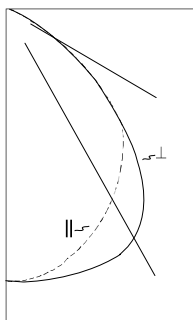
*Convertibility applies to housing only. Appropriate shielding media assemblies must be utilized.

**Reference the lamp/ballast data in the Technical Section for specific lamp/ballast requirements.

ADF020586
(Supersedes ADF991715)



PHOTOMETRICS



2P2GAX-2U6T8S44I
Electronic Ballast
FB31T8/TL735/6
Lamps
2600 Lumens

Spacing criterion:
(II) 1.2 x mounting height, (L) 1.4 x mounting height

Efficiency 67.8%

Test Report:
2P2GX2U6T8S44I.IES
LER = FP-54

Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = \$4.43

Coefficients of Utilization

rc	Effective floor cavity reflectance																																																																																																																																																																																																																
	80%						70%						50%						30%						10%						0%																																																																																																																																																																																		
	rw	70	50	30	10	0	70	50	30	10	0	50	30	10	0	50	30	10	0	50	30	10	0	50	30	10	0																																																																																																																																																																																						
RCR	0	81	81	81	81	79	79	79	79	75	75	75	72	72	72	69	69	69	68	1	76	73	71	69	74	72	70	68	69	68	66	67	65	64	64	63	62	61	2	71	67	63	60	69	65	62	59	63	60	58	61	59	57	59	57	56	54	3	66	60	56	52	64	59	55	52	57	54	51	56	53	50	54	52	50	48	4	61	54	50	46	60	54	49	46	52	48	45	51	47	45	49	46	44	43	5	56	49	44	40	55	48	43	40	47	43	39	46	42	39	45	41	39	37	6	52	44	39	35	51	44	39	35	43	38	35	41	38	35	41	37	34	33	7	48	40	35	31	47	40	35	31	39	34	31	38	34	30	37	33	30	29	8	45	36	31	27	44	36	31	27	35	30	27	34	30	27	33	29	27	25	9	41	33	27	24	40	32	27	24	31	27	23	31	26	23	30	26	23	22	10	38	30	24	21	37	29	24	21	28	24	21	28	24	21	27	23	21	19

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1293	24.4	36.0
0-40	2120	40.0	58.9
0-60	3367	63.5	93.7
0-90	3595	67.8	100.0
0-180	3595	67.8	100.0

Typical VCP Percentages

Room Size (Ft.)	Height Along		Height Across	
	8.5'	10.0'	8.5'	10.0'
20 x 20	74	69	80	75
30 x 30	81	76	86	80
30 x 60	84	79	88	84
60 x 30	84	79	88	85
60 x 60	86	82	89	87

Candela

Angle	Along II	45°	Across L
0	1566	1566	1566
5	1554	1571	1576
10	1528	2569	1602
15	1484	1564	1641
20	1427	1556	1670
25	1362	1529	1672
30	1285	1480	1597
35	1197	1391	1377
40	092	1235	1095
45	973	1005	846
50	835	756	700
55	658	530	547
60	448	347	312
65	241	182	166
70	80	66	41
75	32	20	20
80	16	10	9
85	6	3	3
90	0	0	0

ORDERING INFORMATION

SAMPLE NUMBER: 2P2GAX-2U6S44I-120V-EB81-U

<p>HR=Heat Removal (1)</p> <p>HRDO=Heat Removal Damper Open</p> <p>HRDC=Heat Removal Damper Closed</p> <p>Width 2=2' Width</p> <p>P=Paralux Louver</p> <p>2=2' Louver Depth</p> <p>Trim Type G=Grid/Lay-in (Standard) G or T=Concealed T G or T=Slot Grid(2) F=Flange Trim MZ=Modular Trim</p> <p>Convertible Fixture Standard G (Grid) Type-Fixtures can be field converted to T-option or vice-versa.(3) Fixture also adaptable with flanged or modular trims.</p> <p>AX=Air Supply Floating Louver X=Blank Side/Floating Louver - Non-Air Supply (Omit A) AVX=Air Supply Floating Louver with Directional Air Vane (Add V)</p>	<p>Number of Lamps (4) 2 lamps (Not included)</p> <p>Wattage (Length) U6=40W T12 (24") U6T8=31W T8 (24") U15/8=31W T8 (24") BX40=40W Biax (24")</p> <p>Louder Color S=Silver G=Gold W=White</p> <p>Cell Configuration 44=4 Rows of 4, 16 Cell</p> <p>Louder Finish H=Semi-Specular/Haze (Gold only) I=Semi-Specular/Haze (Low Iridescent) Standard (Silver Only) M=Specular/Mirrored (Low Iridescent) (Silver Only) P=Painted (White only)</p>	<p>Voltage (5) 120V=120 Volt 277V=277 Volt 347V=347 Volt UNV=Universal Voltage 120-277(6)</p> <p>Options GL=Single Element Fuse GM=Double Element Fuse WTR=White Reveal Lamps=Lamps Installed Flex=Flex Installed Emergency=EM Installed</p>	<p>Ballast Type (5) Blank=Standard Magnetic Ballast (Biax & 20W) LE3=T12 Magnetic Energy Saving LEOC8=T8 Magnetic Energy Saving EB8 =T8 Electronic Instant Start. Total Harmonic Distortion < 20%</p> <p>No. of Ballast 1, 2 or 3</p> <p>EB8 /PLUS= T8 Electronic Instant Start. High Ballast Factor >1.13. Total Harmonic Distortion < 20%</p> <p>No. of Ballast 1, 2 or 3</p> <p>ER8 =T8 Electronic Program Rapid Start. Total Harmonic Distortion < 10%</p> <p>No. of Ballast 1, 2 or 3</p> <p>TEB8 =T8 Electronic Instant Start. Total Harmonic Distortion < 10%</p> <p>No. of Ballast 1, 2 or 3</p> <p>EB5 =T5 Biax Electronic Instant Start. Total Harmonic Distortion < 20%</p> <p>No. of Ballast 1, 2 or 3</p> <p>TEB5 =T5 Biax Electronic Instant Start. Total Harmonic Distortion < 10%</p> <p>No. of Ballast 1, 2 or 3</p> <p>EB2 =T12 Electronic Rapid Start. No. of Ballast 1 or 2</p> <p>DLS=Digital Lighting System Dimming</p>	<p>Options PAF=Painted After Fabrication RIF1=Radio Interference Suppressor FR=Suitable for Fire Rated Applications EQ=T-BAR Safety Earthquake Clips(2) MEP=Modified End Plate/ For End Filter Applications (See Accessory Section) 20GA/REP=20 Gauge Riveted Endplates. For use in New York City. RLS=Rotor-Lock Socket (T8 Lamps Only) (Additional options available. See Accessory Section)</p>	<p>Packaging U=Unit Pack PAL=Job Pack, out of carton PALC=Job Pack, in carton</p>
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------

NOTES: (1) Integral end plate grid lock feature not available in heat removal. (2) An EQ Grid Clip is recommended for all 9/16" ceiling systems. (3) Convertibility applies to housing only, appropriate shielding media assemblies must be utilized. (4) Standard off-center ballast on 3-lamp fixtures. (5) Products also available in non-US voltages and frequencies for international markets. (6) Not available when specifying emergencies, voltage must be specific.

For complete product data, reference the Fluorescent Specification binder. Specifications & dimensions subject to change without notice. Consult your Cooper Lighting Representative for availability and ordering information.

SHIPPING INFORMATION

Catalog No.	Wt.
2P2GAX-2U6S44H	28 lbs.
2P2GAX-2U6T8S44H	28 lbs.
2P2GAX-2U1-5/8S44H	28 lbs.
2P2GAX-2BX40S44H	28 lbs.





FB32T8/6 TL841 22.44 1LP

Product family description

Offer impressive lighting economics for modernizing, expanding facilities or new construction.

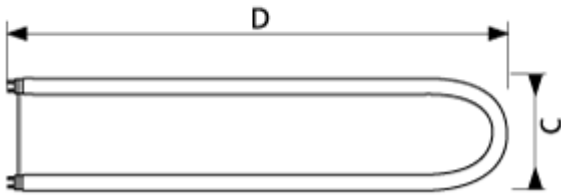
Notes

- Rated average life under specified test conditions with lamps turned off and restarted no more frequently than once every 3 operating hours. Lamp life is appreciably longer if lamps are started less frequently. (202)
- Approximate Initial Lumens. The lamp lumen output is based upon lamp performance after 100 hours of operating life, when the output is measured during operation on a reference ballast under standard laboratory conditions. (203)
- For expected lamp lumen output, commercial ballast manufacturers can advise the appropriate Ballast Factor for each of their ballasts when they are informed of the designated lamp. The Ballast Factor is a multiplier applied to the designated lamp lumen output. (204)
- Design Lumens are the approximate lamp lumen output at 40% of the lamp's Rated Average Life. This output is based upon measurements obtained during lamp operation on a reference ballast under standard laboratory conditions. (208)
- Nominal length measured from face of base to maximum distant outside point of U. Measurement does not include base pins. Leg spacing center to center approximately 6 inches, for /6 and 3 5/8 inches for /3 lamps.

Product data	
Product Number	340885
Full product name	FB32T8/6 TL841 22.44 1LP
Ordering Code	FB32T8/TL841
Pack type	1 Lamp Packed in Case Qty
Pieces per pack	1
Packs per case	20
Pack UPC	046677340889
EAN2US	
Case Bar Code	50046677340884
Successor Product number	
Name Type	FB32T8/6
Color Code	TL841 [CCT of 4100K]
Nominal Length [inch]	22.44
Feature	ALTO [ALTO®]
Packing Type	1LP [1 Lamp Packed in Case Qty]
Packing Configuration	20
Base	Medium Bi- Pin[Medium Bi- Pin]
Base Information	Green Base

Product data	
Bulb	T8- 6U[U- bent T 8/8 inch with 6" spacing]
Rated Avg. Life [3 hr Start][hr]	20000
Energy Saving Product	Energy Saving
Wattage[W]	32
Color Rendering Index[Ra8]	85
Color Temperature[K]	4100
Initial Lumens[Lm]	2800
Design Mean Lumens[Lm]	2535

Data not (yet) available



F- T8- URS Med Bipin



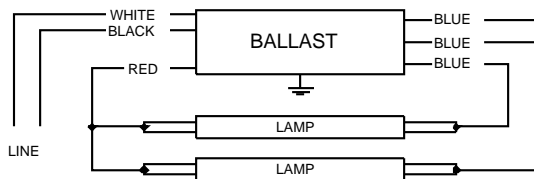


Electrical Specifications

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

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F32T8/U6	1	32	0/-18	0.13	32	0.93	15	0.94	1.7	2.91
* F32T8/U6	2	32	0/-18	0.20	54	0.85	10	0.98	1.7	1.57
F32T8/U6	3	32	0/-18	0.27	73	0.78	10	0.99	1.7	1.07

Wiring Diagram



Diag. 70

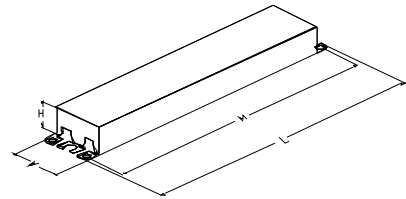
Insulate unused blue lead for 1000V

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

Standard Lead Length (inches)

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

Enclosure



Enclosure Dimensions

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

Revised 03/22/2004



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



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

Electrical Specifications

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 provide Independent Lamp Operation (ILO) for Instant Start ballasts allowing remaining lamp(s) to maintain full light output when one or more lamps fail.
- 2.3 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.
- 2.4 Ballast shall operate from 60 Hz input source of 120V, 277V or 347V as applicable with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.
- 2.5 Ballast shall be high frequency electronic type and operate lamps at a frequency between 42 kHz through 52 kHz to avoid interference with infrared devices and eliminate visible flicker and avoid Article Surveillance System, such as anti-theft devices.
- 2.6 Ballast shall have a Power Factor greater than 0.98 for primary lamp.
- 2.7 Ballast shall have a minimum ballast factor for primary lamp application as follows: 0.78 for Low Watt, 0.88 for Normal Light Output, and 1.18 for High Light.
- 2.8 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.
- 2.9 Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when operated at nominal line voltage with primary lamp.
- 2.10 Ballast shall have a Class A sound rating for all 4-foot lamps and smaller.
- 2.11 Ballast shall have a minimum starting temperature of 0F (-18C) and 60F (16C) for energy-saving T8 lamps.
- 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).
- 3.8 Ballast shall meet NEMA/CEE High Performance T8 Lighting System Specifications.

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

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

Revised 03/22/2004



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

PH Artichoke

ceramic metal halide

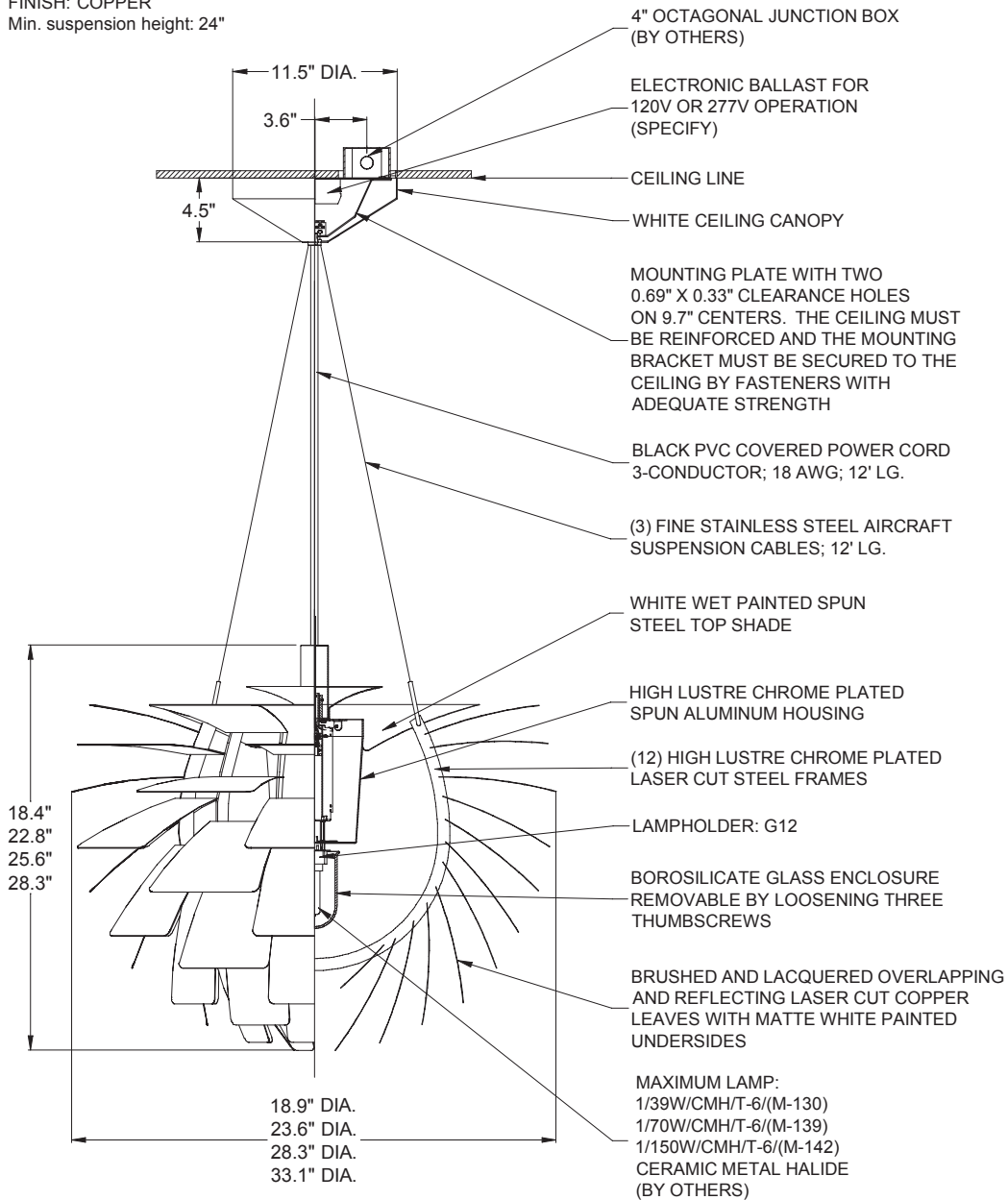
Design: Poul Henningsen

Type:

Project:

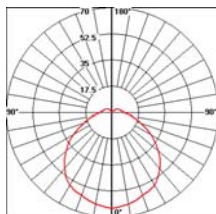
Catalog Number:

FINISH: COPPER
Min. suspension height: 24"



PH Artichoke

ceramic metal halide



Photometric Report: PHA-CMH-150W-G12-COPPER-480.IES
 Report No.: L4802.IES
 Poulsen Report No.: PHA-CMH-150W-G12-COPPER-480.IES
 Luminaire: PH Artichoke COPPER 480
 Lamp: 1/150W/CMH/G12
 Efficiency: 22.4%
 Description: All data shown are per 1000 lumens. Use only actual lumen data when calculating.

Candlepower Distribution

Vertical Angle	Candela
0	64
5	63
10	62
25	58
40	49
55	35
70	20
85	10
90	8
120	4
150	0
180	0

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0-30	50	5.0	22.2
0-40	83	8.3	37.0
0-60	149	14.9	66.3
0-90	202	20.2	90.0
90-120	18	1.8	8.0
90-130	21	2.1	9.2
90-150	22	2.2	9.9
90-180	22	2.2	10.0
0-180	224	22.4	100.0

Coefficients of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance 20%

Ceiling Reflectance (%)	80				70				50				30				10				0
	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
Room Cavity Ratio																					
0	26	26	26	26	25	25	25	25	24	24	24	22	22	22	21	21	21	20	20	20	20
1	24	22	21	20	23	22	21	20	20	19	19	19	18	18	18	17	17	16	16	16	16
2	21	19	18	16	20	19	17	16	18	16	15	16	15	15	15	15	14	13	13	13	13
3	19	17	15	13	19	16	15	13	15	14	13	14	13	12	14	13	12	11	11	11	11
4	18	15	13	11	17	14	13	11	14	12	11	16	11	10	12	11	10	9	9	9	9
5	16	13	11	10	16	13	11	10	12	11	9	11	10	9	11	10	9	8	8	8	8
6	15	12	10	8	14	12	10	8	11	9	8	10	9	8	10	9	8	7	7	7	7
7	14	11	9	7	13	11	9	7	10	8	7	9	8	7	9	8	7	6	6	6	6
8	13	10	8	7	12	10	8	6	9	7	6	9	7	6	8	7	6	6	6	6	6
9	12	9	7	6	12	9	7	6	8	7	6	8	7	6	8	6	5	5	5	5	5
10	11	8	7	5	11	8	6	5	8	6	5	7	6	5	7	6	5	4	4	4	4

PH Artichoke (1958) is a 360-degree glare free luminaire created by 72 leaves, which shield the light source, redirect and reflect the light onto the underlying leaves, giving distinct, unique illumination.

Finish

Copper, brushed and lacquered.
 Stainless steel, brushed and lacquered. White, wet painted.

Material

Leaves: Die cut copper, laser cut stainless steel or steel. Top shade: White, spun steel. Frame: High lustre chrome plated, laser cut steel.
 Housing: High lustre chrome plated, spun aluminum.

Mounting

Suspension type: 3 stainless steel aircraft cables. Suspension length: 12'. Canopy: White. Cord type: 3-conductor, 18 AWG PVC power cord. Cord color: Copper version: Black cord. Stainless steel and white version: White cord. Cord length: 12'.

Weight

Max. 55 lbs.

Label

cUL, Dry location. IBEW.

specification

Ordering example:

1	2	3	4	5
Prod.code	Dimension	Light source	Volt.	Finish
PHA	28.3"	1/70W/CMH/T-6 G12	120V	COP

1 | Product code
PHA

2 | Dimension
18.9"^a
23.6"
28.3"
33.1"

3 | Light source
1/39W/CMH/T-6 G12^b
1/70W/CMH/T-6 G12^b
1/150W/CMH/T-6 G12^b
1/250W/MH/ED-28-0 mogul^{c,d}
1/400W/MH/ED-37 mogul^{c,e}
1/200W/A-23/CL medium^f
1/500W/PS-35/CL mogul^f

4 | Voltage
120/277V
120V
277V

5 | Finish
COP
BR. ST. STEEL
WHT

Specification notes:
 a. 18.9" variant is available in 1/200W incandescent and CMH G12 light sources.
 b. CMH variant is provided with one electronic 120 or 277V ballast in the canopy.
 c. MH variants are provided with one 120/277V F-can style ballast for remote mounting.
 d. MH variants require an open rated lamp (by others).
 e. 1/400W/ED-37/MH mogul is not available in 23.6" or 18.9" dia. variants.
 f. Incandescent variants are only available in 120V.

Info notes:
 l. The comparable EU version has the following classification: Ingress Protection Code: IP20.



MasterColor CDM- T 150W/830 G12 T6 1CT

Product family description
Range of single-ended T6 high-efficiency ceramic metal halide lamps with a stable color over lifetime and a crisp, sparkling light.

Features / Benefits

- Excellent color rendering.
- Superior color stability over life within +/- 200K.
- Lamp to lamp color consistency over life.
- Higher lumen maintenance than standard metal halide.
- Warm (3K) or fresh white (4K) color impression.
- High lamp efficacy (up to 93 lumens per watt) for energy saving and low heat.
- Universal operating position.
- Compact lamp dimensions for high beam intensities.
- FadeBlock for reduced fading risks.
- No shut off required in 24-hour-a-day/7-day-a-week operations (relamp fixtures at or before the end of rated life).
- Long lamp life compared to incandescent and halogen lamps.

Applications

- Accent and General lighting in retail, offices and public buildings. Decorative outdoor: floodlighting and pedestrian areas.

Notes

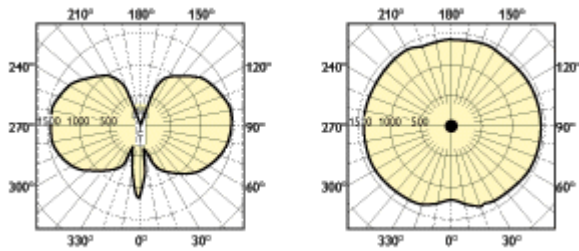
- Requires a ballast specified or approved for Philips Metal Halide lamp or one designed to the indicated ANSI Standard. A pulse ignitor is required.

- Sockets and wiring must withstand starting pulse. (391)
- Supply volts must be +/- 5% of rated ballast line volts for reactor type and +/- 10% for CWA or electronic ballasts. (392)
- UV filtered design (FadeBlock™). (396)
- Operate only on thermally protected ballasts (397)
- MasterColor® Metal Halide Lamps are not recommended for use on dimmers and are not warranted if used on dimmer systems. (401)
- Rated average life is the life obtained, on the average, from large representative groups of lamps in laboratory tests under controlled conditions at 10 or more operating hours per start. It is based on survival of at least 50% of the lamps and allows for individual lamps or groups of lamps to vary considerably from the average. For lamps with a rated average life of 24,000 hours, life is based on survival of 67% of the lamps. (351)
- Approximate lumen values listed are for vertical operation of the lamp. (352)
- Means Lumens is the approximate lumen output at 40% of lamp rated average life. (353)
- Heat resisting glass bulb.

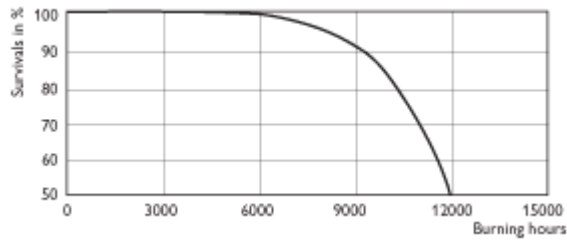
Product data

Product Number	232728
Full product name	MasterColor CDM- T 150W/830 G12 T6 1CT
Ordering Code	CDM150/T6/830
Pack type	1 Lamp in a Folding Carton
Pieces per pack	1
Packs per case	12
Pack UPC	046677232726

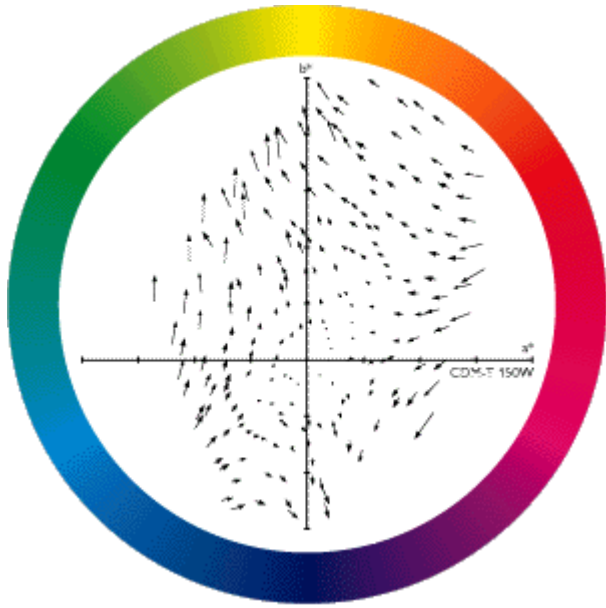
Product data	
EAN2US	
Case Bar Code	50046677232721
Successor Product number	
Wattage[W]	150W
Color Code	830 [CCT of 3000K]
Base	G12
Bulb	T6 [Diameter: .75 inch]
Packing Type	1CT [1 Lamp in a Folding Carton]
Packing Configuration	12
Bulb Finish	Clear
Operating Position	Universal[Any or Universal (U)]
Rated Avg. Life[hr]	12000
ANSI Code HID	M142/E
System Power EL[W]	167
Lamp Voltage[V]	96
Dimmable	No
Mercury (Hg) Content[mg]	
Color Rendering Index[Ra8]	85
Color Designation	Warm White
Color Description	830 Warm White
Color Temperature[K]	3000
Initial Lumens[Lm]	14000
Design Mean Lumens[Lm]	9800
Overall Length C[mm]	110
Diameter D[mm]	20
Light Center Length L[in]	2.21875
Max Overall Length (MOL) - C[in]	4.34375
Diameter D[in]	0.75



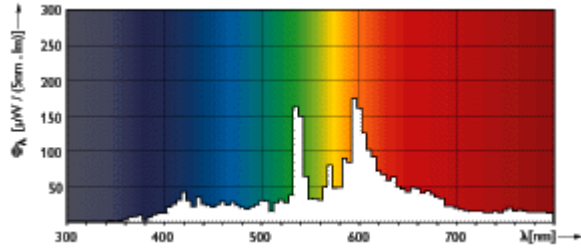
CDM- T 150W



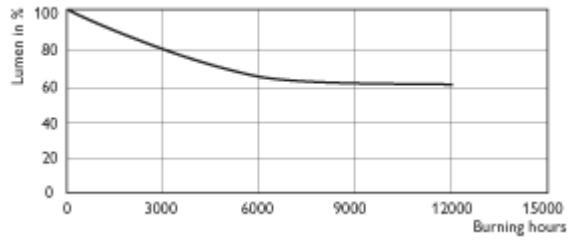
CDM- T 70W/150W/830/942



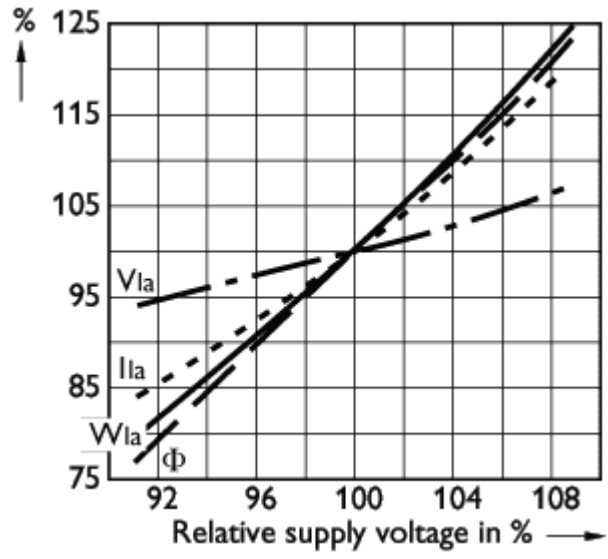
CDM- T 150W/830



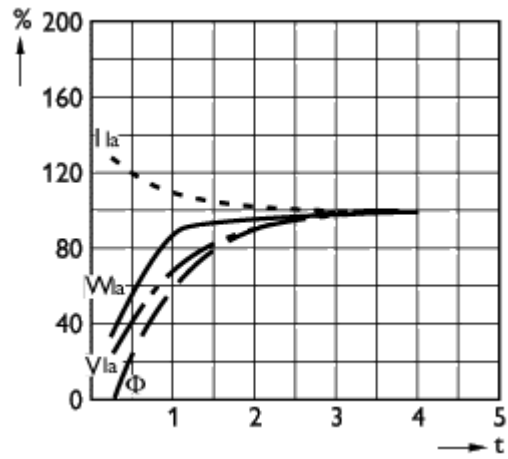
CDM- T/830



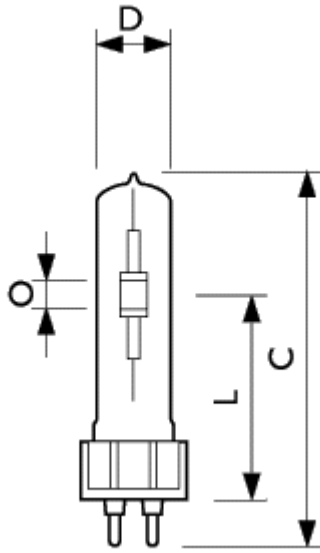
CDM- T 70W/150W/830/942



CDM-T/830



CDM-T



CDM-T

	C		D		L		O	
Full product name	Max	Max	Min	Nom	Max	Min	Max	Min
MasterColor CDM-T 150W /830 G12 T6 1CT	110	20	55	56	57	8.67		
							O	
	Nom			Max				
	9			9.33				



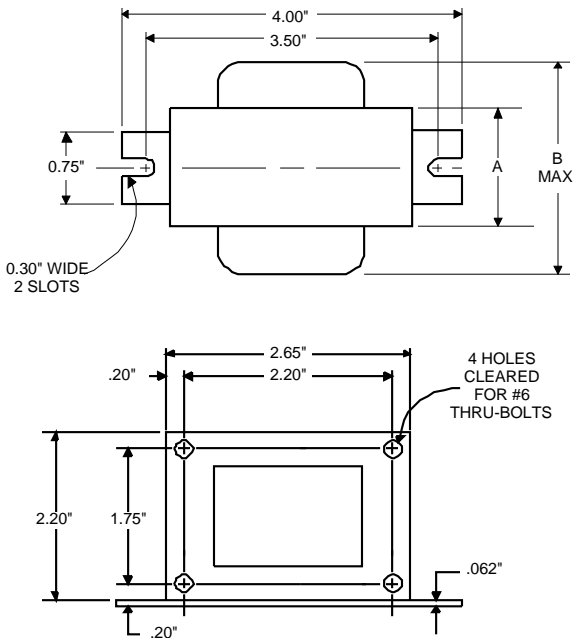


**Metal
Halide
Lamp Ballast**

**Catalog Number 71A5437BP
For 150W M102
60 Hz R-HPF
Status: Active**

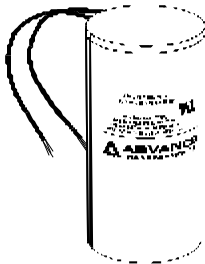
DIMENSIONS AND DATA

2 5/8 X 2 3/16 CORE



INPUT VOLTS	277			
CIRCUIT TYPE	R-HPF			
POWER FACTOR (min)	90%			
REGULATION				
Line Volts	±5%			
Lamp Watts	±10%			
LINE CURRENT (Amps)				
Operating.....	0.63			
Open Circuit.....	1.50			
Starting.....	0.70			
UL TEMPERATURE RATINGS				
Insulation Class	H(180°C)			
Coil Temperature Code	1029	B		
MIN. AMBIENT STARTING TEMP.	-20°F or -30°C			
NOM. OPEN CIRCUIT VOLTAGE	277			
INPUT VOLTAGE AT LAMP DROPOUT.....	170			
INPUT WATTS	173			
RECOMMENDED FUSE (Amps).....	5			
CORE and COIL				
Dimension (A)	2.50			
Dimension (B)	4.00			
Weight (lbs.)	4.2			
Lead Lengths	12"			
CAPACITOR REQUIREMENT				
Microfarads	14.0			
Volts (min.)	280			
Fault Current Withstand (amps)				
60 Hz TEST PROCEDURES (Refer to Advance Test Procedure for HID Ballasts - Form 1270)				
High Potential Test (Volts)				
1 minute	2000			
2 seconds	2500			
Open Circuit Voltage Test (Volts)	250-305			
Short-Circuit Current Test (Amps)				
Secondary Current	2.00-2.50			
Input Current.....	0.50	-	-	-
	0.75			

Capacitor: 7C140M33-R



Capacitance: 14
Dia/Oval Dim: 1.5
Height: 2.9

Temp Rating: 105°C

Ignitor: INTEGRAL

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

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

Wiring Diagram:

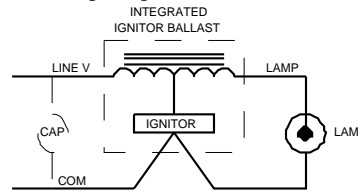


Fig. H

Ordering Information

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

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

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

05/15/03

Small Ceiling Mount



Profile - P1 (basic): Anodized, extruded aluminum specular reflector with solid aluminum endcaps and stainless steel hardware.

Type - Small profile with smooth or ribbed detail.

Indoor; captive, extruded alum. hinge with non-gasketed regressed lens.

Outdoor; captive, extruded alum. door with window cut-out and silicone gasketed regressed lens.

Aperture; patterned tempered glass lens standard.

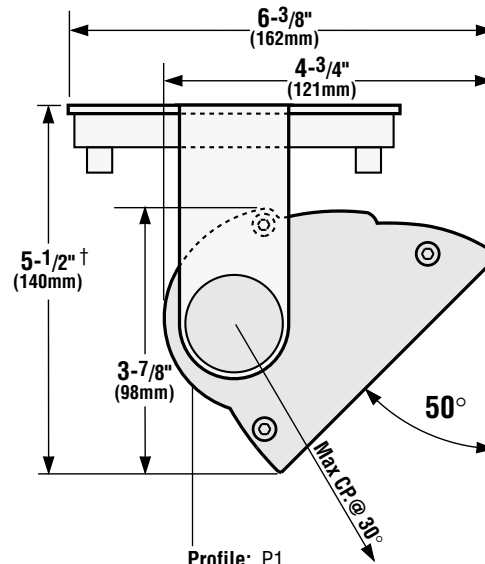
Mounting - Three standard mounts are fully adjustable and lockable. Designed for remote or integral ballast.

Performance - Asymmetric distribution provides a concentration of light on target surface for smooth illumination. Maximum candlepower aimed 30° above nadir has less than 8% spill light within the 0-30° zone and less than 2% spill light within the 90 - 180° zone.

Electrical - HX-HPF ballast for 39W and 70w T6-G12 lamp. CWA ballast for 150w T6-G12 lamp. Ballasts are thermally protected, dual-voltage for 120/277V or 120/347V operation, and offered as remote or integral. Provide 90° C supply wire. See Technical section for ballast data

Finishes - An electrostatically applied wet paint system utilizes a multi-stage process to provide a durable acrylic enamel finish. Suitable for indoor and outdoor applications.

Options - For complete list and detailed descriptions, refer to Options Section.



Profile: P1
Type: SS, SR, SSW, SRW
Mount: SS8
Length: Refer to chart below
Scale: 3/8" = 1"

† Outdoor location fixtures have 1" added to overall height to accommodate wet label wire connector.

HOW TO SPECIFY

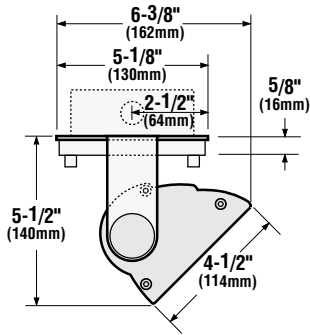
PROFILE	TYPE	LAMPING	VOLTAGE	MOUNTING	FINISH	OPTIONS	CLASS
P1	SS	MH150	277V	SS8	SGW	X	STD
		120V or 277V					
 P1 (basic)	Indoor Locations: (damp label) SS: Small Smooth SR: Small Ribbed Outdoor Locations: (wet label)† SSW: Small Smooth Wet SRW: Small Ribbed Wet	Code Description Length Weight	Remote Ballast SS8: Simple Yoke SD8: Deco Yoke SK8: Knuckle Integral Ballast SS10: Simple Yoke 	SGW: Semi-Gloss White SGB: Semi-Gloss Black ALP: Aluminum Paint (matte finish) LGP: Light Gold Iridescent (gloss finish) PBP: Pale Bronze Paint (gloss finish) CPF: (MOD) Custom Painted Finish	X: No Options SV: (P1 only) Short Visor SB: Straight Blade Baffle (external mount) MP: Micro-Prismatic Lens (max. forward throw) SO: (MOD) Special Option EB: Electronic Ballast	STD: Indicate only when specifying a standard. MOD: Indicate when specifying any modification. <div style="border: 1px solid black; padding: 2px; text-align: center;">PHOTOMETRY</div> MH150 Refer to Technical Section for detailed Photometry Reports. Report #10953	
		Code Description Length Weight	Remote Ballast MH39 39W T6-G12 12" 5 lbs. MH70 70W T6-G12 12" 5 lbs. MH150 150W T6-G12 12" 5 lbs.	Integral Ballast MH39 39W T6-G12 16" 20 lbs. MH70 70W T6-G12 16" 20 lbs. *MH150 150W T6-G12 16" 23 lbs.			

Ballast ANSI codes: M130, M139 & M142. *Consult factory for availability of MH150 integral electronic ballast.

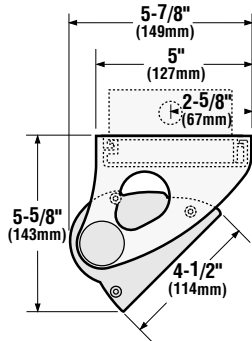
Small Ceiling Mount

MOUNTING STYLES*

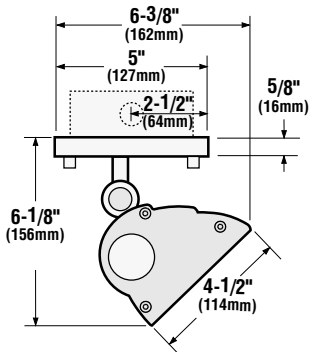
Remote Ballast



P1
(basic)
Smooth
Simple Yoke
SS8

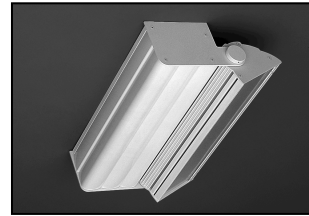
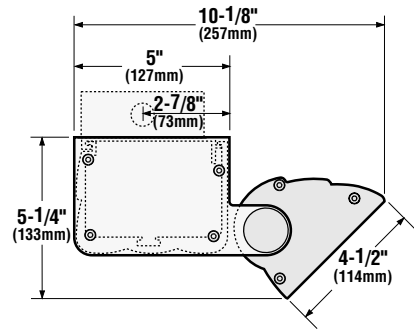


P1
(basic)
Smooth
Deco Yoke
SD8



P1
(basic)
Ribbed
Knuckle Mount
SK8

Integral Ballast



P1
(basic)
Ribbed
Simple Yoke
SS10

* P1 profile can be combined with any mounting style



MasterColor CDM- T 35W/830 G12 T6 1CT

Product family description
Range of single-ended T6 high-efficiency ceramic metal halide lamps with a stable color over lifetime and a crisp, sparkling light.

Features / Benefits

- Excellent color rendering.
- Superior color stability over life within +/- 200K.
- Lamp to lamp color consistency over life.
- Higher lumen maintenance than standard metal halide.
- Warm (3K) or fresh white (4K) color impression.
- High lamp efficacy (up to 93 lumens per watt) for energy saving and low heat.
- Universal operating position.
- Compact lamp dimensions for high beam intensities.
- FadeBlock for reduced fading risks.
- No shut off required in 24-hour-a-day/7-day-a-week operations (relamp fixtures at or before the end of rated life).
- Long lamp life compared to incandescent and halogen lamps.

Applications

- Accent and General lighting in retail, offices and public buildings. Decorative outdoor: floodlighting and pedestrian areas.

Notes

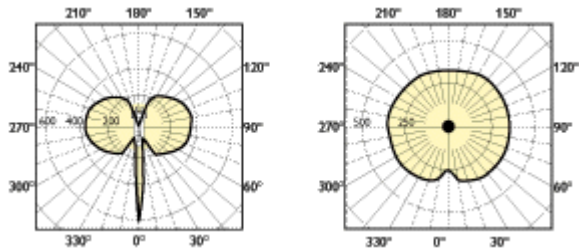
- Requires a ballast specified or approved for Philips Metal Halide lamp or one designed to the indicated ANSI Standard. A pulse ignitor is required.

- Sockets and wiring must withstand starting pulse. (391)
- Supply volts must be +/- 5% of rated ballast line volts for reactor type and +/- 10% for CWA or electronic ballasts. (392)
- UV filtered design (FadeBlock™). (396)
- Operate only on thermally protected ballasts (397)
- MasterColor® Metal Halide Lamps are not recommended for use on dimmers and are not warranted if used on dimmer systems. (401)
- Rated average life is the life obtained, on the average, from large representative groups of lamps in laboratory tests under controlled conditions at 10 or more operating hours per start. It is based on survival of at least 50% of the lamps and allows for individual lamps or groups of lamps to vary considerably from the average. For lamps with a rated average life of 24,000 hours, life is based on survival of 67% of the lamps. (351)
- Approximate lumen values listed are for vertical operation of the lamp. (352)
- Means Lumens is the approximate lumen output at 40% of lamp rated average life. (353)
- Heat resisting glass bulb.

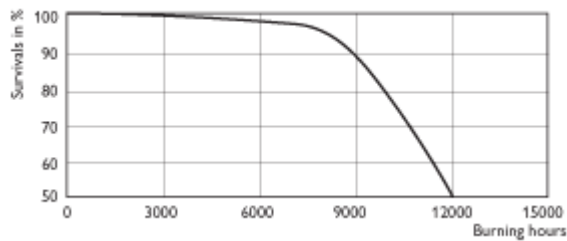
Product data

Product Number	223289
Full product name	MasterColor CDM- T 35W/830 G12 T6 1CT
Ordering Code	CDM35/T6/830
Pack type	1 Lamp in a Folding Carton
Pieces per pack	1
Packs per case	12
Pack UPC	046677223281

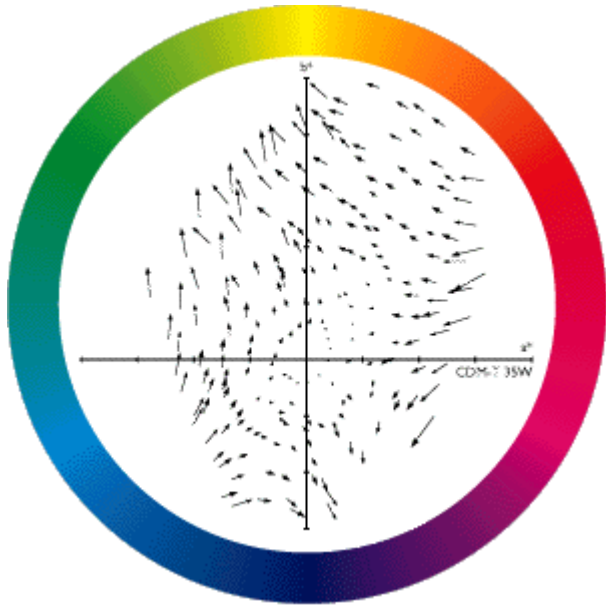
Product data	
EAN2US	
Case Bar Code	50046677223286
Successor Product number	
Wattage[W]	35W
Color Code	830 [CCT of 3000K]
Base	G12
Bulb	T6 [Diameter: .75 inch]
Packing Type	1CT [1 Lamp in a Folding Carton]
Packing Configuration	12
Bulb Finish	Clear
Operating Position	Universal[Any or Universal (U)]
Rated Avg. Life[hr]	12000
ANSI Code HID	M130/E
System Power EL[W]	44
Lamp Voltage[V]	88
Dimmable	No
Mercury (Hg) Content[mg]	
Color Rendering Index[Ra8]	81
Color Designation	Warm White
Color Description	830 Warm White
Color Temperature[K]	3000
Initial Lumens[Lm]	3300
Design Mean Lumens[Lm]	2600
Overall Length C[mm]	103
Diameter D[mm]	20
Light Center Length L[in]	2.21875
Max Overall Length (MOL) - C[in]	3.9375
Diameter D[in]	0.75



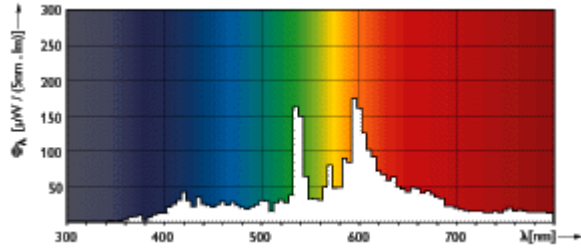
CDM- T 35W



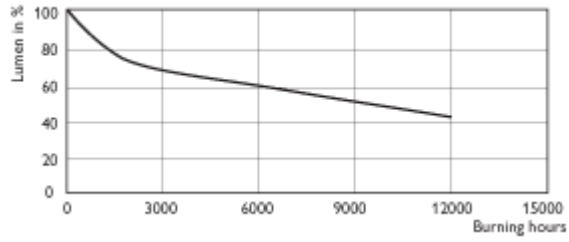
CDM- T 35W/830



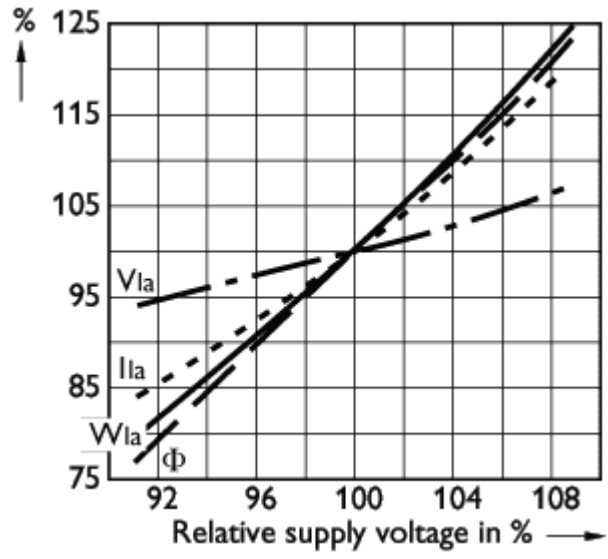
CDM- T 35W/830



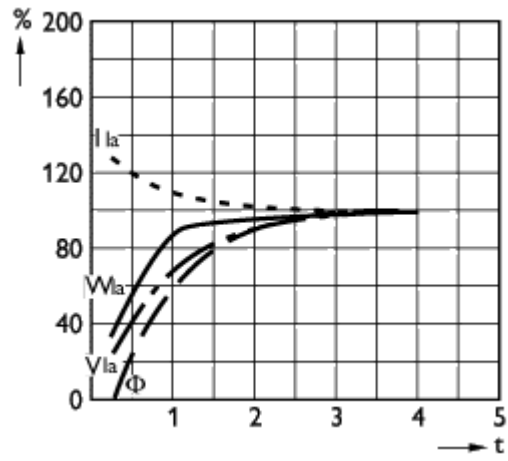
CDM- T/830



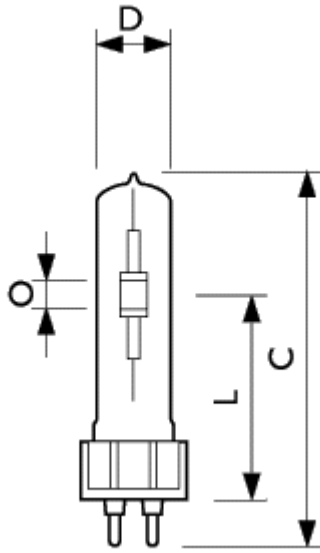
CDM- T 35W/830



CDM-T/830



CDM-T



CDM-T

	C		D		L		O	
Full product name	Max	Max	Min	Nom	Max	Max	Min	Min
MasterColor CDM-T 35W/830 G12 T6 1CT	103	20	55	56	57		4.69	
							O	
	Nom			Max				
	4.9			5.11				



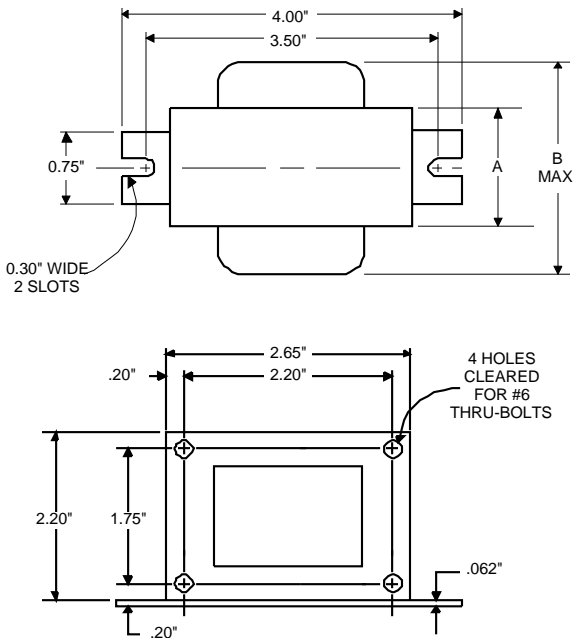


**Metal
Halide
Lamp Ballast**

**Catalog Number 71A5037BP
For 35/39W M130
60 Hz R-HPF
Status: Active**

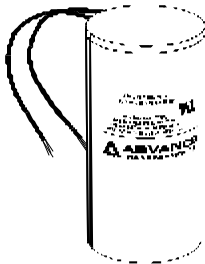
DIMENSIONS AND DATA

2 5/8 X 2 3/16 CORE



INPUT VOLTS		277			
CIRCUIT TYPE	R-HPF				
POWER FACTOR (min)	90%				
REGULATION					
Line Volts	±5%				
Lamp Watts	±10%				
LINE CURRENT (Amps)					
Operating.....	0.19				
Open Circuit.....	0.52				
Starting.....	0.30				
UL TEMPERATURE RATINGS					
Insulation Class	H(180°C)				
Coil Temperature Code	1029	A			
MIN. AMBIENT STARTING TEMP.	-20°F or -30°C				
NOM. OPEN CIRCUIT VOLTAGE	277				
INPUT VOLTAGE AT LAMP DROPOUT.....	190				
INPUT WATTS	48				
RECOMMENDED FUSE (Amps).....	2				
CORE and COIL					
Dimension (A)	0.95				
Dimension (B)	2.70				
Weight (lbs.)	1.9				
Lead Lengths	12"				
CAPACITOR REQUIREMENT					
Microfarads	5.0				
Volts (min.)	280				
Fault Current Withstand (amps)					
60 Hz TEST PROCEDURES (Refer to Advance Test Procedure for HID Ballasts - Form 1270)					
High Potential Test (Volts)					
1 minute	2000				
2 seconds	2500				
Open Circuit Voltage Test (Volts)	260-290				
Short-Circuit Current Test (Amps)					
Secondary Current	0.50-0.80				
Input Current.....	0.10	-	-	-	-
	0.16				

Capacitor: 7C050L33



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

Ignitor: INTEGRAL

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

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

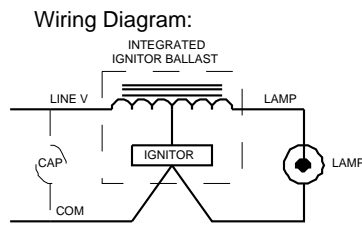


Fig. H

Ordering Information

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

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

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

12/14/05

DESCRIPTION

The Paralux II Series features recessed aesthetics and the latest in energy efficient technology. The luminaire incorporates a 2" precision cell louver into a nominal 4-1/2" deep para-contoured fixture housing. This combination creates a total low profile parabolic optical assembly for optimum performance. The series is compatible with all of today's popular ceiling systems and is available with a number of options and accessories for application versatility.

APPLICATION

The low profile luminaire is designed to offer the market-place a parabolic choice when economics and shallow plenum space are factors. The Paralux II series is an excellent choice for commercial office spaces, schools, hospitals or retail merchandising areas.

SPECIFICATION FEATURES

A... Construction

Nominal 4-1/2" deep, para-contoured housing, die formed code gauge, prime cold rolled steel. Full length die formed stiffeners for added strength. Contoured ballast/wireway cover, easily removed without tools. Die formed captive lampholder bracket fully encloses lampholder wiring permitting easy lampholder replacement. Heavy end plates, securely attached with interlocking tabs and screws. Four auxiliary fixture end suspension points provided. KOs for continuous row wiring. End plates have integral Grid-Lock feature for safety and convenience. Housing features enable fixture to be converted from Grid to T-option or vice versa in the field.*

B... Electrical**

Ballasts are CBM/ETL Class "P" and are positively secured by mounting bolts. Pressure lock lampholders. UL/CUL listed. Suitable for damp locations.

C... Finish

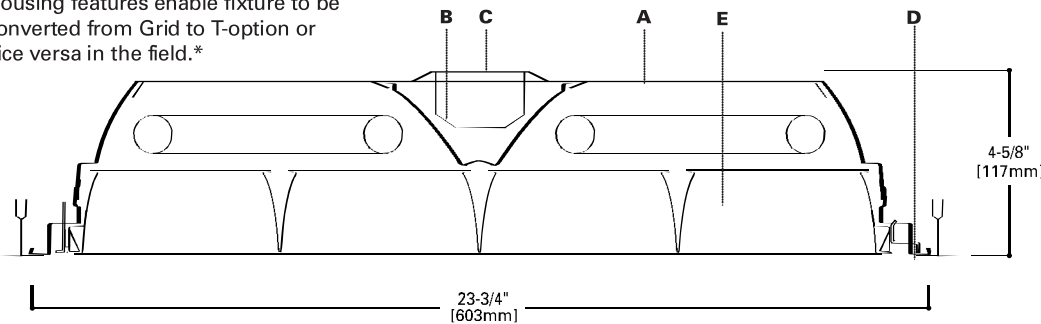
Lighting grade, baked white enamel finish. Multistage, iron phosphate pretreatment ensures maximum bonding and rust inhibition.

D... Hinging/Latching

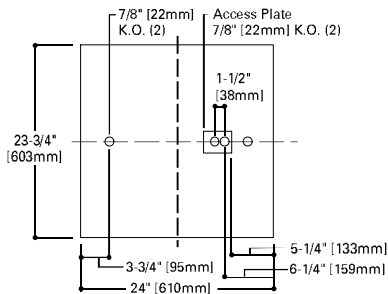
Positive cam action spring loaded, self locking, black steel latches. Safety lock T-hinges allow hinging and latching either side.

E... Louver

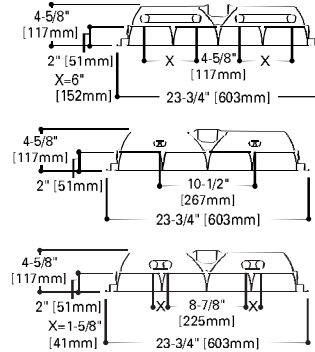
Die formed of semi-specular aluminum. Finish is anodic oxide coating. Accurate precision parabolic cells are held in place by interlocking feature. True-cut mitered corners. Black reveal with mechanical light seal around entire perimeter of louver. Louver protected by polyethylene cover.



MOUNTING DATA



LAMP CONFIGURATIONS



CEILING COMPATIBILITY

G
Grid/Lay-in
Standard

T
Concealed T

T
Slot Grid

F
Flange Trim
With Supporting
Swing Gates

MZ
Modular Trim
With Supporting
Swing Gates

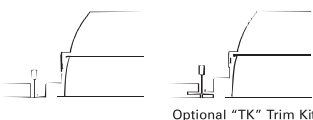
**Ceiling
Type**

**Trim
Type**

Exposed Grid
Concealed T
Slot Grid
Flange
Concealed Spine
Metal Pan

G
G or T
G or T
F
MZ
MZ

(Verify compatibility/ consult Pre Sales Technical Support.)



COOPER LIGHTING

Catalog #	Type
Project	
Comments	
Prepared by	Date



2P2GAX2U6
2U6T8
2U1-5/8
2BX40

16 Cell

**2' X 2' PARABOLIC
2 LAMP
SEMI-SPECULAR LOUVER**

Paralux II
Recessed Air Supply
Troffer

ENERGY DATA

Input Watts:
EB Ballast & STD Lamps
2U6 (72)
2U6T8 (61)
2U1-5/8 (61)
2BX40 (67)

ES Ballast & STD Lamps

2U6 (86)
2U6T8 (71)
2U1-5/8 (71)

STD Ballast & STD Lamps

2BX40 (82)

Luminaire Efficacy Rating

LER = FP-54

Catalog Number: 2P2GAX-2U6T8

**Yearly Cost of 1000 lumens,
3000 hrs at .08 KWH = \$4.43**

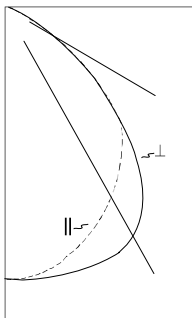
*Convertibility applies to housing only. Appropriate shielding media assemblies must be utilized.

**Reference the lamp/ballast data in the Technical Section for specific lamp/ballast requirements.

ADF020586
(Supersedes ADF991715)



PHOTOMETRICS



2P2GAX-2U6T8S44I
Electronic Ballast
FB31T8/TL735/6
Lamps
2600 Lumens

Spacing criterion:
(II) 1.2 x mounting height, (L) 1.4 x mounting height

Efficiency 67.8%

Test Report:
2P2GX2U6T8S44I.IES
LER = FP-54

Yearly Cost of 1000 lumens, 3000 hrs at .08 KWH = \$4.43

Coefficients of Utilization

rc	Effective floor cavity reflectance																							
	80%				70%				50%				30%				10%				0%			
	rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0		
RCR	0	81	81	81	81	79	79	79	79	75	75	75	72	72	72	69	69	69	68	68	68	68		
	1	76	73	71	69	74	72	70	68	69	68	66	67	65	64	64	63	62	61	61	61	61		
	2	71	67	63	60	69	65	62	59	63	60	58	61	59	57	59	57	56	54	54	54	54		
	3	66	60	56	52	64	59	55	52	57	54	51	56	53	50	54	52	50	48	48	48	48		
	4	61	54	50	46	60	54	49	46	52	48	45	51	47	45	49	46	44	43	43	43	43		
	5	56	49	44	40	55	48	43	40	47	43	39	46	42	39	45	41	39	37	37	37	37		
	6	52	44	39	35	51	44	39	35	43	38	35	41	38	35	41	37	34	33	33	33	33		
	7	48	40	35	31	47	40	35	31	39	34	31	38	34	30	37	33	30	29	29	29	29		
	8	45	36	31	27	44	36	31	27	35	30	27	34	30	27	33	29	27	25	25	25	25		
	9	41	33	27	24	40	32	27	24	31	27	23	31	26	23	30	26	23	22	22	22	22		
	10	38	30	24	21	37	29	24	21	28	24	21	28	24	21	27	23	21	19	19	19	19		

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1293	24.4	36.0
0-40	2120	40.0	58.9
0-60	3367	63.5	93.7
0-90	3595	67.8	100.0
0-180	3595	67.8	100.0

Typical VCP Percentages

Room Size (Ft.)	Height Along		Height Cross	
	8.5'	10.0'	8.5'	10.0'
20 x 20	74	69	80	75
30 x 30	81	76	86	80
30 x 60	84	79	88	84
60 x 30	84	79	88	85
60 x 60	86	82	89	87

Candela

Angle	Along II	45°	Across L
0	1566	1566	1566
5	1554	1571	1576
10	1528	2569	1602
15	1484	1564	1641
20	1427	1556	1670
25	1362	1529	1672
30	1285	1480	1597
35	1197	1391	1377
40	092	1235	1095
45	973	1005	846
50	835	756	700
55	658	530	547
60	448	347	312
65	241	182	166
70	80	66	41
75	32	20	20
80	16	10	9
85	6	3	3
90	0	0	0

ORDERING INFORMATION

SAMPLE NUMBER: 2P2GAX-2U6S44I-120V-EB81-U

<p>HR=Heat Removal (1)</p> <p>HRDO=Heat Removal Damper Open</p> <p>HRDC=Heat Removal Damper Closed</p> <p>Width 2=2' Width</p> <p>P=Paralux Louver</p> <p>2=2' Louver Depth</p> <p>Trim Type G=Grid/Lay-in (Standard) G or T=Concealed T G or T=Slot Grid(2) F=Flange Trim MZ=Modular Trim</p> <p>Convertible Fixture Standard G (Grid) Type-Fixtures can be field converted to T-option or vice-versa.(3) Fixture also adaptable with flanged or modular trims.</p> <p>AX=Air Supply Floating Louver X=Blank Side/Floating Louver - Non-Air Supply (Omit A) AVX=Air Supply Floating Louver with Directional Air Vane (Add V)</p>	<p>Number of Lamps (4) 2 lamps (Not included)</p> <p>Wattage (Length) U6=40W T12 (24") U6T8=31W T8 (24") U15/8=31W T8 (24") BX40=40W Biax (24")</p> <p>Louder Color S=Silver G=Gold W=White</p> <p>Cell Configuration 44=4 Rows of 4, 16 Cell</p> <p>Louder Finish H=Semi-Specular/Haze (Gold only) I=Semi-Specular/Haze (Low Iridescent) Standard (Silver Only) M=Specular/Mirrored (Low Iridescent) (Silver Only) P=Painted (White only)</p>	<p>Voltage (5) 120V=120 Volt 277V=277 Volt 347V=347 Volt UNV=Universal Voltage 120-277(6)</p> <p>Options GL=Single Element Fuse GM=Double Element Fuse WTR=White Reveal Lamps=Lamps Installed Flex=Flex Installed Emergency=EM Installed</p>	<p>Ballast Type (5) Blank=Standard Magnetic Ballast (Biax & 20W) LE3=T12 Magnetic Energy Saving LEOC8=T8 Magnetic Energy Saving EB8 =T8 Electronic Instant Start. Total Harmonic Distortion < 20%</p> <p>No. of Ballast 1, 2 or 3</p> <p>EB8 /PLUS= T8 Electronic Instant Start. High Ballast Factor >1.13. Total Harmonic Distortion < 20%</p> <p>No. of Ballast 1, 2 or 3</p> <p>ER8 =T8 Electronic Program Rapid Start. Total Harmonic Distortion < 10%</p> <p>No. of Ballast 1, 2 or 3</p> <p>TEB8 =T8 Electronic Instant Start. Total Harmonic Distortion < 10%</p> <p>No. of Ballast 1, 2 or 3</p> <p>EB5 =T5 Biax Electronic Instant Start. Total Harmonic Distortion < 20%</p> <p>No. of Ballast 1, 2 or 3</p> <p>TEB5 =T5 Biax Electronic Instant Start. Total Harmonic Distortion < 10%</p> <p>No. of Ballast 1, 2 or 3</p> <p>EB2 =T12 Electronic Rapid Start. No. of Ballast 1 or 2</p> <p>DLS=Digital Lighting System Dimming</p>	<p>Options PAF=Painted After Fabrication RIF1=Radio Interference Suppressor FR=Suitable for Fire Rated Applications EQ=T-BAR Safety Earthquake Clips(2) MEP=Modified End Plate/ For End Filter Applications (See Accessory Section) 20GA/REP=20 Gauge Riveted Endplates. For use in New York City. RLS=Rotor-Lock Socket (T8 Lamps Only) (Additional options available. See Accessory Section)</p>	<p>Packaging U=Unit Pack PAL=Job Pack, out of carton PALC=Job Pack, in carton</p>
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------

NOTES: (1) Integral end plate grid lock feature not available in heat removal. (2) An EQ Grid Clip is recommended for all 9/16" ceiling systems. (3) Convertibility applies to housing only, appropriate shielding media assemblies must be utilized. (4) Standard off-center ballast on 3-lamp fixtures. (5) Products also available in non-US voltages and frequencies for international markets. (6) Not available when specifying emergencies, voltage must be specific.

For complete product data, reference the Fluorescent Specification binder. Specifications & dimensions subject to change without notice. Consult your Cooper Lighting Representative for availability and ordering information.

SHIPPING INFORMATION

Catalog No.	Wt.
2P2GAX-2U6S44H	28 lbs.
2P2GAX-2U6T8S44H	28 lbs.
2P2GAX-2U1-5/8S44H	28 lbs.
2P2GAX-2BX40S44H	28 lbs.



FB32T8/6 TL841 22.44 1LP

Product family description

Offer impressive lighting economics for modernizing, expanding facilities or new construction.

Notes

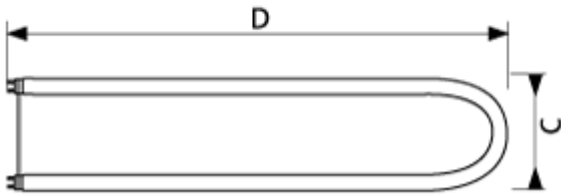
- Rated average life under specified test conditions with lamps turned off and restarted no more frequently than once every 3 operating hours. Lamp life is appreciably longer if lamps are started less frequently. (202)
- Approximate Initial Lumens. The lamp lumen output is based upon lamp performance after 100 hours of operating life, when the output is measured during operation on a reference ballast under standard laboratory conditions. (203)
- For expected lamp lumen output, commercial ballast manufacturers can advise the appropriate Ballast Factor for each of their ballasts when they are informed of the designated lamp. The Ballast Factor is a multiplier applied to the designated lamp lumen output. (204)
- Design Lumens are the approximate lamp lumen output at 40% of the lamp's Rated Average Life. This output is based upon measurements obtained during lamp operation on a reference ballast under standard laboratory conditions. (208)
- Nominal length measured from face of base to maximum distant outside point of U. Measurement does not include base pins. Leg spacing center to center approximately 6 inches, for /6 and 3 5/8 inches for /3 lamps.

Product data	
Product Number	340885
Full product name	FB32T8/6 TL841 22.44 1LP
Ordering Code	FB32T8/TL841
Pack type	1 Lamp Packed in Case Qty
Pieces per pack	1
Packs per case	20
Pack UPC	046677340889
EAN2US	
Case Bar Code	50046677340884
Successor Product number	
Name Type	FB32T8/6
Color Code	TL841 [CCT of 4100K]
Nominal Length [inch]	22.44
Feature	ALTO [ALTO®]
Packing Type	1LP [1 Lamp Packed in Case Qty]
Packing Configuration	20
Base	Medium Bi- Pin[Medium Bi- Pin]
Base Information	Green Base

Product data

Bulb	T8- 6U[U- bent T 8/8 inch with 6" spacing]
Rated Avg. Life [3 hr Start][hr]	20000
Energy Saving Product	Energy Saving
Wattage[W]	32
Color Rendering Index[Ra8]	85
Color Temperature[K]	4100
Initial Lumens[Lm]	2800
Design Mean Lumens[Lm]	2535

Data not (yet) available



F- T8- URS Med Bipin



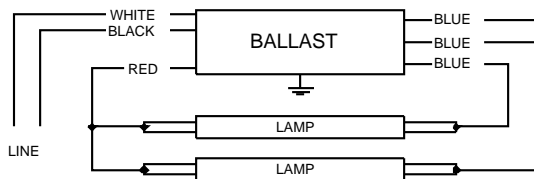


Electrical Specifications

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

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F32T8/U6	1	32	0/-18	0.13	32	0.93	15	0.94	1.7	2.91
* F32T8/U6	2	32	0/-18	0.20	54	0.85	10	0.98	1.7	1.57
F32T8/U6	3	32	0/-18	0.27	73	0.78	10	0.99	1.7	1.07

Wiring Diagram



Diag. 70

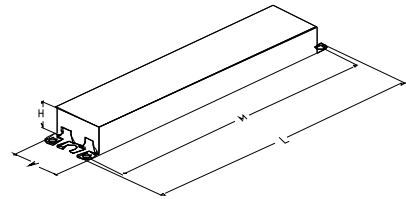
Insulate unused blue lead for 1000V

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

Standard Lead Length (inches)

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

Enclosure



Enclosure Dimensions

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

Revised 03/22/2004



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



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

Electrical Specifications

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 provide Independent Lamp Operation (ILO) for Instant Start ballasts allowing remaining lamp(s) to maintain full light output when one or more lamps fail.
- 2.3 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.
- 2.4 Ballast shall operate from 60 Hz input source of 120V, 277V or 347V as applicable with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.
- 2.5 Ballast shall be high frequency electronic type and operate lamps at a frequency between 42 kHz through 52 kHz to avoid interference with infrared devices and eliminate visible flicker and avoid Article Surveillance System, such as anti-theft devices.
- 2.6 Ballast shall have a Power Factor greater than 0.98 for primary lamp.
- 2.7 Ballast shall have a minimum ballast factor for primary lamp application as follows: 0.78 for Low Watt, 0.88 for Normal Light Output, and 1.18 for High Light.
- 2.8 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.
- 2.9 Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when operated at nominal line voltage with primary lamp.
- 2.10 Ballast shall have a Class A sound rating for all 4-foot lamps and smaller.
- 2.11 Ballast shall have a minimum starting temperature of 0F (-18C) and 60F (16C) for energy-saving T8 lamps.
- 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).
- 3.8 Ballast shall meet NEMA/CEE High Performance T8 Lighting System Specifications.

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

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

Revised 03/22/2004



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

vision™ I



FEATURES

1'x2' or 1'x4' recessed luminaire designed specifically to address teleconference lighting requirements.

Shielding may be specified in following configurations:

- Lens only
- Louver only
- Lens and Louvers

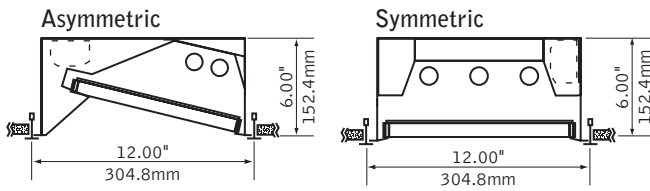
Asymmetric or Symmetric distribution models available.

Matte black louver eliminates glare.

Luminaires may be continuously row mounted.

Vision™ I is an essential part of videoconferencing lighting systems.

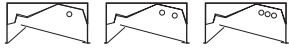
DIMENSIONAL DATA



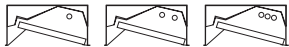
lamping options

asymmetric

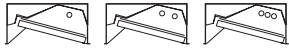
lens



louver



lens & louver



T8, T5 & T5HO LAMPS

symmetric

lens



louver

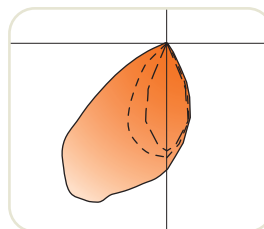


lens & louver



T8, T5 & T5HO LAMPS

PERFORMANCE



3-Lamp T8 Asymmetric
24% Efficiency
2210 cd @ 25°

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

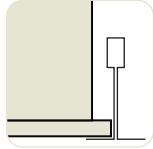
fixture type:

project name:

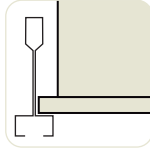
DETAILS

mounting

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



"G" flat tee

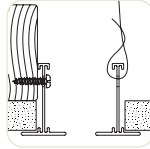


"ST" slot tee
Luminaire sits on top of 9/16" slot tee grid.

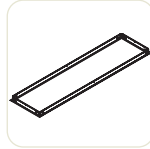
Luminaires cannot be installed in T-bar ceiling systems over 1.5" high in T8 lamp configurations.

drywall frame kit

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



Use tie-wire or screws to secure frame kit.



cut out dimensions:
1': Min: 12.125"
Max: 12.563"
4': Min: 48.125"
Max: 48.563"

SPECIFICATIONS

construction

One-piece 20 Ga. steel housing.

One-piece 20 Ga. steel regressed bevel for asymmetric applications.

Bottom access 20 Ga. steel ballast compartment.

2' unit weight: 12 lbs.

4' unit weight: 22 lbs.

Optic

Die-formed .023" thick specular aluminum reflector.

Parallel Louver Blade: .040" aluminum, 1"H x 1" frequency x .187" thick, Matte Black finish.

Shielding: clear acrylic lens with K19 diagonal prismatic pattern.

Paracube Louver: injection molded specular silver, .75" x .75" x .5"H.

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:

T8 Lamps: Up to 475 lumens

T5 Lamps: Up to 550 lumens

T5H0 Lamps: Up to 825 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 Black.

ORDERING

luminaire series

Vision FTV

FTV

nominal size

1' x 4' 14

1' x 2' 12

distribution

Direct Symmetrical D

Direct Asymmetrical W

lamp quantity

One Lamp 1

Two Lamps 2

Three Lamps 3

lamp type

T8 T8

T5 T5

T5H0 T5H0

Asymmetric: 1,2 or 3 Lamps

Symmetric: 2 or 3 Lamps

ballast

Electronic Instant Start <20% THD (T8 only) 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 347

(Consult factory for availability)

mounting

Grid G

G

shielding

K12 Lens 12

Parallel Blade Louver, Black PB

Parallel Blade Louver, Black with K12 Overlay PBA

Silver Paracube, 3/4 x 3/4 x 1/2 PQ

factory options

Chicago Plenum CP

Drywall Frame Kit DF

(Cut out dimensions:

Min: 12.125"/Max: 12.563"

Min: 24.125"/Max: 24.563"

Min: 48.125"/Max 48.563")

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

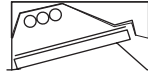
Separate Circuit SC

finish

Matte Black BK

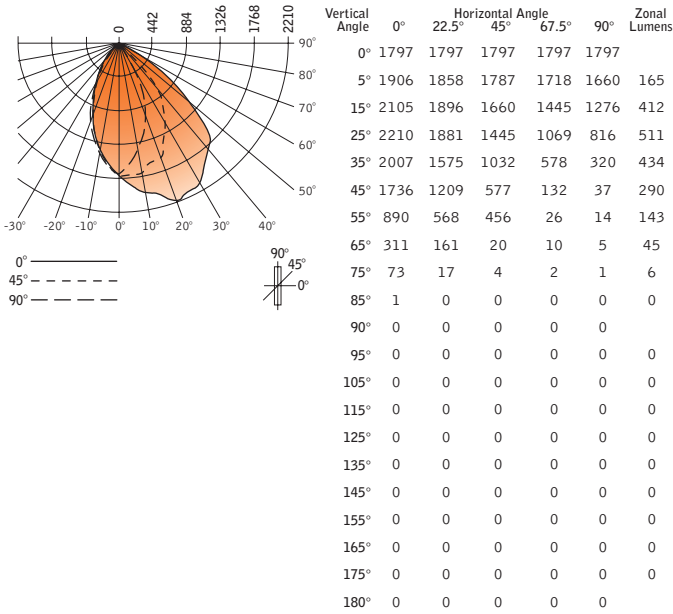
BK

vision™ I



Filename: FTV14W3T8PBA.IES
 Catalog #: FTV-14-W-3-T8-E-120-G-PB/A-BK
 Efficiency: 24%
 Test #: 9699.0

CANDLEPOWER DISTRIBUTION



LUMEN SUMMARY

Zone	Lumens	% Lamp	% Fixt
0°-30°	1088	12.7	54.2
0°-40°	1522	17.8	75.9
0°-60°	1955	22.9	97.5
0°-90°	2006	23.5	100.0
Total Luminaire	2006	23.5	100.0

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



54W/835 WH Min Bipin HO UNP

Product family description
 Powerful, environmentally- responsible ultra- slim lamps.

Features/Benefits

- Miniaturization: slim profile lamp and ballast.
- Operated on programmed start electronic ballasts.
- Low mercury: TCLP* compliant.
- Energy efficeint.
- Long life.
- Less mercury and fewer lamps in landfills, combined with energy efficiency reduces the impact on the environment.
- 85 CRI in 3000, 3500, 4100 and 5000K.
- 20,000 hours rated average life.

Applications

- Ideal for medium and high bay retail. Ideal for industrial applications.

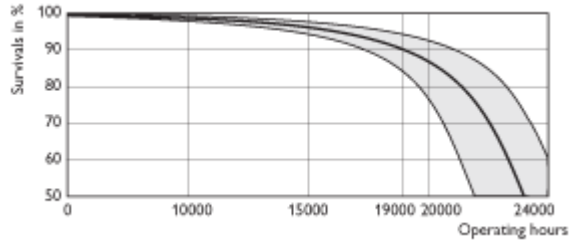
Note

- NOT compatible ith dimming ballasts.
- Silhouette™ T5 nominal lamp lengths are shorter than standard sizes. See dimension chart for details.

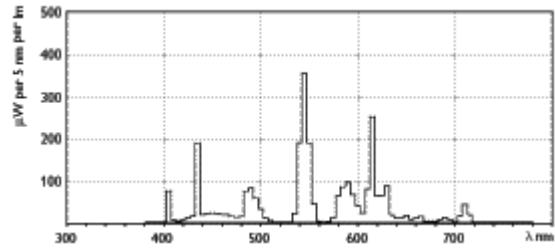
Product data	
Product Number	290288
Full product name	54W/835 WH Min Bipin HO UNP
Ordering Code	F54T5/835/HO/ALTO
Pack type	Unpacked
Pieces per pack	1
Packs per case	40
Pack UPC	046677290283
EAN2US	
Case Bar Code	50046677290288
Successor Product number	
Wattage[W]	54W
Color Code	835 [CCT of 3500K]
Base	Min Bipin [Miniature Bipin]
Bulb	T5 [16mm]
Special packing	ALTO
Packing Type	UNP [Unpacked]
System Description	High Output
Base Information	Green[Green Base]
Packing Configuration	40
Rated Avg. Life[hr]	24000
Dimmable	Yes

Product data

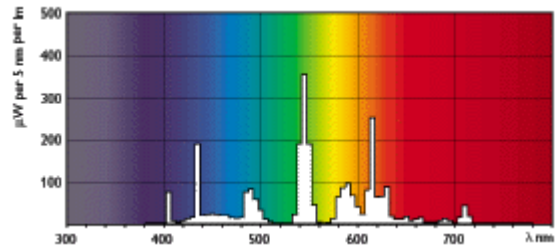
Mercury (Hg) Content[mg]	
Color Rendering Index[Ra8]	85
Color Temperature[K]	3500
Initial Lumens[Lm]	-
Overall Length C[mm]	1163.2
Diameter D[mm]	17



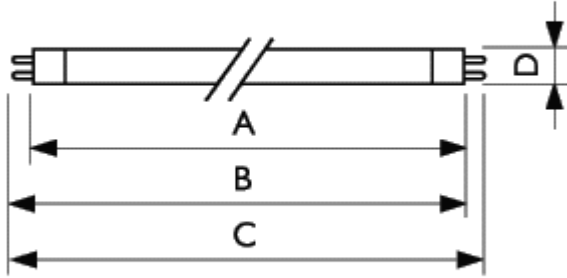
TL5



TL5/835



TL5/835



	A		B		C	D
Full product name	Max	Min	Max	Max	Max	
54W/ 835 WH Min Bipin HO UNP	1149.0	1153.7	1156.1	1163.2	17	

TL5





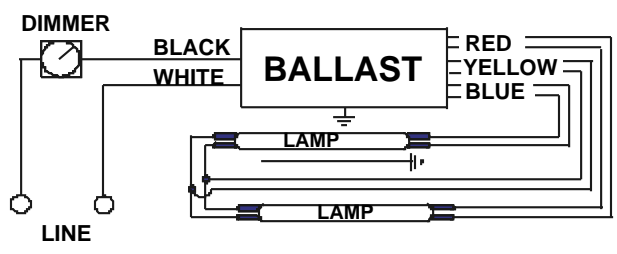
VEZ-2S54

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

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts)	Ballast Factor	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
* F54T5/HO	2	54	50/10	0.45	24	0.03	10	0.98	1.7	0.13
FC12T5/HO	2	55	50/10	0.42	24	0.03	10	0.98	1.7	0.13
FT55W/2G11	2	55	50/10	0.42	24	0.03	10	0.98	1.7	0.13

Wiring Diagram

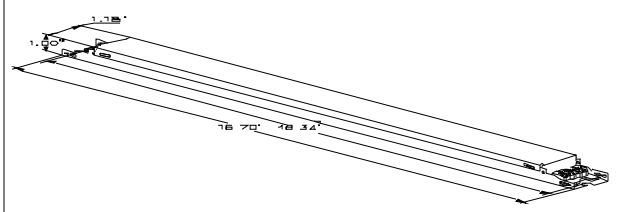


The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.		in.	cm.
Black	0	0	Yellow/Blue	0	0
White	0	0	Blue/White	0	0
Blue	0	0	Brown	0	0
Red	0	0	Orange	0	0
Yellow	0	0	Orange/Black	0	0
Gray	0	0	Black/White	0	0
Violet	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 12/05/2001



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



VEZ-2S54	
Brand Name	MARK X Powerline
Ballast Type	Electronic Dimming
Starting Method	Programmed 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 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 or 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 60 Hz input source of 120V, 277V or 347V as applicable 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 at full light output and greater than 0.90 throughout the dimming range for primary lamp.
- 2.6 Ballast shall have a minimum ballast factor of 1.00 at maximum light output and 0.05 at minimum light output for primary lamp application.
- 2.7 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less throughout the dimming range in accordance with lamp manufacturer recommendations.
- 2.8 Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% at maximum light output when operated at nominal line voltage with primary lamp. Total Harmonic Current (THC) at minimum light output shall not exceed THC at maximum light output.
- 2.9 Ballast shall have a Class A sound rating.
- 2.10 Ballast shall have a minimum starting temperature of 10C (50F) for primary lamp.
- 2.11 Ballast shall provide Lamp EOL Protection Circuit for all T5, T5/HO, and CFL lamps.
- 2.12 Ballast shall control lamp light output from 100% - 5% relative light output for T8 and CFL lamps and 100% - 1% relative light output for T5/HO lamps.
- 2.13 Ballast shall ignite the lamps at any light output setting without first going to another output setting.
- 2.14 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 controlled by a compatible Mark 10 Powerline two-wire dimmer.

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

Revised 12/05/2001



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

avenue® a



FEATURES

Narrow aperture high performance T5/T5HO asymmetric wall wash.

Precision micro-optic delivers shadow free illumination from the ceiling to the floor.

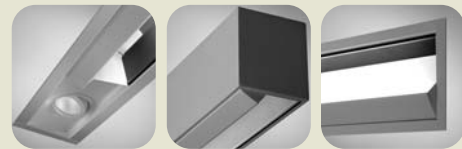
Features 2" narrow aperture for clean unobtrusive aesthetic.

Universal mounting allows compatibility for multiple grid types.

Drywall installation is available, which allows for both individual or continuous row mount capability.

Great solution for conference rooms, highlighting artwork, corridors, white board or any application that requires high levels of vertical illumination.

companion luminaire



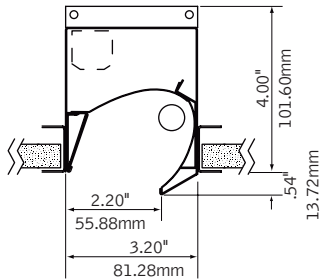
mr16

linear

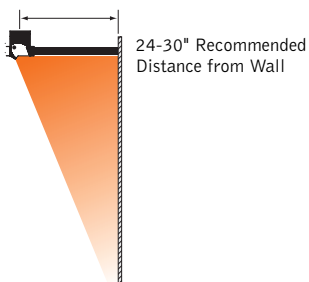
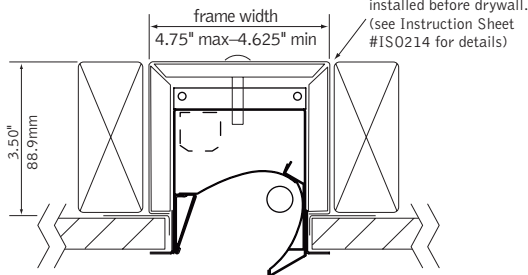
recessed wall mount

DIMENSIONAL DATA

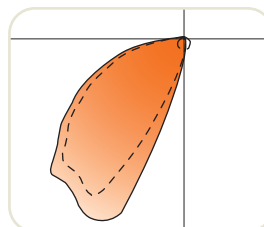
Grid Mount



Drywall Flange



PERFORMANCE



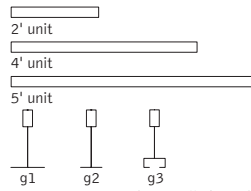
1-Lamp T5HO
57% Efficiency
1933 cd @ 25°

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

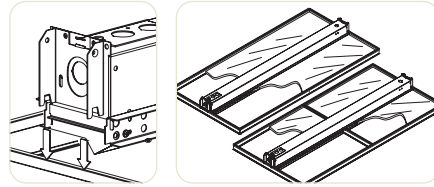
fixture type:
project name:

DETAILS

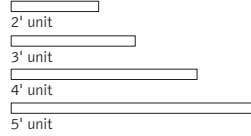
grid



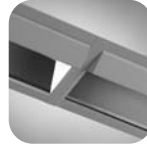
Luminaires cannot be installed in T-bar ceiling systems over 1.5".



drywall



Drywall flange version provided with mounting yoke.



row mount
detail

SPECIFICATIONS

construction

One-piece 20 Ga. steel housing

Grid fixtures include 20 Ga. steel, .5" wide universal flange rail finished in matte satin white.

Drywall flange option is provided with 20 Ga. steel, .5" wide flange kit and 20 Ga. galvanized steel mounting yoke.

2' unit weight:	5 lbs.
3' unit weight:	6 lbs.
4' unit weight:	7 lbs.
5' unit weight:	8 lbs.

optic

.020" specular aluminum upper reflector and .020" semi-specular lower reflector.
24 Ga. perforated matte black diffuser with 24% opening.

electrical

Luminaires are individually wired for specified circuits.

Thru-wiring not available.

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:

T5 Lamp:	Up to 550 lumens
T5HO Lamps:	Up to 825 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 or Matte Black.

Perforated diffuser finished in Matte Black as standard.

ORDERING

luminaire series FAVA
Avenue A FAVA

shielding _____
No Shielding, Open Optic NS

lamping _____
One Lamp T5 1T5
One Lamp T5HO 1T5HO

circuits 1C
Single Circuit 1C

voltage _____
120 Volt 120
277 Volt 277
347 Volt 347
(Consult factory for availability)

ballast _____
Electronic Program Start <10% THD S
Electronic Dimming Ballast D
(Consult factory for dimming availability)

mounting _____
15/16" Grid G1
9/16" Grid G2
9/16" Slot Tee G3
Drywall Flange F
Cut out dimensions:
2': 3.5" x 23.6"
3': 3.5" x 35.6"
4': 3.5" x 47.6"
5': 3.5" x 59.6"

factory options _____
Chicago Plenum CP
Emergency Circuit EC
Emergency Battery Pack EM
(3' & 4' Fixtures Only)
Seismic Brackets EQ
HLR/GLR Fuse FU
Include 3000K Lamp L830
Include 3500K Lamp L835
Include 4100K Lamp L841

finish _____
Matte White Housing WH
Matte Black Housing BK
(Perforated diffuser always painted black)

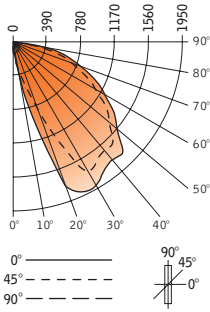
luminaire length _____
2' Nominal Housing 2'
3' Nominal Housing 3'
4' Nominal Housing 4'
5' Nominal Housing 5'
(For continuous row mount in drywall ceiling, specify luminaire run length, ie 24')

avenue® a



Filename: FAVANS1T5H.IES
 Catalog #: FAVA-NS-1T5H0-1C-120-S-G-WH-4'
 Efficiency: 57%
 Test #: 12355.0

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle				Zonal Lumens
	0°	22.5°	45°	67.5°	
0°	108	108	108	108	108
5°	276	256	214	154	101
15°	919	771	499	291	102
25°	1933	1873	1300	415	101
35°	1832	1799	1695	707	96
45°	1806	1775	1647	1296	88
55°	1434	1416	1329	1108	74
65°	1072	1052	962	811	56
75°	655	631	568	458	39
85°	317	294	224	129	14
90°	183	165	112	40	2
95°	0	0	0	0	0
105°	0	0	0	0	0
115°	0	0	0	0	0
125°	0	0	0	0	0
135°	0	0	0	0	0
145°	0	0	0	0	0
155°	0	0	0	0	0
165°	0	0	0	0	0
175°	0	0	0	0	0
180°	0	0	0	0	0

LUMEN SUMMARY

Zone	Lumens	% Lamp	% Fixt	
0°-30°	376	7.5	13.2	
0°-40°	784	15.7	27.4	
0°-60°	1975	39.5	69.0	
0°-90°	2861	57.2	100.0	
Total Luminaire	0°-180°	2861	57.2	100.0

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



28W/835 Min Bipin T5 UNP

Product family description
Ultra-slim design with extraordinary light output.

Features/Benefits

- Improved optical control.
- Fixtures can be 40% smaller than T8 systems.
- Design flexibility for cove and cabinet lighting.
- Better fit in 2 x 2 and 2 x 4 grid ceilings.
- Up to 104 lumens per watt.
- 95% lumen maintenance.
- 85 CRI in 3000, 3500 and 4100K.
- High system efficacy.
- Fail-safe operation at end of life.
- 20,000 hours rated average life.

Applications

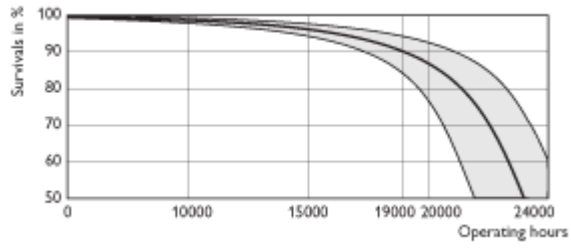
- Ideal for general, decorative and architectural lighting in offices, retail stores, hotels, schools and hospitals.

Notes

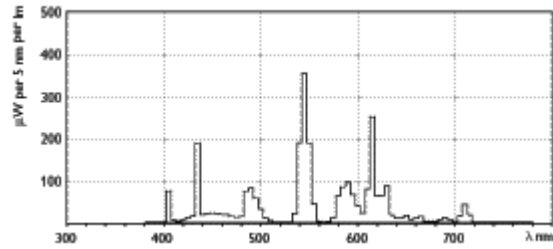
- NOT compatible with dimming ballasts.
- Silhouette™ T5 nominal lamp lengths are shorter than standard sizes. See dimension chart for details.

Product data	
Product Number	230854
Full product name	28W/835 Min Bipin T5 UNP
Ordering Code	F28T5/835
Pack type	Unpacked
Pieces per pack	1
Packs per case	40
Pack UPC	046677230852
EAN2US	
Case Bar Code	50046677230857
Successor Product number	
Wattage[W]	28W
Color Code	835 [CCT of 3500K]
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

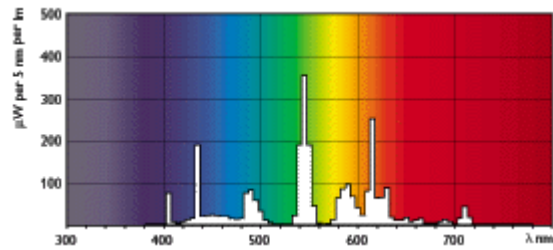
Product data	
Dimmable	Yes
Mercury (Hg) Content[mg]	
Color Rendering Index[Ra8]	85
Color Temperature[K]	3500
Initial Lumens[Lm]	-
Overall Length C[mm]	1163.2
Diameter D[mm]	17



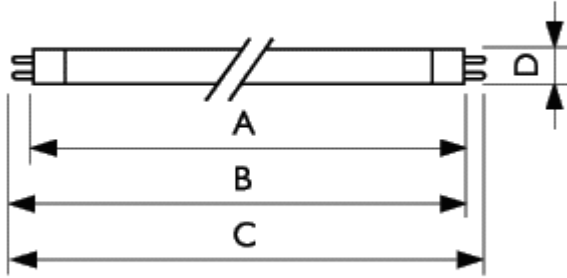
TL5



TL5/835



TL5/835



	A		B		C	D
Full product name	Max	Min	Max	Max	Max	
28W/ 835 Min Bipin T5 UNP	1149.0	1153.7	1156.1	1163.2	17	

TL5





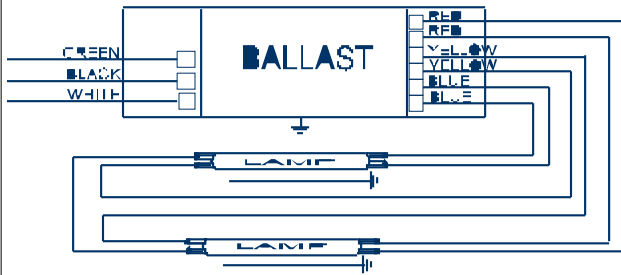
ICN-2S28@277

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

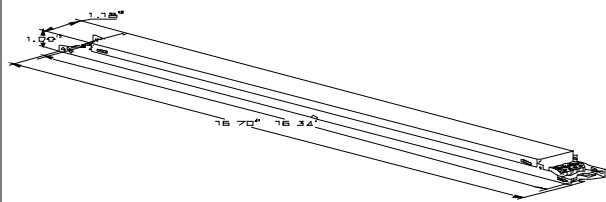


The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

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

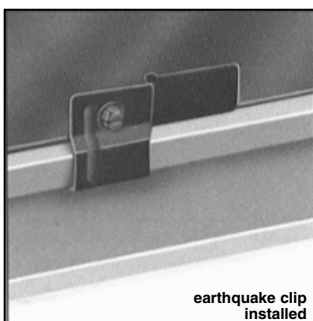
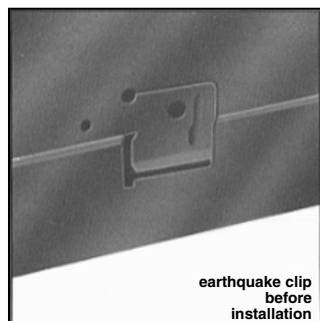
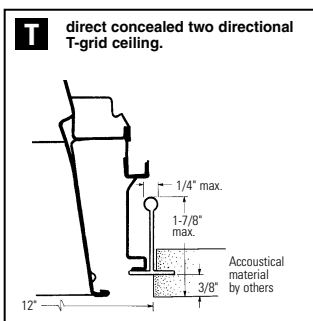
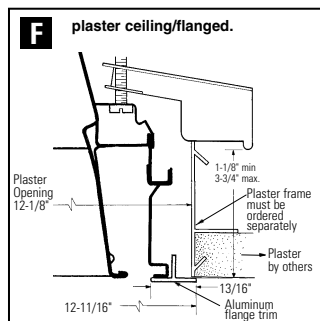
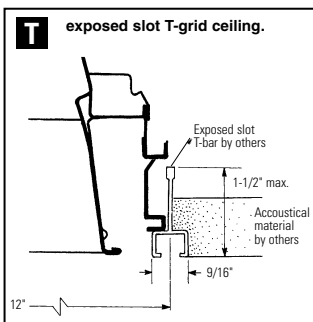
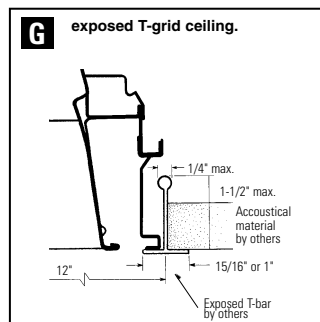
VR PARABOLIC VRA1G12LS132

Features

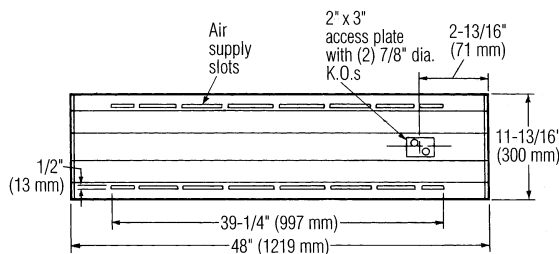
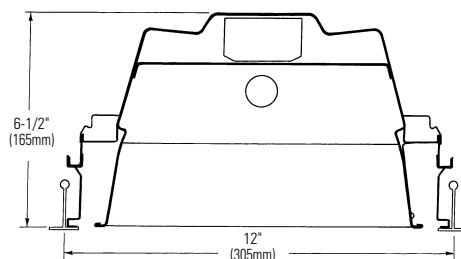
- 60.3% efficient (T8).
- 1.4 spacing mounting ratio.
- Semi-specular low iridescence pre-anodized louver.
- Vertical grain on louver eliminates reflected lamp image on cross baffle.
- Louver frame with integrated positive light stop.
- Spring loaded latches (self centering).
- Reversible louver hinging.
- Louver has protective dust guard.
- Only 6-5/8" deep body.
- Black housing exterior for cooler ballast operating temperature.
- Turned-in edges for safe handling.
- Built-in earthquake clip (pat. no. 5,072,344).
- UL-Listed twin knockout access plate.
- Air closure strips (optional).
- Construction to meet NYC Code or Chicago Plenum is available.



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

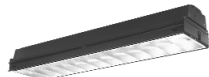
We reserve the right to change details of design, materials and finish.

© 2002 Genlyte Thomas Group LLC (Lightolier Division)

A0902

SECTION 2/Folio G05-37 REV. A

LIGHTOLIER®



VR PARABOLIC VRA1G12LS132

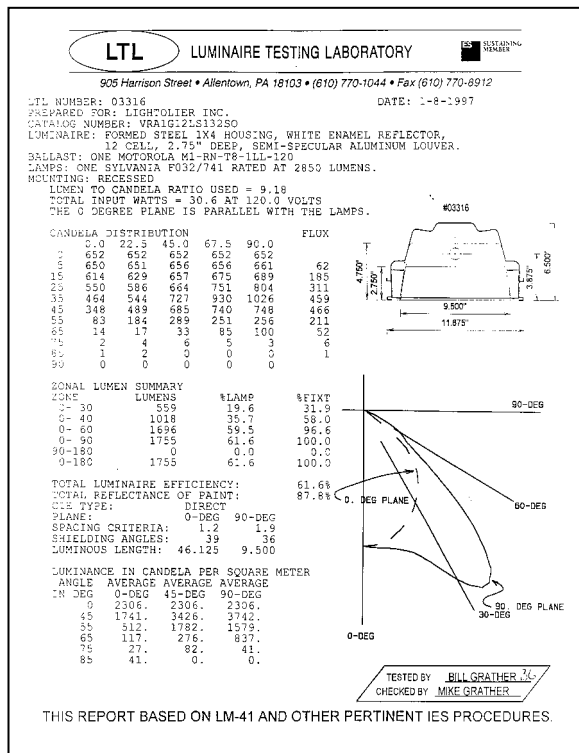
1'x4' RECESSED FLUORESCENT, 3" DEEP, 12 CELL (1 ROW) PARABOLIC LOUVER STATIC OR AIR SUPPLY/RETURN, IES RP1 FOR NORMAL VDT USE

PHOTOMETRY

MODEL NO. VRA1G12LS132120SO

LER = FP - 50.1 IW - 30.6 BF - 0.88

Comparative yearly lighting energy cost per 1000 lumens = \$4.80



coefficients of utilization — zonal cavity method

RF	20			50			20			
RC	80			50			30			
RW	70	50	30	50	30	10	50	30	10	
room cavity ratio	1	69	67	65	63	61	60	61	59	58
2	64	61	58	58	55	53	56	54	52	
3	60	55	51	52	49	47	51	48	46	
4	56	50	45	48	44	41	46	43	41	
5	51	45	40	43	39	36	42	38	36	
6	47	40	36	39	35	32	38	34	32	
7	44	36	31	35	31	28	34	30	28	
8	40	32	27	31	27	24	30	27	24	
9	37	29	24	28	23	20	27	23	20	
10	34	26	21	25	21	18	24	21	18	

visual comfort probability

room size		ceiling height				ceiling height			
W	L	8.5	10.0	13.0	16.0	8.5	10.0	13.0	16.0
20	20	95	94	92	88	90	85	81	80
20	30	96	94	93	90	90	88	82	77
20	40	96	95	93	92	90	88	83	79
20	60	96	95	94	92	90	88	84	79
30	20	95	94	92	87	90	87	85	82
30	30	96	95	94	89	90	89	85	79
30	40	96	95	94	91	90	88	86	80
30	60	97	96	95	91	91	88	86	80
30	90	97	96	95	91	91	88	86	80
40	20	95	95	93	88	90	87	85	84
40	30	96	95	94	90	90	88	86	82
40	40	97	95	94	91	91	88	87	82
40	60	97	96	95	91	91	88	87	82
40	80	97	96	95	91	91	88	87	83
40	100	97	96	95	91	91	88	87	83
60	30	96	95	94	91	91	88	86	82
60	40	97	96	94	92	91	88	87	83
60	60	97	96	95	92	91	89	87	83
60	80	97	96	95	92	91	89	87	83
60	100	97	96	95	92	91	89	87	83
100	40	97	95	94	92	91	88	87	83
100	60	97	96	95	92	91	89	87	83
100	80	97	96	95	92	91	89	87	83
100	100	97	96	95	92	91	89	87	83

ORDERING INFORMATION

Explanation of Catalog Number. Example: VRA1G12LS132120SOGLR

BLANK = Standard N = NYC Code	VR VR: 3" Deep Pre-anodized Aluminum Louver for normal VDT use	BODY STYLE: A=Air Handling S=Static	1 FIXTURE WIDTH	12 CEILING TYPE: G= Grid (lay-in T bar) F=Flanged (overlap) Z spline and plaster frame T=Slot grid or two-directional concealed T (see options)	NUMBER OF CELLS: 1 row of 12 cells	S LOUVER FINISH: L=Low Irrescence Semi-specular (standard) P=Low Irrescence specular	1 LAMP QUANTITY	LAMP/ FIXTURE LENGTH: 32=T8 34=T12 (Nominal 48")	VOLTAGE: 120 or 277	BALLAST TYPE: LE <20THD SO* PS 1 Lamp Mag. T12 1 Lamp Elec. T8 LOL Dimming *Instant Start Standard Other dimming options, consult factory.	OPTIONS: Add appropriate suffix to catalog no., ie: (GLR) HI*
----------------------------------	--------------------------------------------------------------------------	--------------------------------------------------	---------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------	------------------------------------------------------------------------------------------------------	---------------------------	---------------------------------------------------------------	-------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------

OPTIONS & ACCESSORIES

- ACCESS PLATE:** 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: **ACP 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 standard. SUFFIX: **RF**.
- CONTINUOUS ROW INSTALLATION:** For F type fixtures, half-width flanges are required between fixtures. Order Catalog Number: **1FCTRIM** (each joint).
- SPRAY TRIM:** For T ceiling type only. SUFFIX: **CTZ14 S2 SPLAY TRIM**.
- AIR CLOSURE STRIP:** SUFFIX **ACS4** (factory installed).
- DRYWALL KIT:** Order Catalog Number: **FK91X4**. Request Folio OA30-10.
- CHICAGO PLENUM:** SUFFIX: **CP**.

SPECIFICATIONS

PERFORMANCE: In an installation of 1 lamp 32W luminaires in a room cavity ratio of 1, reflectance 80% ceiling, 50% wall, 20% floor, the C.U. shall not be less than .67 with a spacing to mounting ratio of 1.9 perpendicular to the lamps. To meet IES RP-1 recommended (basic) requirements for VDT areas the VCP (visual comfort probability) shall not be less than 91 either crosswise or lengthwise and the maximum average brightness at 65°, 75° and 85° shall not exceed 837, 82 and 41 candelas per square meter respectively in the 0°, 45° and 90° horizontal planes. Candelas at Nadir (0°) not to exceed 652.

SPECIFICATIONS (continued)

- AIR HANDLING:** (VRA only) side air passages for air supply or air return. Optional side closure strips. Air return is also provided through the lamp compartment through fixture body ends.
- MATERIALS:** Chassis parts are die-formed embossed cold rolled steel.
- Housing:** is embossed for rigidity with all edges turned-in for safe handling.
- LOUVER:** Pre-anodized aluminum (Coilzak® or equal).
- FINISH:** Louver—low iridescence semi-specular anodized vertical grain aluminum reflector sheet is standard. Reflector—white baked polyester enamel minimum 86% reflectance. Phosphate undercoating. Chassis exterior—black baked polyester enamel.
- 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 C-UL.

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
We reserve the right to change details of design, materials and finish.
© 2002 Genlyte Thomas Group LLC (Lightolier Division)
A0902 **SECTION 2/Folio G05-37 REV. A**

LIGHTOLIER®



F32T8 ADV835 48 ALTO 1LP

Product family description
High performance, long life,
environmentally- responsible lamps.

Features/Benefits

- 3100 lumens is 10% more than standard T8 lamps.
- Low mercury: TCLP* compliant.
- Sustainable lighting solutions; Less mercury and fewer lamps in landfills, combined with energy efficiency and long life reduces the impact on the environment.
- HI- VISION® Phosphor combined with Philips exclusive cathode guard delivers: 95% lumen maintenance; reduced lamp- end blackening.
- Our Green End- Caps mean you are using environmentally- responsible lamps.
- 85 CRI.
- Higher lumens enables multiple system options to maximize energy saving and reduce lighting costs.
- Fully dimmable without burn- in.

Applications

- Ideal for T8 applications requiring maximum light output and long life. Ideal for light harvesting.

Notes

- Rated average life under specified test conditions with lamps turned off and restarted no more frequently than once every 3 operating hours. Lamp life is appreciably longer if lamps are started less

- frequently. (202)
- Average life under engineering data with lamps turned off and restarted once every 12 operating hours. (241)
- Approximate Initial Lumens. The lamp lumen output is based upon lamp performance after 100 hours of operating life, when the output is measured during operation on a reference ballast under standard laboratory conditions. (203)
- For expected lamp lumen output, commercial ballast manufacturers can advise the appropriate Ballast Factor for each of their ballasts when they are informed of the designated lamp. The Ballast Factor is a multiplier applied to the designated lamp lumen output. (204)
- Design Lumens are the approximate lamp lumen output at 40% of the lamp's Rated Average Life. This output is based upon measurements obtained during lamp operation on a reference ballast under standard laboratory conditions. (208)
- Design lumens rated at 3 hours per start on Instant Start ballast. (239)
- Exclusive to Philips Lighting Company.

Product data	
Product Number	139881
Full product name	F32T8 ADV835 48 ALTO 1LP
Ordering Code	F32T8/ADV835/ALTO
Pack type	1 Lamp Packed in Case Qty
Pieces per pack	1
Packs per case	25
Pack UPC	046677139889
EAN2US	
Case Bar Code	50046677139884

Product data	
Successor Product number	
Name Type	F32T8
Nominal Length [inch]	48
Feature	ALTO [ALTO®]
Packing Type	1LP [1 Lamp Packed in Case Qty]
Packing Configuration	25
Base	Medium Bi- Pin[Medium Bi- Pin]
Base Information	Green Base
Bulb	T8[Diameter: 1 inch]
Rated Avg. Life [3 hr Start][hr]	25000
Rated Avg. Life [12- Hr Start][hr]	30000
Energy Saving Product	Energy Saving
Wattage[W]	32
Mercury (Hg) Content[mg]	3.5
Color Code	Advantage 835[CCT of 3500K]
Color Rendering Index[Ra8]	85
Color Temperature[K]	3500
Initial Lumens[Lm]	3100
Design Mean Lumens[Lm]	2950

Data not (yet) available



F- T8- Adv Med Bipin





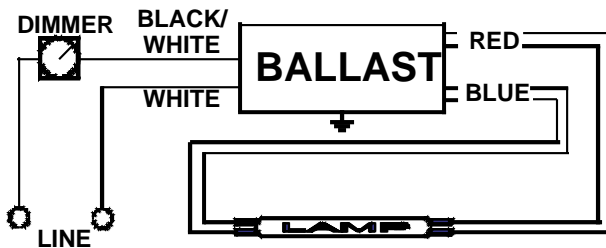
VEZ-132

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

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts)	Ballast Factor	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
F25T8	1	25	50/10	0.11	08	0.05	10	0.99	1.6	0.63
* F32T8	1	32	50/10	0.13	09	0.05	10	0.99	1.6	0.56

Wiring Diagram

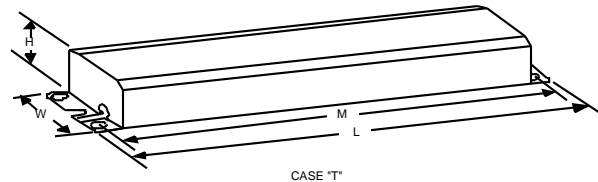


The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.		in.	cm.
Black	0	0	Yellow/Blue	0	0
White	22	55.9	Blue/White	0	0
Blue	36	91.4	Brown	0	0
Red	26	66	Orange	0	0
Yellow	0	0	Orange/Black	0	0
Gray	0	0	Black/White	22	55.9
Violet	0	0	Red/White	0	0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	2.375 "	1.5 "	8.90625 "
9 1/2	2 3/8	1 1/2	8 29/32
24.1 cm	6 cm	3.8 cm	22.6 cm

Revised 08/26/2002



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



VEZ-132	
Brand Name	MARK X Powerline
Ballast Type	Electronic Dimming
Starting Method	Programmed 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 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 or 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 60 Hz input source of 120V, 277V or 347V as applicable 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 at full light output and greater than 0.90 throughout the dimming range for primary lamp.
- 2.6 Ballast shall have a minimum ballast factor of 1.00 at maximum light output and 0.05 at minimum light output for primary lamp application.
- 2.7 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less throughout the dimming range in accordance with lamp manufacturer recommendations.
- 2.8 Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% at maximum light output when operated at nominal line voltage with primary lamp. Total Harmonic Current (THC) at minimum light output shall not exceed THC at maximum light output.
- 2.9 Ballast shall have a Class A sound rating.
- 2.10 Ballast shall have a minimum starting temperature of 10C (50F) for primary lamp.
- 2.11 Ballast shall provide Lamp EOL Protection Circuit for all T5, T5/HO, and CFL lamps.
- 2.12 Ballast shall control lamp light output from 100% - 5% relative light output for T8 and CFL lamps and 100% - 1% relative light output for T5/HO lamps.
- 2.13 Ballast shall ignite the lamps at any light output setting without first going to another output setting.
- 2.14 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 controlled by a compatible Mark 10 Powerline two-wire dimmer.

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

Revised 08/26/2002



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



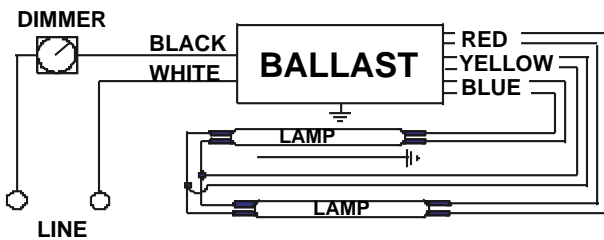
VEZ-2S32

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

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts)	Ballast Factor	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
F25T8	2	25	50/10	0.22	14	0.05	10	0.99	1.6	0.36
* F32T8	2	32	50/10	0.26	16	0.05	10	0.99	1.6	0.31

Wiring Diagram

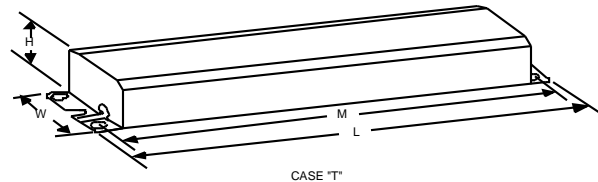


The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.		in.	cm.
Black	22	55.9	Yellow/Blue	0	0
White	22	55.9	Blue/White	0	0
Blue	26	66	Brown	0	0
Red	26	66	Orange	0	0
Yellow	36	91.4	Orange/Black	0	0
Gray	0	0	Black/White	0	0
Violet	0	0	Red/White	0	0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	2.375 "	1.5 "	8.90625 "
9 1/2	2 3/8	1 1/2	8 29/32
24.1 cm	6 cm	3.8 cm	22.6 cm

Revised 08/26/2002



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



VEZ-2S32	
Brand Name	MARK X Powerline
Ballast Type	Electronic Dimming
Starting Method	Programmed 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 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 or 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 60 Hz input source of 120V, 277V or 347V as applicable 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 at full light output and greater than 0.90 throughout the dimming range for primary lamp.
- 2.6 Ballast shall have a minimum ballast factor of 1.00 at maximum light output and 0.05 at minimum light output for primary lamp application.
- 2.7 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less throughout the dimming range in accordance with lamp manufacturer recommendations.
- 2.8 Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% at maximum light output when operated at nominal line voltage with primary lamp. Total Harmonic Current (THC) at minimum light output shall not exceed THC at maximum light output.
- 2.9 Ballast shall have a Class A sound rating.
- 2.10 Ballast shall have a minimum starting temperature of 10C (50F) for primary lamp.
- 2.11 Ballast shall provide Lamp EOL Protection Circuit for all T5, T5/HO, and CFL lamps.
- 2.12 Ballast shall control lamp light output from 100% - 5% relative light output for T8 and CFL lamps and 100% - 1% relative light output for T5/HO lamps.
- 2.13 Ballast shall ignite the lamps at any light output setting without first going to another output setting.
- 2.14 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 controlled by a compatible Mark 10 Powerline two-wire dimmer.

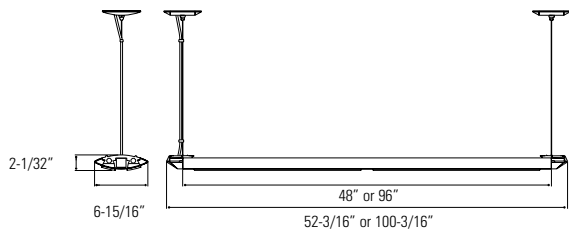
4.5 Ballast shall be Advance Transformer part # _____ or approved equal.

Revised 08/26/2002



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



Luminaire comes without end-caps.

Ordering Information

AG	L		P			2			PI	
Family	Type	Luminaire Length	Mounting	Housing Finish	Wiring	Lamp Qty in a cross section	Lamp	Voltage	Ballast*	Options
AG: Agili-T	L: Direct-Indirect Slim Body with Single Optic & Louvers	4: 4' 8: 8'	P: Pendant	GR: Titanium WH: White	SS: Single-circuit* DS: Double-circuit* SN: Single-circuit Network-Ready* DN: Double-circuit Network-Ready*	2	28: 28W T5 54: 54W T5	120: 120V 277: 277V 347: 347V UNV: Dual Voltage 120/277V	PI: Electronic Instant Start T5	M: Emergency Ballast (Bodine LP550) N.B.: Use Suspension Kit with suffix M (see Suspension Kit Emergency Option on back).

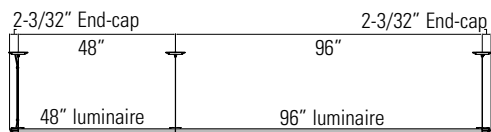
Features

- Direct-Indirect (59% up, 41% down), 88.8% efficient using T5 lamp technology.
- Ultra-Light construction (4' luminaire less than 12lb.) favors mobility, adds installation and remodeling convenience.
- Wide indirect distribution for uniform ceiling luminance.
- Trouble-free luminaire-to-luminaire connectability and luminaire-to-end-cap installation.
- Special die-cast aluminum joining mechanism (patent pending) providing continuous trouble-free, simultaneous mechanical and electrical connections (plus network connections on Agili-T Network version), as well as no-hassle end-cap installation.
- Built-in network connectors and wiring (Agili-T Network).

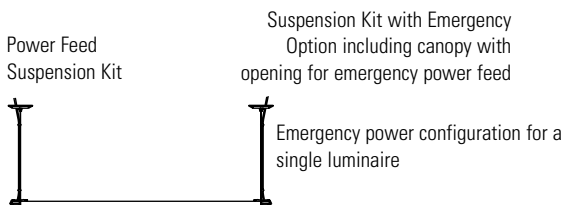
Construction

- One-piece aluminum extrusion
- Highly resistant composite plastic in-cap
- Optic made of highly reflective matte aluminum
- Unique contoured louver design with integral light stop

Fixture Lengths & Mounting Locations



Pendants measure exactly 48" or 96" (plus end-caps) to facilitate installation.



* For 347V applications
 ** If electrical junction box is needed to connect emergency wiring, order AGEb, AGES or AGEo.
 *** 18-gauge wire. Maximum of 10A per breaker. 2 circuits using 2 breakers with common neutral.
 † For maximum flexibility, DS & DN wiring options include continuous 2-circuit wiring: one circuit for upper compartment, one circuit for lower compartment (single and double compartment luminaires can be mixed).
 † Listed as a standard electrical box for through-branch wiring.
 †† Consult your Lightolier representative for other adapter shapes.
 * To order the latest network-type ballast for the Agili-T Network luminaire, consult your Lightolier representative for availability.

Labels

Electrical

- AGL comes with one 2-lamp ballast per 4' of luminaire.
- Standard product offering (DS and DN version, 120V and 277V only) includes continuous 2-circuit wiring, one circuit for the upper compartment (if applicable) and one circuit for the lower compartment (if applicable). Single and double compartment luminaires can be mixed.
- Integrated quick connectors for power and network cable (Agili-T Network only) and auto plug-in connections between luminaires.
- 18-gauge wire, maximum 10A per circuit.

Mounting

- Suspension points on module: every 4' (4' luminaire) or every 8' (8' luminaire).
- Fast installation using mounting clip for Standard T-bar and Slim T-bar or for Slot T-bar (see next page).

Finish

- Seamless color and texture finish between luminaire and end-caps.
- Available with textured (white or titanium) high resistant powder-based coating.

Options and Accessories

- Emergency circuiting and emergency ballast

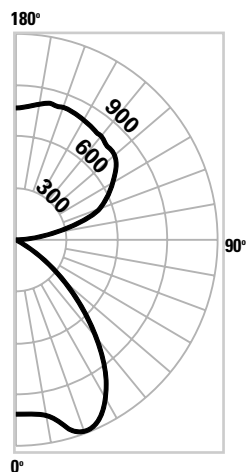
Job Information

Type:

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

Performance

Candlepower Curve



REPORT NO: LSC8477
 CAT. NO: AGL4PGRDS228120PI
 2 x 28W T5 at 2900 lumens. Efficiency: 88.8%.
 Indirect Maximum candela: 817.
 Indirect Peak at: 165°. Candela at Nadir: 1017

Candlepower

ZONE DEG	0	22.5	45	67.5	90
0	1017	1017	1017	1017	1017
5	1009	1004	1016	1021	1014
15	943	960	1011	1097	1131
25	842	877	1051	1140	1163
35	686	795	934	929	922
45	508	647	641	575	551
55	242	364	302	225	178
65	11	17	38	32	2
75	2	0	0	3	1
85	0	0	0	0	0
90	0	0	1	11	10
95	19	82	97	91	92
105	115	250	348	403	426
115	244	364	518	572	603
125	371	481	611	716	724
135	492	577	671	746	769
145	600	665	730	779	795
155	683	720	773	806	812
165	740	753	794	803	817
175	764	767	769	787	778
180	769	769	769	769	769

Coefficients of utilization

ZONAL CAVITY METHOD • EFFECTIVE FLOOR CAVITY REFLECTANCE = .20

ROOM CAVITY RATIO	Wall reflectance										
	80			70			50				
	70	50	30	70	50	30	10	50	30	10	
0	.93	.93	.93	.93	.85	.85	.85	.85	.70	.70	.70
1	.86	.83	.80	.77	.79	.76	.74	.71	.63	.61	.60
2	.80	.74	.69	.65	.73	.68	.64	.61	.57	.54	.52
3	.74	.66	.61	.56	.67	.61	.56	.52	.51	.48	.45
4	.68	.59	.53	.49	.62	.55	.50	.45	.46	.42	.39
5	.63	.53	.47	.42	.57	.49	.44	.39	.42	.38	.34
6	.58	.48	.41	.37	.53	.44	.39	.35	.38	.34	.30
7	.53	.43	.37	.32	.49	.40	.34	.30	.34	.30	.27
8	.49	.39	.33	.28	.45	.36	.30	.26	.31	.26	.23
9	.45	.35	.29	.25	.42	.33	.27	.23	.28	.24	.20
0	.42	.32	.26	.22	.39	.30	.24	.20	.25	.21	.18

DETERMINED IN ACCORDANCE WITH CURRENT IES PUBLISHED PROCEDURES
 LUMINAIRE INPUT WATTS = 65.4

Distribution

ZONE	LUMENS	%LAMP	% LUMINAIRE
0-30	856	14.76	16.63
0-40	1393	24.02	27.06
0-60	2094	36.10	40.68
0-90	2130	36.74	41.39
40-90	737	12.72	14.33
60-90	36	.63	.71
90-180	3017	52.02	58.61
0-180	5147	88.76	100.00

Agili-T Accessories

Suspension Kit

AG	AC		X		
Family	Type	Suspension Length	End-cap Color	Canopy Color	Emergency Option**
AG: Agili-T	AC: Aircraft cable, canopy and joiner mechanism	24: Adjustable 6-24" 36: Adjustable 6-36"	X: N/A	G: Titanium W: White	M: Canopy supplied with opening for emergency power feed

Power Feed Suspension Kit***

AG	EC					
Family	Type	Suspension Length	End-cap Color	Canopy Color	Voltage	Wiring
AG: Agili-T	EC: End-caps (2), aircraft cable, canopy, joiner mechanism	24: Adjustable 6-24" 36: Adjustable 6-36"	G: Titanium W: White	G: Titanium W: White	120: 120V Cable 277: 277V Cable 347: 347V Cable	SS: Single-circuit* DS: Double-circuit* SN: Single-circuit Network-Ready* DN: Double-circuit Network-Ready*

90° End-cap Adapter††

AG		90	
Family	Type	Shape	Wiring
AG: Agili-T	CG: Titanium CW: White	90: 90-degree "L" shape	SS: Single-circuit* DS: Double-circuit* SN: Single-circuit Network-Ready* DN: Double-circuit Network-Ready*

Ordering Instructions

1. Choose Agili-T luminaire.
2. Choose Power Feed Suspension Kit. One Kit per individual luminaire or one per row at row extremity (18-gauge wire feed, maximum of 10A per circuit).
3. Choose Suspension Kit. One per luminaire.
4. Choose Mounting Elements. One per Suspension Kit.
5. Choose Mounting Elements With Junction Box. One per Power Feed Suspension Kit, as needed.

Job Information

Type:

Lightolier a Genlyte Thomas Company www.lightolier.com
 631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710
 We reserve the right to change details of design, materials and finish.
 © 2002 Genlyte Thomas Group LLC (Lightolier Division) • A0902



28W/835 Min Bipin T5 UNP

Product family description
Ultra-slim design with extraordinary light output.

Features/Benefits

- Improved optical control.
- Fixtures can be 40% smaller than T8 systems.
- Design flexibility for cove and cabinet lighting.
- Better fit in 2 x 2 and 2 x 4 grid ceilings.
- Up to 104 lumens per watt.
- 95% lumen maintenance.
- 85 CRI in 3000, 3500 and 4100K.
- High system efficacy.
- Fail-safe operation at end of life.
- 20,000 hours rated average life.

Applications

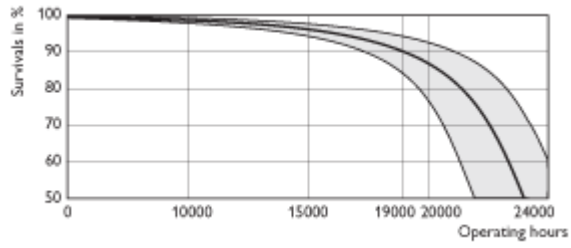
- Ideal for general, decorative and architectural lighting in offices, retail stores, hotels, schools and hospitals.

Notes

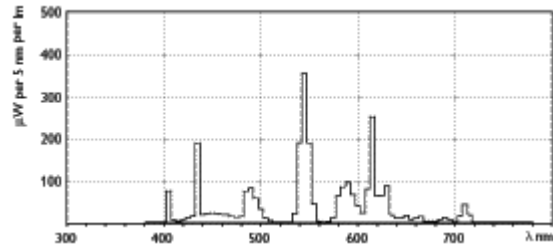
- NOT compatible with dimming ballasts.
- Silhouette™ T5 nominal lamp lengths are shorter than standard sizes. See dimension chart for details.

Product data	
Product Number	230854
Full product name	28W/835 Min Bipin T5 UNP
Ordering Code	F28T5/835
Pack type	Unpacked
Pieces per pack	1
Packs per case	40
Pack UPC	046677230852
EAN2US	
Case Bar Code	50046677230857
Successor Product number	
Wattage[W]	28W
Color Code	835 [CCT of 3500K]
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

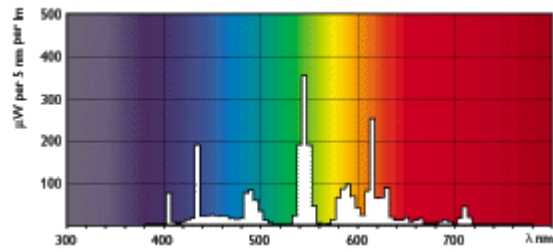
Product data	
Dimmable	Yes
Mercury (Hg) Content[mg]	
Color Rendering Index[Ra8]	85
Color Temperature[K]	3500
Initial Lumens[Lm]	-
Overall Length C[mm]	1163.2
Diameter D[mm]	17



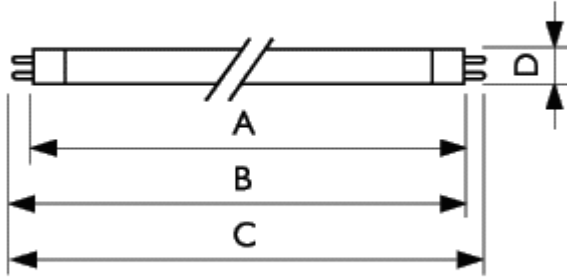
TL5



TL5/835



TL5/835



	A		B		C	D
Full product name	Max	Min	Max	Max	Max	
28W/ 835 Min Bipin T5 UNP	1149.0	1153.7	1156.1	1163.2	17	

TL5





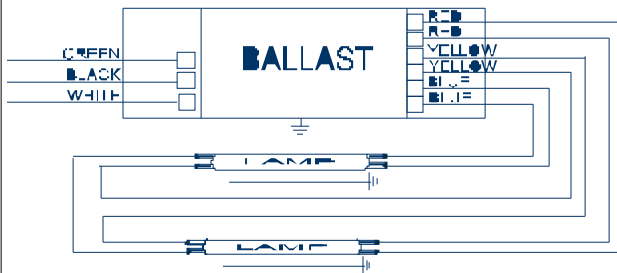
ICN-2S28@277

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

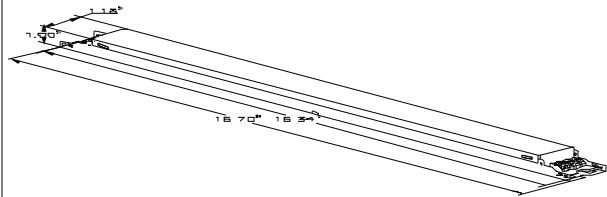


The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

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

Kipp Post

Design: Alfred Homann

high intensity discharge
incandescent

Type:

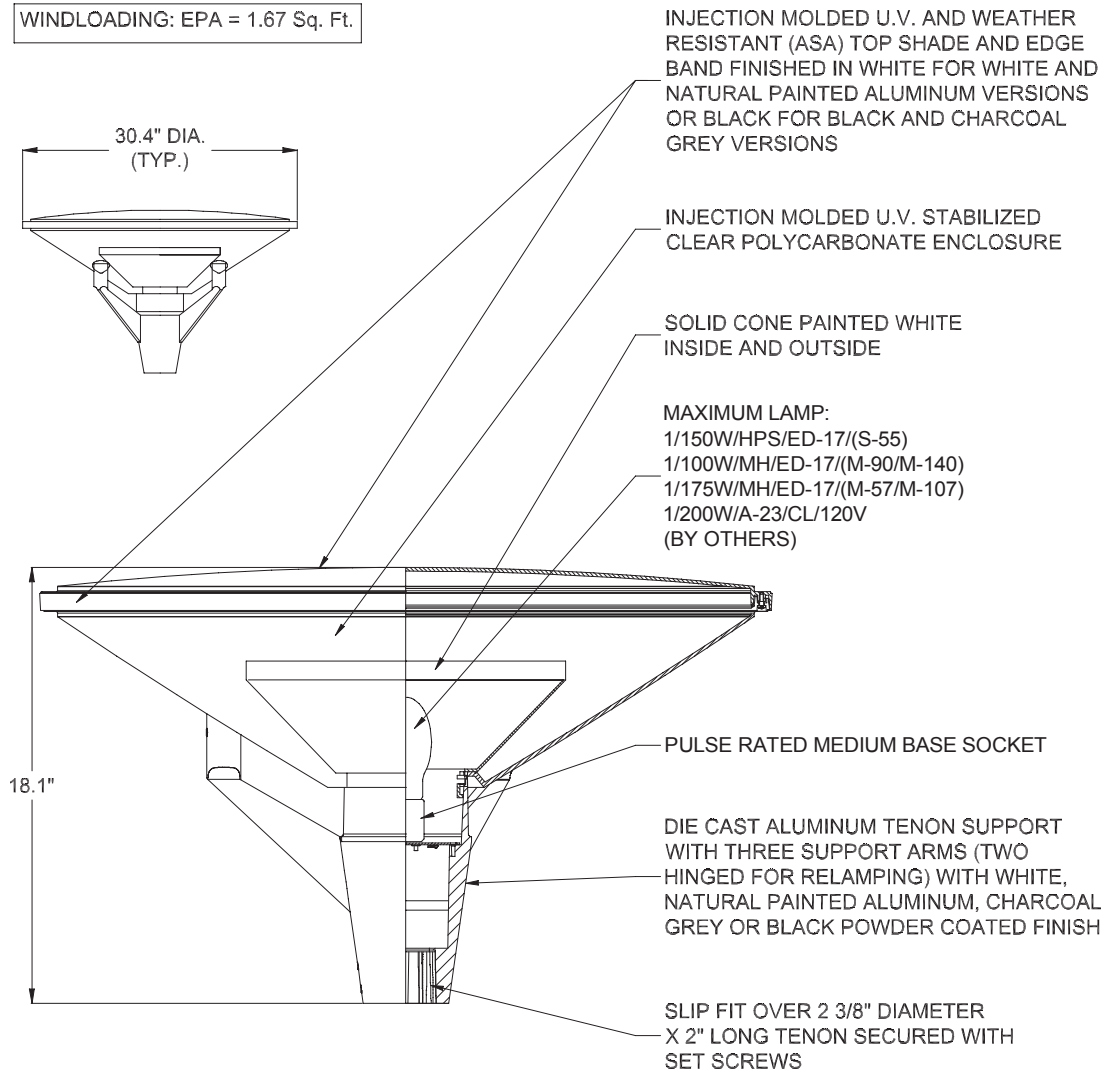
Project:

Catalog Number:

NOTES:

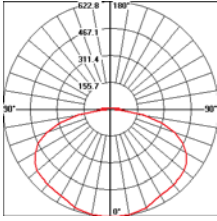
1. HID VERSIONS ARE PROVIDED STANDARD WITH ONE 120/277V F-CAN STYLE BALLAST FOR INSTALLATION IN POLES WITH INSIDE DIAMETERS OF 4 1/4" OR LARGER
2. MAXIMUM BALLAST TO LAMP DISTANCE FOR 150W/HPS 5 FT. (FOR WIRE LENGTH), FOR 100W/MH 50 FT. AND FOR 175W/MH 65 FT.

WINDLOADING: EPA = 1.67 Sq. Ft.



Kipp Cutoff

high intensity discharge
incandescent



Photometric Report: KIP-Conical-1-70W-G12-CMH-CUTOFF.IES
 Report No.: L5374
 Poulsen Report No.: KIP-Conical-1-70W-G12-CMH-CUTOFF.IES
 Luminaire: Kipp, Conical
 Lamp: 1/70W/G12/T6/CMH
 Efficiency: 40.9%
 Cutoff Classification: Cutoff
 Description: All data shown are per 6600 lumens. This report can be used for calculation on all versions listed below. Use only actual lumen data when calculating.

Vertical Angle	Candela
0	623
5	623
15	615
25	591
35	573
45	565
55	539
65	564
75	309
90	24
120	1
150	1
180	1

Zone	Lumens	% Lamp	% Fixture
0-30	507	7.7	18.8
0-40	867	13.1	32.1
0-60	1783	27	66.1
0-90	2648	40.1	98.1
90-120	46	0.7	1.7
90-130	47	0.7	1.7
90-150	49	0.7	1.8
90-180	50	0.8	1.9
0-180	2698	40.9	100.0

Kipp Post emits symmetrical, downward illumination. The relationship between the slightly curved design of the top shade and the calculated distance to the light source ensures a uniform and wide distribution of light. The design of the internal diffuser ensures an optimal and glare free illumination. The optional opaque diffuser satisfies cutoff requirements.

Finish
 White, natural painted aluminum, charcoal grey or black, powder coated.

Material
 Top shade: Black or white, injection molded ASA. Diffuser: Injection molded white opal acrylic and white aluminum. Enclosure: Injection molded clear polycarbonate. Frame: Die cast aluminum.

Mounting
 Post Top: Mounted on dual round aluminum (DRA) or round straight aluminum (RSA) pole.

Weight
 Max. 24 lbs.

Label
 CUL, Wet location. IBEW.

s p e c i f i c a t i o n

Ordering example:

1	2	3	4	5	6
Prod.code	Light source	Volt.	Finish	Diffuser	Trans.
KIP	1/150W/CMH/T-6 G12	120/277V	BLK	WHITE OPAL	T-RSA-4.5"

- Product code**
KIP
- Light source**
1/85W/QL^a
1/150W/CMH/T-6 G12^b
1/150W/HPS/ED-17 medium^{b,c}
1/100W/MH/ED-17 medium^b
1/175W/MH/ED-17 medium^b
1/200W/A-23/CL medium^d
- Voltage**
120/277V
120V
- Finish**
BLK^e
CHAR. GREY^e
NAT. PAINT ALU.^f
WHT^f
- Diffuser**
WHITE OPAL
WHITE CUTOFF
- Transition to pole**
T-DRA-5"-3"^c
T-RSA-4.5"

Specification notes:
 a. QL variant is provided with 120V HF integral generator and can only be used with RSA-4.5" pole.
 b. CMH and HID variants are provided with one 120/277V F-can style ballast to be mounted in RSA-4.5" or DRA-5"-3" poles.
 c. HPS variant is not available with T-DRA-5"-3".
 d. Incandescent variant is only available in 120V.
 e. Black top shade is provided with black and charcoal grey finishes.
 f. White top shade is provided with white and natural painted aluminum finishes.

Info notes:
 I. Enclosure is U.V. stabilized polycarbonate.
 II. For pole selection, refer to Pole Guide.
 III. The comparable EU version has the following classification: Ingress Protection Code: IP66.



MasterColor CDM- T 150W/830 G12 T6 1CT

Product family description

Range of single-ended T6 high-efficiency ceramic metal halide lamps with a stable color over lifetime and a crisp, sparkling light.

Features / Benefits

- Excellent color rendering.
- Superior color stability over life within +/- 200K.
- Lamp to lamp color consistency over life.
- Higher lumen maintenance than standard metal halide.
- Warm (3K) or fresh white (4K) color impression.
- High lamp efficacy (up to 93 lumens per watt) for energy saving and low heat.
- Universal operating position.
- Compact lamp dimensions for high beam intensities.
- FadeBlock for reduced fading risks.
- No shut off required in 24-hour-a-day/7-day-a-week operations (relamp fixtures at or before the end of rated life).
- Long lamp life compared to incandescent and halogen lamps.

Applications

- Accent and General lighting in retail, offices and public buildings. Decorative outdoor: floodlighting and pedestrian areas.

Notes

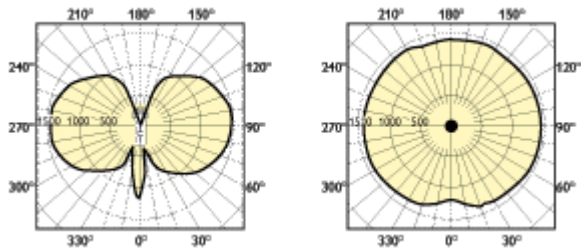
- Requires a ballast specified or approved for Philips Metal Halide lamp or one designed to the indicated ANSI Standard. A pulse ignitor is required.

- Sockets and wiring must withstand starting pulse. (391)
- Supply volts must be +/- 5% of rated ballast line volts for reactor type and +/- 10% for CWA or electronic ballasts. (392)
- UV filtered design (FadeBlock™). (396)
- Operate only on thermally protected ballasts (397)
- MasterColor® Metal Halide Lamps are not recommended for use on dimmers and are not warranted if used on dimmer systems. (401)
- Rated average life is the life obtained, on the average, from large representative groups of lamps in laboratory tests under controlled conditions at 10 or more operating hours per start. It is based on survival of at least 50% of the lamps and allows for individual lamps or groups of lamps to vary considerably from the average. For lamps with a rated average life of 24,000 hours, life is based on survival of 67% of the lamps. (351)
- Approximate lumen values listed are for vertical operation of the lamp. (352)
- Means Lumens is the approximate lumen output at 40% of lamp rated average life. (353)
- Heat resisting glass bulb.

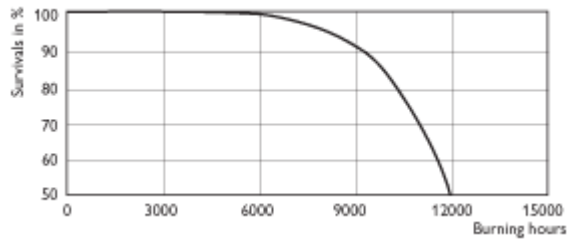
Product data

Product Number	232728
Full product name	MasterColor CDM- T 150W/830 G12 T6 1CT
Ordering Code	CDM150/T6/830
Pack type	1 Lamp in a Folding Carton
Pieces per pack	1
Packs per case	12
Pack UPC	046677232726

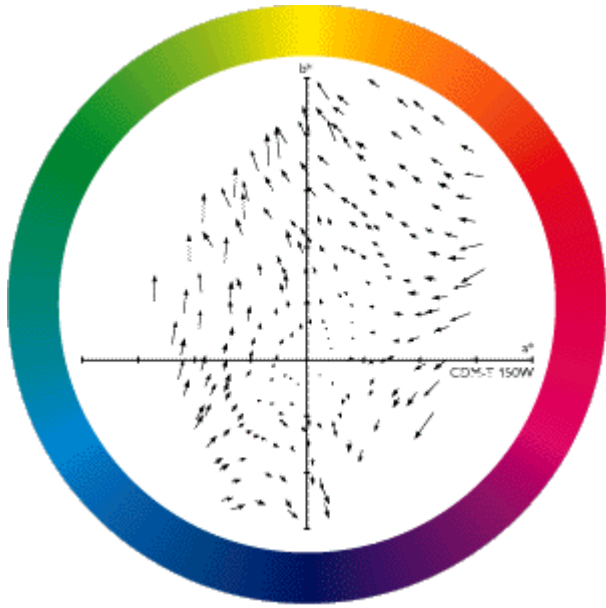
Product data	
EAN2US	
Case Bar Code	50046677232721
Successor Product number	
Wattage[W]	150W
Color Code	830 [CCT of 3000K]
Base	G12
Bulb	T6 [Diameter: .75 inch]
Packing Type	1CT [1 Lamp in a Folding Carton]
Packing Configuration	12
Bulb Finish	Clear
Operating Position	Universal[Any or Universal (U)]
Rated Avg. Life[hr]	12000
ANSI Code HID	M142/E
System Power EL[W]	167
Lamp Voltage[V]	96
Dimmable	No
Mercury (Hg) Content[mg]	
Color Rendering Index[Ra8]	85
Color Designation	Warm White
Color Description	830 Warm White
Color Temperature[K]	3000
Initial Lumens[Lm]	14000
Design Mean Lumens[Lm]	9800
Overall Length C[mm]	110
Diameter D[mm]	20
Light Center Length L[in]	2.21875
Max Overall Length (MOL) - C[in]	4.34375
Diameter D[in]	0.75



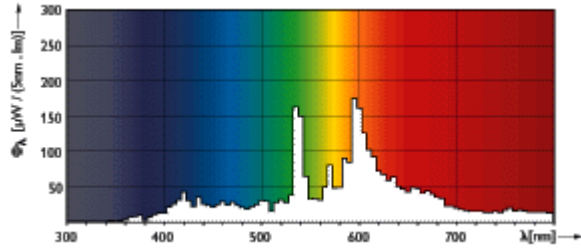
CDM- T 150W



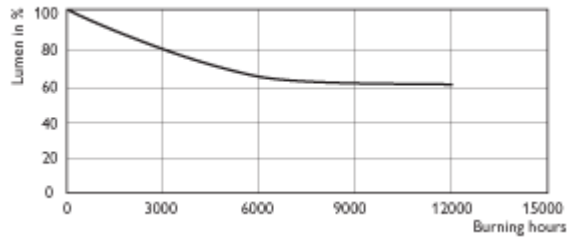
CDM- T 70W/150W/830/942



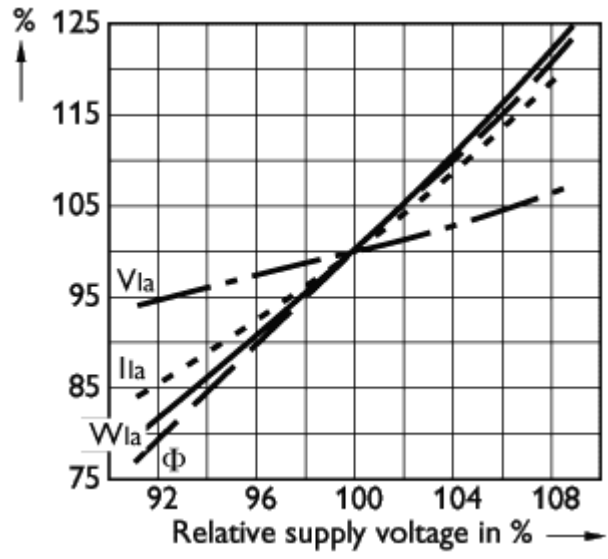
CDM- T 150W/830



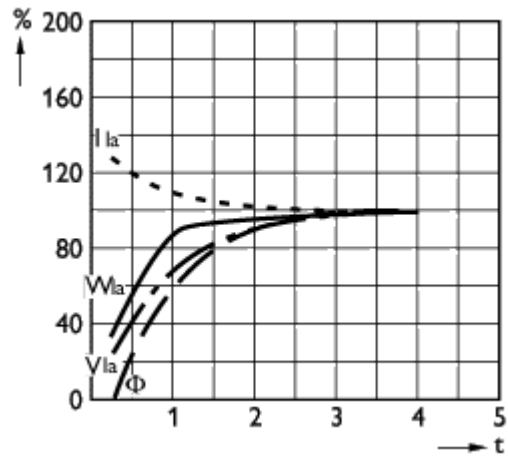
CDM- T/830



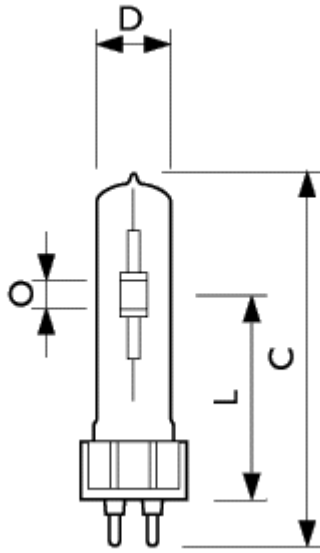
CDM- T 70W/150W/830/942



CDM-T/830



CDM-T



CDM-T

	C		D		L		O	
Full product name	Max	Max	Min	Nom	Max	Min	Max	Min
MasterColor CDM-T 150W /830 G12 T6 1CT	110	20	55	56	57	8.67		
							O	
	Nom			Max				
	9			9.33				

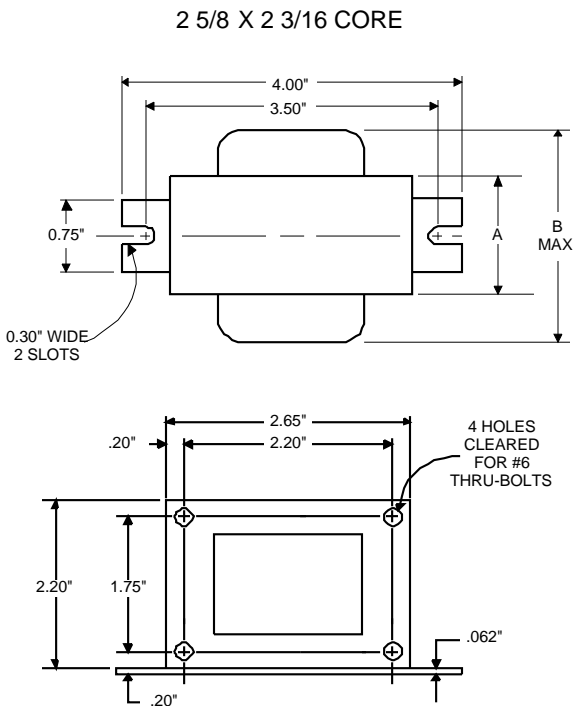




**Metal
Halide
Lamp Ballast**

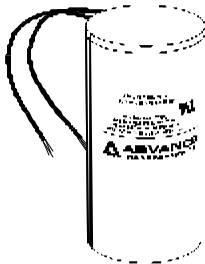
**Catalog Number 71A5437BP
For 150W M102
60 Hz R-HPF
Status: Active**

DIMENSIONS AND DATA



INPUT VOLTS	277			
CIRCUIT TYPE	R-HPF			
POWER FACTOR (min)	90%			
REGULATION				
Line Volts	±5%			
Lamp Watts	±10%			
LINE CURRENT (Amps)				
Operating.....	0.63			
Open Circuit.....	1.50			
Starting.....	0.70			
UL TEMPERATURE RATINGS				
Insulation Class	H(180°C)			
Coil Temperature Code	B			
MIN. AMBIENT STARTING TEMP.	-20°F or -30°C			
NOM. OPEN CIRCUIT VOLTAGE	277			
INPUT VOLTAGE AT LAMP DROPOUT.....	170			
INPUT WATTS	173			
RECOMMENDED FUSE (Amps).....	5			
CORE and COIL				
Dimension (A)	2.50			
Dimension (B)	4.00			
Weight (lbs.)	4.2			
Lead Lengths	12"			
CAPACITOR REQUIREMENT				
Microfarads	14.0			
Volts (min.)	280			
Fault Current Withstand (amps)				
60 Hz TEST PROCEDURES (Refer to Advance Test Procedure for HID Ballasts - Form 1270)				
High Potential Test (Volts)				
1 minute	2000			
2 seconds	2500			
Open Circuit Voltage Test (Volts)	250-305			
Short-Circuit Current Test (Amps)				
Secondary Current	2.00-2.50			
Input Current.....	0.50	-	-	-
	0.75			

Capacitor: 7C140M33-R



Capacitance: 14
Dia/Oval Dim: 1.5
Height: 2.9

Temp Rating: 105°C

Ignitor: INTEGRAL

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

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

Wiring Diagram:

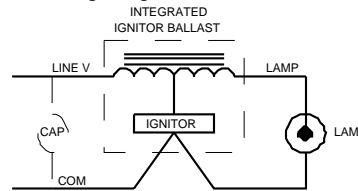


Fig. H

Ordering Information

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

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

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

05/15/03