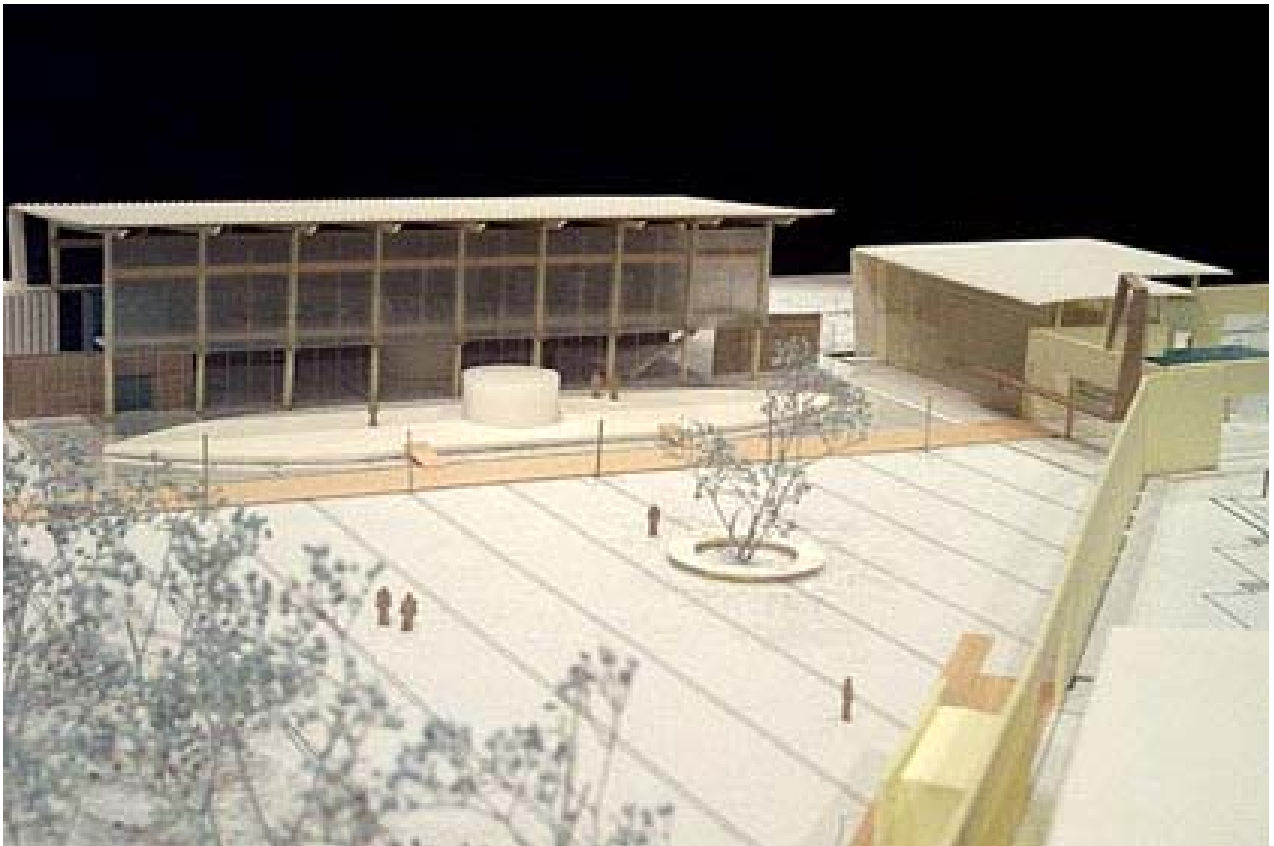


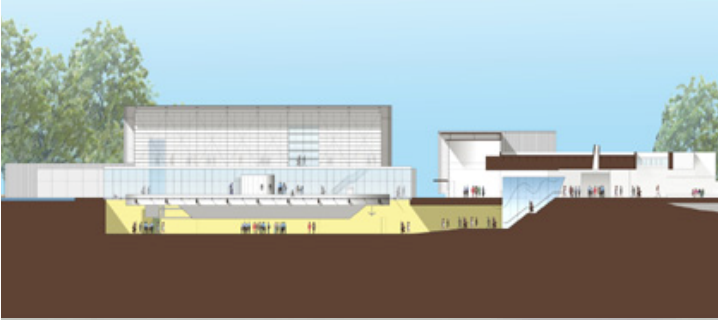
Senior Thesis Final Report

The U.S. Mariner's Museum
Newport News, VA



Christine Brazill
Lighting/Electrical Option
Faculty Consultant: Dr. Moeck
April 2, 2004

THE U.S. MARINER'S MUSEUM NEWPORT NEWS, VIRGINIA



ARCHITECTURAL

- Display area houses USS Monitor Turret as well as other recovered artifacts
- Overhead walkway in tank gallery for visitors
- Concept of waterline conserved with visitors moving above and below this line

LIGHTING

- All lighting 120 V.
- 24 Zone Grafik Eye dimming system and dimming panel used.
- Daylight incorporated into tank gallery
- Underwater lighting used in turret tank

STRUCTURAL

- Concrete slab floor
- Steel lateral framing
- Exposed steel beam roof with metal deck
- Overhead 25 ton crane in place to move pieces throughout process of conservation

*Christine Brazill
Architectural Engineering
Lighting/Electrical Option.*

GENERAL

- \$30,000,000 construction cost for 3 phases
- Size: 39,000 sq. ft.
- Owner: Mariner's Museum
- AE Firm: SmithGroup
- Lighting Consultant: Brandston Partnership

ELECTRICAL

- Museum campus has its own distribution system
- Primary service: 13.2 kV
- Secondary service: 480V Wye
- Additional service: 120V Wye

MECHANICAL

- Enhanced temperature and humidity in all conservation areas.
- Economizer cycle system with main AHU for Conservation Lab Building and two additional AHUs for Gallery
- Containment system in supply room to prevent chemicals from entering municipal waste



Table of Contents

EXECUTIVE SUMMARY	4
BUILDING BACKGROUND	5
GENERAL ARCHITECTURE	5
LIGHTING STUDY	6
CONSERVATION LAB	6
<i>Space Conditions</i>	7
<i>Space Criteria</i>	7
<i>Design Goals</i>	8
<i>Final Design</i>	8
<i>Analysis</i>	9
<i>Controls</i>	11
CONSERVATION LAB ALTERNATE DESIGN	11
<i>Final Design</i>	11
TANK GALLERY	14
<i>Design Goals</i>	14
<i>Space Conditions</i>	15
<i>Space Criteria</i>	15
<i>Final Design</i>	15
<i>Analysis</i>	17
MEZZANINE	20
<i>Design Goals</i>	20
<i>Space Conditions</i>	20
<i>Space Criteria</i>	21
<i>Final Design</i>	21
<i>Analysis</i>	22
NORTH FAÇADE	23
<i>Design Goals</i>	23
<i>Space Conditions</i>	24
<i>Space Criteria</i>	24
<i>Final Design</i>	24
<i>Analysis</i>	25
ELECTRICAL STUDY	27
<i>System Type</i>	27
<i>Building Utilization Voltage</i>	27
<i>Transformer Configuration</i>	27
<i>Emergency Power System</i>	27
<i>Design Requirements</i>	28
<i>Electrical Changes</i>	28
<i>Overcurrent Protection</i>	28
<i>Lighting Systems</i>	29
<i>Lamps and Ballasts</i>	29
<i>Major Mechanical Equipment</i>	30
<i>Electrical Equipment</i>	31
<i>NEC Building design load</i>	31
MECHANICAL ANALYSIS	32
CONSTRUCTION ANALYSIS	32
FINAL CONCLUSIONS	34
APPENDIX A: DIAGRAMS	35
APPENDIX B: DESIGN LOAD CALCULATIONS	39
APPENDIX C: WORKS CITED	42
APPENDIX D: LIGHTING CUT SHEETS	43

Executive Summary

The USS Monitor Museum is an addition to an existing museum campus in Newport News, Virginia. The project mainly studied in this thesis was the USS Monitor Center's first phase: the Tank Gallery, where artifacts can be viewed throughout real-time conservation efforts, and then eventually after conservation is complete. The next phase will be the design of a full-scale replica of the USS Monitor on the north of the Tank Gallery.

This project explores in-depth the lighting design of four spaces: the conservation lab, where research and small-scale conservation work is carried out; the tank gallery, where large artifacts will be on display in their conservation tanks; the mezzanine, where visitors can view into the tanks from above, and the front façade, which plays a role in the future replica. Also explored was the electrical system and any changes that can be made to it due to changes in the lighting system. Studied as breadth work were mechanical and construction aspects. The glazing's impact on cooling loads was studied for mechanical, and cost estimates were created for construction.

Building Background

The U.S. Mariner's Museum is located along the Chesapeake Bay in Newport News, Virginia. At 40,000 sq. ft. and \$3 million, the USS Monitor Center is the first of three phases of expansion to the museum. The goal of the Mariner's Museum is to illustrate the discovery, recovery, and conservation of the USS Monitor, with the USS Monitor Center displaying important relics from the USS Monitor throughout the process of conservation. The next phase of the project will include a full-scale replica of the USS Monitor to be located outside the north wall of the Gallery.



Figure 1 – 3D view of museum campus
(image by Smithgroup)

General Architecture

The main space in the Monitor Center is the Tank Gallery, where the turret from the Monitor can be viewed through portholes in its conservation tank. Also planned to be on display are the ship's engine, anchor, and other large artifacts. A mezzanine level at the north side of the gallery allows visitors to view the tanks from above.

Besides the Tank Gallery, the Monitor Center houses the conservation work spaces for the museum. An X-ray room, cold room, conservation lab, and library make up the conservation area.

The architect has created the concept of a water line so that replica is located “underwater” by being below the grade level of the Monitor Center.

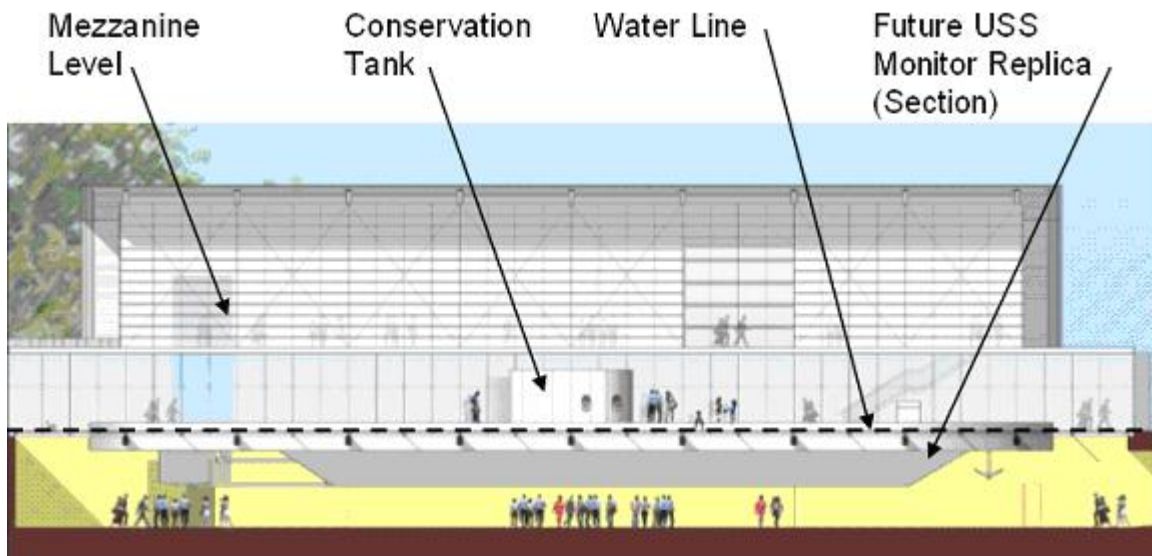


Figure 2 – Elevation of Monitor Center and section through future replica
5 of 85

Lighting Study

Four spaces in the USS Monitor Center were considered in the lighting study. The Conservation Lab, where conservation work is carried out on artifacts; the Tank Gallery, where the USS Monitor turret and engine are on display; the Mezzanine where visitors can view the Gallery from above; and the north façade, where the main view of the building is.

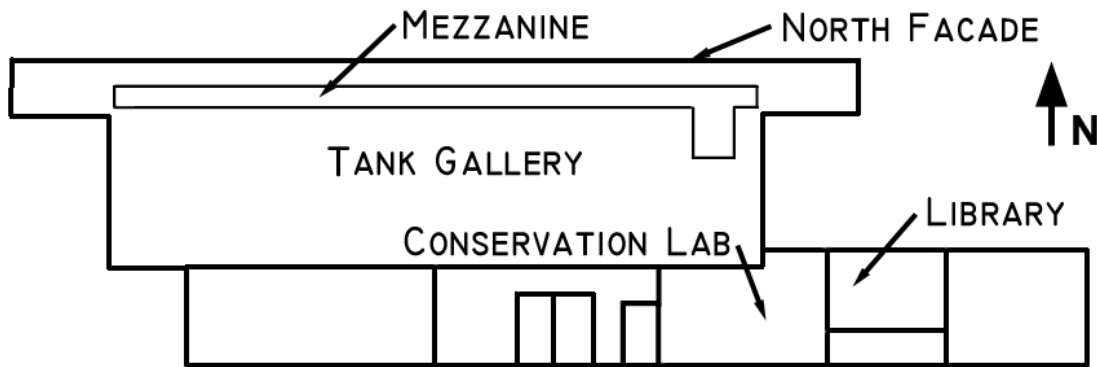


Figure 3 – Layout of studied spaces

Conservation Lab

The Conservation Lab is an important feature of the building in that most of the restoration and conservation work of the museum organization takes place here. The room contains scientific equipment including microscopes and balances.

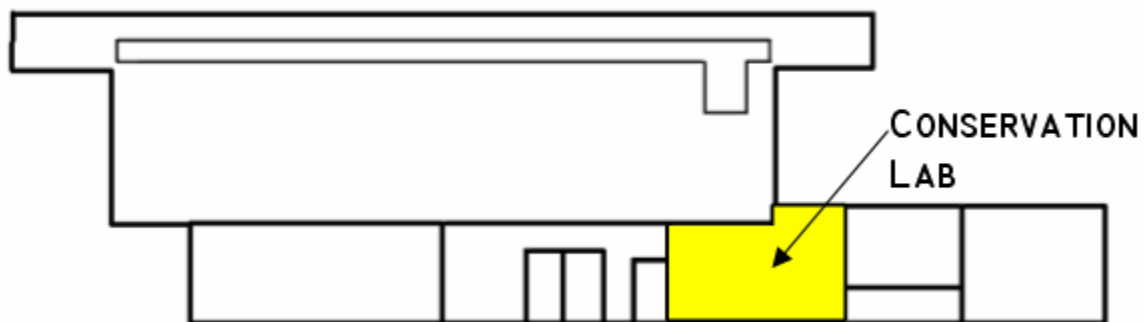


Figure 4 – Conservation Lab Location

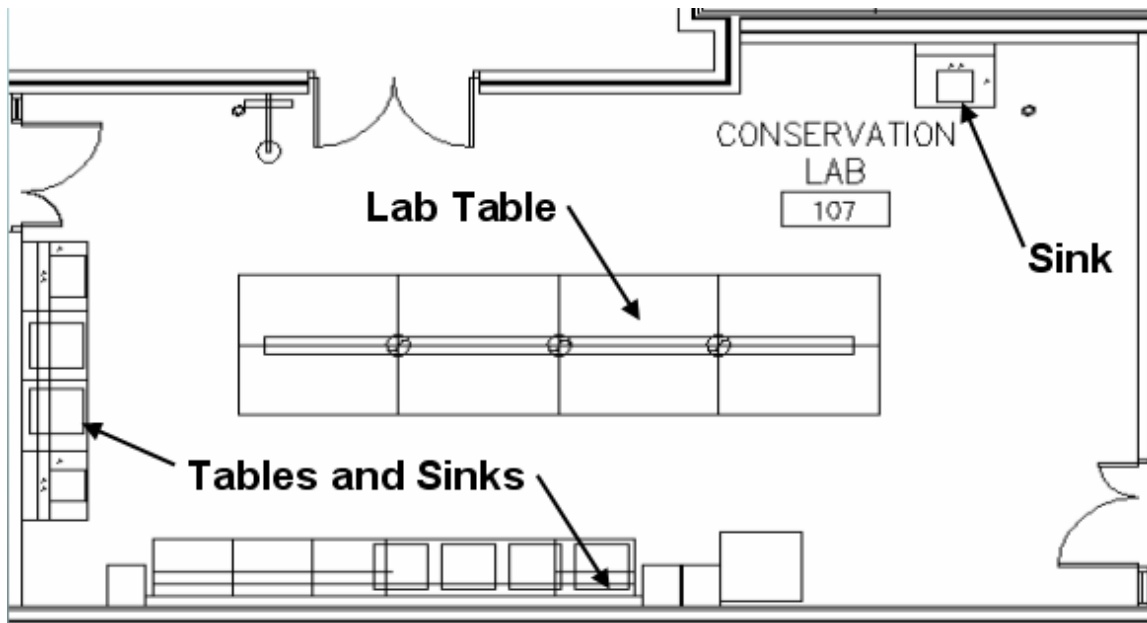


Figure 5: Furniture layout

Space Conditions

❖ Tasks	cleaning artifacts handling conservation materials analyzing artifacts under microscopes		
❖ Materials	walls	latex paint	reflectance: 52%
	ceiling	latex paint	reflectance: 70%
	floor	epoxy coating	reflectance: 35%
	lab tables	plastic laminated	reflectance: 20%

Space Criteria

❖ Illuminance	work area	50 fc horizontal
	perimeter sinks and tables	30 fc horizontal
❖ Power density	2.5 W/ft ²	

Design Goals

Because of the work done in this area, glare on artifacts is an issue and must be limited. To analyze artifacts, conservators must be able to see color differences and surface imperfections. Therefore color rendering becomes important and the need for a large-area low-luminance source is introduced, allowing surface details to be viewed without glare. Also the central lab table is where most of the scrutinous work will be done, so high illuminance levels are needed there.

Final Design

The ceiling was used to create the ideal large-area low-luminance source. A cove was built around the perimeter of the room to create this effect, and a row of direct/indirect luminaires was placed in the center of the room above the lab table. This gave the main table a significant amount of light (average of 57 fc) while creating an even distribution of light.

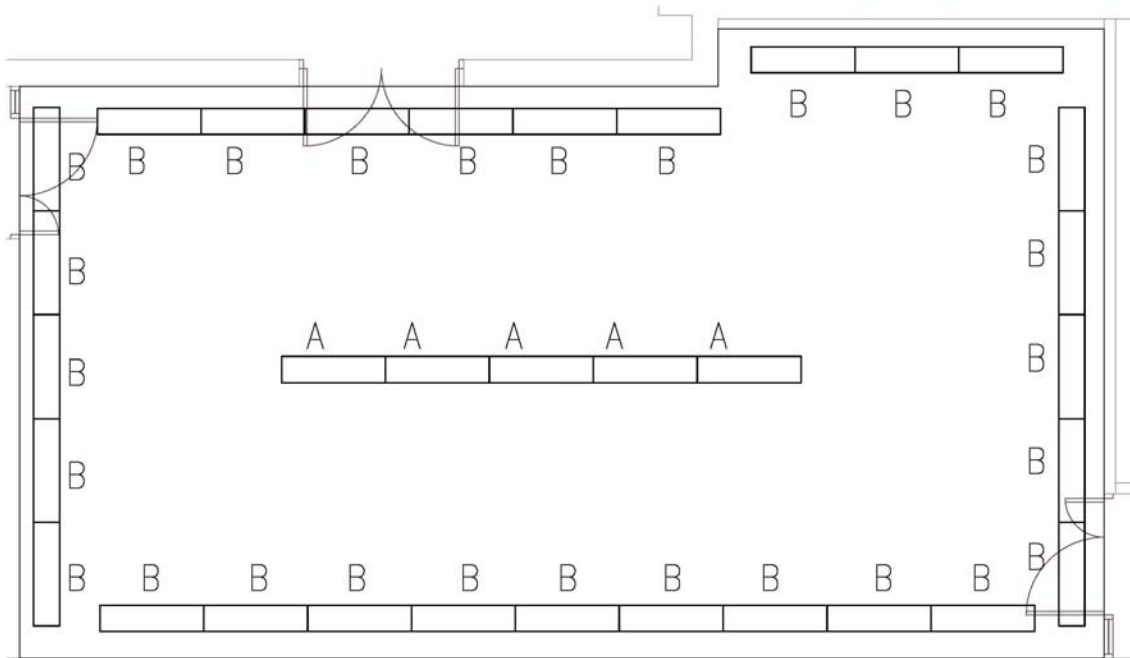


Figure 6: Reflected Ceiling Plan

Table 1: Fixture Schedule

Type	Description	Manufacturer	Catalog	Mounting	Watts
A	Suspended	Litecontrol	P-ID-93-2-4-T8-	Pendant	59.3

	direct/indirect		PBSS-ELB-1CWQ-120		
B	Cove	Focal Point	FCV-26-1T5-1C-120-E-CV-L835-HW-4'	Cove	58

Table 2: Lamp Data

Type	Lamp	Lamp Manufacturer	Lamp Type	Lumens per lamp	No. of lamps	CRI/CCT
A	T8	Philips	F32T8/TL850/ALTO	2950	2	86/3500
B	T5HO	Philips	F54T5/835/HO	5000	1	85/3500

Table 3: Ballast Data

Type	Ballast	Ballast Manufacturer	Control	Voltage	Ballast Factor
A	100-5% dimming electronic	Advance	2-lamp T8	120V	.95
B	Electronic	Advance	1-lamp T5HO	120V	1.02

Table 4: Light Loss Factors

Type	Ballast Factor	Luminaire Dirt Depreciation	Lamp Lumen Depreciation	RSDD	Total LLF
A	.95	.95	.95	.95	.81
B	1.02	.87	.90	.95	.76

Analysis

This design achieved an even illumination on the center lab table, with an average value of 66 fc. Figure 4 shows the pseudocolor analysis of the lab in plan view. The west table and sink area (on the left) receives an average of 40 fc, while the south table receives an average of 33fc. This design achieves the goal of 50 fc on the room's main work space and 30 fc in the perimeter areas while maintaining a power density of 2.1 W/ft² (see Table 4).

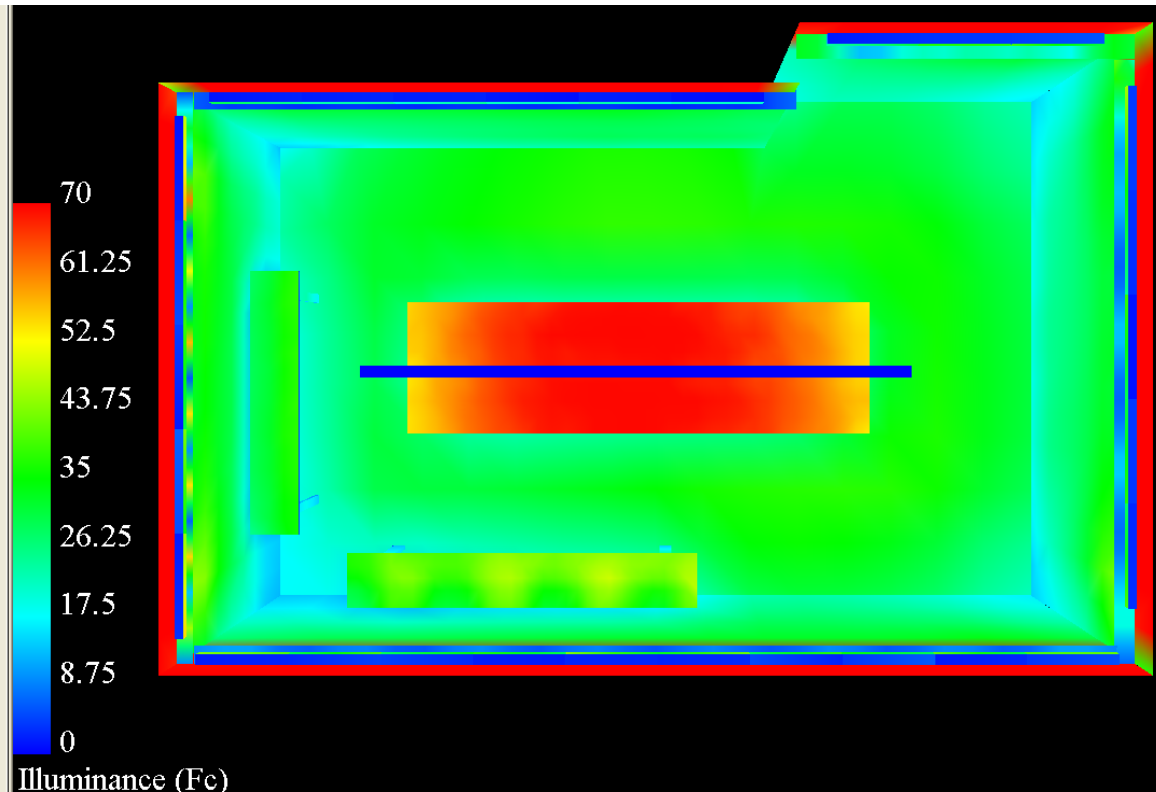


Figure 7: Pseudocolor analysis of lab in plan view

Table 5: Power Density

Type	Wattage	Number Used	Watts	Total Wattage	Room Area (ft ²)	Power Density
A	59.3	6	355.8	1937.8	952	2.14 W/ft ²
B	58	29	1682			

Table 6: Room Illuminance Values (fc)

	MAXIMUM	MINIMUM	AVERAGE
Center lab table	71.4 fc	54.8 fc	65.6 fc
West table and sink area	48.4 fc	29.6 fc	40.9 fc
South table and sink area	37.4 fc	28.4 fc	33.4 fc

Controls

The Conservation Lab only requires two circuits: one for the cove luminaires and one for the center luminaires. The luminaires above the lab table are dimmable to the benefit of the researchers, and the cove lighting is simply on a switch. Because this is a specialty space, occupancy sensors are not used. Switches and dimmers are located at each of the three doors

Conservation Lab Alternate Design

Because the power density was higher than desired in the Conservation Lab, I explored the possibility of using all direct/indirect luminaires rather than having the cove. The same luminaire, lamp, and ballast were used from the first design (lamp A).

Table 7: Power Density

<i>Type</i>	<i>Wattage</i>	<i>Number Used</i>	<i>Total Wattage</i>	<i>Room Area (ft²)</i>	<i>Power Density</i>
A	59.3	20	1186	952	1.25 W/ft²

Table 8: Room Illuminance Values (fc)

	<i>MAXIMUM</i>	<i>MINIMUM</i>	<i>AVERAGE</i>
Center lab table	79.8	59.1	73.1
West table and sink area	40.4	25.6	34.0
South table and sink area	57.0	28.0	46.0

Final Design

The power density for the scenario without the cove was 40% lower than than the first design. Uniformity was still able to be achieved here on perimeter spaces while still emphasizing the center lab table with an average of 70 fc. The purpose of designing a cove in the first place was to use the ceiling to create the ideal large-area source, however with a system of all direct-indirect luminaires this was still achieved while giving enough direct light to help define shadows and edges.

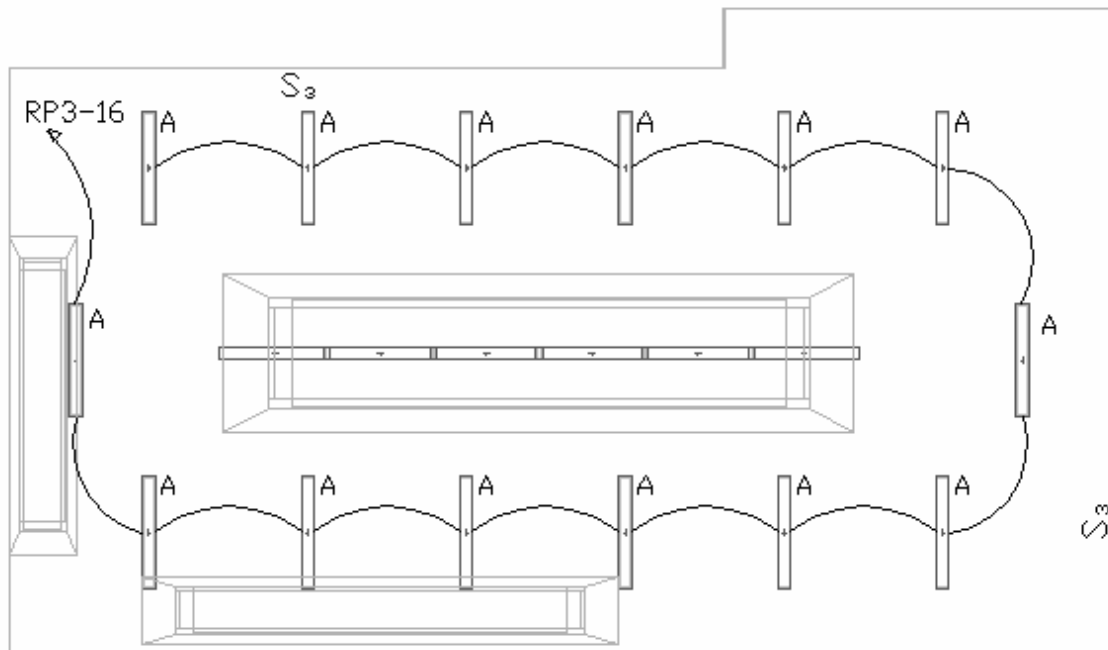


Figure 8 – Power plan of lab

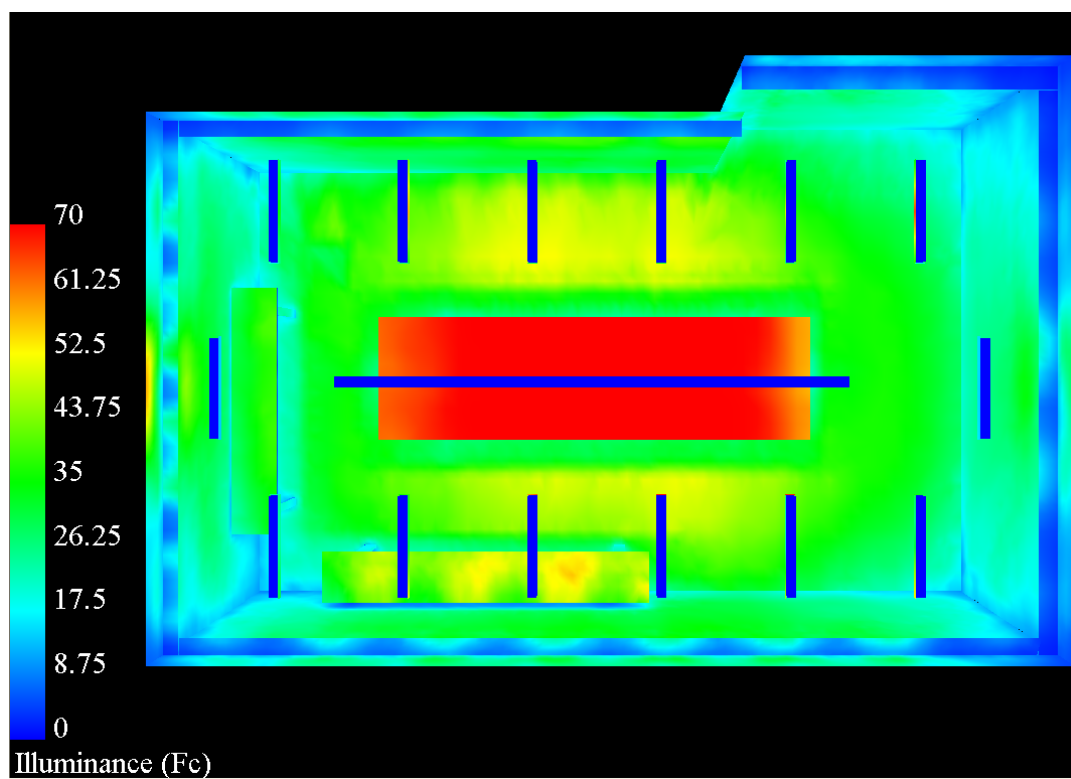


Figure 9 – Pseudocolor analysis of lab in plan view with all direct/indirect luminaires



Figure 10 – Rendering of lab without coves



Figure 11 – Rendering of lab with coves

Tank Gallery

The Tank Gallery is the main public exhibition space of this building. It contains a large tank to display USS Monitor artifacts, including the turret, cannons and the engine, as well as treatment tanks to preserve artifacts. The gallery is a two-story space, allowing visitors to access an overhead walkway to observe the 9-foot tall tanks. The north wall of the gallery is a glass façade, allowing a view of the USS Monitor turret tank from outside. The walls of the Gallery are masonry with sound insulation, the floor is sealed concrete, and the ceiling is an exposed structure.

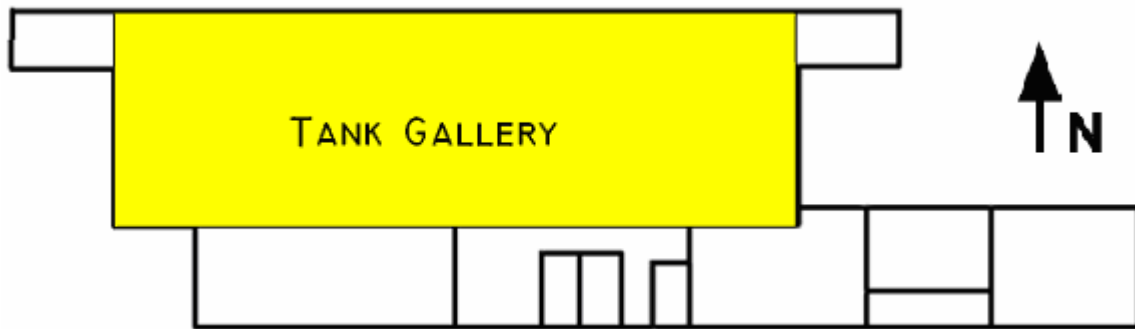


Figure 12 – Location of Tank Gallery

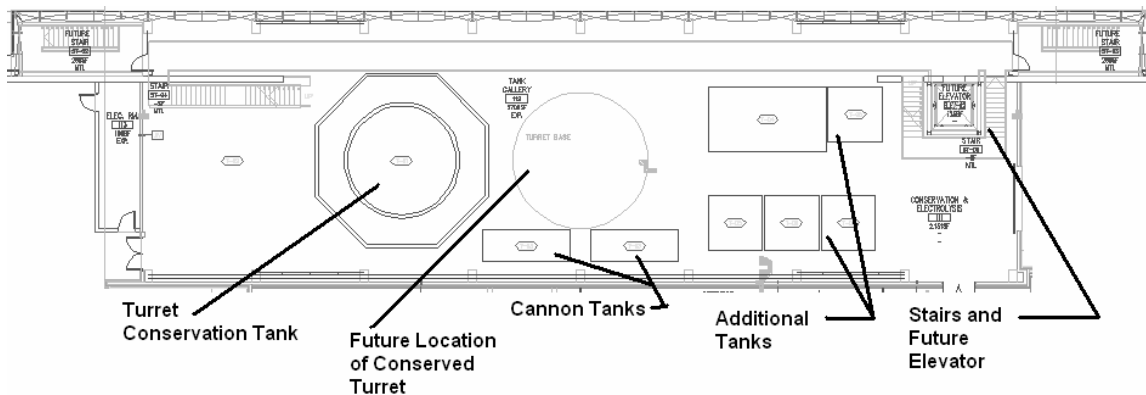


Figure 13 – Space layout of Tank Gallery showing locations of tanks

Design Goals

In a museum space such as this, it is important to balance exhibition and conservation needs. Too much exposure to light could potentially damage museum artifacts, but without enough light to observe and appreciate the artifacts, there is not much reason to preserve them. Special consideration must be given to daylight and UV exposure of the artifacts. Therefore a careful

balance between light exposure and visual enjoyment is required. For lighting three-dimensional objects, it is important to provide light from several directions, creating key light, fill light, and background light. In the gallery this must be achieved in the tanks to see all the lines and shadows of the turret and other artifacts. When using glass tanks to display objects, direct and reflected glare become important factors to consider. If the light is hitting a tank at a bad angle, the artifacts will not be visible. The contrast between the objects and their surrounding should be 5:1.



Figure 14 – Conservation tank

Space Conditions

❖ Tasks	conserving artifacts viewing conservation process displaying conserved artifacts		
❖ Materials	walls	masonry	reflectance: 60%
	floor	concrete	reflectance: 20%
	ceiling	exposed structure	reflectance: 80%
	north façade	glazing	transmittance: 81%
	conservation tank	metal	reflectance: 45%

Space Criteria

❖ Illuminance	3D objects on display	30fc horizontal 5fc vertical
	museum lobby	10fc horizontal
❖ Power density	1.6 W/ft ²	

Final Design

The high ceiling height in this space, sloping from 39 feet on the south end to 44 feet at the north end, posed a challenge in terms of efficiently lighting the entire space. First, to emphasize the height of the space and therefore the immense size of the USS Monitor artifacts, the ceiling was lit using pendant luminaires, each with two 54WT5 lamps. To bring additional light to the floor, thin round linear luminaires, each with 2 54WT5 lamps, were mounted to the wall on the south side and beneath the mezzanine on the north side. The luminaires at

the south side were rotated 30 degrees to spread more light into the room. To add emphasis to the conservation tank and the base where the turret will eventually be on display, recessed compact fluorescent uplights are located around the perimeter of each display. These luminaires are aimed to wash the sides of the tanks. Additional lighting for future artifacts will be provided within the displays. Following the architect's theme of a "waterline" in the replica, the floor of the gallery would be at that waterline. This means that everything above the floor in the gallery is "above water." Rather than dealing with blue light, I am recommending that the architect specify the floor to be finished in a blue color because it is simply a painted concrete floor. See Appendix A for layout.

Table 9 – Fixture Schedule

Type	Description	Manufacturer	Model	Mounting	Watts
A	Indirect	Elliptipar	M117-1000-Y-81-A-000	Suspended	400
B	Direct	Erco	12414.023	Wall	118
C	Recessed Uplight	Erco	33723.023	Recessed	70
D	Tank Light	Bega	8509INC	Bracket	50

Table 10 – Lamp Data

Type	Lamp	Manufacturer	Lamp Type	Lumens per Lamp	Number of Lamps	CRI/CCT
A	Metal Halide	Philips	1000W	104,500	1	70/ 3400
B	Fluorescent	Sylvania	54WT5	4650	2	82/ 3500
C	Metal Halide	Philips	70W T6	6000	1	92/ 4200
D	Incandescent	GE	50 W	330	1	100/

Table 11 – Ballast Data

Type	Ballast	Manufacturer	Watts	Voltage	Ballast Factor
A	1 lamp	Advance	1080	120	1.0
B	1 lamp dimming	Sylvania	62	120	1.0
C	1 lamp	Advance	92	120	1.0
D	NA				

Table 12 – Light Loss Factors

Type	Ballast Factor	LDD	LLD	RSDD	Total LLF
A	1.0	.92	.95	.82	.72
B	1.0	.85	.95	.94	.76
C	1.0	.92	.95	.82	.72
D	None	1.0	1.0	1.0	1.0

Analysis

Table 13: Power Density

Type	Wattage	Number Used	Total Wattage	Room Area (ft²)	Power Density
A	98.1	26	2548	8316	0.86 W/ft²
B	124	28	3572		
C	62	16	992		
D	50	8	40		
			7152		

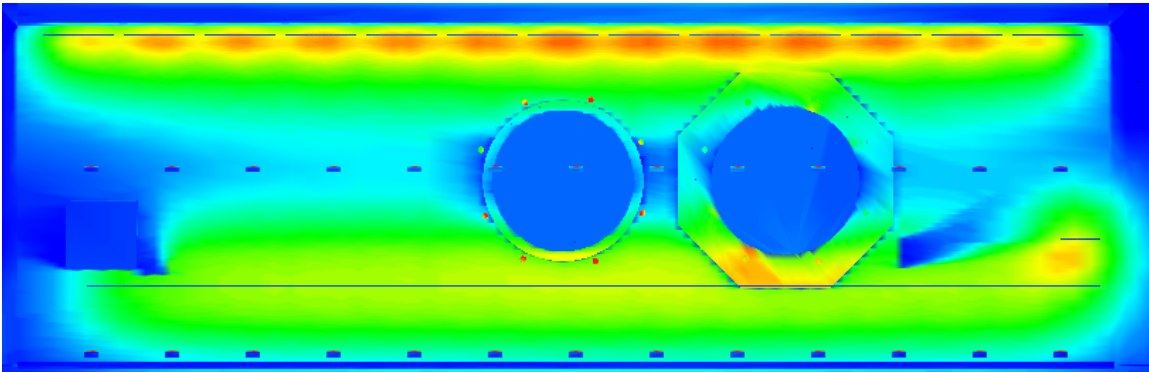


Figure 15 – Pseudocolor analysis of the tank gallery in plan view.

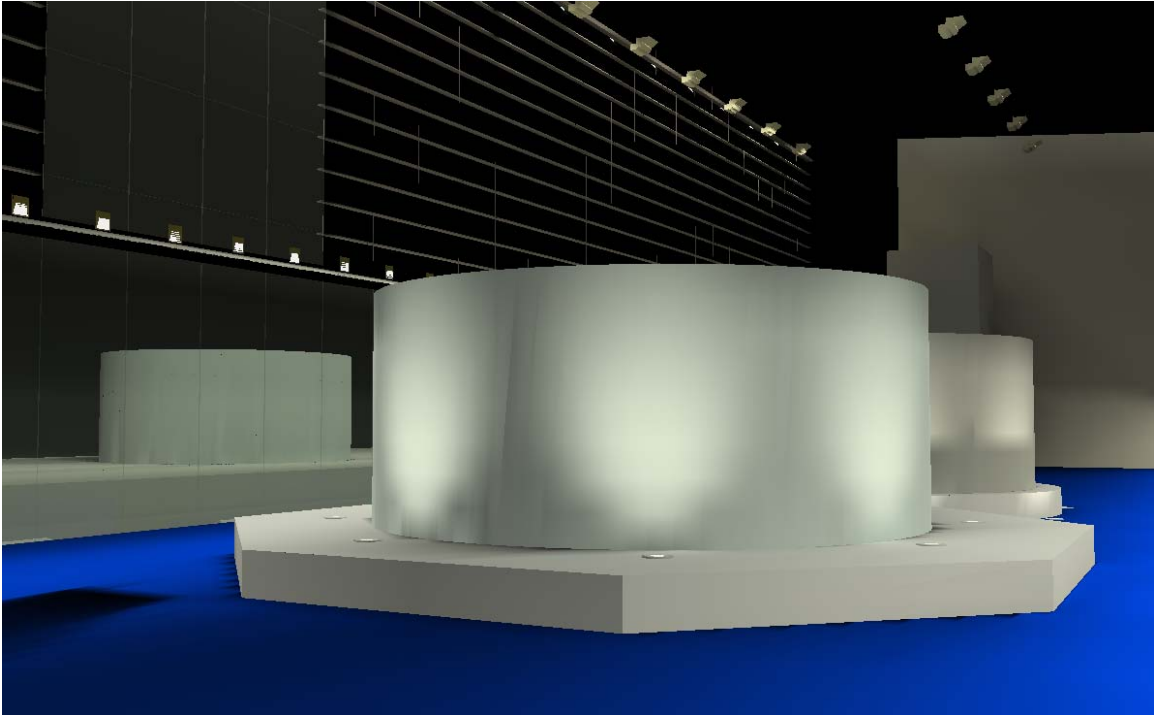


Figure 16 – View from southwest corner of gallery

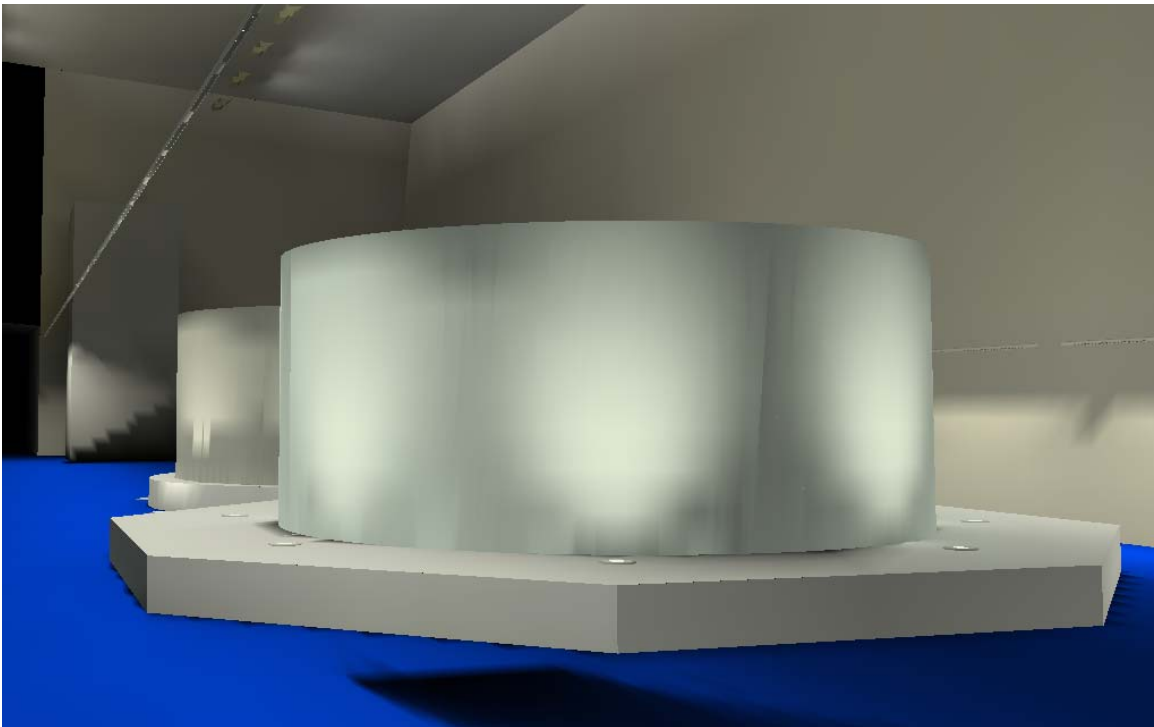


Figure 17- View from northwest corner of gallery

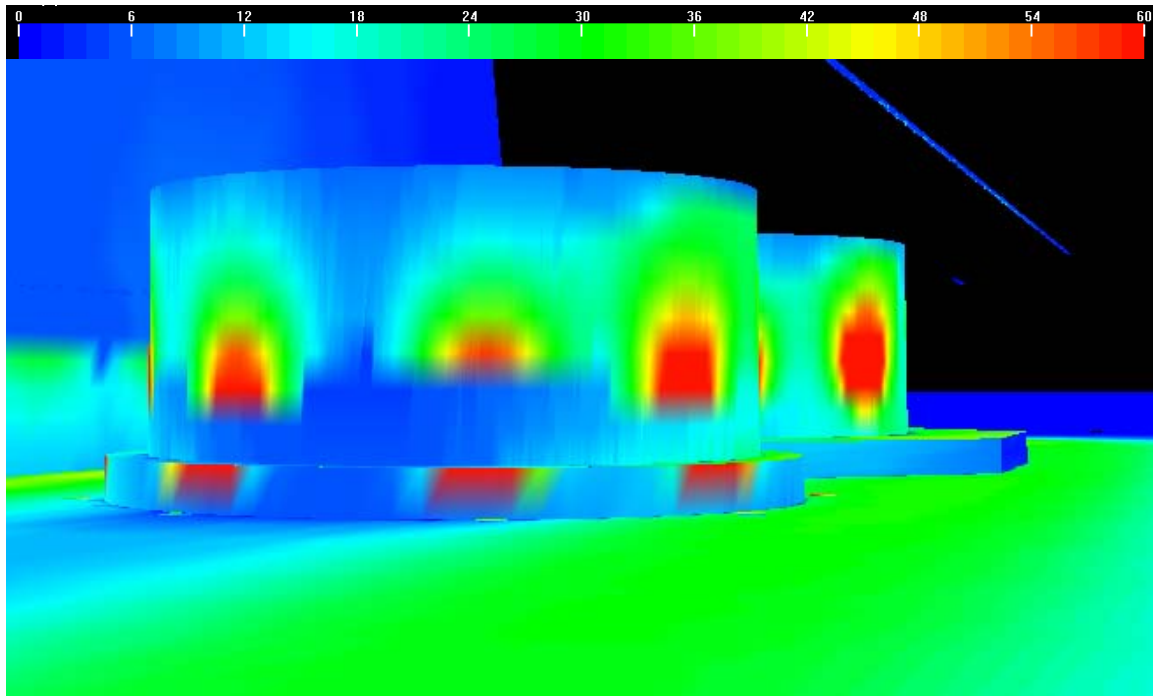


Figure 18 – Pseudocolor analysis of tanks

There is enough light in the space and on the key objects to function well as a museum gallery area. One reason that the power density is so low is that additional lighting will come with display cases, increasing the power density. As far as the quality of light, it was almost impossible to get an even amount of light throughout the room because of the large volume of open space. The design does, however, do a good job of emphasizing the turret tank and the future location of the fully conserved turret.

Controls

The tank gallery and mezzanine are all controlled through a Lutron Grafik Eye system. Luminaires are circuited directly to dimming panels for their power and control.

Mezzanine

The mezzanine area is the overhead walkway for visitors to observe the tanks in the gallery from above and into the tanks. This space is open to the public with a large staircase at the east end, and a smaller stairway at the west end. The north side of the mezzanine is approximately 5 feet from the glass façade, and the walkway itself is 5 feet wide. The sides of the mezzanine are the same polycarbonate glass material that is on the north façade, and the walkway is a mesh metal material.



Figure 19 – Turret viewed from above

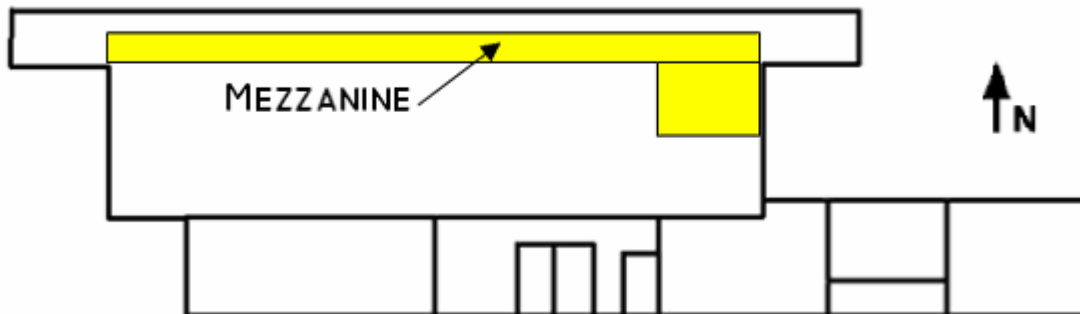


Figure 20 – Location of Mezzanine

Design Goals

Here it is not so important for the user to have their attention focused on the building because they will be viewing the large tanks to the side and below. What is important is highlighting points of interest, here the tanks, and providing enough lighting for the user to function in the space, that is, move from one end of the walkway to the other while viewing the tanks. Daylighting can be incorporated into this space, especially with the glass façade only five feet away.

Space Conditions

- ❖ Tasks viewing display tanks
- ❖ Materials walkway metal reflectance: 79%

railing sides metal polycarbonate reflectance: 79% transmittance: 60%

Space Criteria

- ❖ Illuminance museum corridor 10fc horizontal
- ❖ Power density 0.7 W/ft²

Final Design

The mezzanine space was difficult to design because the light could not distract from the display below. Uplighting from the walkway would have been distracting, and downlighting from above was almost impossible because there was nowhere to mount luminaires. The final design consists of compact fluorescent luminaires recessed in the north side of the mezzanine and washing the surface of the walkway.

Table 14 – Fixture Schedule

Type	Description	Manufacturer	Model	Mounting	Watts
E	Floor Washlight	Erco	44553.023	Wall Recessed	9

Table 15 – Lamp Data

Type	Lamp	Manufacturer	Lamp Type	Lumens per Lamp	Number of Lamps	CRI/CCT
E	Compact Fluorescent	Sylvania	9W CF	580	1	82/3500

Table 16 – Ballast Data

Type	Ballast	Manufacturer	Watts	Voltage	Ballast Factor
E	Integral	Sylvania	10	120	1.0

Table 17 – Light Loss Factors

Type	Ballast Factor	LDD	LLD	RSDD	Total LLF
E	1.0	.88	.95	.89	.74

Analysis

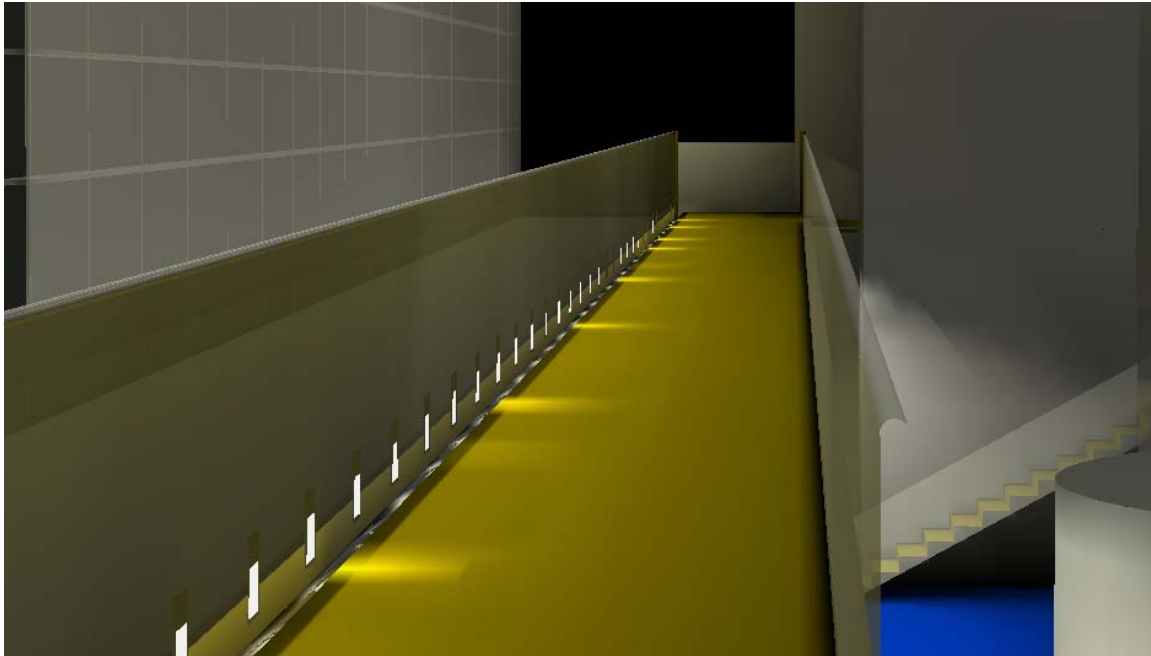


Figure 21 – View looking east along mezzanine

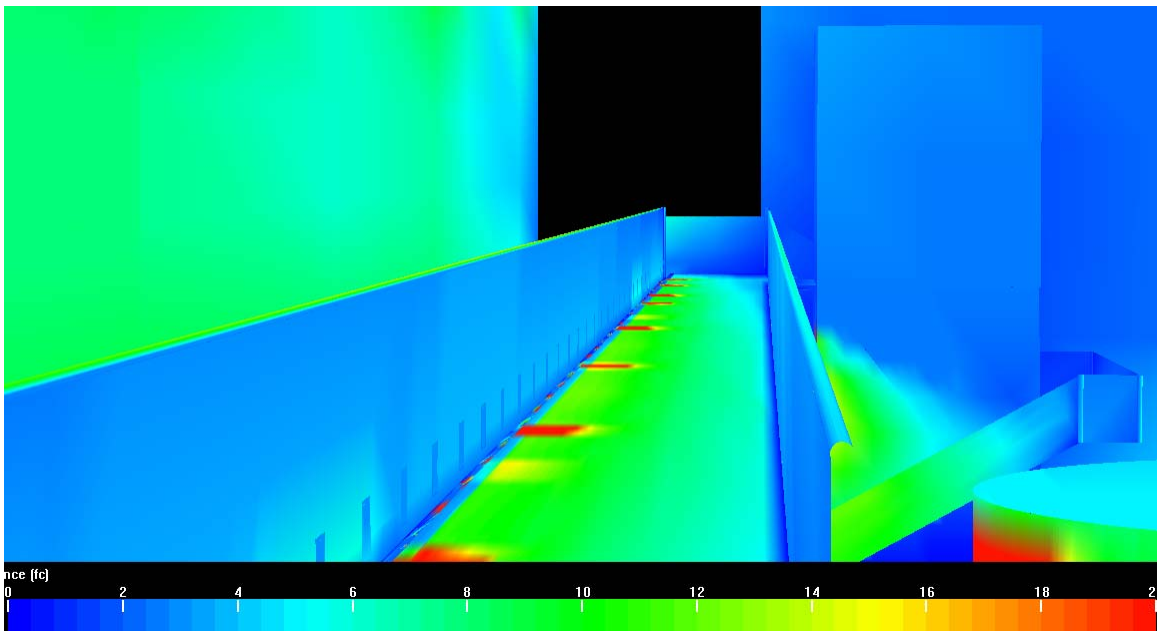


Figure 22 – Pseudocolor analysis of mezzanine

The mezzanine was able to receive its required 10 fc on average throughout the walkway. With the luminaires being on the north side of the mezzanine, they are not a glare source or other distraction to the visitor who is looking over the railing into the tanks. The power factor for the mezzanine is 0.5 W/ft².

North Façade

The front façade of this part of the museum is very important. Located on the north side of the building, the façade is made up of polycarbonate panels and frameless glass. The frameless glazing was designed with the intention of partially reflecting the Monitor replica which will be in front of the Gallery. This reflection will line up with the actual displayed artifacts inside the Gallery to give the effect of a ghosted ship. The USS Monitor Replica will be mostly below grade level, where the “water line” concept has been created by the architect. The portion of the replica that is above grade is to be considered above water, and the portion below grade is to be considered submerged in water. A room is built around the replica with a roof of glass so that visitors may walk up to the replica and look through the glass to the “underwater” portion of the replica.



Figure 23 – Model showing North Façade and future USS Monitor replica

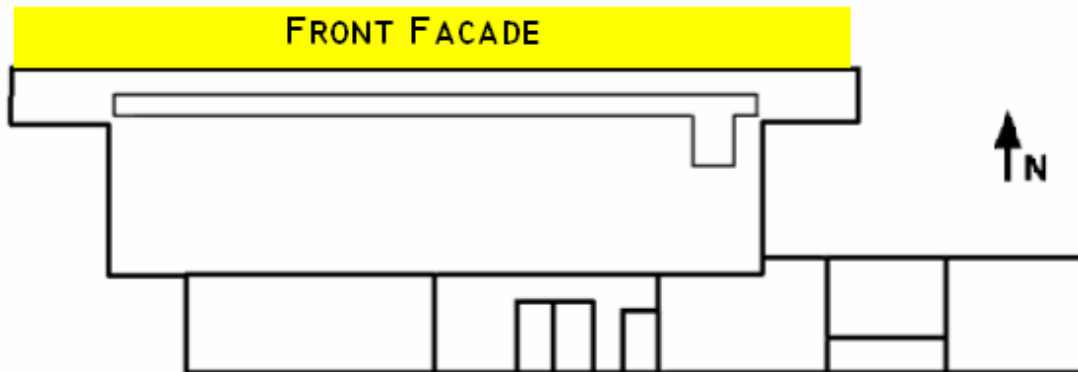


Figure 24 – Location of North Façade

Design Goals

As well as lighting the front façade, I wanted to provide lighting for the future USS Monitor replica being designed in the next phase of the project.

Lighting the gallery as a prominent building would help to emphasize the size of the USS Monitor replica as well as provide a backdrop showing the actual conserved turret, engine, and other pieces. High light levels for tasks and movement are not important since this building is not active at night. The concept of the water line should also be carried through here especially around the USS Monito replica.

Space Conditions

❖ Tasks	none, just lighting a prominent building	
❖ Materials	frameless glazing	transmittance: 79%
	polycarbonate panels	transmittance: 79%
	USS Monitor replica – metal	reflectance: 45%

Space Criteria

❖ Illuminance	prominent structure	5fc horizontal 3fc vertical
❖ Power density	0.25 W/ft ²	

Final Design

In order to achieve the look of the building glowing like a lantern, the front façade was lit from the inside. With the polycarbonate panels being diffuse rather than clear, it was possible to create the effect of a glow. Also, luminaires were added on the building canopy aimed at the replica in front of the gallery, and two floodlights were added on either side of the replica on its north side in order to light it from all sides. To further emphasize the concept of the water line, fluorescent luminaires with blue color filters will be installed along the walls of the room surrounding the replica. They will be located below the glass and washing the walls so that upon approaching the replica, the surface around it will look to be glowing blue.

Table 18 – Fixture Schedule

<i>Type</i>	<i>Description</i>	<i>Manufacturer</i>	<i>Model</i>	<i>Mounting</i>	<i>Watts</i>
F	Floodlight	Erco	34159.023	Surface	160
G	Wallwash	Prudential	P611T8PRAD1	Surface	36

Table 19 – Lamp Data

Type	Lamp	Manufacturer	Lamp Type	Lumens per Lamp	Number of Lamps	CRI/CCT
F	Metal Halide	Sylvania	150W T6	14500	1	89/3000
G	Fluorescent	Sylvania	T8		1	82/3500

Table 20 – Ballast Data

Type	Ballast	Manufacturer	Watts	Voltage	Ballast Factor
F	Integral	Sylvania	10	120	1.0

Table 21 – Light Loss Factors

Type	Ballast Factor	LDD	LLD	RSDD	Total LLF
F	1.0	.88	.95	.89	.74

Analysis

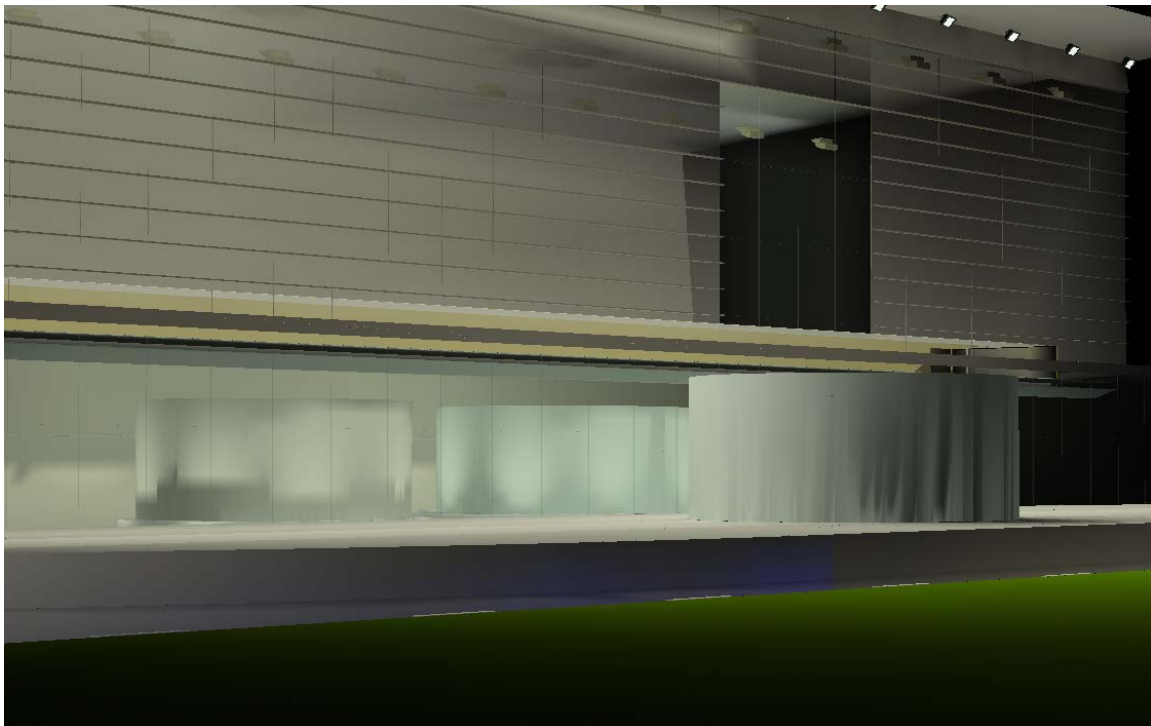


Figure 25 – View looking from outside towards replica and gallery

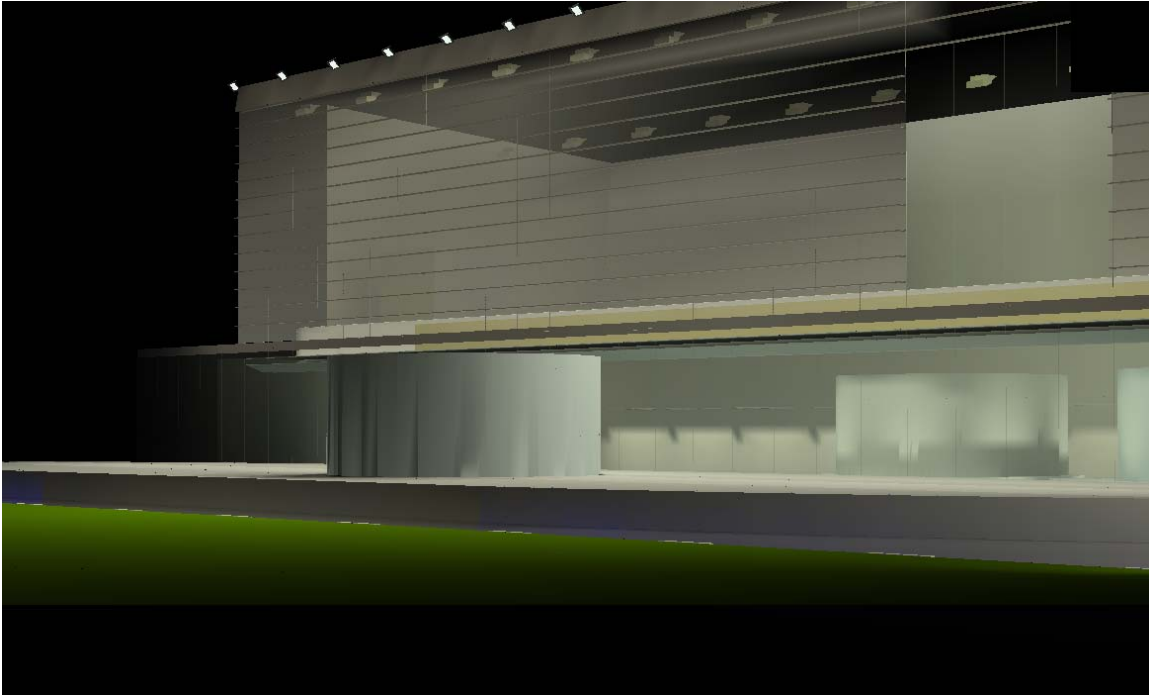


Figure 26 – View looking southeast

The Monitor was lit well with the lighting from the gallery and the two floodlights that were placed at the corners furthest from the gallery. The idea of having blue lighting did not work well, mostly because it is not possible to light glass. The area around the monitor still does manage to have somewhat of a blue glow about it, giving a feeling of water or mist.

Electrical Study

System Type

Mariner's Museum uses a radial system with one primary service feeder. The service from the utility comes in at 34.5 kV, and is controlled and maintained throughout the museum campus by Mariner's Museum. A transformer at the utility entrance steps down the voltage to 13.2kV. This is then distributed throughout the campus. Additional transformers are located at each building throughout the campus to step down the voltage to a utilization value of 480V.

Building Utilization Voltage

Service to the building is at 480 Volts to the main 1200A 480/277V switchboard. Large mechanical equipment and a crane in the gallery are on the 480/277V panels. Another transformer steps down the voltage to 120/208 Volts for lighting, receptacles, and other equipment.

Transformer Configuration

Service from the utility company comes to the museum campus at a medium voltage of 34.5 kV. A transformer on the campus steps that down to 13.2 kV, which is distributed throughout the site. At the tank gallery is a new 750kVA, 13.2kV:480/277V step-down transformer and a new 112.5kVA 480:120/208V dry-type transformer for lighting and power distribution panels.

Emergency Power System

Emergency power for the museum campus is supplied by a 100kW, 480/277V, 3 phase, 4 wire diesel generator. The generator has a 150A, 3 pole, automatic transfer switch and an emergency distribution panel located in the Chiller Plant. The emergency distribution panel serves a 100A, 480/277V emergency panel located near the Main Building. The emergency power for the Tank Gallery is served by this emergency panel. A new 30kVA, 480:208/120V, 3 phase, 4 wire step-down transformer is provided for the Conservation Facility's emergency lights, fire alarm system, and security system.

Emergency Lighting

Emergency lighting is provided throughout the gallery with the building lighting. All emergency lighting that must be dimmed under regular lighting conditions is circuited to the emergency dimming panel. In the case of an

emergency, the power is transferred over to the emergency power panel and emergency dimming panel by an automatic transfer switch.

Design Requirements

The only unique design features for the gallery was its connection to the campus system that is owned and operated by the Museum. This means that the step-down transformer located outside of the gallery needed to be sized and specified by the electrical designer, and site work needed to be considered. An additional manhole was provided on the campus to splice off of the existing 13.2 kV distribution system.

Electrical Changes

All lighting in redesigned spaces was removed from the panelboards and new circuits were calculated. The following information includes the new electrical loads.

<i>Circuit Removed</i>	<i>Load (VA)</i>	<i>Circuits Added</i>	<i>Load (VA)</i>
DP-3	960	DP-3	992
DP-6	1250	DP-6	1276
DP-7	1250	DP-7	1276
DP-18	1000	DP-18	400
DP-19	1000	DP-19	1860
DP-20	1000	DP-20	1612
DP-28	1250	RP3-16	1186
RP3-16	900	RP3-17	440
RP3-17	720		
RP3-18	720		
<i>TOTAL</i>	<i>10,050</i>	<i>TOTAL</i>	<i>9,042</i>

The electrical load due to lighting was able to be reduced by approximately 1000 VA, even with the addition of exterior lighting that was not in the project before, but this change will not effect any equipment sizes.

Overcurrent Protection

All overcurrent protection devices on panelboards are circuit breakers. Transformers have fused overcurrent protection.

Equipment	Overcurrent Protection
Panel MDP-1	200A circuit breaker at SWBD
Panel MDP-2	200A circuit breaker at SWBD

Panel RP-1	200A circuit breaker at DRP
Panel RP-2	200A circuit breaker at DRP
Panel RP-2A	30A main circuit breaker
Panel RP-3	100A circuit breaker at DRP
Dimming Panel	80A circuit breaker at DRP
Distribution Panel	800A main circuit breaker
Switchboard	1200A main circuit breaker
Elevator	70A fused safety switch at DRP

Lighting Systems

A variety of lighting systems are used throughout the tank gallery and conservation facilities. The gallery has fluorescent, incandescent, and low-voltage halogen lighting. The conservation lab has fluorescent and low-voltage halogen lighting. The library has all fluorescent lighting, and the front façade of the building will have metal halide lights. The low-voltage systems operate at 12V, while all other systems operate at 120V.

Lamps and Ballasts

All ballasts are electronic and have a ballast factor greater than .95, total harmonic distortion less than 10%, and a minimum starting temperature of 0 degrees Celsius.

Lamps Used

- 250W ED28 Metal Halide
- 32W T5HO Fluorescent
- 250W Quartz PAR38 Flood Incandescent
- 150W Quartz PAR38 Flood Incandescent
- 100W T4 G6.35 Tungsten Halogen (12V)
- 75W A19 Incandescent
- 50W MR16 NFL Halogen (12V/120V)
- 39W T6 Metal Halide

Major Mechanical Equipment

MECHANICAL EQUIPMENT (HP) (VA)

SUPPLY FAN 1	15 HP	17460
RETURN FAN 1	3 HP	3990
PUMP 1	5 HP	6330
PUMP 2	5 HP	6330
PUMP 3	1.5 HP	2160
PUMP 4	1.5 HP	2160
EXHAUST FAN 5	3 HP	3990
EXHAUST FAN 4	3 HP	3990
SUPPLY FAN 3	20 HP	22440
SUPPLY FAN 4	20 HP	22440
AIR COMPRESSOR		6330
TOTAL kVA		97.62

FUTURE

AHU RETURN FAN		6330
AHU SUPPLY FAN		23520
AHU SUPPLY FAN		43200
AHU RETURN FAN		17460
CHILLER PUMP		6330
CHILLER PUMP		6330
TOTAL kVA		103.17

CRANE (HP) (VA)

CRANE TROLLEY	2 HP	2760
CRANE HOIST	20 HP	22440
TOTAL kVA		25.2

Electrical Equipment

Equipment	Location
15kV Outdoor Metal Clad Switchgear	Behind Maintenance Building
2000kVA Transformer	Outside east wall of Tank Gallery
225kVA Transformer	Tank Gallery Electric Room 113
1200A Switchboard	Tank Gallery Electric Room 113
30kVA Emergency Transformer	Tank Gallery Electric Room 113
3P - 60A Emergency Safety Switch	Tank Gallery Electric Room 113

NEC Building design load

	kVA
Motor Load	273.99
Lighting Load	24.45
Receptacle Load	24.48
Future Panel	30.00
Total Load	352.91
Total Current	498.17

The building was sized for future phase additions to the system. An additional panel was included in calculations; however other future work was not available for calculations. The distribution panel in the electric room of the Gallery was sized at 800A, the typical smallest size used in commercial buildings, and the switchboard was sized at 1200A, above its calculated operating ampacity.

Feeder Sizes

To Panel DRP	349A	4#300kcmil
To MDP1	221A	3#3/0
To MDP2	119A	4#3/0
To Elevator Safety Switch	30A	4#4
To 225kVA Transformer	271A	3#3/0
To Switchboard	367A	4#350kcmil

See Appendix B for design load calculations.

Mechanical Analysis

In the mechanical analysis, the glazing was the main focus. Originally the Gallery had a north façade that was single pane complete glazing. Two different types of glazing exist: a clear frameless glazing along the bottom and in a middle section of the upper half; and a polycarbonate paneling for the rest. The transmittance of the frameless glazing is 79% with a solar heat gain coefficient of .69. The polycarbonate panels have a transmittance of 60% with a SHGC of .62. In the analysis, it was determined that by having two panes of glass with an air space between them, additional energy could be saved because of that airspace. The transmittance would also go down, but the solar heat gain coefficient would also decrease, therefore allowing the cooling load in the space to go down by approximately 15%.

In the case of the Tank Gallery, the view through the clear glazing is important to both the architect and the owner. If only the polycarbonate panels are changed while the clear glazing is left as single pane then there is still a significant difference. I am recommending that the clear glazing be changed from simply a double-glazed material to a clear low-e triple glazed. If the polycarbonate panels are doubled up, they can save energy costs and because that material is lighter than the clear glass, it is not too much of a structural burden.

Construction Analysis

A detailed cost estimate was never made available for this project, so the construction work focused on estimating the cost of the USS Monitor center gallery area. The original estimate the architect gave was very close to \$5 million. Following are the results of two estimates:

- ❖ Building location: Newport News, VA

- ❖ 39,000 sq. ft.
- ❖ 2 stories
- ❖ Assumptions:
 - Rectangular or slightly irregular shape
 - Average construction quality
 - Average story height
 - Heating and cooling are based on occupancy
 - No sprinklers
 - No elevators
 - Exterior wall based on construction type (fireproofed structural steel)
 - Slab on grade
 - No basement
- ❖ Two main sections: museum (25,000 ft) and laboratory (14,000 ft)
- ❖ Cost results: total cost of \$4.01 million
 - \$105.10 per square foot

Estimate 2

- ❖ 3 stories (include basement, ground floor, and mezzanine)
- ❖ Same basic assumptions as previous estimate
- ❖ Two main sections: museum (20,000 ft) and laboratory (19,000 ft)
- ❖ Cost results:
 - Total cost of \$4.3 million
 - \$110.19 per square foot

Conclusions

The estimates I found were much lower than the architect's rough estimate for several reasons. First of all, many of the assumptions were incorrect, such as the lack of elevator and the average story height. The main reason, however, is that the USS Monitor center is a very specialized space. They need specific equipment including a crane system in the gallery area, as well as state-of-the art lab equipment. This is enough to bring the estimate off the track of a "typical" museum.

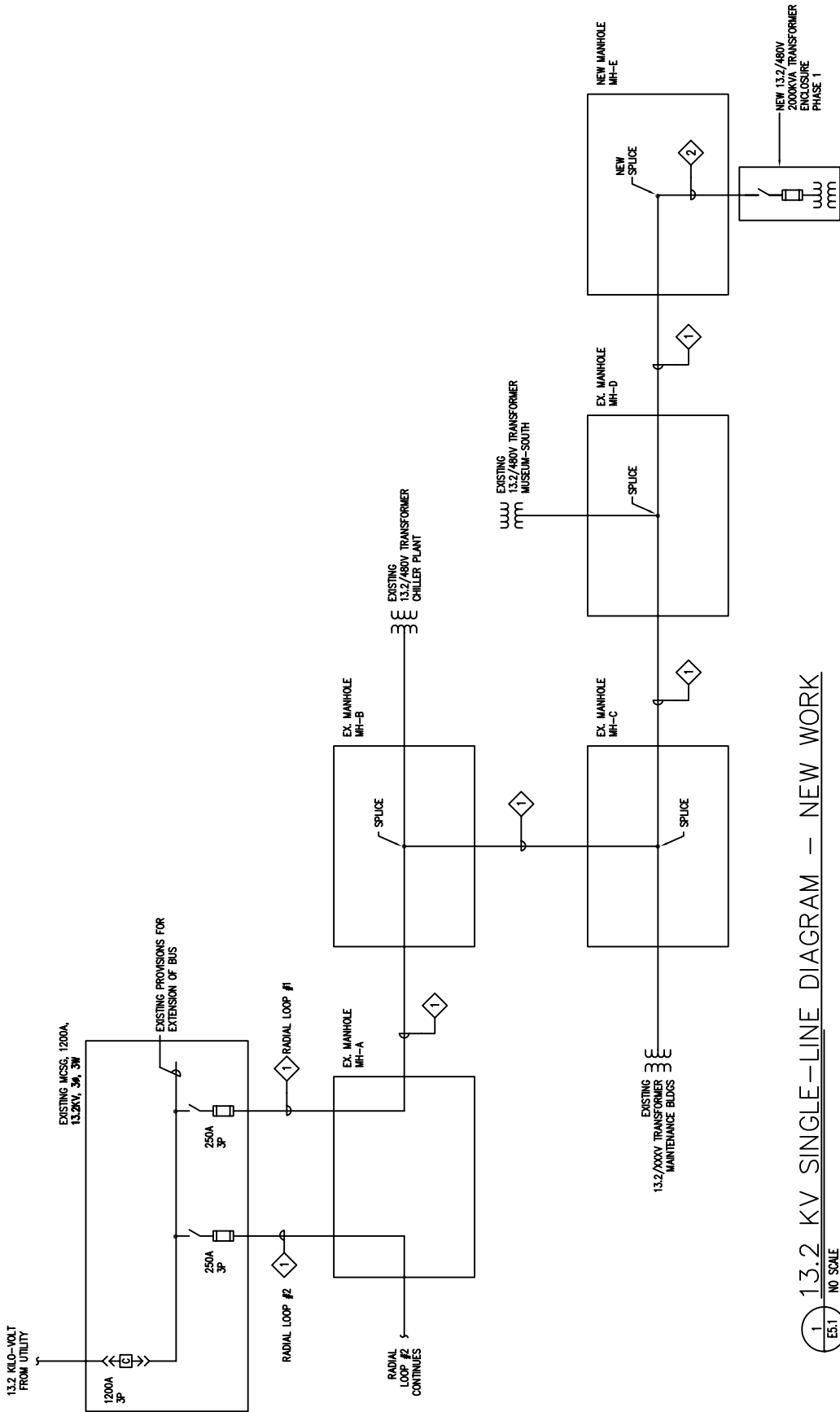
Final Conclusions

The U.S. Mariner's museum was able to be efficiently well lit, giving emphasis and drawing the visitor to important artifacts. The concept of a water line was carried through the tank gallery, where the floor color was changed to blue and washed with light, and outside in the USS Monitor replica with the blue light surrounding it. The mezzanine was effectively lit to give visitors enough light along the walkway without distracting from the main attraction of the tanks below. Both the displayed tanks and the replica were highlighted to draw the visitors not only to those pieces but to allow them to understand how the artifacts on display inside are the same pieces of the replica they are exploring outside.

Energy costs were able to be decreased in this project by using more efficient lighting: fluorescent and metal halide often, and only incandescent in the underwater lighting. Energy can also be saved by changing the glazing and its arrangement on the north façade of the building.

Appendix A: Diagrams

- One-line diagram from utility service to building entrance
- Riser diagram of building power equipment
- Riser diagram of emergency power equipment
- Tank Gallery circuiting

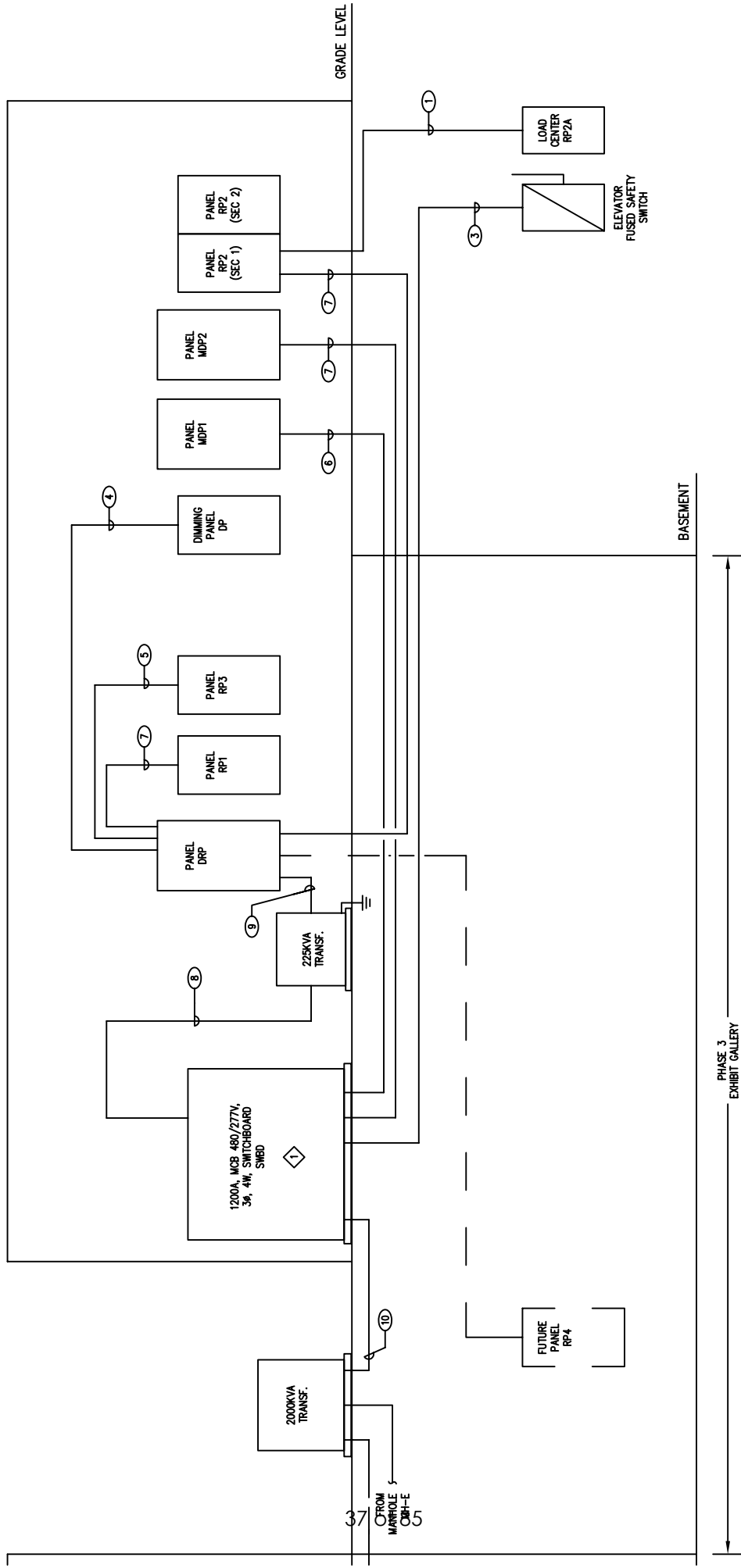


1
ES:1
NO SCALE

13.2 KV SINGLE-LINE DIAGRAM - NEW WORK

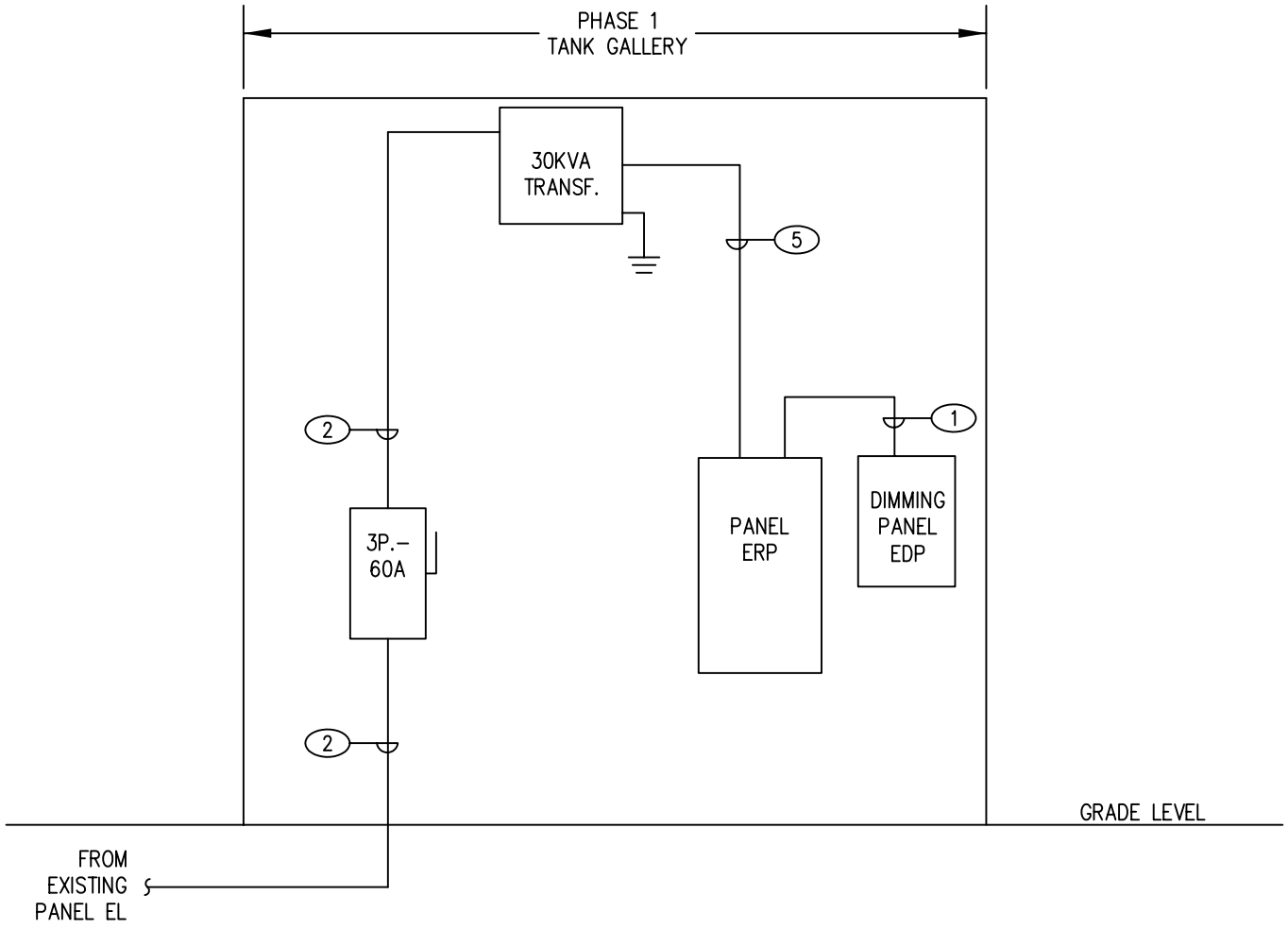
13.2 KV SINGLE-LINE NOTES

- ① EXISTING 3-1/C #4/0 COPPER, SHIELDED EPR CABLE WITH 133% INSULATION.
- ② NEW 3-1/C #4/0 COPPER, SHIELDED EPR CABLE WITH 133% INSULATION.
- ③ EXISTING 3-1/C #4/0 COPPER, SHIELDED EPR CABLE WITH 133% INSULATION TO BE REMOVED AS PART OF PHASE III.



1 RISER DIAGRAM
ES.2 NO SCALE

PHASE 3
EXHIBIT GALLERY

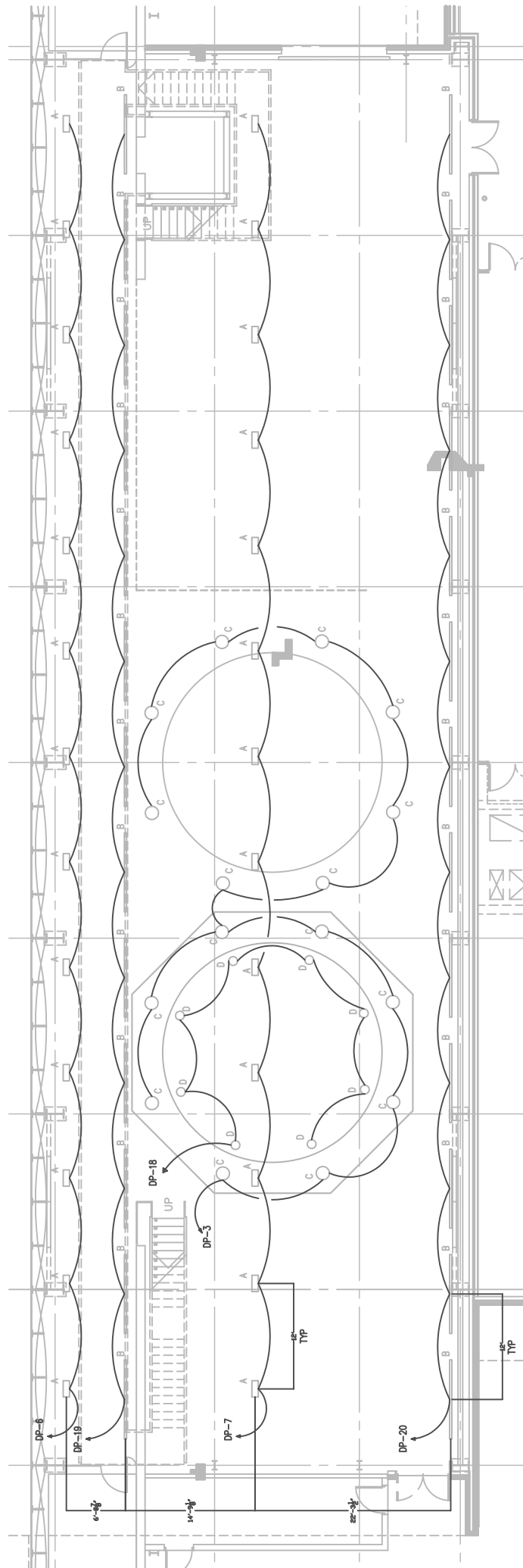


2 EMERGENCY RISER DIAGRAM
E5.2 NO SCALE

FEEDER SCHEDULE (#)						
FEEDER NO.	CB SIZE	NO. SET	WIRE NO. AND SIZE	GROUND NO. AND SIZE	CIRCUIT NO. AND SIZE	REMARKS
1	30A	1	3#10	1#10	(1)-3/4"	
2	60A	1	4#4	1#8	(1)-1 1/4"	
3	70A	1	4#4	1#8	(1)-1 1/4"	
4	80A	1	4#3	1#8	(1)-1 1/4"	
5	100A	1	4#1	1#8	(1)-1 1/2"	
6	200A	1	3#3/0	1#6	(1)-2"	
7	200A	1	4#3/0	1#6	(1)-2"	
8	400A	2	3#3/0	1#3	(2)-2"	
9	800A	3	4#300KMIL	1#1/0	(3)-3"	
10	1,200A	4	4#350KMIL	1#4/0	(4)-4"	
-	-	-	-	-	-	

GENERAL NOTES:

- FEEDER SCHEDULE IS BASED ON 75 DEGREES C. COPPER CONDUCTORS. CONDUIT FILL CAPACITY IS BASED ON 1996 NEC TABLE 3B. CONDUCTOR SIZES ARE BASED ON 1999 NEC TABLE 310-16. GROUND CONDUCTOR SIZES ARE BASED ON 1999 NEC TABLE 250-122.



Appendix B: Design Load Calculations

Calculations

Motors	HP	VA
SF-1	15 HP	17460
RF-1	3 HP	3990
P-1	5 HP	6330
P-2	5 HP	6330
P-3	1.5 HP	2160
P-4	1.5 HP	2160
AIR COMPRESSOR		6330
AHU RETURN FAN		6330
AHU SUPPLY FAN		23520
AHU SUPPLY FAN		43200
AHU RETURN FAN		17460
CHILLER PUMP		6330
CHILLER PUMP		6330
EF-5	3 HP	3990
CRANE TROLLEY	2 HP	2760
EF-4	3 HP	3990
SF-3	20 HP	22440
CRANE HOIST	20 HP	22440
SF-4	20 HP	22440
EF-2	.5 HP	1176
UNIT HEATER		1000
SUPPLY FANS		2112
SUPPLY FANS		2112
OVERHEAD DOOR		1600
SUPPLY FANS		2112
SUPPLY FANS		2112
CRANE BRIDGE CONTROL		1000
CRANE ELEC. RUNWAY		600
WELDER		11520
CIRCULATION PUMP		7500
FILTER TURRET TANK		5184
CIRC. PUMP CONTROL		1000
COLD ROOM CONTROL		4590
COLD RM. CONDENSING		2814
EXHAUST FAN		200
FOUNTAIN		400
ELEVATOR CAB FAN		400
FUME HOOD		400
XFMR		143.4
elev safety switch		22.5
TOTAL		273987.90
kVA		273.99
kVA*1.25		342.48

Receptacles	VA
RECEPTACLES	800
RECEPTACLES	400
RECEPTACLES	400
RECEPTACLES	600
RECEPTACLES	800
LAB EQUIP	600
LAB EQUIP	200
EXT. RECEP	600
RECEPTACLES	400
RECEPTACLES	400
RECEPTACLES	400
RECEPTACLES	400
RECEPTACLES	400
RECEPTACLES	400
RECEPTACLES	200
LAB EQUIP	2000
X-RAY RECEPTACLE	600
RECEPTACLES	600
RECEPTACLES	600
RECEPTACLES	400
RECEPTACLES	400
FURNITURE	600
FURNITURE	600
RECEPTACLES	800
RECEPTACLES	400
CRAWL SPACE LTG/RECEP	800
BASEMENT LTG/RECEP	1400
RECEPTACLES	600
RECEPTACLES	800
LTG/RECEP	400
LTG/RECEP	400
GFI RECEP	600
RECEPTACLES	200
LAB EQUIP	276
RETRACTABLE RECEP	400
RETRACTABLE RECEP	400
RETRACTABLE RECEP	400
RETRACTABLE RECEP	400
RECEPTACLES	600
RECEPTACLES	400
RECEPTACLES	400
RECEPTACLES	400
RECEPTACLES	400
RECEPTACLES	400
LAB EQUIP	1600
TOTAL	24476
kVA	24.48

Calculations

Lighting	VA
EXTERIOR LIGHTS	360
STAIR LIGHTS	240
X-RAY LIGHTS	280
LIGHTING	1500
LIGHTING	900
MECH. RM LTG	960
ELEVATOR CAB LTG	400
LIGHTING	720
TRACK LTG	900
DIMMING PANEL	18185
TOTAL	24445
kVA	24.45

TOTAL	384.17
INCLUDING FUTURE	414.17
LOAD CURRENT	498.17

Appendix C: Works Cited

LEED Green Building Rating System.

Version 2.1st ed. N.p.: n.p., 2002.

The US Green Build Council publishes this green building rating system as a guide for earning points towards a LEED certified building. This publication is used as a guideline for thesis lighting design work in energy conservation

The IESNA Lighting Handbook.

Ed. Mark S. Rea. N.p.: Illuminating Engineering Society of North America, 2000.

The Lighting Handbook is used to determine all illuminance guidelines and criteria in this thesis project.

ASHRAE Standard 90.1-2001.

N.p.: ASHRAE, 2001. 51-58.

The ASHRAE Standard contains power density allowances for lighting on a space by space basis.

National Electrical Code.

N.p.: NFPA, 2002.

All electrical work is designed to conform to the 2002 NEC.

US Navy Ships - USS Monitor.

20 June 2001. Department of the Navy. Oct. 2003

<<http://www.history.navy.mil/photos/sh-usn/usnsh-m/monitor.htm>>.

Monitor Expedition 2002.

15 May 2003. NOAA, U.S. Department of Commerce. Oct. 2003

<<http://oceanexplorer.noaa.gov/explorations/02monitor/monitor.html>>.

Monitor National Marine Sanctuary.

12 Aug. 2003. National Oceanic and Atmospheric Administration. Oct. 2003

<<http://monitor.noaa.gov>>.

NMS Monitor Marine Sanctuary.

12 Feb. 2003. National Marine Sanctuaries. Oct. 2003

<<http://www.sanctuaries.nos.noaa.gov/oms/omsmonitor/omsmonitor.html>>.

Appendix D: Lighting Cut Sheets

Conservation Lab

Luminaire A & B
Lamps A&B
Ballasts A&B

Gallery

Luminaires A, B, C & D
Lamps A, B, C & D
Ballasts A, B & C

Mezzanine

Luminaire E
Lamp E
Ballast E

Front Façade

Luminaires F&G
Lamps F&G
Ballast F&G

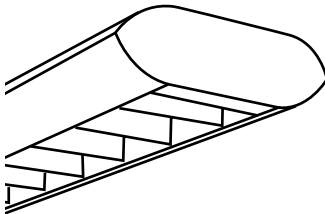
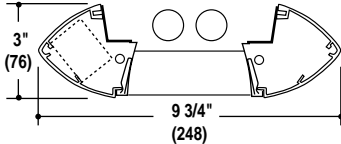


LC-93™
P-ID-9300

TYPE: A
PROJECT:

PENDANT INDIRECT
INDIRECT/DIRECT

SPECIFICATIONS



HOUSING. Two-sided housing, 6063 T5 extruded aluminum. End caps are of 14-gauge steel, no holes or knockouts, finished to match housing.

UPPER SIDE REFLECTORS. Die-formed specular anodized aluminum.

PARABOLIC BAFFLE. Die-formed semi-specular aluminum baffles. Snap-fit construction provides easy removal and access to wireway. Two safety tethers secure baffle to fixture. **PBSS** has 13 cells, producing 25° lengthwise and crosswise shielding. Optional **PBSSH** high-performance baffle, of performance grade semi-specular aluminum, has 17 cells, producing increased lengthwise shielding of 31°. **PBCWM**, 13-cell baffle finished in white, is also available.

ALTERNATE DISTRIBUTION OPTION. Opaque or specially perforated top covers are available to provide either 100% or 60% downlight. See Alternate Distribution Options below for details.

LAMPING. Available in 2- and 3-lamp T8 cross-sections. Lamp access/replacement from above. Removal of baffle is not required.

BALLAST. Electronic high power factor, thermally protected Class P, Sound Rated A, manufactured by a UL Listed manufacturer, as available, determined by Litecontrol. The minimum number of ballasts will be used.

TANDEM WIRING. Where listed in "Ordering Guide" below, fixtures can be wired to switch in-line lamps only, providing two or three (three-lamp cross-section fixtures only) levels of light.

PRE-WIRING. Fixtures are supplied with #12 AWG type THHN wire for branch circuits. One end will have factory-installed push-in quick-connects. The other end will be stripped back 1/2" for quick connection in field. For fixtures with special circuits such as night/emergency, dimming controls, etc., in-field wiring will be required. See *Pre-Wiring Information* sheet for further details.

SUSPENSION. Fixtures are suspended with either stems or aircraft cable using Litecontrol's easy-hang system. Allows both vertical and horizontal leveling adjustments. For on-module mounting or adapting to existing conditions, an adjustable mounting yoke (AMY) is available.

ROW JOINING. Litecontrol's at-joint flat strap supporting two fixtures allows one-person, one-hand-free fixture joining and installation. Support points are centered above the midpoint of joint ("on seam") for aligned, symmetrical appearance. Fixture end headers are threaded in two locations to allow easy row joining without removing reflectors.

SYSTEM CONNECTORS. Corners, tees and crosses available. Sides are extruded aluminum with filler plate across bottom. Bottom and sides have no exposed fasteners or knockouts. Each system connector shall have a rigid cross-member with a .687" diameter stem hole at center to accept any of Litecontrol's pendant assemblies.

CERTIFICATION. Fixture and electrical components shall be UL and/or CUL Listed and shall bear the I.B.E.W., A.F. of L. label.

Note: Litecontrol reserves the right to change specifications without notice for product development and improvement.

ORDERING GUIDE

Section	Mounting	- Distribution	- Series	Lamp Count	Nominal Length (ft.)	Lamp Type	- Diffuser	- Finish	- Tandem Wiring	- Ballast	- Pre-Wiring	- Option	Volts	Lamps	Length in. (mm)
	2	ID	93	2	4	T8	PBSS		--	ELB	1CWQ			2-F32T8	51 (1295)
	P	ID	93	4	8	T8	PBSS		TW	ELB	2CWQ			2-F32T8	51 (1295)
	P	ID	93	4	8	T8	PBSS		--	ELB	1CWQ			4-F32T8	102 (2591)
	P	ID	93	6	12	T8	PBSS		TW	ELB	2CWQ			4-F32T8	102 (2591)
	P	ID	93	6	12	T8	PBSS		TW	ELB	2CWQ			6-F32T8	153 (3886)
	P	ID	93	3	4	T8	PBSS		--	ELB	1CWQ			3-F32T8	51 (1295)
	P	ID	93	3	4	T8	PBSS		TW	ELB	2CWQ			3-F32T8	51 (1295)
	P	ID	93	6	8	T8	PBSS		TW	ELB	2CWQ			6-F32T8	102 (2591)
	P	ID	93	9	12	T8	PBSS		TW	ELB	2CWQ			9-F32T8	153 (3886)

P-ID-93612T8-PBSS-TCWM-TW-ELB-2CWQ-120 is a typical catalog number for a six-lamp, 12-foot long T8 fixture with semi-specular parabolic baffles, painted Textured Matte White, tandem-wired with electronic ballasts, pre-wired with two-circuit branch wiring and quick-connects, 120 volts.

For Diffuser Choices and Alternate Distribution Options, see below.

Finish: TCWM (Textured Matte White) is standard. For other finishes, see *LiteColors* brochure.

DIFFUSER CHOICES

- 3PBSS** Parabolic baffle of semi-specular aluminum, having 13 cells, producing 25° lengthwise and crosswise shielding.
- PBSSH** High-performance baffle, of performance grade semi-specular aluminum, having 17 cells, producing 31° lengthwise shielding and 25° crosswise shielding.
- PBCWM** Parabolic baffle finished Matte White, having 13 cells, producing 25° lengthwise and crosswise shielding.

ALTERNATE DISTRIBUTION OPTIONS

The indirect/direct distribution of the standard fixture is approximately 65% / 35%. The following options modify that ratio. Not available with AMY option.

- CV** Cover. Solid cover over lamps to provide 100% direct distribution, finished in high-reflectance Matte White. Can be added or removed in field.
- PFCV** 40/60 Perforated Cover. Provides 40% indirect, 60% direct distribution, finished in high-reflectance Matte White. Can be added or removed in field.

OPTIONS

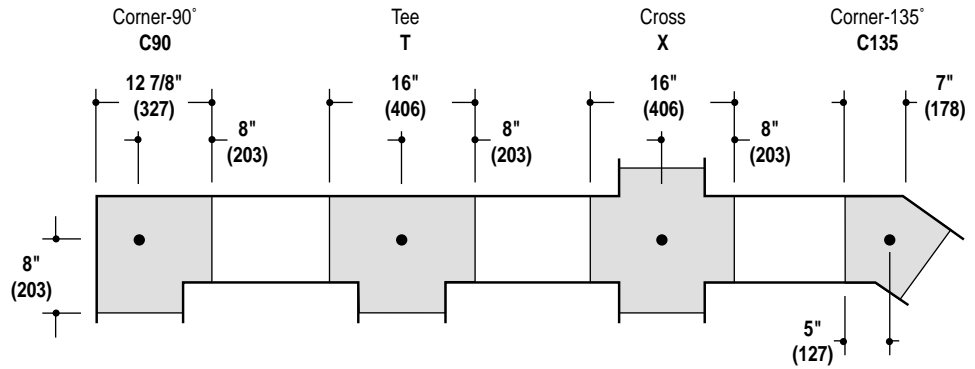
- LP/EF** Low-profile emergency fluorescent ballast. Battery-powered ballast from a UL Listed manufacturer will operate one T8 lamp in a 4' or 8' fixture for 1 1/2 hours.
- LPD/ELB** Low-profile dimming ballast. Contact factory for compatibility and availability.
- F** Fuse. Slow or fast blow, determined by Litecontrol.
- AMY** Adjustable mounting yoke. Used for on-module mounting or for adapting to existing pendant locations. Contact factory for information.

SYSTEM CONNECTORS

Catalog Number

Series	Connector	Finish
P-ID-9300	C90	
P-ID-9300	C135	
P-ID-9300	T	
P-ID-9300	X	

P-ID-9300-C90-CWM is a typical catalog number for a 90° corner connector finished Matte White.



PLANNING FOR INSTALLATION

SUSPENSION ASSEMBLIES

Provided with P6S (5/8" dia., 3/8" NPT) stems, or 3/32" diameter aircraft cable assemblies. Stems with 0-45° swivel joints are available. Aircraft cable is provided at fixed lengths (with 1/4-20 stud adjustment for leveling purposes), or may be ordered with "field-adjustable" fittings that allow unlimited vertical positioning and adjustment. See *Stems & Aircraft Cables* sheet for further details.

STEM LENGTHS

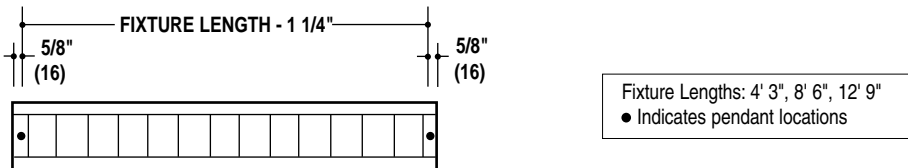
P6S stems are available in eight standard lengths from 6" to 36". The actual ceiling-to-top-of-fixture dimensions are: 6", 9", 12", 15", 18", 24", 28", and 36". Refer to *Standard Length Stem Assemblies* sheet for dimensional information on sloped ceiling (SC/P6) and earthquake (EQ/P6) stem assemblies.

SUSPENSION MOUNTING LOCATIONS

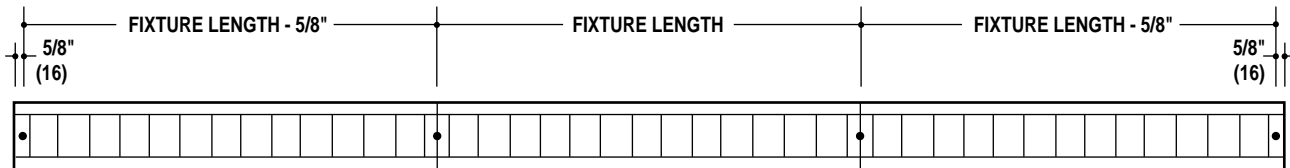
Pendant locations at ends of rows (or individual fixtures) are 5/8" from fixture end. Pendant locations at in-row joints are at the joint. All pendant types (cable or stem) attach to universal flat strap for mounting either at fixture end or across two fixtures at a row joint. Strap attachment allows for horizontal adjustment to "fine-tune" side-to-side leveling.

For on-module mounting or for adapting to existing pendant locations, an adjustable mounting yoke (AMY) is available. Contact factory for information.

INDIVIDUAL FIXTURE:



ROW DIAGRAM:



QUESTIONS TO ASK:

1. 120 or 277 volt?
2. Row information, including desired fixture length?
3. White, *LiteColor*, or special color?
4. Cables or stems, what length?
5. Tandem wiring?
6. Other options?



COVELIGHT 26



FCV 26

Low-profile cove mounted 2" x 6" luminaire with indirect asymmetric distribution.



1 Lamp T8



2 Lamp T5 & T5HO



2 Lamp T5 & T5HO

Features

Construction

One piece housing of die-formed 22 Ga. C.R.S. forming 2"H x 6"W rectangular profile. Socket bridge and 20 Ga. Galvanized end caps are mechanically fastened.

Weight: 4' unit—7 lbs
8' unit—14 lbs

Optic

Die-formed 20 Ga. steel reflector with aluminum insert, finished in high reflectance white paint (90% reflectance).

Electrical

Luminaires are pre-wired with factory installed branch circuit wiring with over-molded quick connects. All ballasts are thermally protected and have a Class "P" rating.

Consult Ballast Ordering Guide on following page for ballast specifications

Optional DALI and other dimming ballasts available. Consult factory for specifications and availability. UL and cUL listed.

Emergency

Emergency battery packs provide 90 minutes of one lamp illumination. Initial lumen output for lamp types are as follows:

T8 Lamp: Up to 550 lumens
T5 Lamp: Up to 550 lumens
T5HO Lamp: Up to 825 lumens

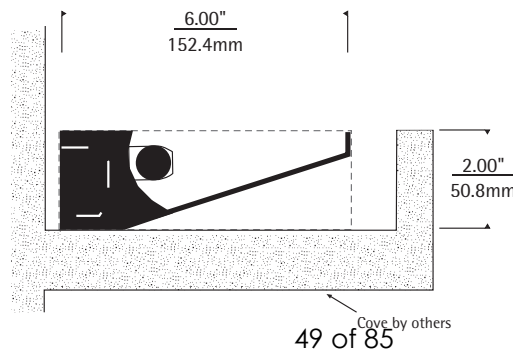
Battery pack requires unswitched hot from same branch circuit as AC ballast.

Finish

Luminaire housing and reflector are finished in high reflectance white paint (90% reflectance).

- High performance indirect luminaire designed for concealed cove applications.
- Covelight provides pleasing and even illumination that highlights architectural details.
- Standard continuous row installations are configured with 4' and 8' luminaire lengths.
- Additional continuous run lengths may be configured with combinations of luminaire lengths up to 8'. (See standard luminaire lengths on following page).
- Enhanced ease of installation: simple plug connection eliminates need to access electrical components in luminaire housing.

Sept. 2003



T H E
A R T O F
L I G H T

Fixture Type: _____

Project Name: _____

COVELIGHT 26



T H E
A R T O F
L I G H T

Order Information

Luminaire Series **FCV**
Covelight **FCV**

Profile **26**
2" x 6" **26**

Lamping
1 Lamp T8 **1T8**
1 Lamp T5 **1T5**
1 Lamp T5HO **1T5HO**
2 Lamp T5 **2T5**
2 Lamp T5HO **2T5HO**

Circuit
Single Circuit **1C**
Dual Circuit **2C**
(note: Dual circuit available on two lamps only)

Voltage
120 Volt **120**
277 Volt **277**
*347 Volt **347**
**(Consult factory for availability)*

Ballast
Electronic Instant Start <20% THD **E**
(T8 Only)
Electronic Program Start <10% THD **S**
Electronic Dimming Ballast **D**
(consult factory for dimming availability)

Mounting **CV**
Cove **CV**

Factory Options
Emergency Circuit **EC**
(consult factory for details)
Emergency Battery Pack **EM**
HLR/GLR Fuse **FU**
Include 3000K Lamp **L830**
Include 3500K Lamp **L835**
Include 4100K Lamp **L841**

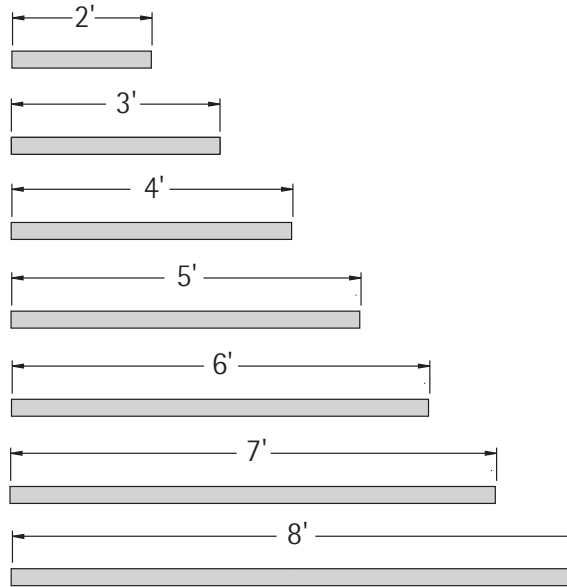
Finish **HW**
High Reflectance White **HW**

Luminaire Length
Designate length in feet **XX'**
Nominal lengths: 2', 3', 4', 5', 6', 7', 8'

Corner Flex Whip **CFW**
18" Flexible conduit with Plug **CFW**

Supplied for every corner condition. Specify run and pattern details when ordering.

Standard Luminaire Lengths

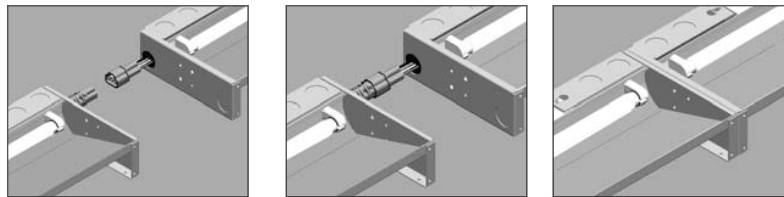


Continuous run lengths may be configured with combinations of 2', 3', 4', 5', 6', 7' and 8' luminaire lengths.

Ballast Ordering Guide

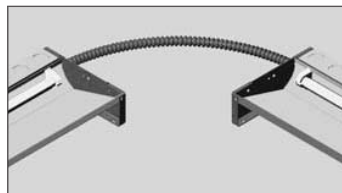
Code	Lamping	Specifications
E	T8	Electronic instant start 265mA, <20% THD
S	T8	Electronic program start 265mA, <10% THD
S	T5	Electronic program start 160mA, <10% THD
S	T5HO	Electronic program start 160mA, <10% THD
D	T8	Standard dimming range from 100% to 10% lumen output. <i>Consult factory for further specifications.</i>
D	T5HO	Standard dimming range from 100% to 1% lumen output. <i>4' lamps only. Consult factory for further specifications.</i>
D	T5	Standard dimming range from 100% to 10% lumen output. <i>4' lamps only. Consult factory for further specifications.</i>

Continuous Run Installation Detail



Branch circuit thru-wire harness with plug allows for easy continuous run installation without accessing luminaire interior.

Corner Installation Detail



18" long flexible conduit with plug simplifies corner installation. For even corner illumination, a maximum 3" distance from end of cove to end of luminaire is recommended.

Sept. 2003 Focal Point LLC reserves the right to change specifications for product improvement without notification.



1T8

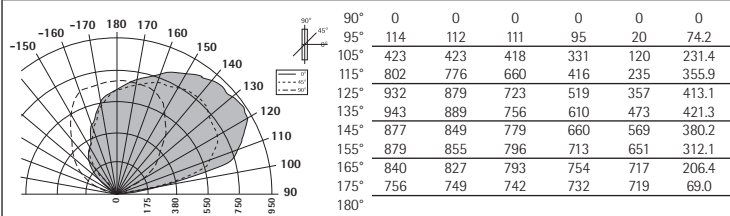
Luminaire: One lamp T8 surface mounted coverlight with indirect asymmetric distribution.
Filename: FCV26-1.T8
Efficiency: 83.5%
 Independent testing laboratory report no. 11277.0



2T5HO

Luminaire: Two lamp T5HO surface mounted coverlight with indirect asymmetric distribution.
Filename: FCV26-2.T5H
Efficiency: 79.5%
 Independent testing laboratory report no. 11073.0

Candlepower Distribution

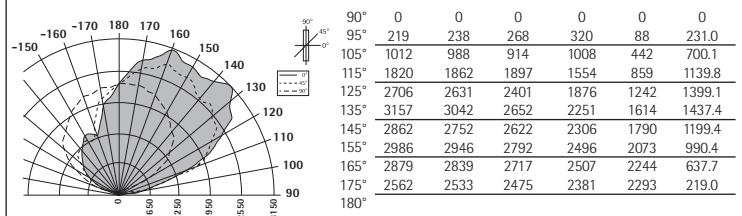


Vertical angle	0°	22.5°	45°	67.5°	90°	Zonal lumens
90°	0	0	0	0	0	0
95°	114	112	111	95	20	74.2
105°	423	423	418	331	120	231.4
115°	802	776	660	416	235	355.9
125°	932	879	723	519	357	413.1
135°	943	889	756	610	473	421.3
145°	877	849	779	660	569	380.2
155°	879	855	796	713	651	312.1
165°	840	827	793	754	717	206.4
175°	756	749	742	732	719	69.0
180°						

Lumen Summary

Zone	Lumens	% Lamp	% Fixt
90°-120°	661	22.4	26.9
90°-130°	1075	36.4	43.6
90°-150°	1876	63.6	76.2
90°-180°	2464	83.5	100.0
Total Luminaire:	0°-180°	2464	83.5 100.0

Candlepower Distribution



Vertical angle	0°	22.5°	45°	67.5°	90°	Zonal lumens
90°	0	0	0	0	0	0
95°	219	238	268	320	88	231.0
105°	1012	988	914	1008	442	700.1
115°	1820	1862	1897	1554	859	1139.8
125°	2706	2631	2401	1876	1242	1399.1
135°	3157	3042	2652	2251	1614	1437.4
145°	2862	2752	2622	2306	1790	1199.4
155°	2986	2946	2792	2496	2073	990.4
165°	2879	2839	2717	2507	2244	637.7
175°	2562	2533	2475	2381	2293	219.0
180°						

Lumen Summary

Zone	Lumens	% Lamp	% Fixt
90°-120°	2071	20.7	26.0
90°-130°	3470	34.7	43.6
90°-150°	6107	61.1	76.8
90°-180°	7954	79.5	100.0
Total Luminaire:	0°-180°	7954	79.5 100.0

Light Levels (maintained footcandles)

Light Levels (maintained footcandles)

ceiling height	10" MD Floor Reading Interval						
	2'	4'	6'	8'	10'	12'	14'
10' 6"	12	13	12	10	9	7	5
9' 6"	15	15	13	11	9	7	5
8' 6"	16	16	14	12	9	6	5
7' 6"	18	18	15	11	8	6	5

ceiling height	15" MD Floor Reading Interval						
	2'	4'	6'	8'	10'	12'	14'
10' 6"	45	47	45	38	31	24	19
9' 6"	53	55	50	41	32	25	19
8' 6"	60	62	53	42	32	24	19
7' 6"	61	62	50	37	27	20	15

ceiling height	15" MD Floor Reading Interval						
	2'	4'	6'	8'	10'	12'	14'
10' 6"	13	13	13	11	9	7	5
9' 6"	15	15	14	11	9	7	5
8' 6"	17	17	15	12	9	7	5
7' 6"	17	18	14	11	8	6	4

ceiling height	24" MD Floor Reading Interval						
	2'	4'	6'	8'	10'	12'	14'
10' 6"	48	52	48	41	34	28	22
9' 6"	55	59	51	42	34	27	21
8' 6"	54	55	48	39	30	22	17
7' 6"	72	72	60	46	34	25	19

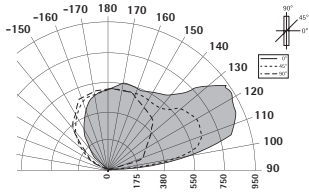
Sept. 2003 Focal Point LLC reserves the right to change specifications for product improvement without notification.



1 T5HO

Luminaire: One lamp T5HO surface mounted
cove light with indirect asymmetric
distribution
Filename: FCV26-1.T5H
Efficiency: 82.5%
Independent testing laboratory report no. 11072.0

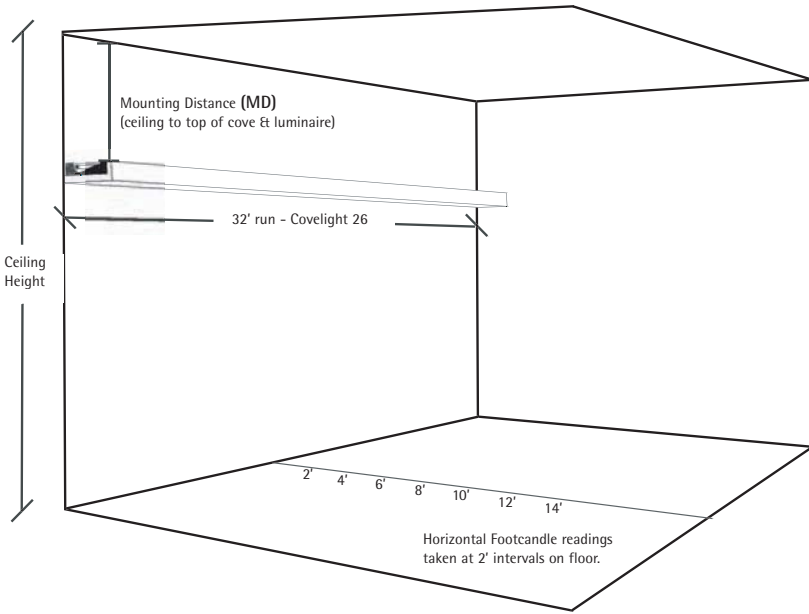
Candlepower Distribution



Vertical angle	Horizontal angle									Zonal lumens
	0°	22.5°	45°	67.5°	90°	112.5	135.0	157.5	180.0	
90°	0	0	0	0	0	0	0	0	0	0
95°	212	216	235	273	37	58	72	70	70	168.3
105°	1043	1045	1006	665	202	90	102	124	131	508.9
115°	1741	1626	1301	686	395	231	153	155	158	669.5
125°	1813	1662	1226	743	580	425	295	230	224	686.3
135°	1576	1429	1117	867	761	634	493	408	384	646.3
145°	1236	1176	1061	923	878	817	694	614	593	554.4
155°	1207	1178	1104	1024	1016	1009	908	848	824	469.7
165°	1158	1142	1117	1101	1105	1109	1099	1061	1044	312.7
175°	1121	1117	1115	1120	1122	1129	1129	1131	1131	107.3
180°										

Lumen Summary

Zone	Lumens	% Lamp	% Fixt
90°-120°	1347	26.9	32.7
90°-130°	2033	40.7	49.3
90°-150°	3234	64.7	78.4
90°-180°	4123	82.5	100.0
Total Luminaire:	0°-180°	4123	82.5 100.0



Light Levels (maintained footcandles)

12" MD		Floor Reading Interval					
ceiling height	2'	4'	6'	8'	10'	12'	14'
10' 6"	24	25	24	21	17	13	11
9' 6"	29	30	27	22	18	14	11
8' 6"	32	33	29	23	17	13	10
7' 6"	34	34	28	21	15	11	8

21" MD		Floor Reading Interval					
ceiling height	2'	4'	6'	8'	10'	12'	14'
10' 6"	26	28	26	22	19	15	12
9' 6"	29	31	28	23	19	15	12
8' 6"	31	32	28	23	18	14	11
7' 6"	37	38	32	25	19	14	11

Above Test Room Defined (applies to all tests)

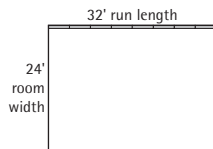
Size: 24' x 32'

Run Length: 32'

Reflections: - ceiling: 80
- walls: 50
- floor: 20

LLF: .85 (T5/T5HO) .75 (T8)

Table values are maintained footcandles.



Sept. 2003 Focal Point LLC reserves the right to change specifications for product improvement without notification.



Universal T8 Fluorescent Lamps

Full Rated Average Life on all T8 Ballast Types, Environmentally-Responsible Lamps



Photo at far left: Mark DeCarso of Visus, Ltd.

Ideal for any lighting application requiring maximum quality of light and maintained light output



Green End-Caps are a registered trademark of Philips Electronics North America Corporation.

Philips Exclusive Universal Design

The only T8 lamps to deliver full rated average life on all T8 ballast types (Instant Start, Rapid Start, Programmed Start and Hybrid ballasts)

Environmentally Responsible

- Low mercury: TCLP* and California TTLC* compliant
- Energy efficient
- Long life

Sustainable Lighting Solution

Less mercury and fewer lamps in landfills, combined with energy efficiency reduces the impact on the environment

Look for the Green End-Caps®

Our Green End-Caps mean you are using environmentally-responsible lamps

Outstanding Lumen Maintenance

HI-VISION® Phosphor combined with Philips exclusive cathode guard delivers:

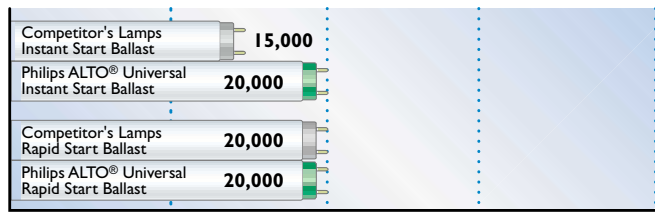
- 95% lumen maintenance
- Reduced lamp-end blackening

Enhanced CRI

86 CRI for TL80 lamps; 78 CRI for TL70 lamps

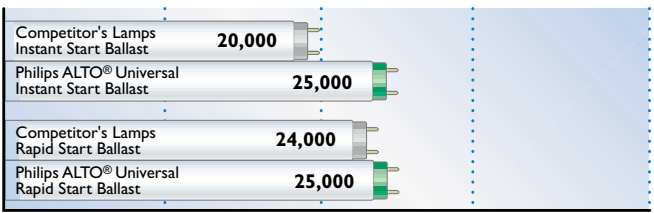
* The TCLP is the US EPA's Toxicity Characteristic Leaching Procedure, and the TTLC is California's Total Threshold Limit Concentration test.

ALTO® Universal Lamp Rated Average Life Based on 3 Hours Per Start



Rated Average Life in Hours

ALTO® Universal Lamp Rated Average Life Based on 12 Hours Per Start



Rated Average Life in Hours



Philips Lighting Company
 200 Franklin Square Drive ■ P.O. Box 6800
 Somerset, NJ 08875-6800
 1-800-555-0050

www.lighting.philips.com/nam

A Division of Philips Electronics North America Corporation

Printed in USA 1/03

P-5338-D

Philips Electronics Ltd.
 281 Hillmount Road
 Markham, Ontario
 Canada L6C 2S3
 1-800-555-0050
www.lighting.philips.com/nam

ALTO® Universal T8 Fluorescent Lamps

Electrical, Technical and Ordering Data (Subject to change without notice)

Product Number	Ordering Code	Package Quantity	Color Temp. (Kelvin)	Nominal Length (In.)	Rated Average Life (Hrs.) ⁽¹⁾		Approx. Initial Lumens	Design Lumens ⁽²⁾	CRI	Lumen Maintenance
					3-Hr. Start	12-Hr. Start				
Ⓔ 24667-8	F32T8/TL830/ALTO	25	3000K	48	20,000	25,000	2950	2800	86	95%
32 24670-2	F32T8/TL835/ALTO	25	3500K	48	20,000	25,000	2950	2800	86	95%
Ⓔ 24671-0	F32T8/TL841/ALTO	25	4100K	48	20,000	25,000	2950	2800	86	95%
Ⓔ 27229-4	F32T8/TL850/ALTO	25	5000K	48	20,000	25,000	2950	2800	86	95%
Ⓔ 27252-6	F32T8/TL730/ALTO	25	3000K	48	20,000	25,000	2850	2710	78	95%
Ⓔ 27249-2	F32T8/TL735/ALTO	25	3500K	48	20,000	25,000	2850	2710	78	95%
Ⓔ 27248-4	F32T8/TL741/ALTO	25	4100K	48	20,000	25,000	2850	2710	78	95%
Ⓔ 27268-2	F32T8/TL750/ALTO	25	5000K	48	20,000	25,000	2750	2550	78	95%

⁽¹⁾ Rated average life under specified test conditions with either Rapid Start, Programmed Start or Instant Start ballasts 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.

⁽²⁾ Approximate lumens at 40% of rated average life at 3 hours per start.

Ⓔ Lamp meets US Federal Minimum Efficiency Standards.

Cost of Ownership Savings

ALTO Universal 4-Ft. T8 Lamps vs. Standard 4-Ft. T8 Lamps

General Overview

ALTO Universal T8 lamps provide up to 33% longer life than standard T8 products on Instant Start ballasts. With no incremental cost, the benefits and financial impact can be significant.

Benefits

By using ALTO Universal T8 lamps, the lamp replacement and labor costs are extended by an extra 15 months on a facility that operates an average of 4,000 hours per year. For example, current T8 products, with a rated average life expectancy of 15,000 hours on Instant Start ballasts, will last 3 years and 9 months. Conversely, ALTO Universal T8 lamps will operate for 5 years due to their rated average life expectancy of 20,000 hours on Instant Start ballasts.

Financial Impact

With the extended life expectancy of 15 months, combined with the benefits of Philips' exclusive ALTO TCLP-compliant, low mercury technology, the positive financial impact of installing ALTO Universal T8 lamps will provide cost of ownership savings per lamp as follows:

Incremental Cost	(\$.00)
Material Cost Avoidance ^A	\$.82
Labor Cost Avoidance ^B	\$ 1.47
Disposal Cost Avoidance ^C	\$.36
Cost of Ownership Savings	\$ 2.65

A Material Cost Avoidance is the annualized acquisition cost per lamp (average cost per lamp of \$2.50 for standard T8 product / 3 3/4 years = \$.66 per year). By installing ALTO Universal T8 lamps, a material cost per lamp of \$.82 is avoided due to the extra 15 months of life expectancy. Note that the average cost per lamp may vary.

B Labor Cost Avoidance is the annualized labor replacement cost per lamp (labor replacement cost per lamp of \$4.45 / 3 3/4 years = \$1.18 per year). By installing ALTO Universal T8 lamps, a labor replacement cost per lamp of \$1.47 is avoided in the sixth year due to the extra 15 months of life expectancy. Note that the labor replacement cost per lamp may vary. Source: National Lighting Bureau Guide to Office Lighting and Productivity.

C Disposal Cost Avoidance is based on an average of \$.09 per ft. for lamp recycling or \$.36 per 4-ft. lamp. Philips Lighting Company encourages the recycling of all fluorescent lamps.

ALTO Universal T8 Fluorescent Lamps Featuring Full Rated Life on all T8 Ballast Types—Lamp Specification Lamps shall be Philips HI-VISION® T8 Lamps having:

- ▶ Full rated life on Instant Start, Rapid Start, Programmed Start and Hybrid ballasts
- ▶ Color rendering index of ____ (78 or 86)
- ▶ T8 diameter bulb
- ▶ Medium bipin bases
- ▶ Color temperature of ____ K (3000, 3500, 4100, 5000)
- ▶ Initial lumens of ____ (2750–2950)
- ▶ Design lumens of ____ (2550–2800)
- ▶ Nominal wattage of 32
- ▶ Cathode guards
- ▶ Featuring HI-VISION Phosphor



† This fluorescent lamp is better for the environment because of its reduced mercury content. All fluorescent lamps contain mercury for effective operation, however, Philips lamps with ALTO® Lamp Technology average 70% less mercury than the 2001 industry average for fluorescent lamps up to sixty inches which are not TCLP-compliant.





SILHOUETTE™ Series 2'-5' T5 High Output Fluorescent Lamps

Powerful, Environmentally-Responsible Ultra-Slim Lamps



***Ideal for high bay retail, industrial
and commercial applications***



Green End-Caps are a registered trademark of Philips Electronics North America Corporation.

▶ Increased Light Output

- Up to 70% more lumens than standard SILHOUETTE T5 lamps
- Improved uniformity for indirect lighting applications

▶ Slim Profile Lamp and Ballast

Improved optical control

▶ Operates on Programmed Start Electronic Ballasts

High system efficacy

▶ Optimized Lamp Lengths

Design flexibility

▶ Sustainable Lighting Solution

Less mercury and fewer lamps in landfills, combined with energy efficiency reduces the impact on the environment

▶ Look for the Green End-Caps®

Our Green End-Caps mean you are using environmentally-responsible lamps

▶ Outstanding Lumen Maintenance

- HI-VISION® Phosphor combined with Philips exclusive cathode guard delivers:
- 95% lumen maintenance
 - Reduced lamp-end blackening

*The TCLP is the US EPA's Toxicity Characteristic Leaching Procedure.



PHILIPS

Philips Lighting Company
 200 Franklin Square Drive ■ P.O. Box 6800
 Somerset, NJ 08875-6800
 1-800-555-0050

www.lighting.philips.com/nam

A Division of Philips Electronics North America Corporation

Printed in USA 4/03

P-5385-C

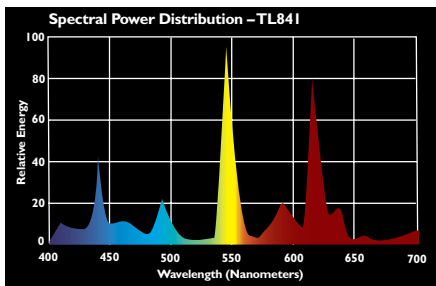
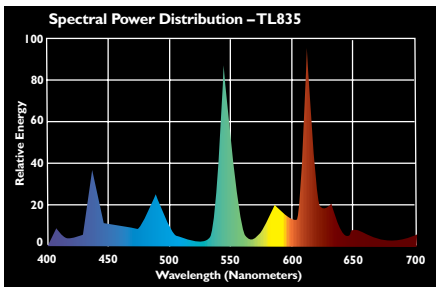
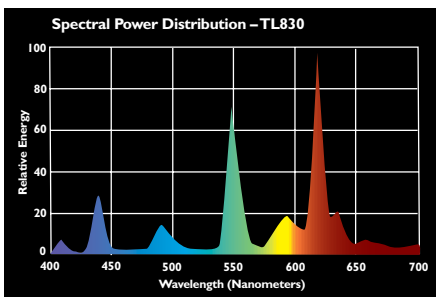
Philips Lighting
 281 Hillmount Road
 Markham, Ontario
 Canada L6C 2S3
 1-800-555-0050
 www.lighting.philips.com/nam
 A Division of Philips Electronics Ltd.

ALTO® SILHOUETTE™ Series 2'-5' T5 High Output Fluorescent Lamps
 Electrical, Technical and Ordering Data (Subject to change without notice)

Product Number	Description	Nom. Watts	Bulb	Base	Std. Pkg. Qty.	Color Temp. (Kelvins)	CRI	Nominal Length (In.)	Rated Avg. Life (Hrs.) ¹	Initial Lumens	Design Lumens ²
29019-7	F24T5/830/HO/ALTO	24	T5	Min. Bipin	40	3000K	85	22	20,000	2000	1900
29020-5	F24T5/835/HO/ALTO	24	T5	Min. Bipin	40	3500K	85	22	20,000	2000	1900
29021-3	F24T5/841/HO/ALTO	24	T5	Min. Bipin	40	4100K	85	22	20,000	2000	1900
29022-1	F39T5/830/HO/ALTO	39	T5	Min. Bipin	40	3000K	85	34	20,000	3500	3325
29023-9	F39T5/835/HO/ALTO	39	T5	Min. Bipin	40	3500K	85	34	20,000	3500	3325
29025-4	F39T5/841/HO/ALTO	39	T5	Min. Bipin	40	4100K	85	34	20,000	3500	3325
29026-2	F54T5/830/HO/ALTO	54	T5	Min. Bipin	40	3000K	85	46	20,000	5000	4750
29028-8	F54T5/835/HO/ALTO	54	T5	Min. Bipin	40	3500K	85	46	20,000	5000	4750
29083-3	F54T5/841/HO/ALTO	54	T5	Min. Bipin	40	4100K	85	46	20,000	5000	4750
29084-1	F80T5/830/HO/ALTO	80	T5	Min. Bipin	40	3000K	85	58	20,000	7000	6650
29088-2	F80T5/841/HO/ALTO	80	T5	Min. Bipin	40	4100K	85	58	20,000	7000	6650

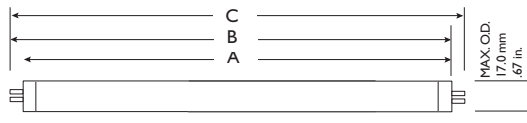
1) Average rated life under specified test conditions with lamps turned off and restarted once every 3 operating hours.
 2) Approximate lumens at 40% of rated average life (8000 Hours).

Spectral Power Distribution



Lamp Dimensions

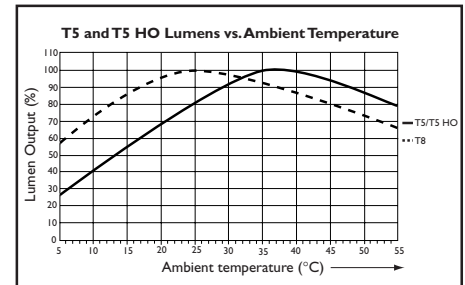
Lamp Type	A MAX. In. / mm	B MIN. In. / mm	B MAX. In. / mm	C MAX. In. / mm
F24T5/HO/ALTO	21.61/549.0	21.80/553.7	21.89/556.1	22.17/563.2
F39T5/HO/ALTO	33.42/849.0	33.61/853.7	33.70/856.1	33.98/863.2
F54T5/HO/ALTO	45.24/1149.0	45.42/1153.7	45.52/1156.1	45.80/1163.2



SILHOUETTE Lamp Specification

Lamps shall be Philips SILHOUETTE High Output T5 lamps having:

- ▶ Color rendering index of 85
- ▶ T5 diameter bulb
- ▶ Miniature bipin bases
- ▶ Color temperature of _____ (3000K, 3500K or 4100K)
- ▶ Initial lumens of _____ (2000, 3500, 5000)
- ▶ Design lumens of _____ (1900, 3325 or 4750)
- ▶ Nominal wattage of _____ (24, 39 or 54)
- ▶ Powered by electronic ballast designed for T5 High Output Lamps



† This fluorescent lamp is better for the environment because of its reduced mercury content. All fluorescent lamps contain mercury for effective operation, however, Philips lamps with ALTO® Lamp Technology average 70% less mercury than the 2001 industry average for fluorescent lamps up to sixty inches which are not TCLP-compliant.





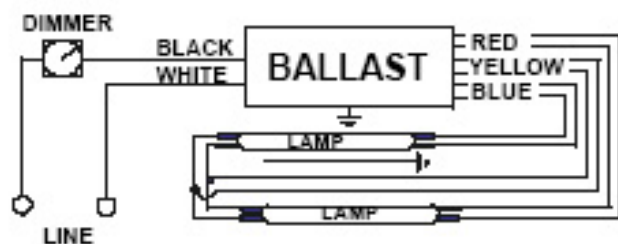
* Indicates ballast used

REZ-2S32-SC	
Brand Name	MARK X Powerline
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts)	Ballast Factor	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
F17T8	2	17	50/10	0.32	13	0.05	10	0.99	1.6	0.38
F25T8	2	25	50/10	0.46	13	0.05	10	0.99	1.6	0.38
* F32T8	2	32	50/10	0.57	15	0.05	10	0.99	1.6	0.33

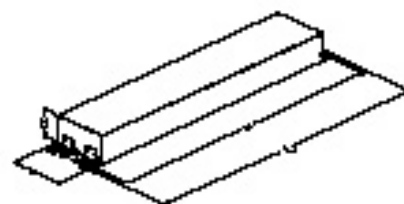
Wiring Diagram



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

Standard Lead Length (inches)

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 09/10/2002



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



Electrical Specifications

Notes:

Advance Mark Xr Powerline Ballast Specifications

Section I - Physical Characteristics

- 1.1 Ballast shall be physically interchangeable with comparable standard electromagnetic or standard electronic ballasts.
- 1.2 Ballast shall be provided with integral leads or color-coded connectors that comply with ANSI standard C82.11 (latest revision).

Section II - Performance Requirements

- 2.1 Ballast shall be Programmed-Start
 - 2.2 Ballast shall operate from a nominal line voltage of 120 or 277 volts +/- 10%, 60Hz and maintain constant light output for line voltage variations of $\pm 10\%$.
 - 2.3 For T8 and CFL, ballast shall control lamp light output from 100% - 5% relative light output. For T5/HO, ballast shall control lamp light output from 100% - 1% relative light output.
 - 2.4 Ballast shall ignite the lamps at any light output setting selected without having first starting at maximum light output.
 - 2.5 Ballast input current shall have a Total Harmonic Distortion (THD) of less than 10% at maximum light output for primary lamps. Total Harmonic Current (THC) at minimum light output shall not exceed THC at maximum light output.
 - 2.6 Ballast shall have a Power Factor greater than 98% at full light output and greater than 90% throughout the dimming range when used with primary lamp.
 - 2.7 Lamp Current Crest Factor shall be 1.6 or less throughout the dimming range in accordance with lamp manufacturer recommendation.
 - 2.8 Ballast shall withstand a sustained short to ground or open circuit of any output leads.
 - 2.9 Ballast shall be sound rated A.
 - 2.10 Ballast shall be a high frequency electronic type, and operate lamps above 40kHz to avoid interference with infrared control systems, and eliminate visible flicker.
 - 2.11 Ballast for compact fluorescent and T5/HO lamps shall have lamp end-of-life detection and shut down circuitry that meets proposed ANSI/IEC standard.
 - 2.12 Ballast shall comply with ANSI C82.11 standards.
 - 2.13 Ballast shall provide transient immunity as specified in ANSI C62..
- ##### Section III - Regulatory Requirements
- 3.1 Ballast shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR Part 18 for Non-Consumer equipment, Class A for EMI (Conducted and Radiated).
 - 3.2 Ballast shall comply with all applicable state and federal efficiency standards.
 - 3.3 Ballast shall be Underwriters Laboratories (UL 935) listed, Class P, Type 1 Outdoor, and CSA Certified where applicable.
- ##### Section IV - Other
- 4.1 Ballast shall not contain Polychlorinated Biphenyl (PCBs).
 - 4.2 Manufacturer shall provide written warranty against defects in material or workmanship including replacement, for five years from date of manufacture when ballast case temperature does not exceed 70°C.
 - 4.3 Ballast manufacturer shall have a fifteen-year history of producing electronic ballasts for the North American market.
 - 4.4 Ballast shall be produced in a factory certified to ISO 9002 Quality System Standards.
 - 4.5 Ballast shall be controlled by a Mark X r Powerline compatible lighting control.
 - 4.6 Ballast shall be connected to rapid-start sockets only. Shunted or jumpered sockets are not to be used

REZ-2S32-SC	
Brand Name	MARK X Powerline
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120
Input Frequency	50/60 HZ
Status	Active



* Indicates ballast used

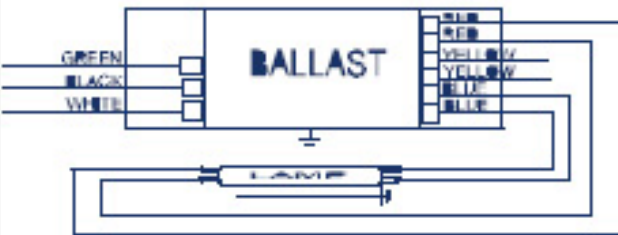
1

ICN-2S54-90C@120	
Brand Name	CENTIUM
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
* F54T5/HO	1	54	0/-18	0.52	62	1.02	10	0.96	1.7	1.65
F54T5/HO	2	54	0/-18	1.00	120	1.00	10	0.98	1.7	0.83
FC12T5/HO	1	55	0/-18	0.46	55	0.87	15	0.96	1.7	1.58
FC12T5/HO	2	55	0/-18	0.89	106	0.85	10	0.98	1.7	0.80
FT36W/2G11	1	36	0/-18	0.39	46	1.22	20	0.96	1.7	2.65
FT36W/2G11	2	36	0/-18	0.75	89	1.20	10	0.98	1.7	1.35
FT50W/2G11	1	50	0/-18	0.51	61	1.12	15	0.96	1.7	1.84
FT50W/2G11	2	50	0/-18	0.99	118	1.10	10	0.98	1.7	0.93
FT55W/2G11	1	55	0/-18	0.49	58	0.92	15	0.96	1.7	1.59
FT55W/2G11	2	55	0/-18	0.94	112	0.90	10	0.98	1.7	0.80

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 06/09/2003



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

ADVANCE 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-2S54-90C@120

Brand Name	CENTIUM
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Notes:

1 Physical Requirements

- 1.1 Ballast must be physically interchangeable with a magnetic core & coil ballast.
- 1.2 Ballast must have permanently connected leads integral to the ballast or poke-in connectors, color coded to ANSI C82.11 (latest version).
- 1.3 Ballast must be formed from recyclable steel painted in accordance with UL 935 standards. Plastic products with gaseous discharges are not allowed.

2 Lighting Performance Requirements

- 2.1 Ballast must have a ballast factor of:
 - 2.1.1 .75-.78 for a low wattage design (LW).
 - 2.1.2 .85-.92 for a normal light output design.
- 2.2 Ballast must have a maximum input wattage (ANSI) as indicated on the data sheet.
- 2.3 Ballast must have a Ballast Efficacy Factor greater than or equal to as indicated on the data sheet.
- 2.4 Ballast must be able to start and operate the specified lamps at a minimum temperature of (-20,0,32,50,60) degrees Fahrenheit as indicated on the data sheet and shall be in accordance with lamp manufacturer recommendations.
- 2.5 Ballast must be sound rated A. (T12/HO and T12/Similne rated B).
- 2.6 Ballast must be designed and UL listed to operate the number of lamps as indicated on the data sheet.

3 Electrical Performance Requirements

- 3.1 Ballast THD shall be less than 10% for the main lamp design (as indicated on the data sheet).
- 3.2 Lamp Current Crest Factor shall not exceed 1.7 for the main lamp design.
- 3.3 Ballast Power Factor must be greater than 98% for the main lamp design.
- 3.4 Ballast output frequency shall be greater than 20kHz and less than 30kHz or greater than 42kHz. Ballast output shall not be between 30 and 42kHz for any lamp combination.
- 3.5 Ballast must operate between 108-132V(120V), 249-305V(277V), 312-382V(347V), or 432-528V (480V) 60 Hz.
- 3.6 Ballast must maintain light output at +/- 10% during a voltage fluctuation of +/- 10%.
- 3.7 Ballast shall be (Instant Start Parallel, Rapid Start Series, Programmed Rapid Start Series) as indicated on the data sheet.
- 3.8 All ballasts for Compact Fluorescent Lamps (CFL) and T5 diameter lamps must contain a lamp End-Of-Life (EOL) detection and shut down circuit in accordance with ANSI/IEC proposed standards and must be operated on a rapid start ballast. Compact Fluorescent lamps shall not be operated on an instant start circuit.

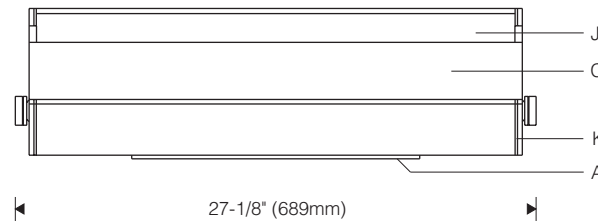
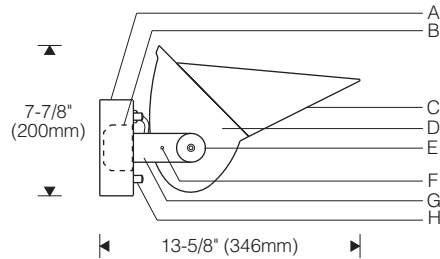
4 Regulatory Requirements

- 4.1 Ballast shall meet ANSI C82.11 limits for Total Harmonic Distortion (THD).
- 4.2 Ballast shall meet FCC Part 18 non-consumer standards for electrical equipment (Class A).
- 4.3 Ballast shall meet ANSI 62.41 Category A standards for Transient Voltage protection.
- 4.4 Ballast shall meet UL 935 standards and be UL listed and CSA approved.
- 4.5 Ballast shall be UL Class P and Type 1 Outdoor.
- 4.6 Ballast shall contain no Polychlorinated Biphenyl (PCBs) in accordance with US law.
- 4.7 Ballast shall meet all US state and federal efficacy laws and all Canadian provincial and federal efficacy laws.

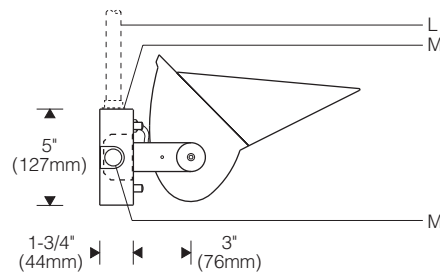
5 Other

- 5.1 Ballast shall carry a 5 year warranty (from date of manufacture) with PLUS 90 system protection warranty (must register). Warranty shall be valid at case temperatures of 70C or less. For 90C rated ballasts, warranty shall be 3 years for ballast case temperatures between 70C and 90C.
- 5.2 Manufacturer must have a 15 year history of designing and manufacturing electronic ballasts for the North American market.
- 5.3 Ballast must be manufactured in a facility Certified to ISO 9002 Quality System Standards.
- 5.4 Ballast must be ordered and shipped from a distribution center Certified to ISO 9002 Quality System Standards.
- 5.5 Ballast must be Advance Transformer Co. brand, part # _____ . All proposed substitutes must be submitted to the specifying authority two weeks prior to bid due date. Submittal does not guarantee acceptance.

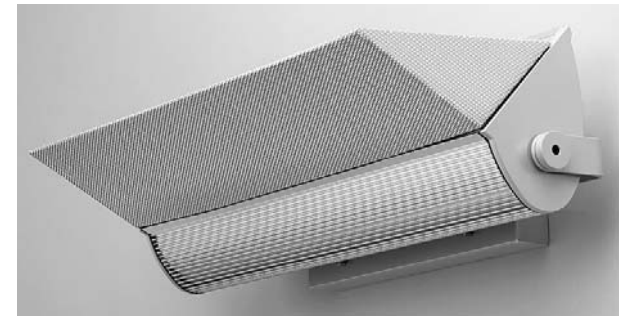
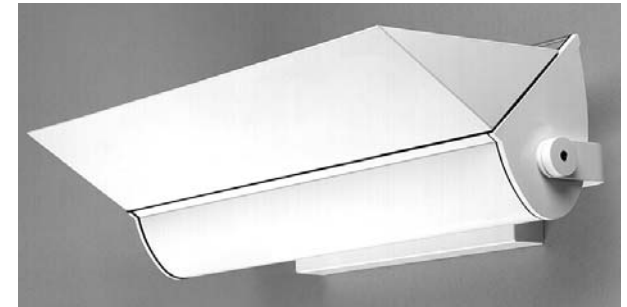
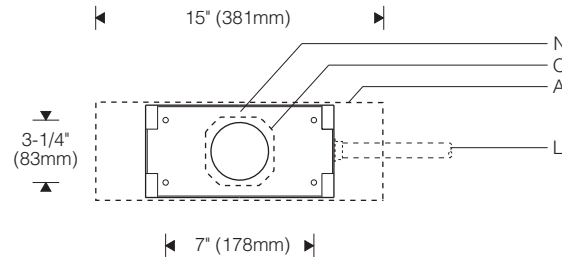
E Mount 1:10 Scale



F Mount 1:10 Scale



Mounting Plate



Specifications

- | | | | |
|--|---------------------------------------|---|--|
| A Aluminum canopy/ ballast housing | D Die-cast aluminum end plates | H Chrome cap nuts | M 7/8" dia. conduit entries, 3 total (F mount only) |
| B Integral electronic ballast (remote for X mount) | E Machined aluminum knobs | J Specular extruded aluminum reflector | N Aluminum mounting plate |
| C Perforated or solid cutoff visor (included) | F Locking set screw | K Aluminum reveal plates (black) | O Recessed outlet box (by others) |
| | G Aluminum yoke | L Conduit (by others) | |

Features

- **4X** focuses the light of two 40, 50 or 55W lamps for high performance, low energy uplighting
- Long twin-tube fluorescent lamps - great color, long life
- Integral electronic ballast - dimming, emergency optional
- Die-cast end plates join at articulated black reveals; machined aluminum knobs - no exposed fasteners



Finish:

Style 113 fluted - bright clear anodized aluminum housing. Painted end plates, visor, yoke and canopy in choice of silver or semi-gloss black.

Style 114 smooth - semi-gloss white exterior.

Visor available solid or perforated. Perforated visor supplied with diffusing translucent insert.

Painted surfaces - 6 stage pretreatment and electrostatically applied thermoset powder coat.

Reflector and internal end plates - extruded high purity aluminum with clear anodized specular finish. All luminaire hardware - stainless steel. All mounting hardware - zinc or cadmium plated.

Mounting:

E mount - canopy mounts over recessed outlet box.

F mount - three 7/8" dia. entries in mounting plate with clearance openings in canopy; one top center, one on each end (surface conduit, connectors by others).

Uplight pendant (back to back) or cantilever assembly ordered separately; specify **X** mount. Supplied with **remote** ballast.

Electrical:

Use 90°C wire for supply connections.

Integral electronic HPF thermally protected class P ballast with end-of-life protection.

X mount (for use with uplight pendant or cantilever) furnished with **remote** electronic ballast. Aluminum ballast enclosure includes four 7/8" dia. entries and a knockout for accessory fuse. **Maximum wire length between remote electronic ballast and fixture is 8' (2.4m) less length of pendant stem or cantilever arm.**

Optional electronic dimming ballast dims to 10% of full light output (**E** and **F** mount only). Not available for **X** mount (pendant or cantilever), or for 55W lamps. Compatible dimmer switch required (by others). Consult sales representative for specifications.

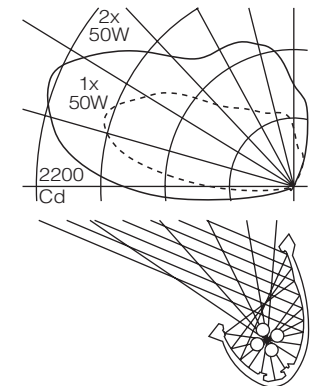
For complete ballast specifications, see Accessories Section.

Standard:

UL listed or CSA certified for damp locations. (*Style 114* hex tube model with gasketed lens recommended for damp location use; see page C-21.0.)

Performance

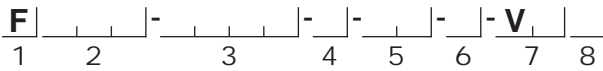
Two parabolic reflector sections drive light across the ceiling from one edge. An elliptical section shields the lamp from normal viewing angles and redirects its light to a parabola. Glare is minimized and asymmetry of the beam is maximized resulting in high beam efficiency and superior surface uniformity.



For complete photometrics, see Indoor Applications Section.



To form a Catalog Number



1 Source

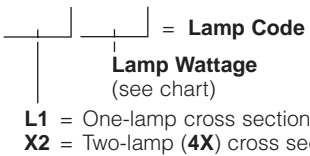
F = Long twin tube compact fluorescent

2 Style

113 = Large fluted surface, **integral** ballast
 114 = Large smooth surface, **integral** ballast

Note: Pendant or cantilever mounted units furnished with **remote** ballast.

3 Lamp



Example: **X240** = two-lamp cross section with 40W lamps

Lamp Wattage	Lamp Number
Long Twin Tube Compact Fluorescent	
39	FT36-39W/2G11
40	FT40W/2G11
50	FT50W/2G11
55	FT55W/2G11

For complete lamp and ballast information, see Accessories Section. Standard long twin tube lamp color is 3000K / 80+ CRI.

4 Mounting

- E** = External yoke on canopy. Mounting plate fastens over recessed outlet box (by others).
- F** = External yoke on canopy. Mounting plate with (3) 7/8" dia. entries, one top center, one on each end for surface conduit (by others).
- X** = External yoke for use with accessory upright pendant or cantilever mounting assembly (order separately)
Note: furnished with **remote** ballast.

Project: _____

5 Finish

Style 113 Fluted

Bright anodized aluminum reflector with painted end plates, yoke, canopy and visor in choice of

- 01** = silver, solid visor
- P1** = silver, perforated visor
- 81** = semi-gloss black, solid visor
- P8** = semi-gloss black, perforated visor

Style 114 Smooth

Semi-gloss white reflector, end plates, yoke and canopy with choice of

- 02** = solid visor finished white
- P2** = perforated visor finished white.
- 99** = Custom RAL or computer matched color to be specified, consult sales representative

6 Voltage/Ballast

*Electronic**

- 1** = 120V
- 2** = 277V
- 3** = 347V (Canada)**

Dimming+

- T** = 120V
- V** = 277V

* **X** mount furnished with **remote** electronic ballast.
 **Consult Factory for availability.
 + Dimming not available for 55W lamps or for use with pendant or cantilever (available in **E** and **F** mount only).

7 Option (See Accessories Section for specifications)

- V0** = Cutoff visor included, no other options
- VE** = Remote emergency battery pack. Maximum distance from battery pack to fixture is 5' (1.5m).
- XX** = For modification not listed, include detailed description. Consult factory prior to specification.

Note: Cutoff visor included unless specified otherwise.

8 Standard

- 0** = UL, Underwriters Laboratories
- J** = CSA, Canadian Standards Association

Example

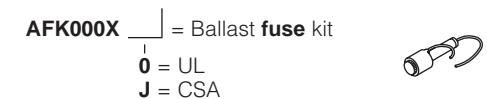
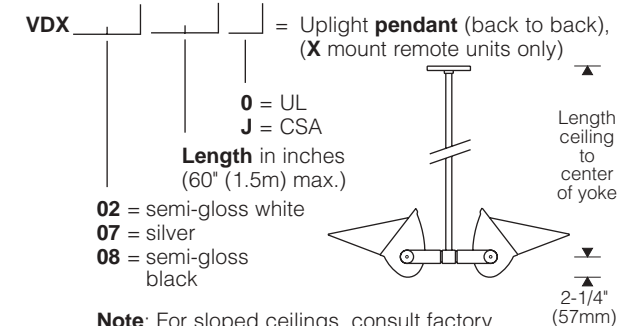
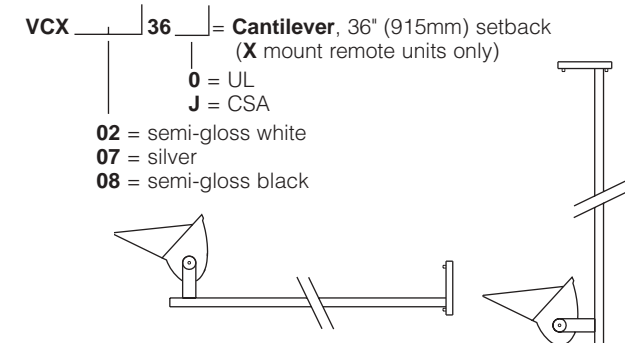
F113 - X250 - E - P1 - 2 - V00

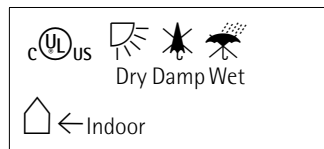
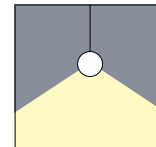
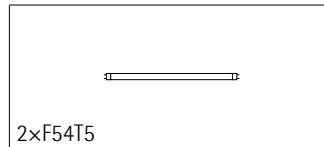
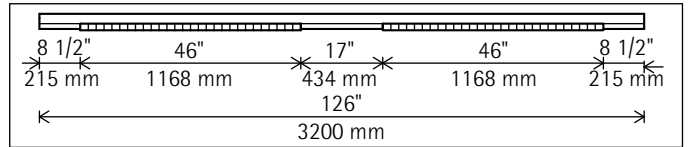
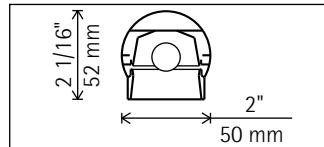
Large fluted model for use with two 50W long twin tube compact fluorescent lamps (**4X** 2-lamp cross section). External yoke on canopy for mounting over recessed outlet box (by others). Bright reflector with silver end plates, yoke and canopy. Integral 277V electronic ballast. UL. Perforated cutoff visor with silver painted finish included.

Type: _____

Accessories

Order separately. See Accessories Section for specifications.

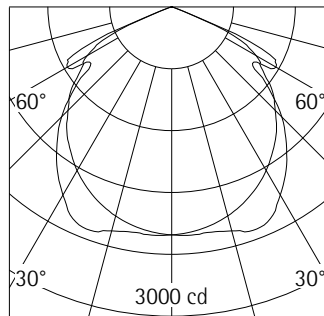




12414.023 White
 2x F54T5 54W Min. Bipin 5000lm
 ECG

Product description

Aluminum profile, powder-coated.
 Lower lateral cover profiles: aluminum, powder-coated.
 Lamps positioned in series.
 Electronic control gear 120V, 60Hz.
 Low brightness reflector: plastic, silver, specular aluminum vaporized. Scratch-resistant special coating. Cut-off 20° from horizontal. Visible parts, silver specular.
 For lamp replacement removable without tools.
 Upper reflector: metal, white powder-coated.
 Weight: 11.02 lbs / 5.00 kg



2x F54T5 54W Min. Bipin 5000lm

Efficiency: 58%

Connected load of luminaire

2x F54T5 54W Min. Bipin 5000lm PL: 118 W

Connected load per 100fc

2x F54T5 54W Min. Bipin 5000lm P*: 0.3 W/ft²

Number of luminaires per 100fc

2x F54T5 54W Min. Bipin 5000lm n*: 2.3 1/1000 ft²

Photometric report

Candlepower distribution

Vertical Angle	Candelas		
	0°	45°	90°
0°	2214	2214	2214
10°	2221	2193	2155
20°	2309	2154	2029
30°	2109	2085	1835
40°	1731	1758	1582
50°	1230	1331	1279
60°	1171	888	945
70°	21	206	28
80°	3	4	4
90°	5	7	8

Zonal Lumen Summery

Zone	Lumens	%Lamp	%Fixture
0°	0	0	0
10°	211	2	4
20°	827	8	14
30°	1804	18	31
40°	2982	30	51
50°	4159	42	72
60°	5138	51	88
70°	5797	58	100
80°	5810	58	100
90°	5815	58	100

Lamp information

2x F54T5 54W Min. Bipin 5000lm

Note:

Photometric data may change when using different lamps.

These guide values are based on 10ft ceiling height in a square room of 1000ft² and mean reflectances (ceiling 70 %, walls 50 % and floor 20 %). Other room shapes or reflectances should be converted accordingly. The values include the light loss factor of 0.8.

Coefficients of Utilisation

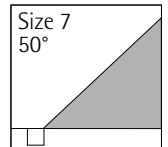
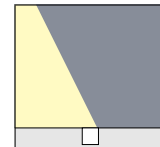
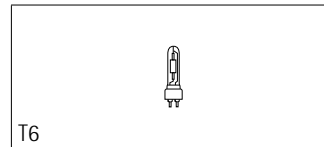
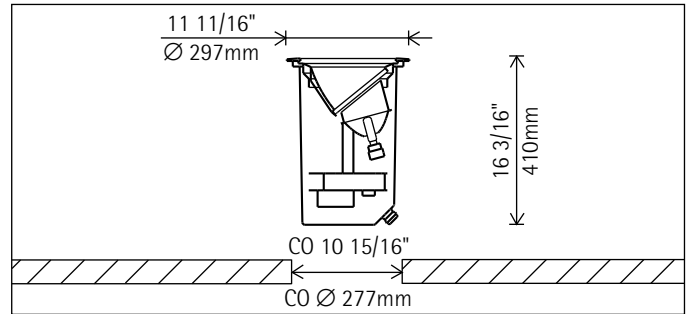
Reflectances																
Ceiling	80	80	80	70	70	70	50	50	50	30	30	30	10	10	10	0
Walls	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
Floor	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20

Room Cavity Ratio

0	69	69	69	68	68	68	65	65	65	62	62	62	59	59	59	58
1	63	61	59	61	59	58	59	57	56	57	55	54	55	54	53	52
2	56	53	50	55	52	50	53	51	49	51	49	48	50	48	47	45
3	50	46	43	49	46	43	48	45	42	46	44	41	45	43	41	40
4	45	41	37	44	40	37	43	39	36	42	39	36	40	38	36	34
5	40	35	32	39	35	32	38	34	31	37	34	31	36	33	31	29
6	36	31	28	35	31	27	34	30	27	33	30	27	32	29	27	26
7	32	27	24	32	27	24	31	27	24	30	26	24	29	26	23	22
8	29	24	21	28	24	21	28	24	21	27	23	20	26	23	20	19
9	26	21	18	25	21	18	25	21	18	24	20	18	24	20	18	17
10	23	19	16	23	19	16	23	18	16	22	18	16	21	18	16	15

Luminance Data

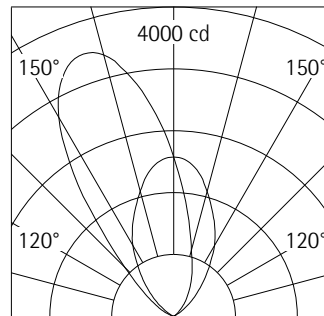
Vertical Angle	Footlamberts		
	0°	45°	90°
45°	70794	72709	66605
50°	63327	68516	65873
55°	55307	62492	62339
60°	77501	58782	62549
65°	75416	52685	51978
70°	2045	19924	2742
75°	178	334	266
80°	584	673	726
85°	1073	1196	1364
90°	0	0	0



33723.023
 Reflector color Silver
 T6 70W G12 6600lm
 ECG

Product description

Housing: corrosion-resistant, cast aluminum, No-rinse surface treatment. Black double powder-coated. Mounting by means of an adjustable bar. Clamp extension up to 1 3/8" / 35mm. Electronic control gear 120V, 60Hz. Cable, L 39" / 1m. Wallwasher reflector: aluminum, silver anodized. Low brightness reflector: aluminum, silver, specular anodized, with wallwasher lens. Cut-off angle 50° from horizontal. Without spill light. Screw-mounted cover ring with flush safety glass: corrosion resistant stainless steel. Safety glass: 1/2" / 12mm, clear. Surface temperature 185°F / 85°C. Can be driven over by vehicles with pneumatic tyres. Load 9890lb.wt / 44kN. Suitable for wet location (IP68): dust-proof. Weighth: 19.84 lbs / 9.00 kg



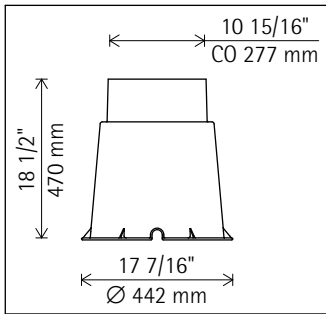
T6 70W G12 6600lm

Accessories



33963.023

Housing for recessed mounting
 Corrosion-resistant, cast aluminum,
 No-rinse surface treatment. Black,
 double powder-coated. 2 cable
 entries.
 Diameter 17 7/16" / 442mm.
 Recessed depth 18 1/2" / 470mm.
 Installation aperture \varnothing 10 15/16" /
 277mm.
 Weight 15.41lbs / 7.00kg.



33951.000

Domed glass
 To hinder accumulation of dirt.
 Load 1125lb.wt / 5kN.

[close window](#)

Bega
8509INC
Stainless steel submersible floodlights
Series



PAR36

Description:

Surface-mounted incandescent underwater light. Spec-grade commercial

Lamping:

1-PAR36 50W max lamp(s)

Optics:

Optics: NEMA Beam Type 4h x 3v

Dimensions:

5.313" length, 3" width, 5.563" height/depth

Electrical:

Remote transformer

Housing:

stainless steel

Options:

Optical accessories

Labels:

UL listed Wet Location. Suitable for Dry, Wet environments.

Notes:

Electro-polish stainless steel housing, also for use out of water and with any mounting orientation. One cable entry and ten feet of underwater cable supplied. Adjustable mounting bracket. Not for use in see water. Color filters available. Adjustability: 90° tilt 360° rotation

Mfr's Notes:

Note: Product data is subject to change without notice. While every effort has been made to ensure the accuracy and reliability of the data, eLumit does not directly or impliedly warrant or endorse the data provided.

This report was generated by eLumit. www.elumit.com

PHILIPS



MasterColor® Ceramic Metal Halide Lamps

Feature: Single-Ended T-6 Style. Enclosed Luminaires Only. Lifetime Color Stability Within +/- 200K

Watts: 70

Bulb: T-6

Base: G12

Product Number: 046677-28137-8

Ordering Code: CDM70/T6/942

ANSI Code/Ballast Ref.: M139/E

Package Quantity: 12

Description: G, Clear, FadeBlock

M.O.L. (in.): 3 15/16

L.C.L. (in.): 2 7/32

Rated Avg. Life Hrs.: 12,000

Approximate Mean Lumens: 4620

Approximate Initial Lumens: 6600

CRI: 92

CCT (K): 4200



Footnotes

- 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.
- Approximate lumen output at 40% of lamp rated average life.
- 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.
- Supply volts must be +/- 5% of rated ballast line volts for reactor type and +/- 10% for CWA or electronic ballasts.
- UV filtered design (Fade-Block™).
- "Operate only on thermally protected ballasts"
- Rated Life: Vertical operation = 10,000 hours, Horizontal = 12,000 hours.
- **MasterColor®** Metal Halide Lamps are not recommended for use on dimmers and are not warranted if used on dimmer systems.
- ANSI CODE RATING, E - Enclosed, O - Open, S - Open or Enclosed
- G12 Bi-pin Based Low Wattage Ceramic Metal Halide Lamp
- [Click here for specific product and ordering information on this lamp.](#)
- Heat resisting glass bulb
- Excellent color rendition - up to 92 CRI

Information for this product last modified on: January 16 2003.

[\[Print page\]](#) | [\[Close window\]](#)

[Return to: Pentron HO](#)

[Print Page](#)



Product Number: 20858
Order Abbreviation: FP54/835/HO
General Description: 54W, T5 PENTRON high output (HO) fluorescent lamp, 3500K color temperature, rare earth phosphor, 82 CRI

Product Information	
Abbrev. With Packaging Info.	FP54835HO 40/CS 1/SKU
Actual Length (in)	45.8
Actual Length (mm)	1163.2
Average Rated Life (hr)	20000
Base	Miniature Bipin
Bulb	T5
Color Rendering Index (CRI)	82
Color Temperature/CCT (K)	3500
Diameter (in)	0.67
Diameter (mm)	17.0
Family Brand Name	Pentron®
Initial Lumens at 25C	4450
Initial Lumens at 35C	5000
Mean Lumens at 25C	4138
Mean Lumens at 35C	4650
Nominal Length (in)	48
Nominal Wattage (W)	54.00

Additional Product Information
Product Documents, Graphs, and Images
Compatible Ballast
Packaging Information



Footnotes
<ul style="list-style-type: none"> ● Approximate initial lumens after 100 hours operation. ● The life ratings of fluorescent lamps are based on 3 hr. burning cycles under specified conditions and with ballast meeting ANSI specifications. If burning cycle is increased, there will be a corresponding increase in the average hours life. ● Lumen output and life rated on high frequency operation.

- Minimum starting temperature is a function of the ballast; consult the ballast manufacturer.
- There is a NEMA supported, industry issue where T2, T4, and T5 fluorescent and compact fluorescent lamps operated on high frequency ballasts may experience an abnormal end-of-life phenomenon. This end-of-life phenomenon can result in one or both of the following: 1. Bulb wall cracking near the lamp base. 2. The lamp can overheat in the base area and possibly melt the base and socket. NEMA recommends that high frequency compact fluorescent ballasts have an end-of-life shutdown circuit which will safely and reliably shut down the system in the rare event of an abnormal end-of-life failure mode described above. The final requirements of this system are yet to be defined by ANSI. For additional information refer to NEMA papers on their WEBSITE at www.NEMA.org.

[Print Page](#)

PHILIPS



Metal Halide Lamp

Feature: Enclosed Luminaires Only
Watts: 1000
Bulb: BT-56
Base: Mog.
Product Number: 046677-29827-3
Ordering Code: MH1000/C/U
ANSI Code/Ballast Ref.: M47/S
Package Quantity: 6
Description: †G, & St. Ltg., Coated
M.O.L. (in.): 15 3/8
L.C.L. (in.): N/A
Rated Avg. Life Hrs.: 12,000
Approximate Mean Lumens: 65,800
Approximate Initial Lumens: 104,500
CRI: 70
CCT (K): 3400



Footnotes

- Vertical lumens. Horizontal lumens 6%–10% lower.
- Rated life: Vertical +/- 15 degrees. Other positions 75% of vertical life
- Requires a ballast specified or approved for Philips metal halide lamps, or one that is designed to operate all popular brands of metal halide lamps. 1000W types will operate from H36 conventional lag type ballast for Mercury Vapor lamps at ambient temperatures of 50 degrees F or higher. 1000W types must not be operated at 1500W.
- Color characteristics may vary somewhat from one lamp type to another. Time should be allowed for the lamp to stabilize in color when it is turned on for the first time or if for any reason its operating position is changed. This may require several hours' operation, with more than one start. Lamp color and output may change temporarily if the lamp is subjected to excess vibration or shock. Lamp color characteristics may change after long accumulate operating time.
- Approximate lumen output at 40% of lamp rated average life.
- Approximate lumen values listed are for vertical operation of the lamp.
- 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.
- ANSI CODE RATING, E - Enclosed, O - Open, S - Open or Enclosed
- Open luminaire if operated vertically +/- 15 degrees.
- Recommended for enclosed luminaires if operated other than vertical +/- 15 degrees.
- [Click here for specific product and ordering information on this lamp.](#)

Information for this product last modified on: July 11 2002.

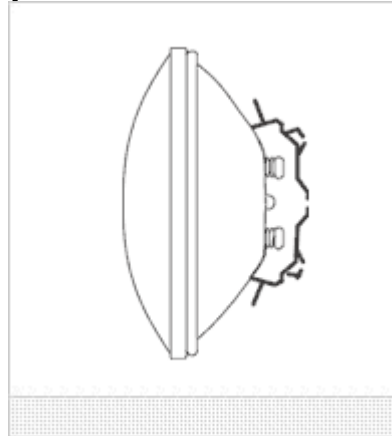
[\[Print page\]](#) | [\[Close window\]](#)

PHILIPS



Incandescent Lamps

Watts: 50
Bulb: PAR-36
Base: M.P.
Product Number: 046677-29603-8
Ordering Code: 50PAR36/WFL
Volts: 12
Package Quantity: 12
Description: Compact Wide Flood
Class and Filament: C, C-6
M.O.L. (in.): 2 3/4
Approximate life (hrs): 2000



Footnotes

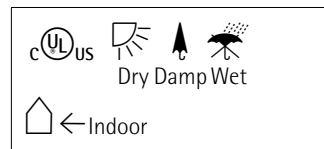
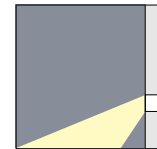
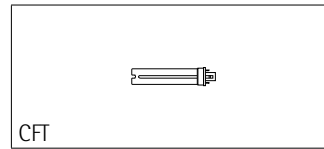
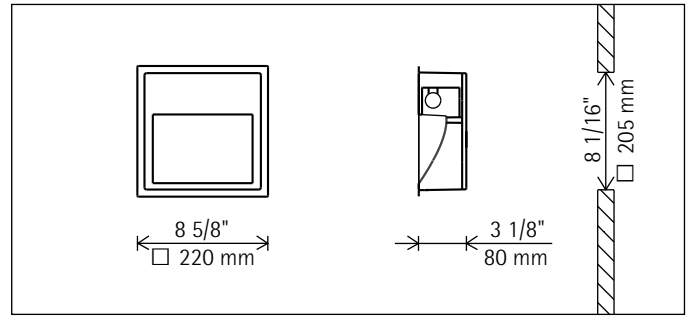
- Aluminum Base
- Heat resisting glass bulb

Information for this product last modified on: December 10 2002.

[\[Print page\]](#) | [\[Close window\]](#)

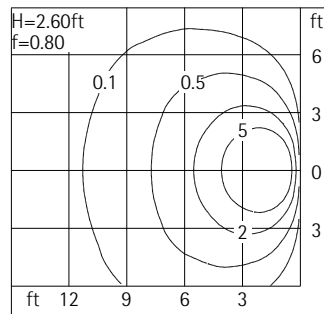
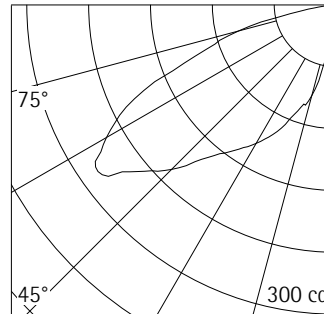
- Data based on primary lamp types. See OSRAM SYLVANIA System Performance Guide for data on other lamp combinations.
- Remote Mounting up to 7 feet
- 70C Max Case Temperature
- UL Listed Class P, Type 1 Outdoor
- Ground ballast case
- Install in accordance with National Electric Codes
- ANSI 62.41 Cat. A Transient Protection
- Class A Sound Rating.
- Input Frequency: 60Hz.
- Minimum Starting Temperature: 50F/10C.
- Data shown is at full light output.

[Print Page](#)



44553.023
 Reflector color Silver
 CFT 9W G23 580lm

Product description
 Housing for recessed mounting in brickwork and dry-wall partitions: cast aluminum, powder-coated. Mounting by means of an adjustable bar. Clamp extension 0-1 3/16" / 0-30mm.
 2 cable entries, through-wiring possible. 3-pole terminal block.
 Control gear 120V, 60Hz.
 Cover plate with reflector: plastic, silver aluminum vaporized, specular. Scratch-resistant special coating.
 Recess depth 4" / 100mm.
 Weight: 4.30 lbs / 1.95 kg



[Return to search](#)

[Print Page](#)



Product Number: 20333
Order Abbreviation: CF9DS/835
General Description: DULUX 9W single compact fluorescent lamp with 2-pin base, 3500K color temperature, 82 CRI, ECOLOGIC

Product Information	
Abbrev. With Packaging Info.	CF9DS835 50/CS 1/SKU
Average Rated Life (hr)	10000
Base	G23
Bulb	T4
Color Rendering Index (CRI)	82
Color Temperature/CCT (K)	3500
Family Brand Name	Dulux® S
Industry Standards	ANSI C78.901 - 2001, IEC 60901- 0013
Initial Lumens at 25C	580
Mean Lumens at 25C	499
Maximum Overall Length - MOL (in)	6.5
Maximum Overall Length - MOL (mm)	165
NEMA Generic Designation (current)	CFT9W/G23/835
Nominal Wattage (W)	9.00

Additional Product Information

[Product Documents, Graphs, and Images](#)

[Packaging Information](#)

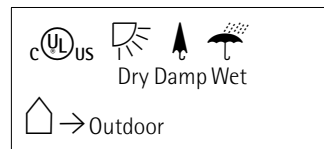
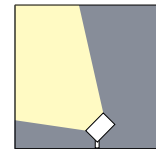
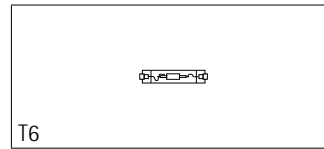
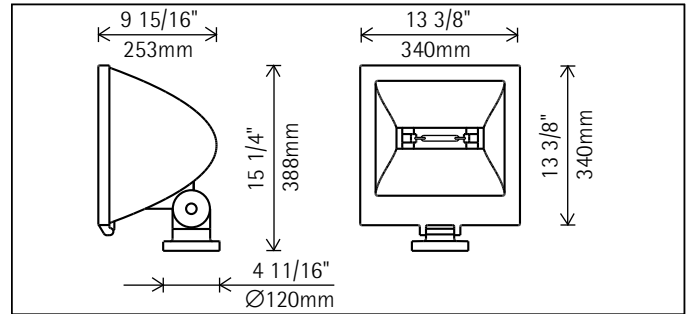


- Footnotes**
- Approximate initial lumens after 100 hours operation.
 - The life ratings of fluorescent lamps are based on 3 hr. burning cycles under specified conditions and with ballast meeting ANSI specifications. If burning cycle is increased, there will be a corresponding increase in the average hours life.
 - Rule of Thumb for Compact Fluorescent Lamps: Divide wattage of incandescent lamp by 4 to determine approximate wattage of compact fluorescent lamp that will provide similar light output.

- Minimum starting temperature: CF5: -22 degrees F; CF7: -4 degrees F; CF9: 14 degrees F; CF13DS: 14 degrees F; CF13DD: -4 degrees F; CF18DD: 5 degrees F; CF18DT: -4 degrees F; CF26: 14 degrees F.
- 2 pin CF lamps should never be installed in 4 pin sockets regardless if lamp will fit.
- SYLVANIA ECOLOGIC fluorescent lamps are designed to pass the Federal Toxic Characteristic Leaching Procedure (TCLP) criteria for classification as non-hazardous waste in most states. TCLP test results are available upon request. Lamp disposal regulations may vary, check your local & state regulations. For more information, please visit www.lamprecycle.org

[Print Page](#)

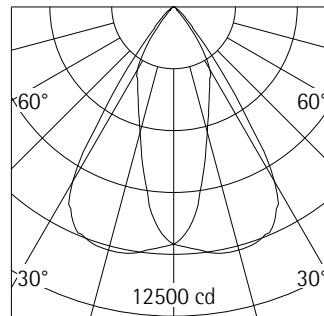
with mounting bracket for metal halide lamps



34159.023 Graphit m
T6 150W RSC 14000lm
ECG

Product description

For mounting on accessories.
Housing, hinge and mounting bracket: corrosion-resistant, cast aluminum, No-rinse surface treatment. Double powder-coated. Optimized surface for reduced accumulation of dirt. Hinge with internal wiring, 0-90° tilt. Graduated disc: stainless steel.
Electronic control gear 120V, 60Hz.
Heat-resistant cable with plug.
Flood reflector with focal emphasis in beam direction: aluminum, silver, specular anodized. Side reflectors to increase the visual comfort along the lamp axis, specular anodized. Cut-off angle 50° along the main axes. Without spill light.
Screw-mounted cover with safety glass: corrosion-resistant cast aluminum, double powder-coated.
Hinge open for lamp replacement.
Mounting accessories to be ordered separately.
Weight: 20.84 lbs / 9.45 kg
Surface exposed to the wind
1.40 ft² / 0,13 m²



T6 150W RSC 14000lm

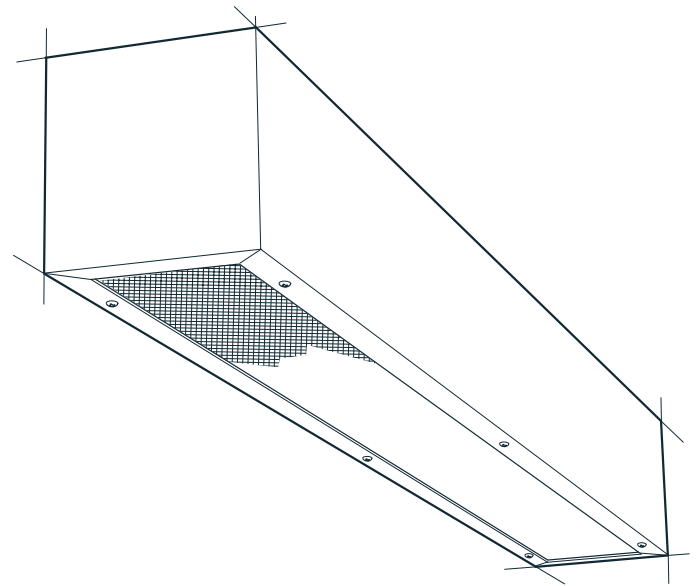
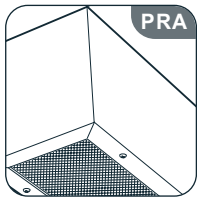
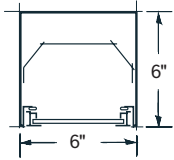
h(ft)	E(fc)	D(ft)	
		C0	C90
3	1067	1'10"	4'1"
6	267	3'8"	8'3"
9	119	5'6"	12'4"
12	67	7'4"	16'6"
15	43	9'2"	20'7"

[Return to: Enclosed Fixtures](#)
[Print Page](#)


Product Number: 64359
Order Abbreviation: MC150T7.5/G12/U/830
General Description: 150W, 3000K, high CRI, reduced color shift, high performance, T6/G12 metal halide lamp, clear, universal burn

Product Information

Abbrev. With Packaging Info.	MC150T75G12U830 12/CS 1/SKU
ANSI Code	M102/E:M142/E
Approx. Lumens (initial - horizontal)	14500
Approx. Lumens (initial - vertical)	14500
Approx. Lumens (mean - horizontal)	11600
Approx. Lumens (mean - vertical)	11600
Arc Length (in)	0.36
Arc Length (mm)	9.20
Average Rated Life - Horizontal (hr)	9000
Average Rated Life - Vertical (hr)	9000
Base	G12
Bulb	T7.5
Color Rendering Index (CRI)	89
Color Temperature/CCT (K)	3000
Diameter (in)	.906
Diameter (mm)	23
Family Brand Name	Metalarc® Ceramic
Fixture Requirement	E
Hot Restrike Time (min)	2-15
Lamp Finish	Clear
Light Center Length - LCL (in)	2.2
Light Center Length - LCL (mm)	56
Maximum Base Temperature - Fahrenheit	650
Maximum Base Temperature - Celsius	280
Maximum Bulb Temperature - Fahrenheit	1112
Maximum Bulb Temperature - Celsius	1202
Maximum Overall Length - MOL (in)	4.125
Maximum Overall Length - MOL (mm)	105
Nominal Voltage (V)	95.00
Nominal Wattage (W)	150.00



ordering

series	lamp rows	nominal length	shielding	color/finish	distribution	circuiting	voltage	mounting	options
P-61	1T8	02'	PRA prismatic acrylic lens	TMW* textured matte white	D1 direct	SC single circuit	120	SUR surface mount	EML-DL*
	2T8	03'	HPRA high-impact acrylic lens, pattern 12	YGW gloss white	D4W* asymmetric toward wall	DC* dual circuit (in-line)	347	WB wall bracket (3")	EMH-DL*
		04'							DM
		06'	PLC12 polycarbonate, pattern 12	Y__ premium color	D4R* asymmetric toward room	*T8 only	*2T8 only		RSE
		08'	WA* white acrylic diffuser	CC custom color					10THD
			HWA high-impact white acrylic diffuser	*standard				B__	
								LT	
									FH
			*standard						*consult factory for fixture lengths < 4'

Applications Stairwells, ramps, commercial roll-up door applications, exterior wall mounts.

Features An aluminum 6" x 6" wet location luminaire. It features one or two lamps in cross-section. The fixture also offers a choice of symmetric or asymmetric light patterns.

Construction The housing, available in 2-, 3-, 4-, 6- or 8-foot standard lengths, is made of die-formed, .030 sheet aluminum.

Finish The standard exterior body color is textured matte white (TMW) or optional gloss white (YGW) using polyester powder paint. Refer to **Defining Section** for optional paint colors.

Electrical T8 fixtures have instant-start electronic ballasts with less than 20% THD. Fixtures are U.L. Wet labeled (non-emergency) and I.B.E.W. manufactured. Maximum ballast size available: 2 3/8" width x 1 1/2" height.

Mounting Fixture is to be wall- or surface-mounted.

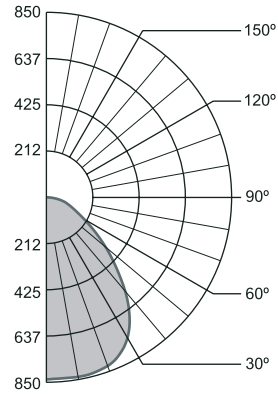
Options **EML-DL:** emergency battery (T8=600 lumens); **EMH-DL:** emergency battery (T8=1200 lumens); **DM:** dimming (consult factory); **RSE:** rapid-start electronic; **10THD:** ballast with < 10% total harmonic distortion; **B_:** specific ballast, specify manufacturer and catalog number (consult factory); **LT:** low-temperature ballast; **FH:** fixture fusing (slow blow).

0118 P-60

photometric data

P-61-1T8-04-PRA-YGW-D1

Report # LSI1944 D=100% I=0.0%
 Spacing Criteria: Along 1.3; Across 1.3
 Lamp Lumens: 3050 Input Watts: 31



Candlepower Summary

Vertical Angle	Horizontal Angle					Output Lumens
	0°	22.5°	45°	67.5°	90°	
0	837	837	837	837	837	
5	835	836	835	835	835	81
10	825	829	832	835	838	
15	808	816	825	832	835	232
20	785	795	812	819	824	
25	755	768	788	791	795	358
30	714	731	747	742	744	
35	660	677	686	664	664	417
40	595	604	598	568	561	
45	514	513	495	463	449	375
50	415	410	387	362	352	
55	316	316	290	273	266	263
60	238	234	207	203	197	
65	175	162	143	148	148	155
70	129	114	100	110	115	
75	95	83	77	78	89	88
80	70	58	54	53	57	
85	32	27	23	22	23	29
90	0	0	0	0	0	

Zonal Lumen Summary

Zone	% Lamp	% Luminaire
0-90	65.52	100.00
90-180	0.00	0.00

Efficiency = 65.5%

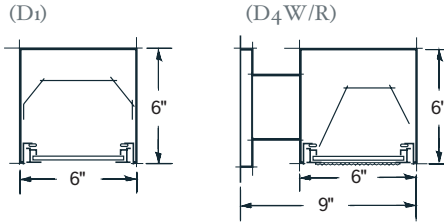
Luminance Summary (cd/m²)

Angle	0°	45°	90°
45	4942	4777	4335
55	3748	3455	3163
65	2819	2307	2386
75	2498	2022	2348
85	2513	1812	1762

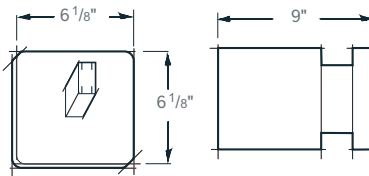
Coefficients of Utilization (%)

	effective floor cavity reflectance = .20									
	Floor		Ceiling		Wall		70		50	
RCR 0	78	78	78	78	76	76	76	76	73	73
1	72	70	67	65	71	69	66	64	66	64
2	67	63	59	55	65	61	58	55	59	56
3	62	56	51	48	60	55	51	47	53	50
4	57	50	45	42	56	50	45	41	48	44
5	53	45	40	36	51	45	39	36	43	39
6	49	41	36	32	48	40	35	32	39	35
7	45	37	32	28	44	37	31	28	36	31
8	42	33	28	25	41	33	28	24	32	27
9	39	30	25	21	38	30	25	21	29	24
10	36	27	22	19	35	27	22	19	26	22

Distribution

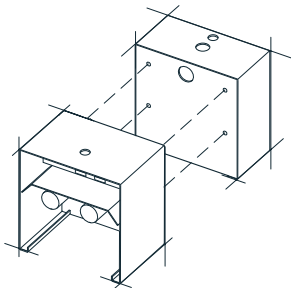


Wall Bracket

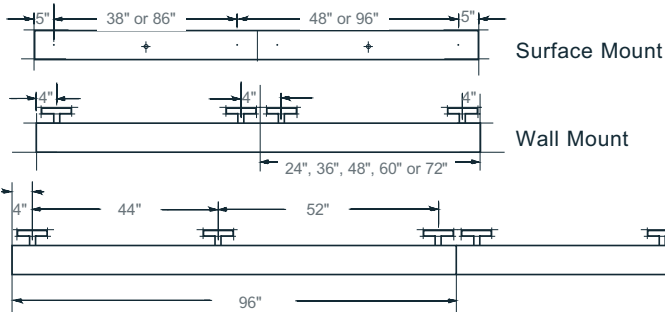


installation

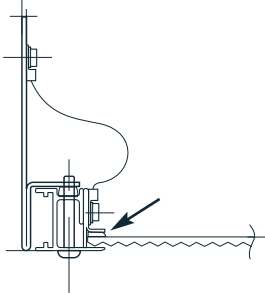
Adjoining Detail



Mounting Locations



Lens Gasketing Detail



In an effort to continually provide the highest quality products, Prudential reserves the right to change design specifications and/or materials, without notice.

Operating Position	Universal
Warm-up Time (min)	2-4

Additional Product Information**Product Documents, Graphs, and Images****Compatible Ballast****Packaging Information****Footnotes**

- Consult your OSRAM SYLVANIA Lighting Representative for compatible electronic operating systems.
- = Lamps classified as E-type are to be used ONLY in suitably enclosed luminaries. See lamp warning.
- The circuit must include overcurrent protection (i.e. Thermally switched ballast).
- UV-Stop quartz
- Lamps may be operated on a M142 Compliant ballast.

[| Print Page |](#)

[Return to: Octron 800](#)

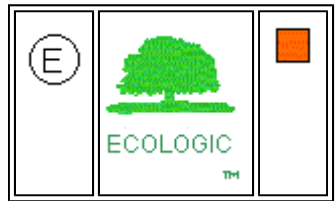
[Print Page](#)



Product Number: 21779
Order Abbreviation: FO32/835/ECO
General Description: 32W, 48" MOL, T8 OCTRON fluorescent lamp, 3500K color temperature, rare earth phosphor, 82 CRI, suitable for IS or RS operation, ECOLOGIC

Product Information	
Abbrev. With Packaging Info.	FO32835ECO 30/CS 1/SKU
Actual Length (in)	47.78
Actual Length (mm)	1213.6
Average Rated Life (hr)	20000
Base	Medium Bipin
Bulb	T8
Color Rendering Index (CRI)	82
Color Temperature/CCT (K)	3500
Diameter (in)	1.10
Diameter (mm)	27.9
Family Brand Name	Octron® 800, Ecologic
Industry Standards	ANSI C78.81 - 2001
Initial Lumens at 25C	2950
Mean Lumens at 25C	2710
Nominal Length (in)	48
Nominal Wattage (W)	32.00

Additional Product Information
Product Documents, Graphs, and Images
Compatible Ballast
Packaging Information



Footnotes

- Approximate initial lumens after 100 hours operation.
- The life ratings of fluorescent lamps are based on 3 hr. burning cycles under specified conditions and with ballast meeting ANSI specifications. If burning cycle is increased, there will be a corresponding increase in the average hours life.
- The life rating of OTRON and OTRON Curvalume lamps operated on magnetic rapid start ballasts is 20,000 hours. The life rating of OTRON and OTRON Curvalume lamps operated on instant start electronic ballasts is 15,000 hours.
- Minimum starting temperature is a function of the ballast; consult the ballast manufacturer.
- OTRON lamps should be operated only with magnetic rapid start ballasts designed to operate 265 mA, T-8 lamps or high frequency (electronic) ballasts that are either instant start, or rapid start, or programmed rapid start specifically designed to operate T8 lamps. OTRON lamps may be operated on instant start ballasts with ballast factors ranging from a minimum of 0.71 to a maximum of 1.20 at the nominal ballast input voltage. When OTRON lamps are operated in the instant start mode, the two wires or two contacts of each socket should be connected to each other. They should then be connected to the appropriate ballast lead wire using National Electric Code techniques.
- SYLVANIA ECOLOGIC fluorescent lamps are designed to pass the Federal Toxic Characteristic Leaching Procedure (TCLP) criteria for classification as non-hazardous waste in most states. TCLP test results are available upon request. Lamp disposal regulations may vary, check your local & state regulations. For more information, please visit www.lamprecycle.org

| [Print Page](#) |

[Return to search](#)

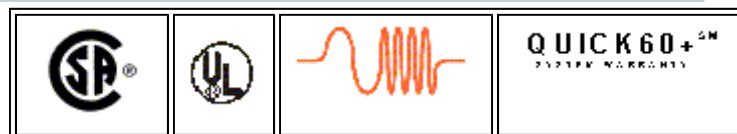
[Print Page](#)



Product Number: 49911
Order Abbreviation: QT1X32T8120ISNSC
General Description: 1-lamp 120V electronic ballast in small enclosure size for 32W T8 lamp

Product Information	
Abbrev. With Packaging Info.	QT1X32T8120ISNSC 120V 10/CS 1/SKU
Ballast Factor	0.90
Ballast Height H (in)	1.1800
Ballast Length L (in)	9.5000
Ballast Width W (in)	1.6800
Circuit Type	Parallel
Family Brand Name	QUICKTRONIC
Input Wattage (W)	30.00
Input Current (Amps)	0.26
Nominal Voltage (V)	120
Number of Lamps	1
Power Factor	>0.97
Primary Lamp Type	FO32/XP
Sound Rating	A
Starting Method	Instant Start
Starting Temperature - Celsius	-18
Total Harmonic Distortion (THD)	<20%
Wiring Method	Leads

Additional Product Information
Product Documents, Graphs, and Images
Compatible Lamps
Packaging Information



Footnotes

- Data based on primary lamp types. See OSRAM SYLVANIA System Performance Guide for data on other lamp combinations.

- Remote Mounting up to 18 feet
- 70C Max Case Temperature
- UL Listed Class P, Type 1 Outdoor
- Ground ballast case
- Lampholder must be shorted per diagram
- Install in accordance with National Electric Codes
- ANSI 62.41 Cat. A Transient Protection
- Class A Sound Rating.
- Minimum Starting Temperature: 0F/-18C.
- Input Frequency: 60Hz.

[Print Page](#)