2011

Drexel University Recreation Center
Philadelphia, PA

Final Thesis Report

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Faculty Consultants:

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the drexel university recreation center philadelphia, pa

britnei godusky | lighting + electrical


image courtesy of drexel university

building statistics

size | 84,400sf
levels | three stories above grade
cost | $40.2 million
construction dates | summer.2008-winter.2009
delivery method design-bid-build

project team

drexel university | owner
sasaki associates, inc. | architecture/interiors
ewingcole | electrical/lighting
ewingcole | structural
ewingcole | mechanical
turner construction | contractor

lighting electrical

1500kva 480Y/277 3θ dual supply from existing campus substation.
indoor diesel 350kw 480/277 3θ 4W emergency generator.
dry-type step-down transformers on each floor for appliance and lighting panels.
primarily fluorescent lighting at 4100K, metal halide for accent in hall of fame.
public and circulation spaces switched via relay-based building wide controls.
energy efficient exterior induction lighting with integral photocell control.

architecture

strong lines and sharp angles are emphasized on glazing/aluminum panel façade, combining for a modern play on transparency and concealment.
athletic center addition includes sports bar, gymnasium with elevated track, fitness centers, rock-climbing wall, racquetball courts and group fitness rooms.
exposed concrete ceilings and columns create exposed, spacious impression.

mechanical

mechanical system operates at full occupancy 24/7 and is composed of:
seven rooftop air handling units, four VAV and three CV,
ranging from 1880cfm for lobby to 32,550cfm in fitness/weight room.
three parallel boilers providing hot water for gas heating system.
air cooled condensers in AHUs feeding blower coil air conditioning.
system controls monitored by supervisory network on Drexel campus.

structural

structural system based entirely on reinforced concrete including:
concrete caissons founded on rock auger refusal.
one-way slab on grade ground floor with perimeter foundation walls.
exposed concrete columns throughout building interior.
additional stories and roof of structural concrete flat plate slabs.
gymnasium roof supported by truss system, the only completely steel structure.

http://www.engr.psu.edu/ae/thesis/portfolios/2011/bjg5004

executive summary

This report provides a comprehensive overview of all work and analysis completed during the AE 897G Senior Thesis and includes four lighting and four electrical depth topics, as well as three additional breadth topics resulting in a re-design of several systems present in the Drexel Recreation Center. This study does not conclude that there are actual problems with the existing designs, but was simply intended to investigate and approach alternative solutions.

The lighting depth follows the design process through schematic design, design development, and construction documentation of four spaces: the exterior courtyard, lobby, fitness center, and restaurant. All three of the interior spaces selected span the Market Street façade, allowing the lighting design to greatly influence the aesthetics of the facility and to directly influence the experience of the passing pedestrians and drivers. The facility is fueled by the energy of the occupants as they move within the space just as the body is fueled by core energy during a workout. The minimalist design of the architecture with its structurally exposed concrete, straight lines, clean materials, and strong angles allow the energy and active users to become the feature of the space, which they are with the interactive LED element in the fitness center that allows the exerciser to generate kinetic energy which is harvested and converted into a color changing design that allows the energy to be visible from the exterior.

The electric depth modified the branch circuit distribution for each space listed above in response to the lighting redesign, and feeders and panels were analyzed for coordination and voltage drop. A protective device coordination study was performed along with short circuit analysis for a path originating at the utility entrance through the main switchboard to distribution panel DP-1-1, and down to panel AP-1-1. A system to convert kinetic energy from the cardio machines into DC power for an interactive LED lighting load was designed and implemented in the fitness center. A cost comparison will be completed of an alternative solution to the existing PVC conduit distribution system located within the concrete slab of MC cable run through solid bottom cable trays on the ceiling below utilizing poke-throughs to distribute power to branch circuit loads.

An MAE focus of daylighting integration into the gymnasium using skylights in turn initiated the two out-of-option breadths of study: acoustical and structural. To incorporate daylight the dropped panel ceiling in the gymnasium was removed, and resulting load distribution adjustments required an analysis of the existing spacing and loading of steel truss system, as well as reverberation time calculations and consideration of echo and noise within the gymnasium. The structural and acoustic studies within prove that not only are daylights beneficial for the electric power consumption, they are also completely feasible without negatively impacting other scopes of the project.

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background

Centrally located in the heart of Drexel's Campus in Philadelphia PA, the 84,000sf University Recreation Center is a $41 million state of the art addition to Drexel's existing athletic facility. Doors opened in January 2010, providing students and faculty with ID swipe card access to athletic areas including a rock climbing wall, group exercise center, and gymnasium with elevated track. The western half of the southern Market Street façade is dedicated to a restaurant and sports bar, contributing an exciting new venue to University City.

The building façade is the highlight and focal point of the Drexel Recreation Center design, reinforcing the main design goal for designer Sasaki Associates: to give the university a strong, modern presence along Market Street, the main thoroughfare directly into Center City. A result of extensive energy studies, the strong lines and sharp angles of the glazing/aluminum panel façade utilize daylighting in the most energy efficient way to create a bold presence with a modern play on transparency and concealment. Exposed concrete interiors interact with the extensive glazing on the southern façade to create an exposed, bright, spacious impression in interior spaces.

building statistics

general building information

location | NW Corner of 33rd and Market Streets Philadelphia, PA

building occupant | Drexel University faculty and students

occupancy type | Gymnasium/Lounge Café

size | The entire athletic center is 250,000sf but the addition covered by this investigation is 84,000sf

total levels | Three levels above grade

dates of construction | June 2008-December 2009

actual cost | $41 million

project delivery method | Design-bid-build with a gross maximum price

primary project team

Drexel University	*owner*
Sasaki Associates	*architecture* *interiors* *landscaping*
EwingCole	*mechanical/electrical/plumbing* *structural* *fire protection*
Pennoni Associates	*civil* *site design* *geotechnical/environmental engineering*
Turner Construction	*contractor*

restaurant fit-out

LDL Studio Inc.	*architect*
FXBonnes Associates Inc.	*mechanical/electrical/plumbing* *fire protection*

architecture

Intended to give a new face to Drexel's presence on Market Street in downtown Philadelphia, the Drexel University Athletic Center is a state of the art facility with ID swipe card access to athletic areas including a rock climbing wall, group exercise center, and gymnasium with elevated track. The western half of their southern Market Street façade is dedicated to a restaurant and sports bar, contributing an exciting new venue to University City. Exposed concrete interiors and floor to ceiling glazing on the southern façade create an exposed, bright, spacious impression.

national code models:

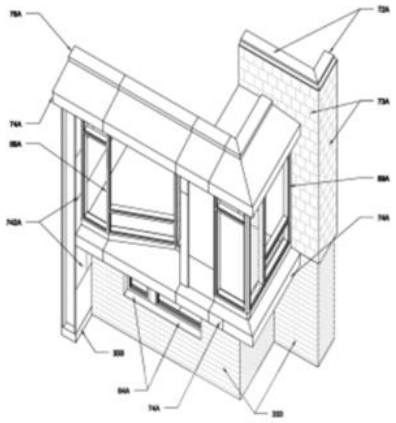
2006 International Building Code with Philadelphia Amendments
2006 International Fire Code
2006 International Fuel Gas Code
2006 International Mechanical Code
2006 International Energy Conservation Code
2006 International Existing Building Code
Pennsylvania Uniform Construction Code
National Electrical Code, 2002 Edition
2006 International Mechanical Code
NFPA Standards 13, 14, 20, 72

zoning requirements:

occupancy | A-3 gymnasium, A-2 Lounge Café
usage| mixed use non-separated occupancy
building occupant | Drexel University faculty and students
construction type | type IIA
allowable height | 3 stories, 85'
allowable area | 151,125'

building enclosure:

envelope | The athletic center uses a thermal envelope system including an exterior air/vapor barrier system (726), cavity insulation (72), and membrane flashing (76).



Façade materials:

architectural concrete exterior wall (333)
slate shingle wall system (73A)
metal plate wall panel system (74A)
solid phenolic exterior wall system (742A)
aluminum window system including metal flashings (84A)

roofing | roofing materials include Zinc-coated steel, aluminum sheet, extruded aluminum, semi-rigid glass fiberboards, asphaltic roofing cement, and bituminous mastic isolation coating on a concrete flat plate slab.

construction

The Daskalakis expansion wraps around the existing Athletic Center, adding 84,000sf to the existing building and more than doubling the amount of recreation space in Drexel's athletic center. Turner Construction won the design-bid-build project with a Guaranteed Maximum Price. The GMP budget for construction was $31 million with the total final project cost coming in at $42 million. The project broke ground in June 2008, and as an initiative to be environmentally conscious, for every tree that was removed in the facility's construction a new tree was planted elsewhere on Drexel's campus.

electrical

The DAC's overall electrical system is a radial system with one point of 13.2 kV service entrance in the main electrical room in the basement of the Fitness Center. This service entrance is fed from existing PECO service switchgear in the Nesbit Building. The entrance is powered by a 1500kVA transformer that steps down the voltage from 13.2kV to a 480Y/277V, 3P, 4W voltage system located in a newly constructed substation to feed the new addition as well as the existing substation in the DAC. A 2500A main distribution system provides power 480Y/277V power to all loads. Dry-type, step-down transformers feed 208Y/120V, 3P, 4W power to receptacles and appliance loads, while lighting panels use 277V power. For backup power to emergency branches powering emergency/egress lighting, sewage ejector pumps, existing sump pumps, and boiler controls, the DAC utilizes an indoor diesel emergency generator rated at 350kW, 480Y/277P, 3P, 4W.

lighting

The lighting throughout the Daskalakis Athletic Center successfully creates a bright, energetic space that interacts and responds directly to the architecture and aesthetic intent of the façade and the building within. Direct and reflected glare is avoided and an attractive rendering of people and objects in the space is achieved by the use of mostly indirect lighting to illuminate the task plane. The lighting design was ASHRAE 90.1 compliant using the total building method, and all of the spaces met or exceeded IESNA's recommended illuminance values. Just as the glazing on the southern and eastern building façades demands attention in each space in the facility, the continuity of both a cool color temperature of 4100K and the linear response to the façade creates cohesion when transitioning from space to space.

mechanical

Drexel's Athletic Center is conditioned by seven direct expansion rooftop air-handling units ranging from 1,880cfm for the lobby to 32,550cfm in the fitness/weight rooms. Three parallel BHP hot water heaters are located below the gymnasium partner with the 3,000 gallon fuel oil tank located

in an underground vault to power the duel heating system. Four AHUs are variable air volume and three are constant volume, utilizing an associated supply, return, and exhaust duct distribution. Shell space was provided in the mechanical room for a future water cooled chiller.

structural

The structural system for the facility is based entirely on reinforced concrete. The one-way slab on grade foundation rests on concrete caissons, with cast-in-place perimeter foundation walls formed above concrete grade beams. Exposed concrete columns are prevalent throughout the building interior, with additional stories and roof composed of structural concrete flat plate slabs. The gymnasium roof is supported by a steel truss system designed to support air handling equipment and cooling towers. The lateral system consists of concrete shear walls in the four gymnasium corners as well as in the space south of the existing DAC.

fire protection

The Athletic Center is utilizes a full sprinkler system supplied by the city's water supply and designed in accordance with NFPA 13. The floor control stations are located in stair towers 3 and 4 and served from a combination sprinkler riser including floor control valve assemblies, test valves, and drains. A manual fire alarm system is installed with an interfaced control system tied into a campus supervising system. Activation initiates an emergency voice/alarm communication system with using speaker strobes that are white in color. Smoke detection is provided in electrical/telecom rooms, above doors controlled by the system, in elevator lobbies, elevator machine rooms, and in HVAC ducts.

transportation

Two hydraulic elevators serve the first through third floors of the DAC. The main stairway is accessed just through the swipe card entrance, and is the primary means of vertical transport between the lobby, gymnasium, and second and third level fitness areas. Additional staircases are located at the north- and south-eastern corners of the fitness areas, and are primarily used for egress.

telecommunications

Voice and data are provided to the conference rooms, offices, and retail space via 4" PVC sleeves in cable trays mounted within the structural concrete slabs. Emergency phones are located in the elevator lobbies, equipment issue room, gymnasium, retail café, and recreation spaces to provide quick response in case of injury during physical activity. A fire alarm annunciator with live voice capability is located at the security desk at the east lobby entrance.

AV

The audiovisual system in the athletic center incorporates an audio/paging system through pendant speakers throughout the lobby and fitness area, as well as ceiling mounted speakers in the gymnasium. LCD screens are located in the climbing lounge, at the east and west lobby entrances, with a total of twenty screens mounted on each floor of the fitness area. AV equipment rooms are

provided on the second and third floors with the second floor space feeding the LCD screens and speakers on the first floor.

security

Electronic security control modules are located in the main security room east of the electrical room on the ground level beneath the gymnasium. Each main entrance is controlled by electronic locks with an emergency override located at the security desk. Electronic locks also guard the gymnasium entrance and each stairway. A pole mounted security camera monitors the exterior on the eastern and alternate north entrance to the new facility, with interior cameras located in the athletics gallery. Swipe card access is required to enter the recreation center, and is located beyond the security desk.

lighting depth

introduction

The Drexel Recreation Center uses its transparent façade to prominently establish Drexel's visual presence in an energy efficient way. Constructed by linear panels of floor-to-ceiling glazing along a majority of the streetscape, the façade is lit almost completely by the interior lighting. The four spaces to be analyzed and redesigned include:

exterior space | courtyard
large workspace | fitness center
circulation space | lobby
special purpose space | restaurant

All three of the interior spaces selected span the Market Street façade, allowing the lighting design to greatly influence the aesthetics of the facility and to directly influence the experience of the passing pedestrians and drivers. Sasaki Associates took care to expose the core energy of the building. The facility is fueled by the energy of the occupants as they move within the space just as the body is fueled by core energy during a workout. The minimalist design of the architecture with its structurally exposed concrete, straight lines, clean materials, and strong angles allow the energy and active users to become the feature of the space. In addition to accentuating the architecture and core concept, the lighting must be designed to meet established design criteria that are outlined for each space, which includes guidelines from both the IESNA handbook and ASHRAE energy Standard 90.1. Included in the lighting analysis are a summary of the space, design concepts criteria and considerations, equipment and controls schedules, and all technical documentation of the design and its performance.

exterior space | courtyard

overall design goals

To reinforce the perception of energy from within the facility, the core of the building appears glowing from the courtyard, and minimalist fixtures were chosen to highlight the architectural features of the area.

The athletic center's courtyard and plaza will feel welcoming while balancing the feeling of a public space during the day and a more private, enjoyable shortcut across campus after dark. Keeping the central area dimmer and guiding the pedestrians through the space with light can transform this space from its current state as a scarecely lit, unnoticeable space to an inviting, engaging spot in which to walk.

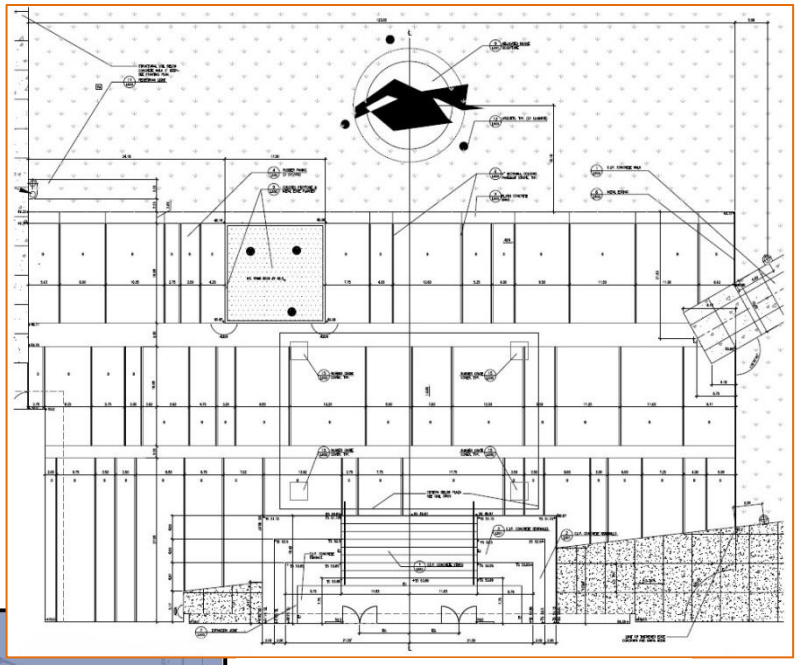


figure 2 - Enlarged courtyard plan

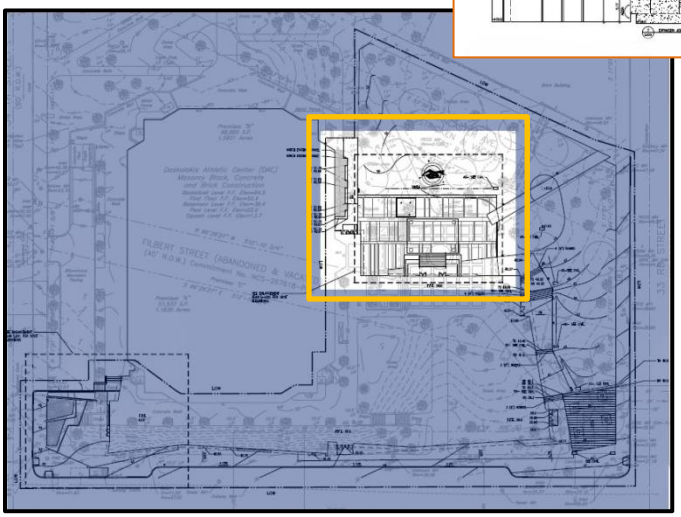


figure 1 - Orientation of courtyard to building site

description

The exterior courtyard space is located on the northern side of the Athletic Center addition, and is bordered on the west by the existing athletic center. Measuring 123' x 117', the courtyard covers close to 15,000sf. Providing access to both the gymnasium and the Hall of Fame entrance to the facility, the space is an important circulation space and is the first impression portrayed to visitors approaching the DAC from the north side. Due to the dynamic functions of the space during the day, no fixtures can obstruct the colored rubber pavement tiles, providing a challenging aspect to the design in order to ensure that facial recognition is heightened to promote a feeling of safety.

Materials and Finishes		
Surface	**Description**	**Reflectance**
asphalt shingles	-	0.24
brick façade	existing brick façade of DAC	0.38
grass	-	0.24
railing and mullions	metal	0.27
rubber pavement	Panorama eggshell 3/8" rubber tiles	0.57
rubber pavement	Panorama light blue 3/8" rubber tiles	0.47
rubber pavement	Panorama blue 3/8" rubber tiles	0.32
rubber pavement	Panorama orange 3/8" rubber tiles	0.23
sidewalk/stairs	concrete	0.25
glazing	insulating laminated Viracon glazing	t = .46

table 1 - exterior materials and finishes

tasks/activities

For a majority of the day, this space is simply a space in which students cut through on their way to class, and a visibly engaging courtyard for the secondary northern entrance to the workout facility. The springy rubber tiles allow yoga, martial arts, and other physical tasks typically needing an indoor practice space performed on wrestling mats to take advantage of this open outdoor space for group activity.

design criteria and considerations

desired illuminance levels and design considerations- **IESNA 2000** ***Parks, Plazas, and Pedestrian Malls***

quantity of light

general lighting: **0.5fc**
paths/steps leading away from building: **1fc**
active entrances: **5fc**
vertical: **0.3fc**

ASHRAE/IESNA 90.1: Building grounds- *Plaza areas* ***0.2W/sf***

quality of light

Very Important Criteria

Color Appearance (and Color Contrast)- In low light levels especially, color rendering plays an important role in the appearance of both individuals and objects throughout the space. To complement the glow from within the gymnasium and also to play on the yellows and blues of the courtyard itself, a cooler temperature will interact in a more pleasing manner with the space.

Direct and Reflected Glare- Glare can be avoided by positioning fixtures outside the direct line of sight of a pedestrian. The expansive glazing on the façade of the gymnasium as well as the glass vestibule the hall of fame have the potential to cause reflected glare if up lighting luminaires are reflecting into the façade.

Light Pollution/Trespass- Specifying shielding or cutoff fixtures can minimize light pollution and trespass. Located in downtown Philadelphia, this is less of an issue and more of a general consideration. Pathway lighting should follow the path, and general luminaires should only send illuminance to the space intended for lighting.

Modeling of Faces or Objects- Due to the levels of foot traffic on campus at night, the modeling of both faces and objects is important within this space to promote a general feeling of safety.

Peripheral Detection- The courtyard is open on two sides to the campus, but both the southeast and northwest entrances to the space are well lit by the entrances to the DAC. However, the location of Drexel on the outskirts of west Philly still make this an important design consideration.

Shadows- The courtyard is a small enough space that shadows should add to the guidance of pedestrians throughout the space. Shadow in the trees and on the plaza will actually add a dramatic and aesthetically pleasing effect for those to view when passing the Rec Center.

Important Criteria

Appearance of Space and Luminaires- The openness of the area makes both the space itself and the luminaires within it on display to the public. To avoid light trespass, luminaires should be placed so as not to be visible from someone not directly inside the boundaries of the space.

Light Distribution on Surfaces- Guided pathways both between entrances and through the space are important and pedestrians are encouraged to walk along them. To counteract the uniform glow from within, the lighting on either side of the façade and on any objects within the space should be dynamic and interesting.

Points of Interest- The gymnasium with its glow from within is automatically highlighted as a main focal point of the space. Interesting patterns could be brought out of the rubber tile at night by grazing the ground's surface. In addition to guiding pedestrians around the building, a clear path into the Hall of Fame entrance should be set by the lighting.

fixtures and equipment

Luminaire Schedule			
Type		**Description**	**Manufacturer**
	M1	13.7' indirect pole-top ceramic metal halide luminaire with square top reflector and asymmetrical distribution	Bega
	M2	Aluminum alloy bollard fixture with 180° distribution with crystal glass optical lens	Bega
	N1	Recessed LED step luminaire with aluminum housing and white safety glass	Bega
	N2	4' linear fluorescent wet location listed surface mounted steplight with aluminum housing and white safety glass	Bega
	N3	4000K Linear LED cove mounted strip fixture with 110° beam spread	Winona
	N4	Ceramic metal halide exterior wall washing luminaire with two-sided light output and 10' mounting height	Bega
	Z1	4" gasketed metal halide floodlight with 20° beam spread, aluminum housing and clear safety glass	Bega

table 2: exterior luminaire schedule

Note: for full luminaire schedule including lamp and power source information and specification, see Appendix A.

Light Loss Factors				
Lamp Type	**LLD**	**LDD**	**BF**	**Total**
M1	0.82	0.8	1.0	0.66
M2	0.85	0.82	1.1	0.77
N1	0.85	0.82	1.0	0.70
N2	0.92	0.82	1.08	0.81
N3	0.7	0.82	-	.574
N4	0.74	0.82	1.0	.61
Z1	0.7	0.82	-	.57

table 3: exterior light loss factors

**The above light loss factors were calculated using the new method in the 2010 IESNA handbook. The Room Surface Dirt Depreciation (RSDD) was neglected and the Luminaire Dirt Depreciation (LDD) was calculated using the updated calculation outlined in the book. A lamp maintenance schedule of twenty-four months was assumed.*

controls

All of the exterior lighting utilizes controllable breakers by photocell.

renderings

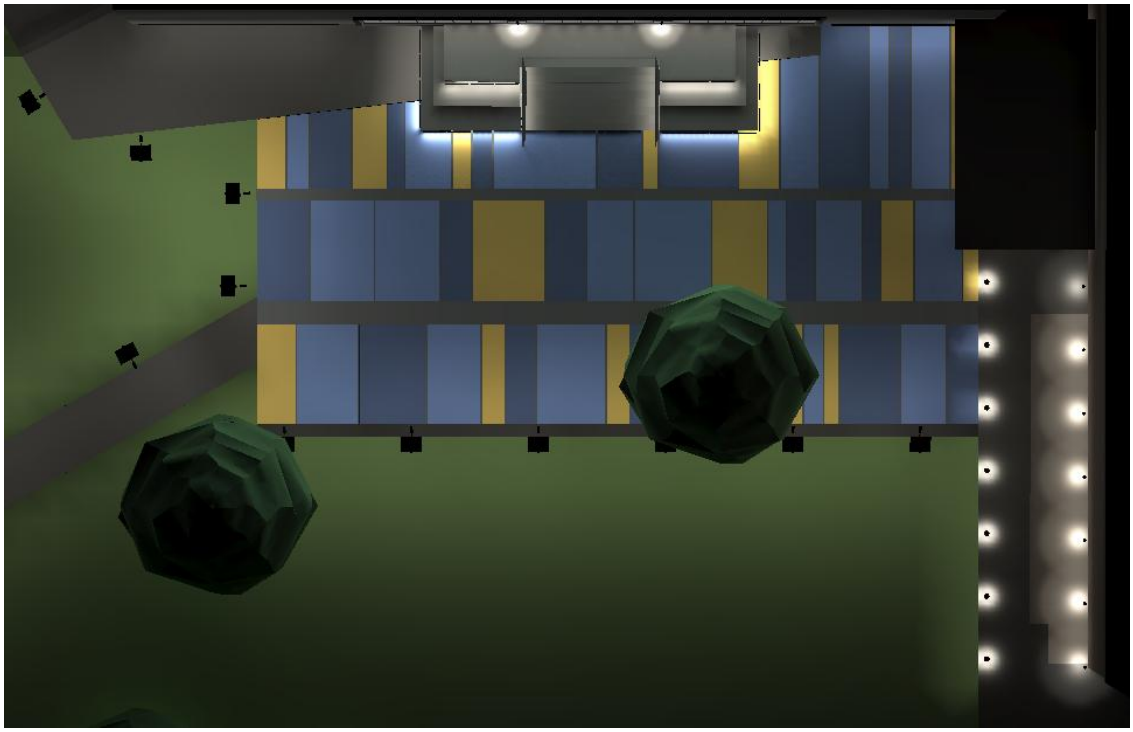


figure 3: aerial rendering of exterior space

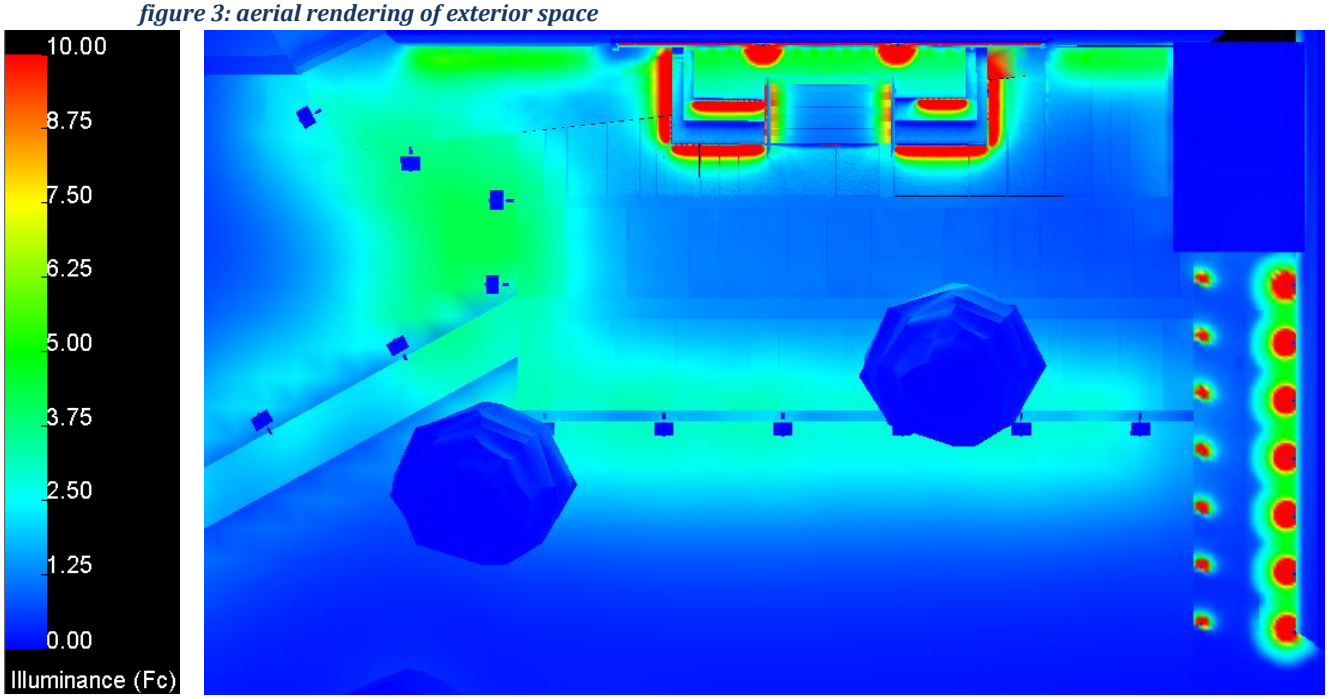


figure 4: aerial psuedocolor rendering of exterior space

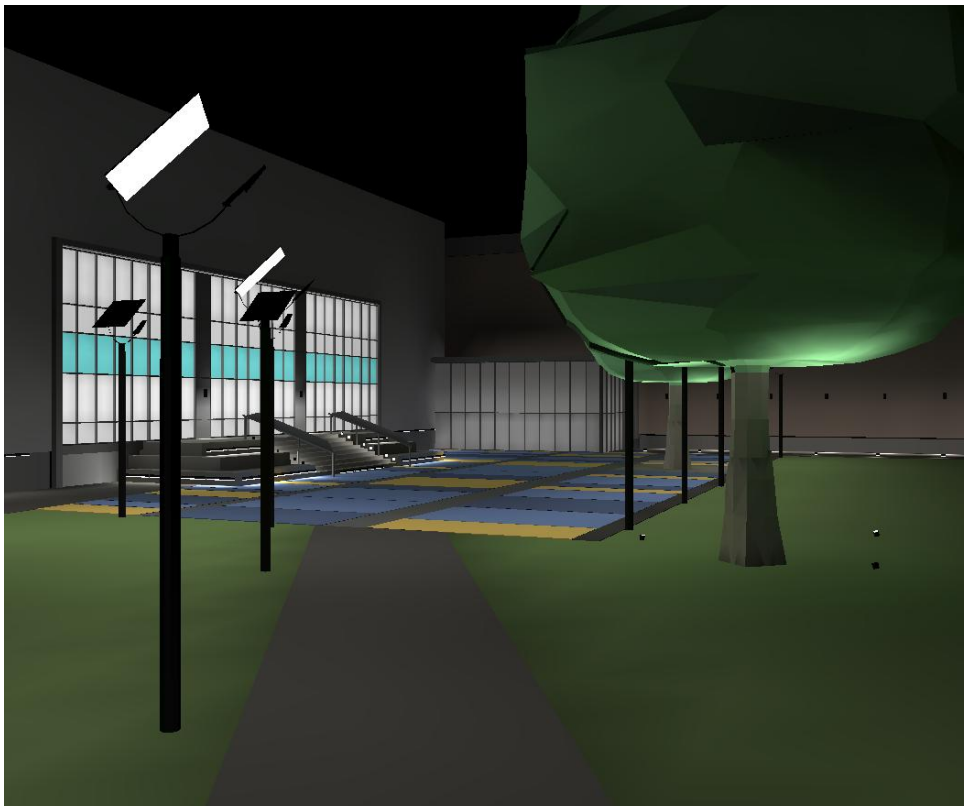


figure 5 – perspective rendering of exterior facing southwest

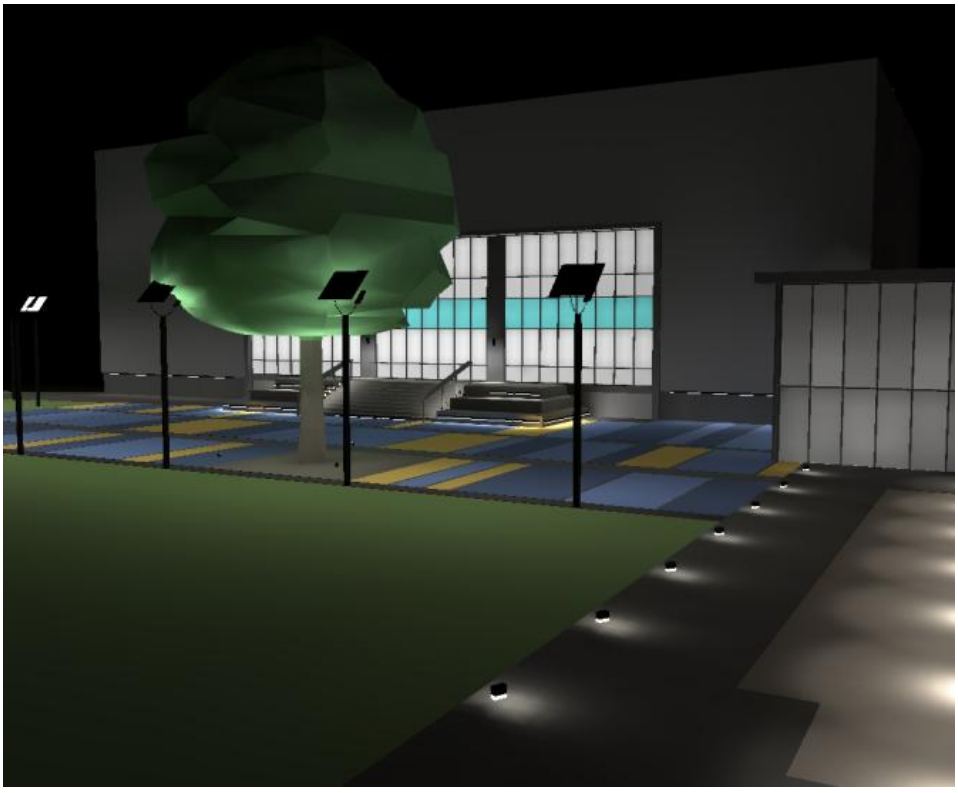


figure 6 – perspective rendering of exterior facing southeast

calculation summary

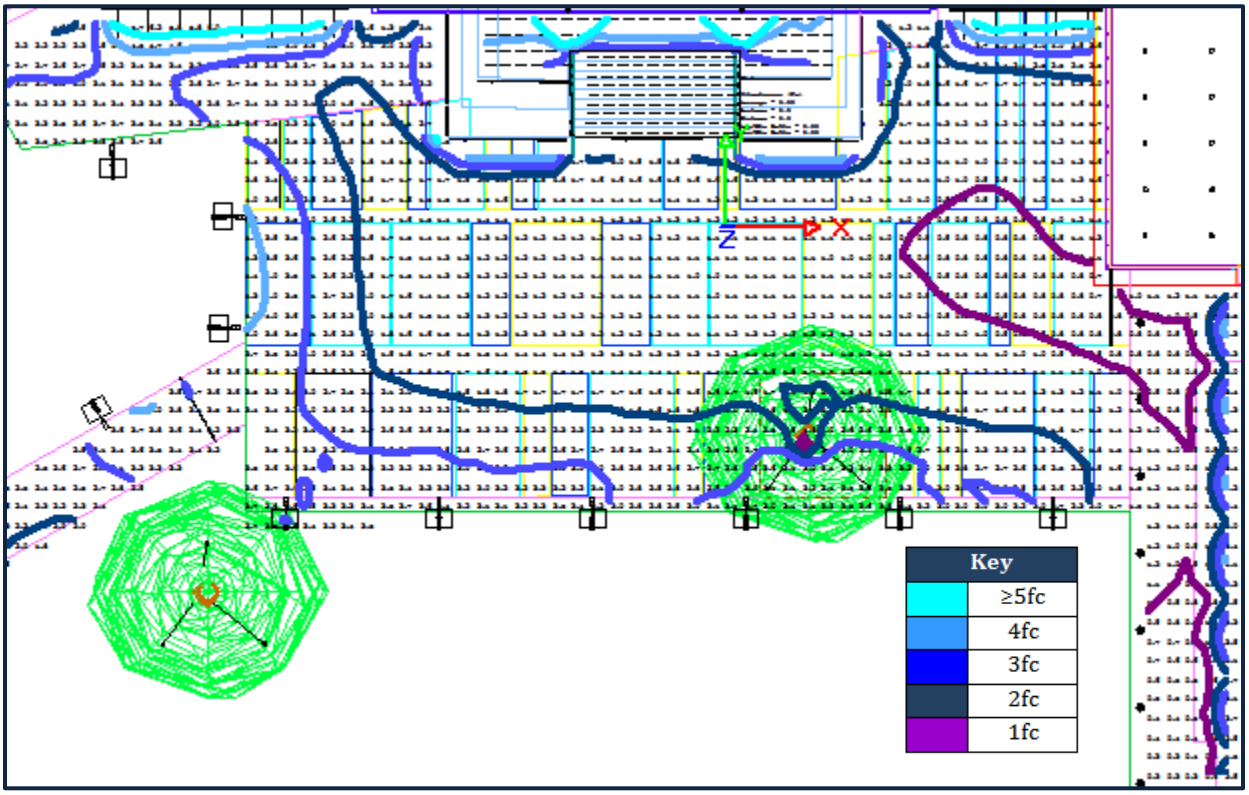


figure 7 – courtyard illuminance values

Courtyard Calculation Summary		
	Ground (0')	**Vertical**
average illuminance	2.13fc	2.09fc
maximum illuminance	6.4fc	3.2fc
minimum illuminance	0.2fc	1.2fc
design criteria	**0.5fc**	**0.3fc**

table 4 – courtyard calculation summary

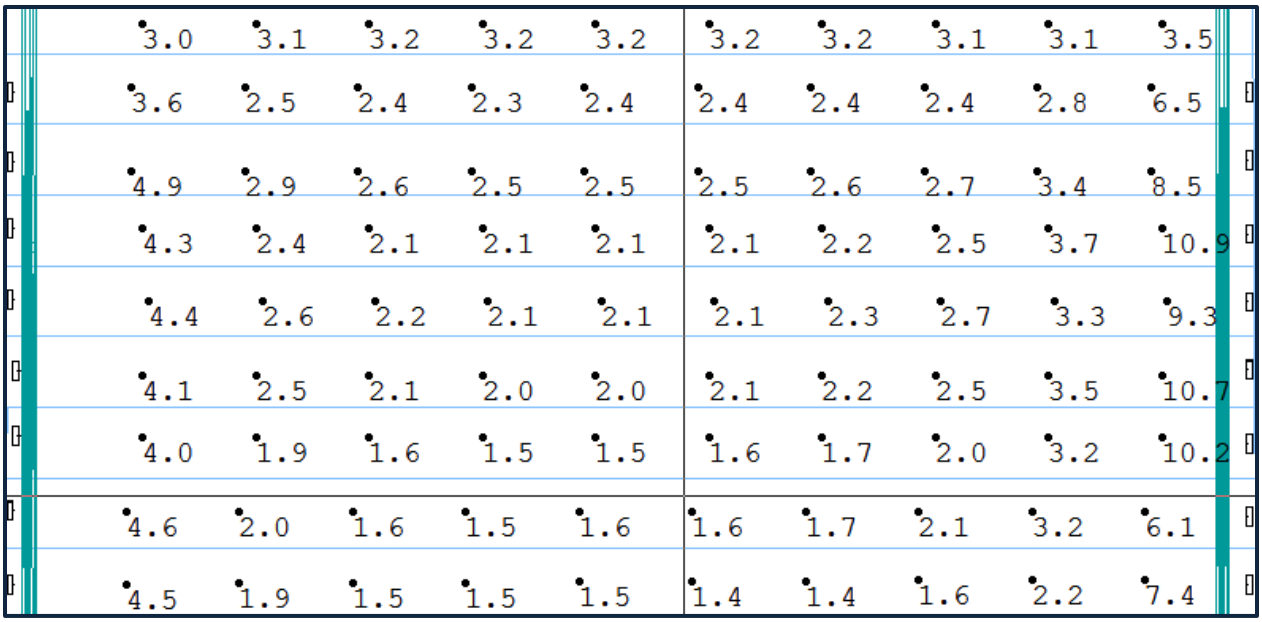


figure 8- staircase illuminance values

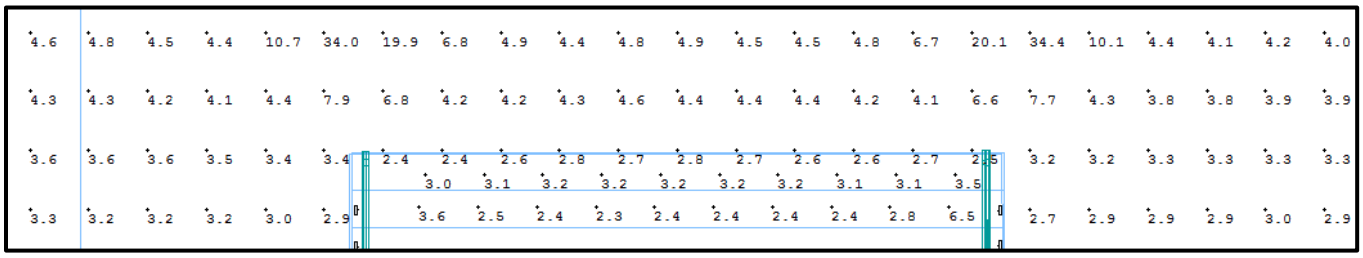


figure 9– entrance illuminance values

Entrance Calculation Summary	
	Ground (0')
average illuminance	5.26fc
maximum illuminance	34.3fc
minimum illuminance	2.6fc
design criteria	**5fc**

table 5 – entrance calculation summary

Stairway Calculation Summary	
	Ground (0')
average illuminance	3.15fc
maximum illuminance	10.9fc
minimum illuminance	1.4fc
design criteria	**1fc**

table 6 – stairway calculation summary

Lighting Power Density			
Fixture Type	Input Wattage	Quantity	Total Watts
M1	78	14	1092
M2	36	7	252
N1	10	17	170
N2	36	24	864
N3	3.9W/ft	52ft	202.8
N4	43	9	387
Z1	17	12	204
Total Watts			3171.8
Selected Lighting Area			16,773ft
Watts/SF			0.18
ASHRAE Std. 90.1 compliance?			**0.2 - yes**

table 7– exterior lighting power density

evaluation

The lighting design in the exterior courtyard successfully creates a visibly engaging, welcoming outdoor space that balances the public feel of the space throughout the day with a private, safe, enjoyable environment created in the evening. Indirect pole mounted fixtures enhance a feeling of safety and security by enabling high levels of vertical footcandles for facial recognition. The perimeter of the rubber courtyard is illuminated to higher levels, creating layers of light that guide the pedestrians through the space without obstructing the central activity space with fixtures. The design reinforces that the first layer of light to the pathway comes from the building itself, from the steplights and cove fixture and also from the gymnasium and vestibule themselves. The very directional fixtures that are mounted on the building, as well as the LED fixtures uplighting the trees create visual interest in the space. Visitors can enjoy the space while either traveling through the courtyard or entering the secondary Hall of Fame entrance.

A cooler color temperature was used for this space both because of the exterior nature of the courtyard but additionally to tie in with the 4100CCT used throughout the building to compliment the cool cement gray and ice blue color scheme within the fitness center. The design is compliant to both the IESNA recommended light levels for horizontal and vertical illuminance, and also to ASHRAE's standard for linear power density.

large workspace | fitness center

overall design goals

The fitness area should feel spacious, and help to energize and uplift the occupants during their workouts. Expansive windows in the Drexel fitness center allow lots of daylight into the space, providing bright, uniform light levels throughout the day. The lighting layout can help to create an energetic, uplifting impression. Peripheral emphasis and clean, uncluttered walls will add to an open space that encourages focus. High illuminance levels on the ceiling and on the workplane will reinforce visual clarity. A bright open space also reinforces safety and cleanliness, which are important within a workout facility. This space is where the energy is actually exerted and returned to the building from the occupants, and so where the most dynamic and representative lighting design is actualized.

description

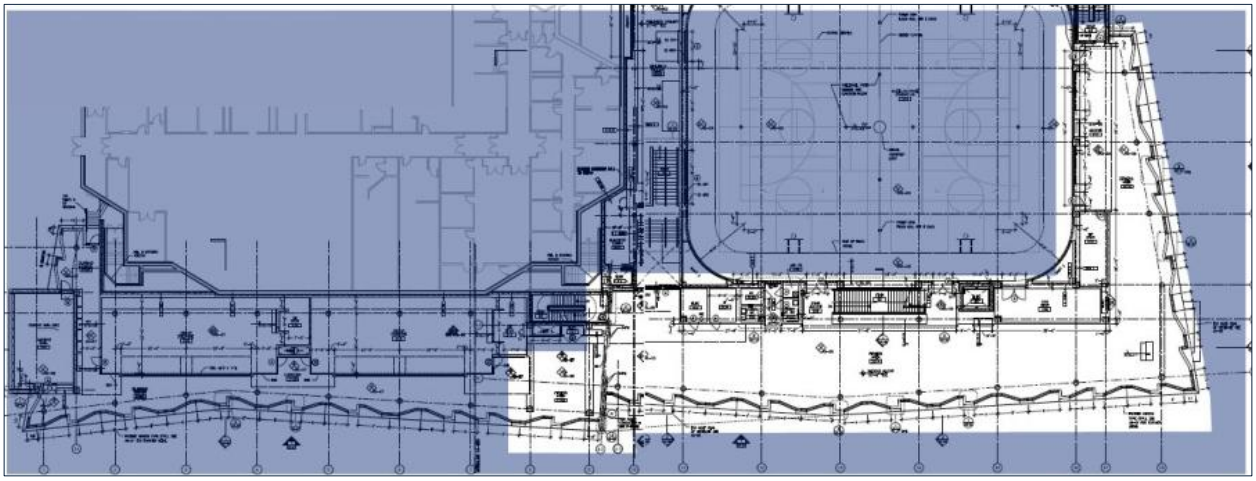


figure 10 – fitness center location in building plan

The fitness and weight lifting areas are located on the second and third floors of the DAC spanning the 140' southern façade. Sections for free weights and strength machines extend along the Eastern façade of the building. A primary focus of the facility, the floor-to-ceiling windows and 13' ceiling heights make the space an open, inviting, energizing place for cardio workouts and strength training.

Materials and Finishes		
Surface	**Description**	**Reflectance**
north, east, and west walls	gypsum wall board painted in Sherwin Williams Dovetail	0.6
south wall	gypsum wall board painted in Sherwin Williams Ceiling Bright White	0.8
flooring	Panorama 3/8" rubber tiles	0.20
base	6" Johnsonite rubber base in Moon Rock	0.2
ceiling	exposed concrete	0.60
framing, trim, railings, desk area	Prodema wood veneer paneling in Pale	0.45
glazing	Viracon insulated glazing	t = .46

table 8 – fitness center materials and finishes

Cardio, strength training, and free weight workouts will take place in this space (see figure 11 below for a detailed equipment layout). It also functions as a vertical circulation path from the lower lobby level into the gymnasium, group exercise rooms, rock climbing wall, and various spaces throughout the facility.

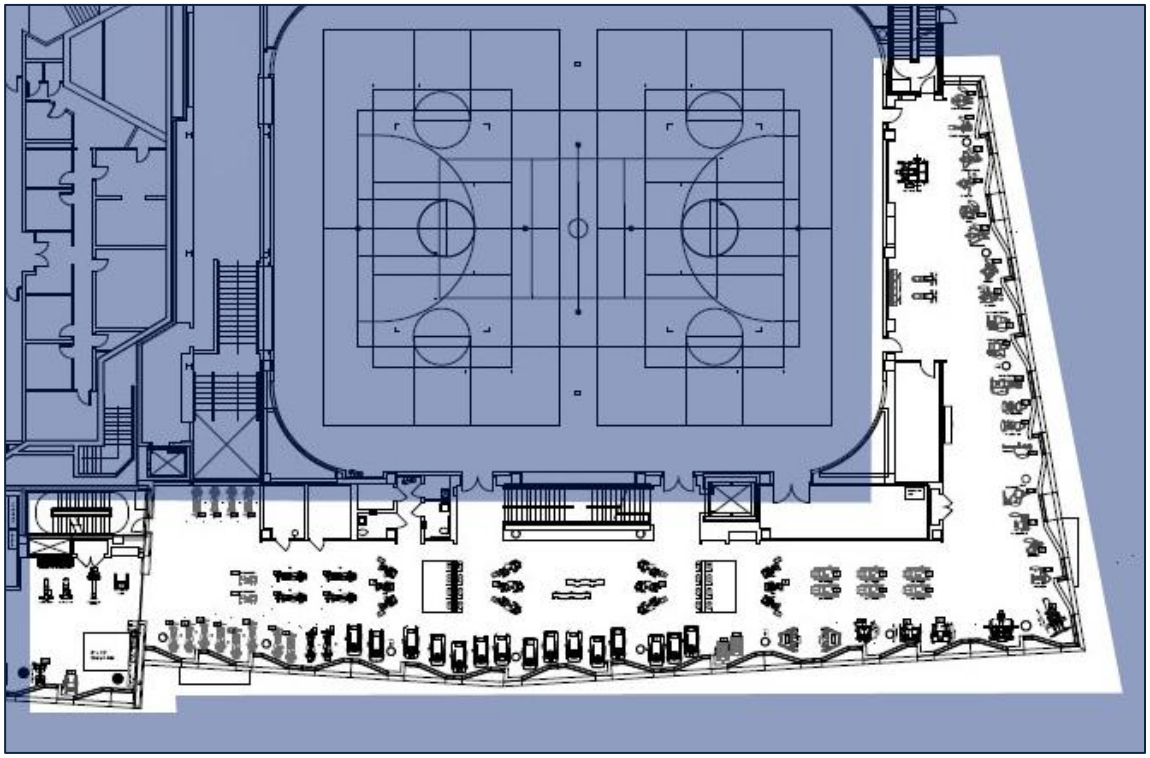


figure 11– fitness equipment layout

design criteria and consideration

desired illuminance levels and design considerations- **IESNA 2000 *Sports and Recreation***

quantity of light

weight training:

horizontal **– 20fc**
vertical **– 2fc**

ASHRAE/IESNA 90.1: Gymnasium/exercise center *playing area* – ***0.9W/sf***

quality of light

Design Considerations

Very Important Criteria
Appearance of Space and Luminaires- The fitness area is entirely visible to Market Street and so is an integral factor in determining the building's initial impression to the public. In addition to the luminaires being completely exposed due to the exposed concrete ceiling, the façade lighting takes place almost entirely from within, making the appearance of both the space and the luminaires crucial in contributing to the sharp lines and strong angles of the glazing and aluminum paneled exterior. Luminaires are consistent with the architectural concepts, with no soft forms or round edges.

The space has an overall appearance of cleanliness and order, and help to encourage activity and efficiency.

Color Appearance (and Color Contrast)- The color appearance throughout all of the workout spaces is consistent to facilitate effortless visual transitions between activities. The fundamental black, white, and grey color scheme would be better accentuated with a cooler color temperature of 4100K. A color rendering index of at least 85 is specified in order to render a pleasant appearance of skin tones and objects with the space to create a more inviting and pleasant place to work out.

Daylighting Integration and Control- A view of the outdoors has positive psychological effects on occupants, and can help to energize those working out during the day. Daylighting used as an overall ambient lighting for the workout space increases overall energy levels and provide a more energetic and dynamic lighting system.

Luminances of Room Surfaces- To reinforce the feelings of spaciousness and energy, brightness levels can be elevated by directly illuminating the ceiling and walls.

Modeling of Faces or Objects- People are continually interacting with both each other and the objects in the fitness area. Objects should be rendered accurately to ensure the safe and proper usage of equipment. Facial recognition as well as visibility of muscles and muscle function is necessary for spotting and correct performance of various exercises.

Important Criteria

Direct and Reflected Glare- Glare is a particular issue in this space because the occupants will have a variable line of site throughout their workouts. This not only causes distractions but also can hinder safety as being blinded can inhibit the ability to use equipment correctly. Glare can be avoided by limiting the use of luminaires that aim directly down, instead using perimeter or indirect lighting.

Light Distribution on Surfaces- Distribution of light on the ceiling and walls should be uniform in order to provide both a more energetic and spacious feeling but also to provide a more luminous glow to the exterior at night. The exposed columns are an interesting architectural feature that could be highlighted to provide visual interest.

Light Distribution on Task Plane (Uniformity)- The task plane within the fitness space is variable and can be located on the floor, the treadmill, or at changing heights throughout strengthening routines. This makes the overall uniformity of the light levels throughout the space important for the effective performance of physical fitness tasks.

Source/Task/Eye Geometry- Placement of luminaires needs to be considered in order to enable proper rendering of machinery as well as electronic displays on cardio equipment and to avoid direct light from the source into the range of vision.

fixtures and equipment

Luminaire Schedule			
Type		**Description**	**Manufacturer**
	A1	3”x4’ recessed linear fluorescent luminaire with extruded aluminum finish and frosted acrylic flush lens.	Focal Point
	C1	4” square 4100K LED downlight with remote phosphor lens, color mixing chamber, and integrated heat sink and power supply.	Indy
	J1	Flexible RGB LED colortape with RGB LEDs integrated into each LED package mounted on self-adhesive tape. See figure below for mounting details.	Osram
	P4-16	3” wide direct/indirect continuous linear fluorescent luminaire with titanium silver finish, flush satin lens and integrated daylighting sensor. Luminaire length indicated in type and on drawings (I.E. P4 = 4’-0” long).	Focal Point

table 9 – fitness center luminaire schedule

**Note: for full luminaire schedule including lamp and power source information and specification, see Appendix A.*

Light Loss Factors				
Lamp Type	**LLD**	**LDD**	**BF**	**Total**
A1	0.92	0.92	1.08	0.91
C1	0.70	0.92	-	0.64
P4-16	0.92	0.92	1.0	0.85

table 10 – fitness center light loss factors

**The above light loss factors were calculated using the new method in the 2010 IESNA handbook. The Room Surface Dirt Depreciation (RSDD) was neglected and the Luminaire Dirt Depreciation (LDD) was calculated using the updated calculation outlined in the book. A lamp maintenance schedule of twenty-four months was assumed.*

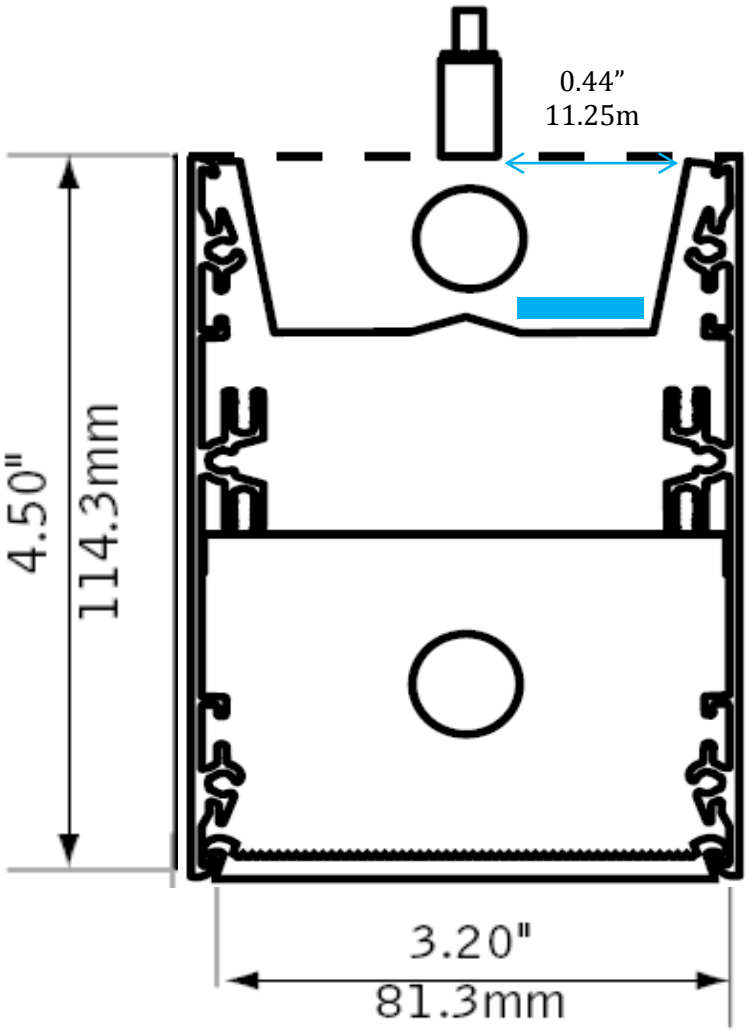


figure 12 - detail of P4-16 with integrated LED light tape

controls

The façade of the Drexel Recreation Center is a product of an extensive energy study to maximize daylighting and minimize solar gain. Since the fenestration faces directly south, desired light levels are met solely with daylight for a majority of the day. The Wattstopper digital lighting management control system will be utilized in the space to enable dimming to 1%, providing energy savings throughout the year. Using natural daylight in place of electric light during the day will not only save energy and money, but will have positive psychological effects on occupants. Daylighting used as an overall ambient lighting for the workout space will increase overall energy levels and provide a more energetic and dynamic lighting system. The selected Focal Point luminaires have been specified to incorporate the available integrated daylight sensor compatible with the Wattstopper controls. The daylighting sensor will be calibrated using a sliding setpoint algorithm in order to maintain the desired minimum of 20fc on the workplane (measured at cardio machine standing level of 1.5’) at all times.

A dynamic component of the lighting in the fitness center is an Osram-Sylvania LED light tape component integrated into each of the linear pendant fixtures. This lighting is not included in the calculations and is strictly an addition to the fluorescent lighting. Power for this component will use the ReRev system to harness kinetic energy generated by the cardio equipment in the space in the form of DC power. The LEDs will use the Osram Sylvania _____ power modulator to provide consistent voltage to the LED component in each luminaire. This blue strip will create a blue glow to visibly show from the exterior where the power is being generated within the space, and will not be daylight controlled.

Fitness Center Control Schedule			
Type	Manufacturer	Product	Description
LC-100	Wattstopper	Intelligent Power Pack	Power pack delivers 0-10V dimming control to lighting loads.
LMLS-305	Wattstopper	LightSaver Photocell	Closed loop photosensor provides the daylight data necessary for operation.
LMRC-201	Wattstopper	LightSaver Room Dimming Controller	Provides automatic dimming control for fluorescent fixtures. Closed loop control utilizes a photocell for single-zone dimming.
LMSW-100	Wattstopper	LightSaver Wall Switches	Allows occupants to temporarily override the daylighting control systems.

table 11 – fitness center control schedule

Note: for full control schedule see Appendix C.

renderings

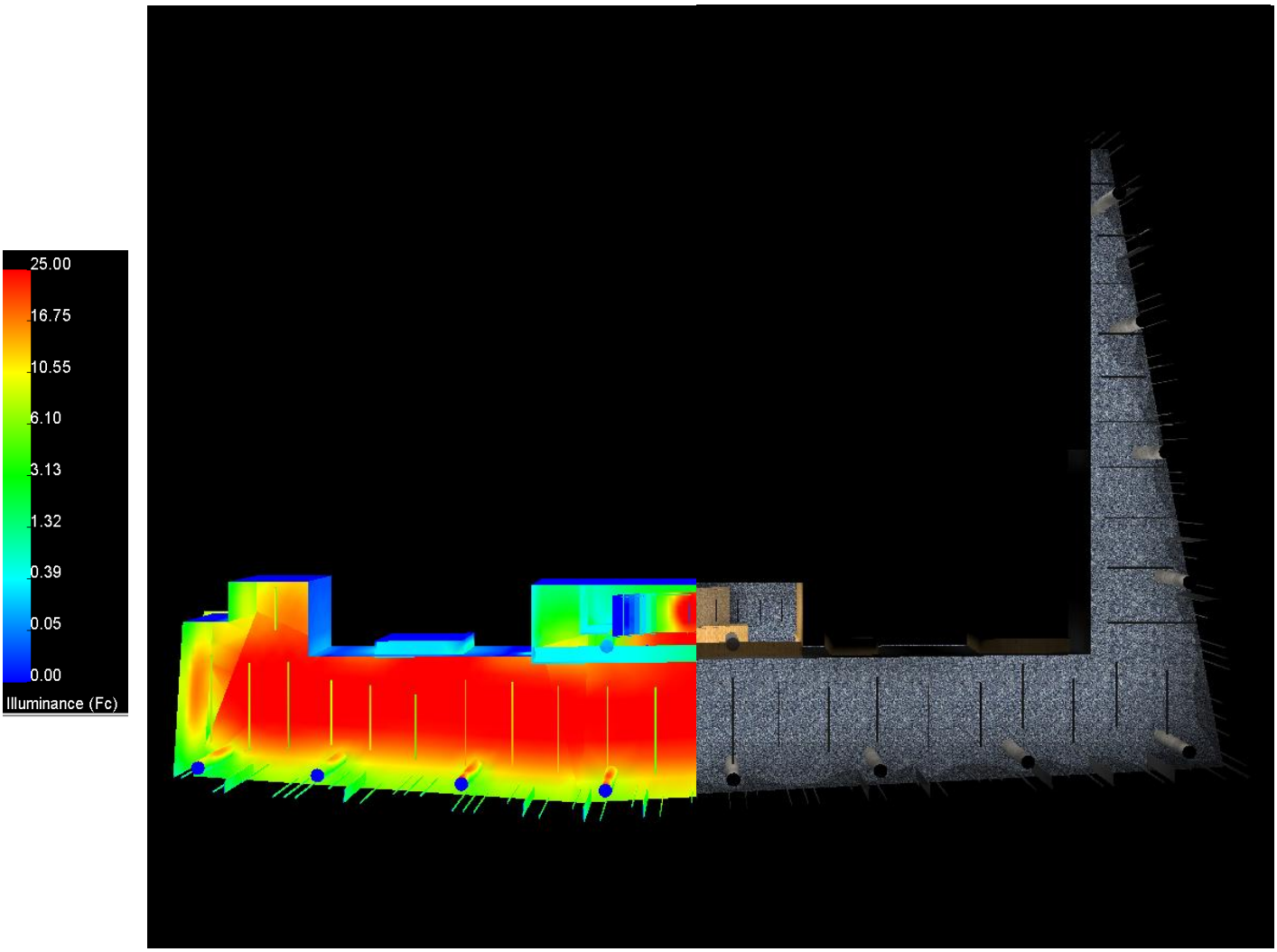


figure 13 - aerial psuedocolor/color rendering of fitness center

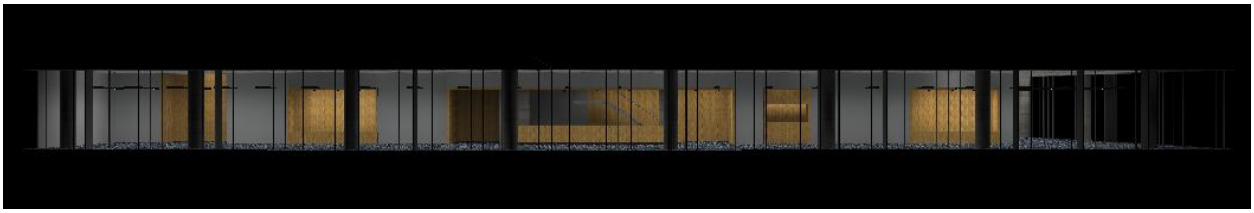


figure 14 - south view of fitness center

figure 15 -perspective view from within fitness center

calculation summary

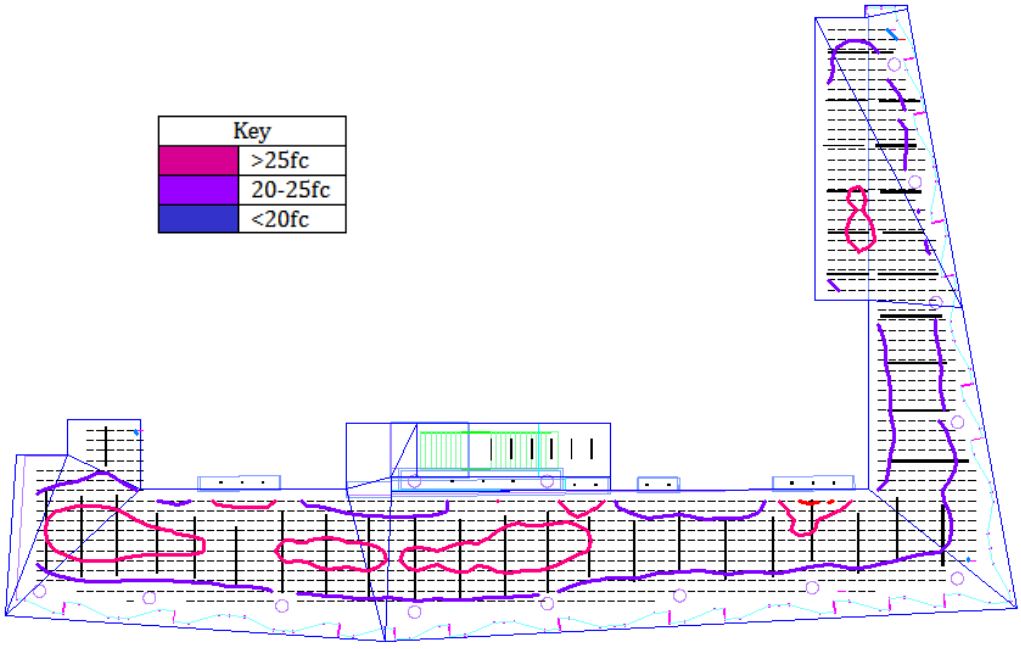


figure 16 - isolines of workplane calculation points (1.5')

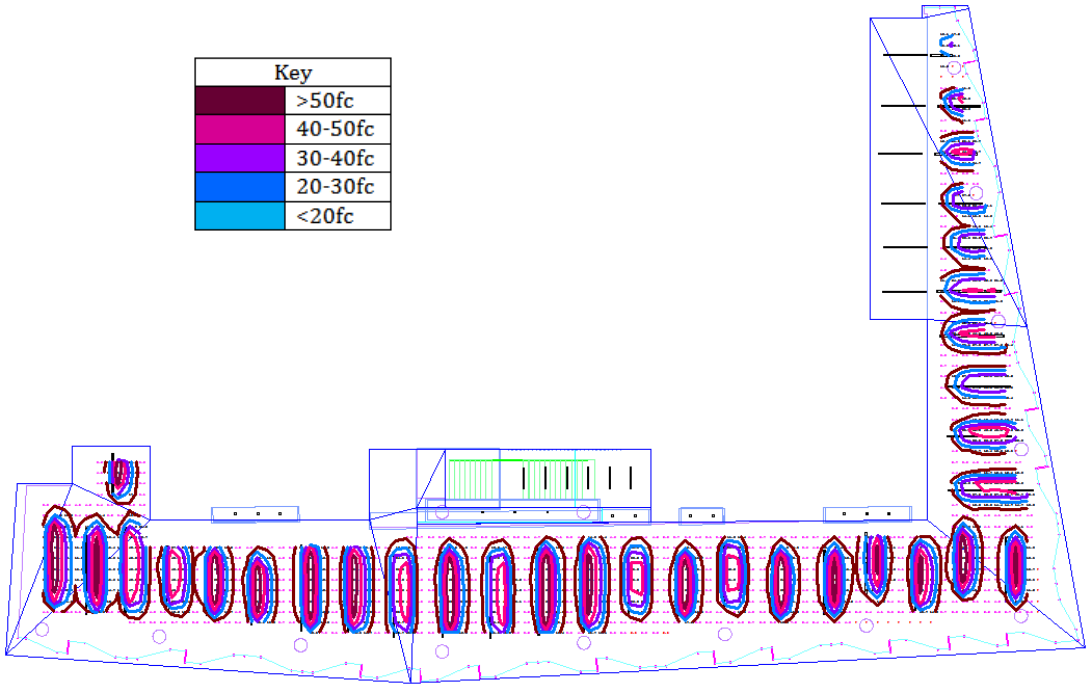


figure 17- isolines of ceiling calculation points for uniformity

Fitness Center Calculation Summary			
	Workplane (1.5')	**Ceiling**	**Vertical**
average illuminance	23.90fc	18.77fc	9.81fc
maximum illuminance	42.4fc	65fc	12.9fc
minimum illuminance	9.4fc	2.0fc	7.5fc
uniformity coefficient	**0.24**	0.89	-
design criteria	**20 fc**	-	**2fc**

table 12 – fitness center calculation summary

Lighting Power Density – 2nd floor			
Fixture Type	Input Wattage	Quantity	Total Watts
A1	36	6	216
C1	33	12	396
P4	63	7	441
P8	126	4	504
P12	189	16	3,024
P16	252	11	2,772
Total Watts			7,353
Selected Lighting Area			8,448sf
Watts/SF			0.86
ASHRAE Std. 90.1 compliance?			**0.9 - yes**

Lighting Power Density – 3rd floor			
Fixture Type	Input Wattage	Quantity	Total Watts
A1	36	6	216
C1	33	12	396
P4	63	7	441
P8	126	4	504
P12	189	16	3,024
P16	252	11	2,772
Total Watts			7,353
Selected Lighting Area			8,448sf
Watts/SF			0.86
ASHRAE Std. 90.1 compliance?			**0.9 - yes**

table 13 and 14 – fitness center lighting power densities

evaluation

The bright, uniform lighting layout gives the fitness center an open, inviting, and energizing place in which to work out. The high, even pattern of illuminance on the ceiling reinforces the already straight lines and angles that enhance the 13' ceiling and give the impressions of cleanliness and focus. The fitness center is lit primarily with daylight through a majority of the day, and the linear fluorescents are dimmed with a WattStopper system to provide maximum energy savings. The LED component makes this space the most interactive element of the building's design, allowing users to both change the way the space appears from the outside, but have tangible evidence of all of the energy that their workout is creating! The uniformity on the floor is interrupted only near the stairwell, where the linear fixtures and LED downlights used for vertical circulation guidance add extra light to call attention to the exit and stair. A high CRI of over 85 is required for the fluorescent fixtures to ensure proper rendering of skintones in the space, and the uplighting component minimizes shadows on the individual, making them not only look better, but work out safer.

This design successfully meets ASHRAE and IESNA standards, and additionally provides a way that the students can give back to their gym, and the environment!

circulation space | lobby

overall design goals

The lobby is the first space that a majority of the people will see, and should reflect the overall design goals of the building. People should have an impression of the public space upon entering the facility, followed by visual clarity and cleanliness. This can be achieved with bright uniformity. Because of the dynamic functions of the building and the precise lines of the space, the lobby should also be visually interesting, playing with punctuations of light. The lobby is also the daylight feature space, and so the LEDs in the ceiling will be switched in order to provide maximum energy savings in the space.

The security desk is an important focus of the space as this is where everyone is either granted or denied access to the rec center. A bright, indirect lighting system avoids shadows and provides the illuminance necessary to perform any tasks necessary.

description

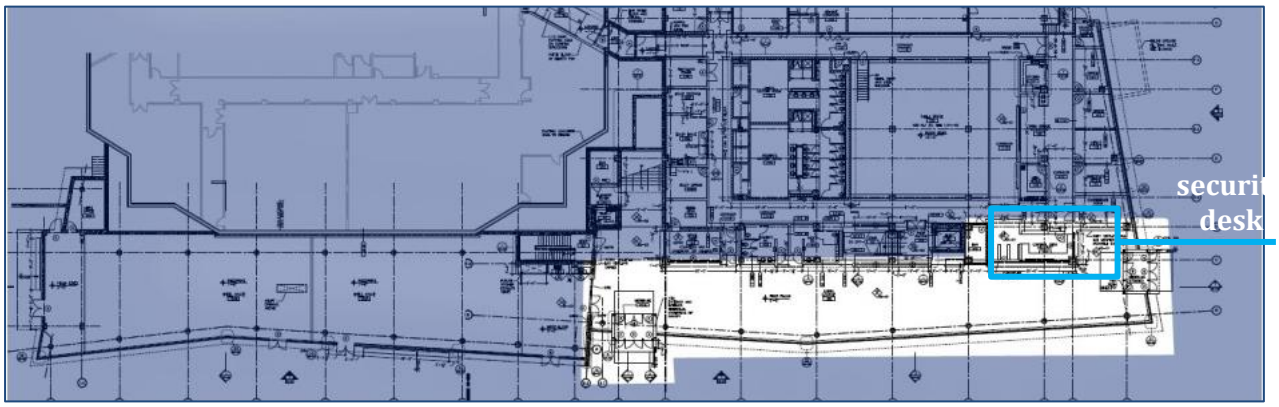


figure 18- orientation of lobby within recreation center

The lobby and main circulation entrance is the daylight feature space of the Drexel Recreation Center. As the initial impression to anyone entering the sporting facility, the lobby orients both to the circulation within the space but also to the feel and aesthetics of the building itself. To check into the athletic facility, visitors must use the key-card accessibility entry past the security desk on the eastern end. The entrance is also accessible from this space at the western side. This makes this corridor the most traveled space in the project. The lobby measures approximately 180' x 20' and has a ceiling height of 13'.

Materials and Finishes - lobby		
Surface	**Description**	**Reflectance**
north, east, and west walls	gypsum wall board painted in Sherwin Williams Dovetail	0.6
south wall	gypsum wall board painted in Sherwin Williams Ceiling Bright White	0.9
accent wall	gypsum wall board painted in Sherwin Williams Blue Bauble	0.69
flooring	1' x 2' Logica stone source tile in Grigio	0.46
base	1" x 1" Dal tile in Suede Grey	0.32
ceiling	exposed concrete	0.60
framing, trim, railings, desk area	Prodema wood veneer paneling in Pale	0.45
glazing	Viracon insulated glazing	t = .46

table 15 – lobby materials and finishes

Materials and Finishes – security desk		
Surface	**Description**	**Reflectance**
back wall	wood veneer Prodema paneling in Pale	0.45
flooring	1' x 2' matte finish porcelain Stone Source tile in Sand Beige	0.46
base	6" Johnsonite rubber base in Moon Rock	0.33
ceiling	Armstrong suspended ceiling tiles in White	0.9

table 16 – security desk materials and finishes

tasks/activities

The main purpose of the corridor is purely circulation, although it does double as a student study/lounge area because of its convenient operating hours and brightness during the daylight hours. Security staff perform administrative duties such as paperwork and camera monitoring, as well as provides services to the students. The northern wall of the lobby has screened windows providing interesting views into the racquetball courts and central staircase.

design criteria and considerations

desired illuminance levels and design criteria- **IESNA 2000*: Lobby Space***

quantity of light

security desk- *lobby: front desk*
horizontal – **30fc**

circulation space- *lobby: general lighting*
horizontal – **10fc**

ASHRAE/IESNA 90.1: *Lobby*- **1.3W/sf**

quality of light

Important
Appearance of Space and Luminaires- Important in every space on the southern side, this is most important in the lobby. In addition to establishing the athletic center's presence on Market Street and on the campus, the lobby is the primary space which presents the architectural concepts to observers. The space should is punctuated with sharp lines and angles of light to complement the sharp dimensions of the façade.

Daylight Integration and Control- The glazing composure of the southern façade makes daylighting a prominent focus of the DAC. The design will need to integrate and respond to the full exposure of daylight to the space during the entirety of the day. Philadelphia is overcast for a good portion of the winter, so photosensors should be incorporated into the system to ensure proper light levels throughout the space in any sky condition.

Direct and Reflected Glare- Transitioning through this space and into the building will be disrupted if occupants experience uncomfortable glare and reflections. The high exposed ceilings will draw eyes upwards and the façade glazing presents a potential for reflected glare. Luminaire position should be considered so that this is avoided. No light should be aimed directly at the glazing.

Light Distribution on Surfaces- The most important surfaces to the occupants are those that will guide them through the space: either through the space to the restaurant or through the security desk and into the fitness center. A uniform light pattern on the walls and ceiling and a non-uniform pattern on the floor will help to direct visitors as well as to reinforce the public aspect of the space.

Luminances of Room Surfaces- The high ceiling should be accentuated by illuminating the perimeter, and high levels of brightness on the walls will help to keep the visual contrast between the walls and the daylight entering through the glazing comfortable.

Design Considerations- *Security Desk*

Very Important

Direct and Reflected Glare- Both direct and reflected glare can limit the ability of workers to read and write, as well as reduce the contrast of computer screens. The monitoring of security cameras, as well as ID scans and other computer work will take place at the security desk. Luminaire placement is not be in line of sight of the eye or directly behind the seats so as not to reflect in the screens.

Modeling of Faces or Objects- Because a majority of the athletic center is controlled access, facial recognition is crucial to maintaining the integrity of the security ID check station. Visible threats need to also be readily identifiable so all aspects of an individual must be clearly rendered.

Important

Appearance of Space and Luminaires- The security desk should present an initially welcoming aesthetic impression followed by one of control and cleanliness. This can be achieved with high illuminance values and an overall uniformly high ambient light level behind the desk.

Light Distribution on Surfaces- The security desk is open on three sides with a dropped ceiling, making uniform distribution of the space difficult. The linear lines on the back wall could be uniformly accented to reinforce the impression of control and cleanliness while still adding visual interest.

Luminances of Room Surfaces- The luminance ratios between the task (in this case the computer or desk) should not exceed 10:1. This is an important consideration for this area because some of the employees directly face the windowed façade while behind their computer. This can cause unnecessary eye strain and lower productivity in the space.

Source/Eye/Task Geometry- The majority of the work at this desk takes place on computers, making luminaire placement an important aspect of design. Luminaires should be placed to the sides of rather than behind to limit reflections.

fixtures and equipment

Luminaire Schedule			
Type		**Description**	**Manufacturer**
	C1	4" square 4100K LED downlight with remote phosphor lens, color mixing chamber, and integrated heat sink and power supply.	Indy
	C2	8" square surface mounted 4000K Energy Star qualified LED downlight with aluminum housing, 2" square luminous area and 65`° beam spread.	Color Kinetics
	J2A	2x2 3form Chroma® square suspended custom LED luminaire with HF² Narrow Stick LEDs and aluminum housing. Color: chroma white out.	Osram/3form
	J2B	2x2 3form Chroma® square suspended custom LED luminaire with HF² Narrow Stick LEDs and aluminum housing. Color: chroma surf.	Osram/3form
	J2C	2x2 3form Chroma® square suspended custom LED luminaire with HF2 Narrow Stick LEDs and aluminum housing. Color: chroma cobalt.	Osram/3form
	S1	2'x2' tubular fluorescent suspended fixture with textile lensing for symmetrical distribution, PVC base and steel housing.	DeltaLight

table 17 – lobby luminaire schedule

**Note: for full luminaire schedule including lamp and power source information and specification, see Appendix A.*

Light Loss Factors				
Lamp Type	**LLD**	**LDD**	**BF**	**Total**
C1	0.70	0.92	-	0.64
C2	0.70	0.92	-	0.64
S1	.95	0.92	1.0	.87

table 18 – lobby light loss factors

**The above light loss factors were calculated using the new method in the 2010 IESNA handbook. The Room Surface Dirt Depreciation (RSDD) was neglected and the Luminaire Dirt Depreciation (LDD) was calculated using the updated calculation outlined in the book. A lamp maintenance schedule of twenty-four months was assumed.*

controls

The façade of the Drexel Recreation Center is a product of an extensive energy study to maximize daylighting and minimize solar gain. The lobby is the daylighting feature space of the rec center, and so is provided with consistent levels of daylight throughout the day, especially given the low lighting level requirement of 10fc. For a more consistent lighting level and in order to minimize possible issues involved with dimming the LEDs, the Wattstopper switching control system will be used on the LEDs, with dimming taking place only over the security desk. The daylighting sensor will be calibrated in order to maintain the desired minimum of 10fc on the ground at all times.

Fitness Center Control Schedule			
Type	Manufacturer	Product	Description
LC-100	Wattstopper	Intelligent Power Pack	Power pack delivers 0-10V dimming control to lighting loads.
LMLS-305	Wattstopper	LightSaver Photocell	Closed loop photosensor provides the daylight data necessary for operation.
LMRC-202	Wattstopper	LightSaver Room Dimming Controller	Provides automatic step-dimming control for LED fixtures. Closed loop control utilizes a single photocell for dual –channel dimming.
LMSW-100	Wattstopper	LightSaver Wall Switches	Allows occupants to temporarily override the daylighting control systems.

table 19 – lobby control schedule

renderings

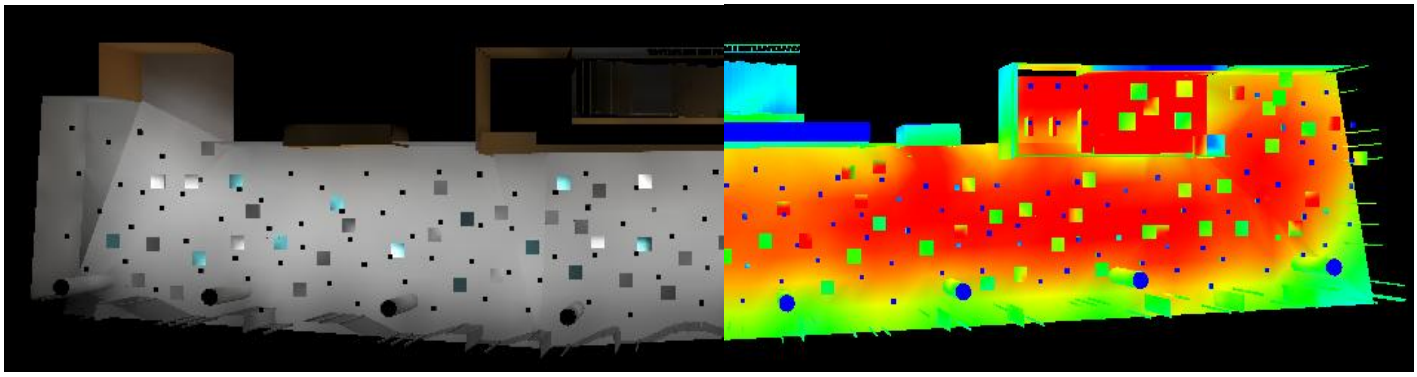


figure 19 – aerial color/psuedocolor rendering of lobby

figure 20 – southern elevation of lobby

figure 21 – perspective view of lobby

calculation summary

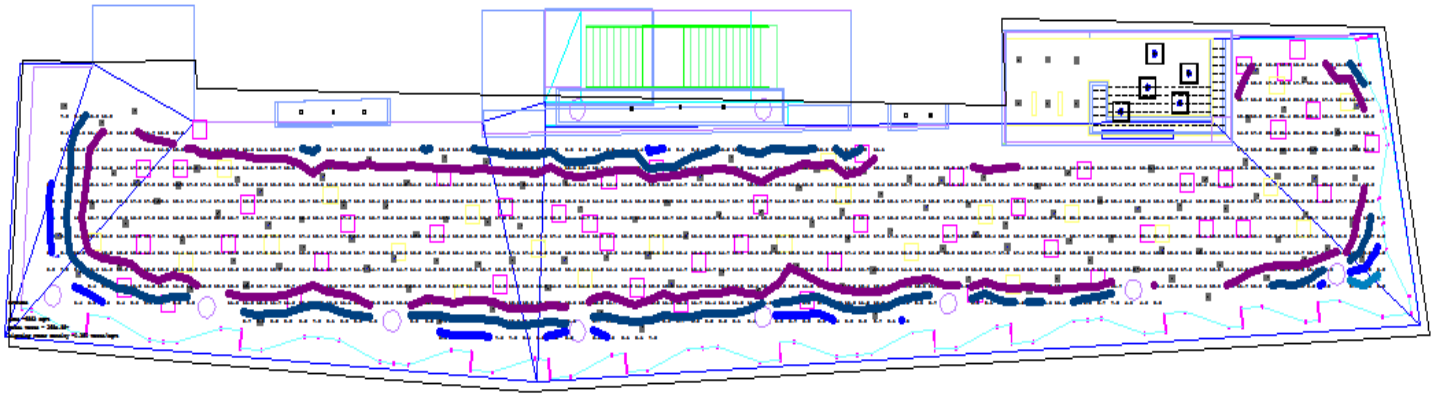


figure 22 – lobby isoline calculation

Lobby Calculation Summary	
	Workplane (0')
average illuminance	14.64fc
maximum illuminance	21.9fc
minimum illuminance	7.2fc
uniformity coefficient	**2.03**
design criteria	**10 fc**

table 20 – lobby calculation summary

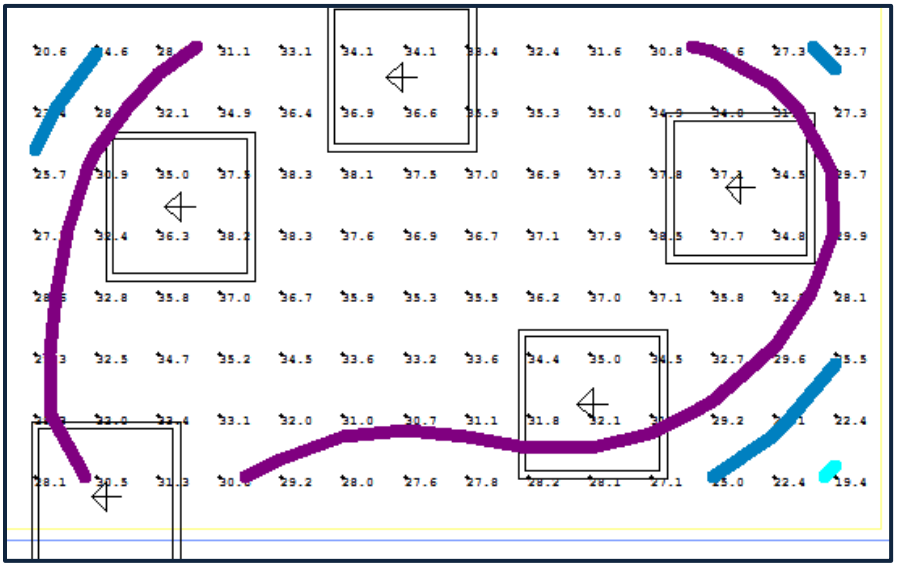


figure 23 – security desk isoline diagram

Security Desk Calculation Summary	
	Workplane (2.5')
average illuminance	32.33fc
maximum illuminance	38.5fc
minimum illuminance	19.4fc
uniformity coefficient	**1.20**
design criteria	**30 fc**

table 21 – security desk calculation summary

Lighting Power Density			
Fixture Type	Input Wattage	Quantity	Total Watts
C1	33	8	264
C2	15	147	2,205
J2	10.6	73	773.8
S1	108	5	540
Total Watts			3,782.8
Selected Lighting Area			8,448sf
Watts/SF			0.45
ASHRAE Std. 90.1 compliance?			**1.3 - yes**

table 22 – lobby lighting power density

evaluation

The design for the lobby took into consideration not only the lobby design goals and criteria, but also the need to be complimentary both to the façade of the building and to the lighting design in the fitness center. Uniform light levels are present on the floor, with the LED fixtures blending into the exposed concrete ceiling to create the impression of floating spots of light. To counteract the closing effect that downlighting can have on a space, the custom LED and Chroma fixtures give the desired impression of a high, evenly luminous ceiling while harmonizing with the angles on the façade. To blend with the design in the lobby and also to provide comfortable indirect lighting for those working the security desk, an evenly luminous cube fixture creates a bright glow in the security desk, both calling attention to it as the space is entered and sufficiently lighting the key area to the building.

Through a majority of the day, the electric light will be switched off, controlled by photosensors within the space. This, coupled with the extremely low linear power density make this the perfect complement to the energy efficient and highly visual presence that Drexel wanted for the Rec Center.

special purpose space | restaurant

overall design goals

The sports bar and restaurant is a multi-faceted space that can be an exciting, engaging place to watch a football game or can be a more relaxing, intimate place to take a break and enjoy dinner and drinks with friends. The lighting throughout the space needs to be adjustable in order to establish the desired atmosphere and impression for specific events. In either mode, a restaurant/lounge area should utilize a non-uniform lighting design with lower light levels immediately surrounding the guest with higher levels away from the guest, providing a sensation of watching without being watched. A highlight or focal point is beneficial in creating this impression.

The sports bar should create intimacy between sports fans, so the guests feel connected to those around them and also to help encourage new relationships between those drinking at the bar. The restaurant portion of the space should create the feeling of a private dinner while still being connected to the other surrounding tables. In contrast to the rest of the fitness center, the lighting can help to differentiate the function and ambience of the restaurant by using a non-uniform lighting mode and warmer temperature lamps while still bringing in the design concepts of minimalist fixtures and the exposed core energy of the building.

description

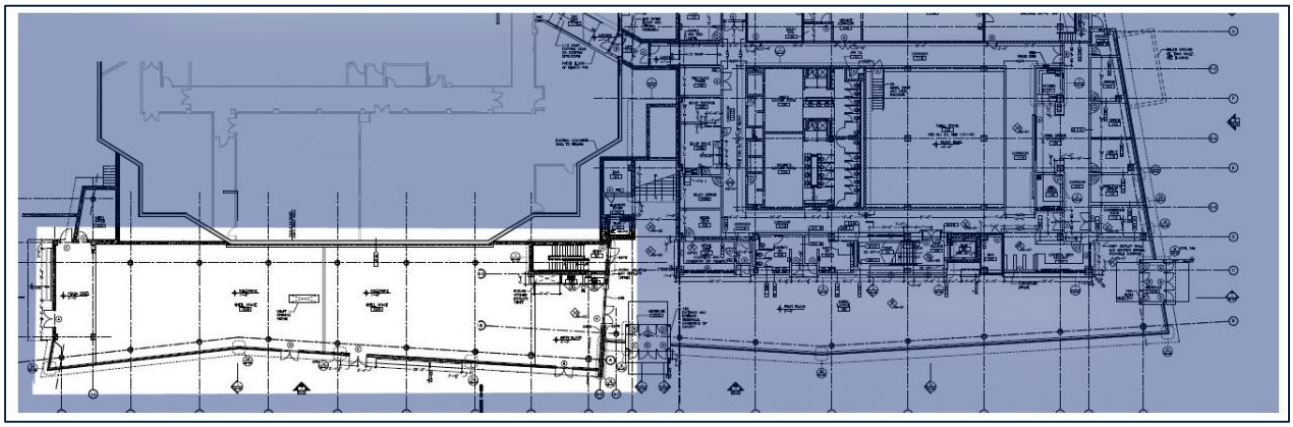


figure 24 – orientation of restaurant within rec center

Centrally located in the heart of Drexel's campus, the Daskalakis Athletic Center dedicated the western half of their southern Market Street façade to a restaurant and sports bar. Windows extending to the ceiling provide a street view to almost every table in the restaurant, with flat screen TVs located throughout facing all directions. A full bar spans the north wall of the main restaurant space, creating a concealed space for an intimate dinner experience shielded from the commotion of the sports bar.

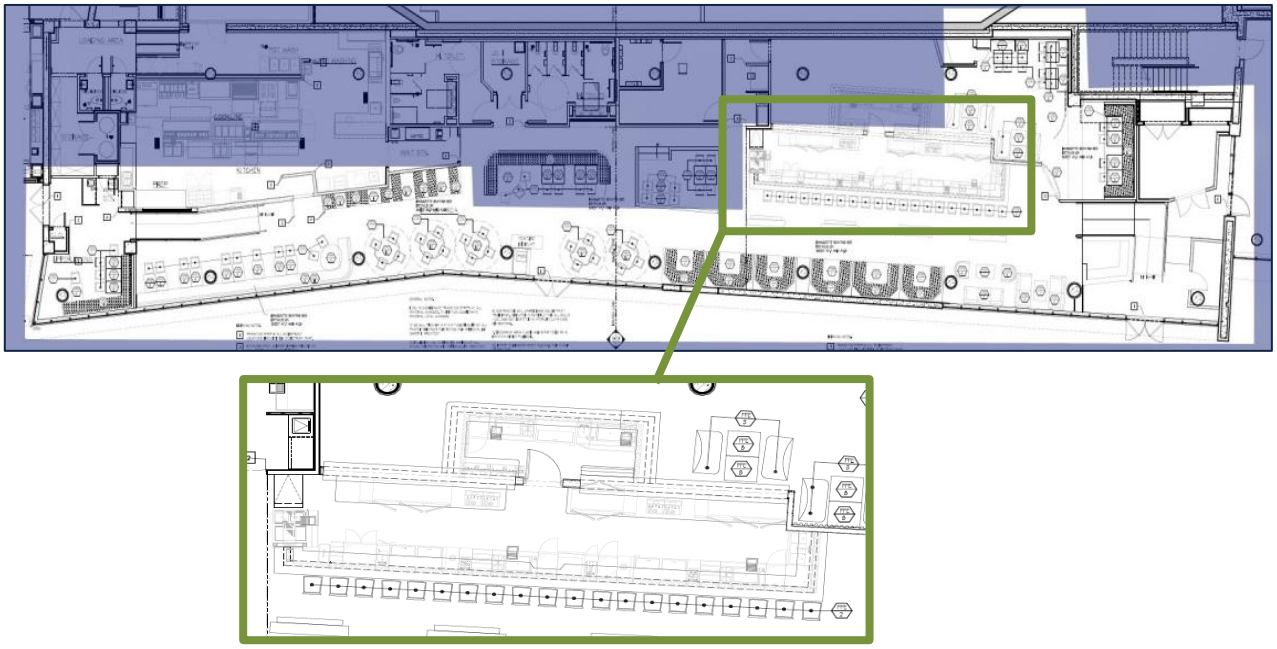


figure 25 – enlarged bar plan

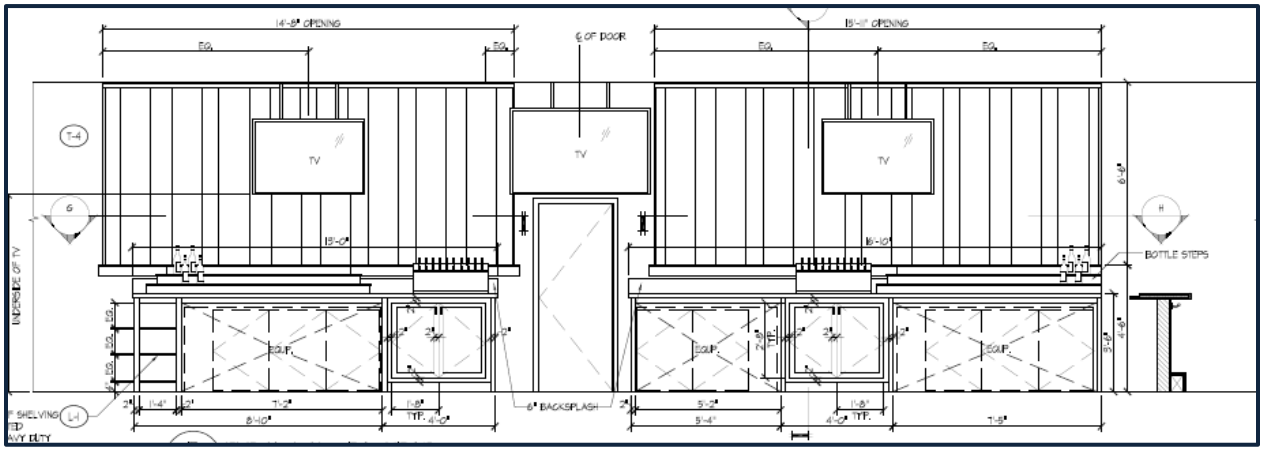


figure 26 – bar elevation

Materials and Finishes		
Surface	**Description**	**Reflectance**
walls	GWB painted Benjamin Moore Soft Chamois	0.8
wall accent strips	back painted tempered glass in Yellow Rain Coat	0.68
flooring	18" x 18" Spartan Surfaces Carpet Tile in Cork	0.22
ceiling	2'x4' USG ATC ceiling tile in Flat Black	0.05
ceiling soffits/columns	GWB painted Benjamin Moore Soft Chamois	0.8
glazing	insulating laminated Viracon glazing	t = .46

table 23 – restaurant materials and finishes

design criteria and consideration

desired illuminance levels and design considerations – **IESNA Handbook 2000: *Entertainment and food service spaces***

quantity of light

dining/bar:
horizontal – **10fc**

ASHRAE/IESNA 90.1: Dining Area *for bar lounge/leisure area*- **1.4W/sf**

An increase in the interior lighting power allowance for spaces in which lighting is specified to be installed in addition to the general lighting for the purpose of decorative appearance, such as chandelier-type luminaires… provided that the additional lighting power shall not exceed **1.0W/sf of such spaces.*

quality of light

Very Important Criteria

Color Appearance (and Color Contrast)- The use of lighting with a high CRI is essential to the task of desirable and appetizing food and drinks, especially with the low lighting levels typical of a bar or late-night restaurant. The appearance and rendering of skin tones is particularly important in a social setting where dating and intermingling with the opposite sex occur. The restaurant is the should be a consistent color temperature as the rest of the project in order to present a uniform façade front during evening hours.

Point(s) of Interest- There are several points of interest in the bar and restaurant. The color intensive accent walls along the northern side of the space as well as behind the bar should be accented, including the patterned decorative panels on the northern side of the private lounge area. The custom luminaires throughout the space are currently a focal point, and the televisions located throughout the bar need to be considered when placing light within the space. The columns and ceiling soffits are interesting architectural features that should be additionally highlighted.

Important Criteria

Appearance of Space and Luminaires- As one of the only venues located directly on Drexel's campus, the appearance of the bar is especially important given the total exposure to Market Street. Guests walking by should see the space and be drawn inside to watch the game or have a drink. The bold colors within should be effectively portrayed, and the luminaires should highlight the lines of the building.

Direct and Reflected Glare- Direct and reflected glare can make guests inadvertently anxious and uncomfortable. No one wants light reflected in their eyes when trying to interact with others. Glare can also be a significant issue by causing veiling reflections when attempting to read a menu in low light levels.

Sparkle/Desirable Reflected Highlights- Sparkle is desirable on glassware, silverware, and decorative objects worn by guests to draw attention such as jewelry.

fixtures and equipment

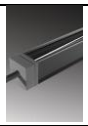
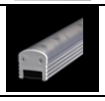
Luminaire Schedule			
Type		**Description**	**Manufacturer**
	B1	24' x 8' ceiling mounted decorative indirect halogen over-bar fixture with polished chrome finish.	Artemide
	C3	2" low voltage halogen adjustable directional flush mount pinhole downlight with 40° beam spread.	Kurt Versen
	D1	Linear fluorescent high performance perimeter open wall wash fixture with extruded aluminum finish and reflector.	Focal Point
	F1	Low voltage halogen cable light system with adjustable ring mounting, integral louver, and satin aluminum finish.	Tech Lighting
	J3	.75" linear surface mounted LED accent fixture with aluminum housing and 45° beam spread.	Cooper io
	J4	1.3" linear LED cove fixture with 130° beam spread, extruded aluminum body and nylon mount clip.	Winona

table 24 – restaurant luminaire schedule

**Note: for full luminaire schedule including lamp and power source information and specification, see Appendix A.*

Light Loss Factors				
Lamp Type	**LLD**	**LDD**	**BF**	**Total**
B1	.94	0.85	-	0.80
C3	.90	0.92	-	0.83
D1	.95	0.85	0.95	.87
F1	.90	0.92	-	.83
J3	0.70	0.92	0.90	.64
J4	0.70	0.92	0.90	.64

**The above light loss factors were calculated using the new method in the 2010 IESNA handbook. The Room Surface Dirt Depreciation (RSDD) was neglected and the Luminaire Dirt Depreciation (LDD) was calculated using the updated calculation outlined in the book. A lamp maintenance schedule of twenty-four months was assumed.*

controls

The bar and lounge are open for both lunch and dinner, as well as for sporting events and off-evenings. The lighting needs to have different scenes, as well as be highly reactive to the daylight that will influence the space through the glazing that makes up almost the entirety of the southern façade. An additional scene with high light levels needs to exist in order to facilitate the wait staff' in cleaning up at the end of the night.

Restaurant Control Schedule			
Type	Manufacturer	Product	Description
LMLS-305	Wattstopper	LightSaver Photocell	Closed loop photosensor provides the daylight data necessary for operation.
LMRC-301	Wattstopper	LightSaver Room Dimming Controller	Provides automatic dimming control for multi-zone dimming control.
LMSW-105	Wattstopper	LightSaver Digital 5-Button Scene Switch	Allows occupant control by accessing four of the 16 scenes available on the local DLM network.

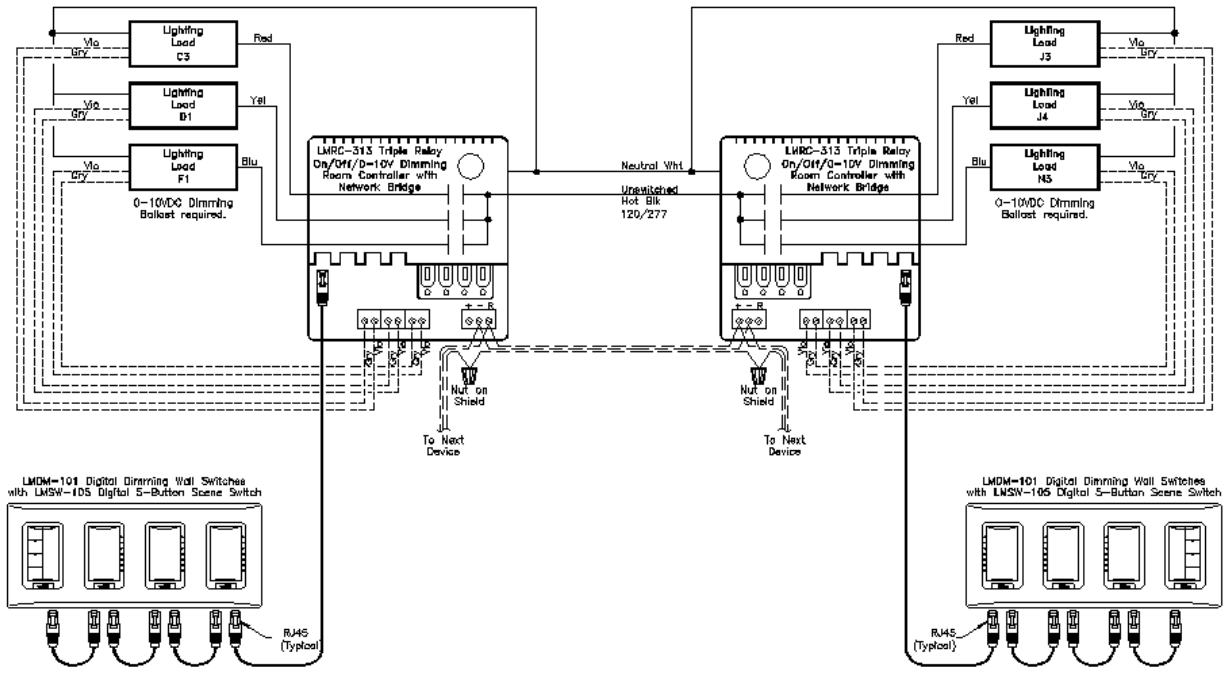


figure 26 – restaurant control diagram

renderings

figure 27 – greyscale southern elevation of restaurant

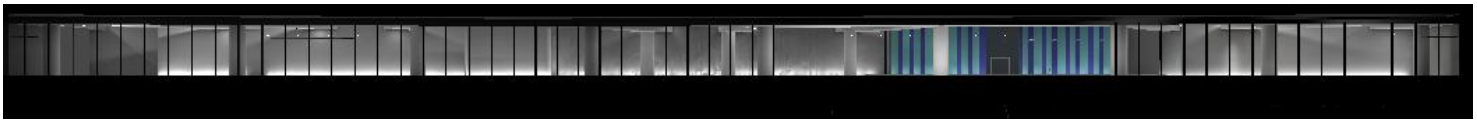


figure 28 – color southern elevation of restaurant

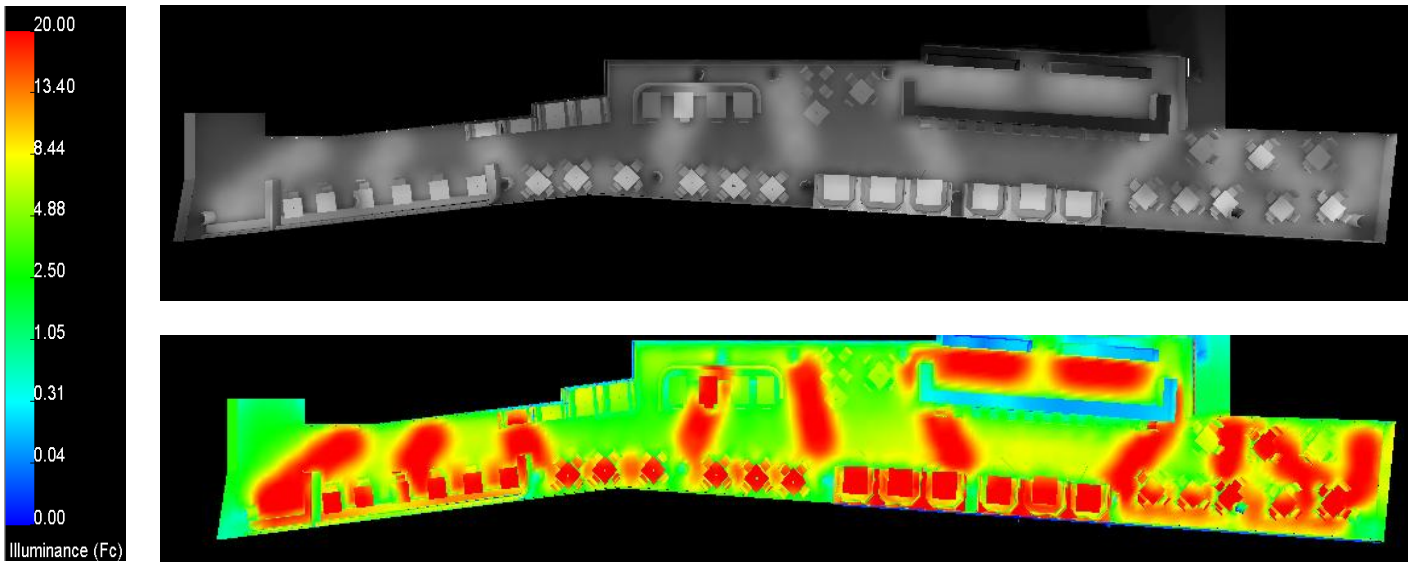


figure 29 – greyscale and psuedocolor aerial views of restaurant

figure 30 – perspective view of restaurant facing east

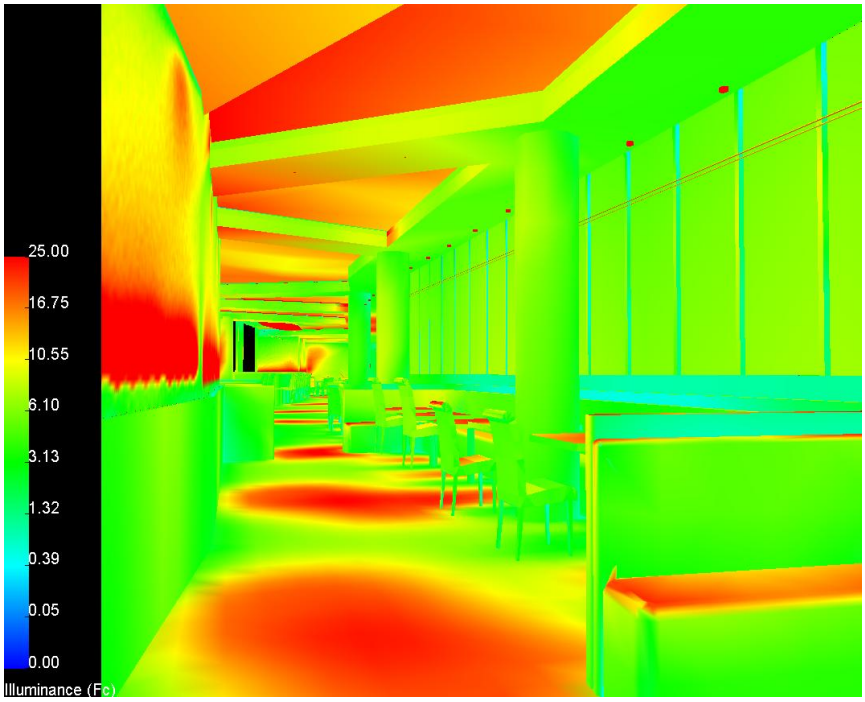


figure 31 – perspective psuedocolor of restaurant facing east

figure 32 –perspective view of restaurant facing west

calculation summary

Restaurant Calculation Summary		
	Workplane (0')	**Tables**
average illuminance	13.83fc	fc
maximum illuminance	41fc	12.9fc
minimum illuminance	2.5fc	7.5fc
uniformity coefficient	**0.60**	-
design criteria	**10 fc**	**2fc**

table 25 – restaurant calculation summary

Lighting Power Density			
Fixture Type	Input Wattage	Quantity	Total Watts
B1	1,200	1	1,200
C3	50	39	1,950
D1	36	38	1,368
F1	35	48	1,680
J3	5.3W/ft	50ft	265
J4	4.5W/ft	595ft	2,677.5
Total Watts			9,140.5
Selected Lighting Area			8,448sf
Watts/SF			1.08
ASHRAE Std. 90.1 compliance?			**1.4 - yes**

table 26 – lighting power density

evaluation

Flexibility is of utmost importance in a hospitality environment, and the controllability and color rendering of halogen fixtures makes them the ideal choice for lighting the restaurant. Power density is met by using LED and fluorescent coves to highlight the architectural ceiling was well as to wash the exposed concrete walls, which simultaneously creates an impression of intimacy and relaxation while tying into the overall building concept of exposed industrial materials, strong lines and angles, and exposed core energy. The LED cove highlighting the ceiling soffit makes the light appear to come from within the building itself. The chrome polished fixture over the bar and the blue frosted glass grazed by hidden linear LEDs create a focal point behind the bar. The warmer color temperature of 3000K helps to delineate the restaurant from the high energy fitness center, and the nonuniform lighting levels and round, soft light created by what are still industrial, clean fixtures completes the effect.

electrical depth

introduction

The electric depth includes a modification of the branch circuit distribution for four spaces in response to the lighting redesign. These spaces include the exterior courtyard, lobby, fitness center, and restaurant. The redesign of the lighting for each space required a recalculation of the loads on each circuit, resulting in the resizing of the affected lighting circuits, panelboards, and feeders. A protective device coordination study is included along with a short circuit analysis.

The electrical depths consist of a system design to retrofit existing cardio equipment to convert kinetic energy from the cardio machines into power for LED lighting, as well as a cost comparison of MC cable trays as an alternative to the existing PVC conduit distribution system located within the poured concrete slab.

The following table highlights which panels in the Drexel Recreation Center were affected by the lighting redesign.

Modified Panelboards						
Panel Tag	**Voltage**	**Normal/ Emergency**	**Courtyard**	**Fitness**	**Lobby**	**Restaurant**
ELP-1-1	480Y/277V, 3P, 4W	Emergency	X		X	
ELP-2-1	480Y/277V, 3P, 4W	Emergency		X		
GDP-L	208/120V, 3P, 4W	Emergency				X
LP-1-1	480Y/277V, 3P, 4W	Normal	X		X	
LP-2-1	480Y/277V, 3P, 4W	Normal		X		
NDP-L	208/120, 3P, 4W	Normal				X

exterior space | courtyard

lighting redesign

The exterior lighting is designed to reinforce the lighting concept of exposed core energy while highlighting the lines and angles of the space and promoting a feeling of safety. The daytime uses of the plaza restrict the placement of luminaires on the rubber tiles, and so following the core energy representation the steplights and linear cove feature add to the impression of a glowing building. The indirect pole-top luminaires highlight facial recognition and add a comfortable feel to the plaza, separating the walkway area to enhance a feeling of separation and creating a sense of space.

electrical redesign

Both the emergency and normal lighting panels that serve the exterior lighting are 480Y/277V 3-phase 4-wire panels, with the emergency sized at 60A and the normal sized at 80A. The addition of energy efficient LED, HID, and fluorescent lighting fixtures in bollard, landscape lighting, and steplighting applications greatly increases the load to the space, therefore increasing the loading to the panelboards.

controls

All of the exterior lighting utilizes controllable breakers by photocell.

panelboards

existing

On the following pages are the existing panelboard schedules for 480Y/277V normal lighting panel LP-1-1 and 480Y/277V emergency lighting panel ESLP-1-1. LP-1-1 is located on the first floor of the DRC in Electrical Switchgear Room 132, and ESLP-1-1 is located on the first floor in the Emergency Generator Room 133. Modified circuits are indicated with a pink box.

PANEL: LP-1-1
SECTION: 1 OF 1
LOCATION: ELEC. SWITCHGEAR ROOM 132
FIRST FLOOR

VOLTAGE: 480/277V
PHASE & WIRE: 3 PH, 4W
MAIN (AMPS): 60A, M.C.B.

[X] NEW
[ ] EXISTING
KAIC RATING: 35
POLES: 30

NOTES	CKT NO.	C.B. A	C.B. P	DESCRIPTION	LOAD (KVA)	A	B	C	LOAD (KVA)	DESCRIPTION	C.B. A	C.B. P	CKT NO.	NOTES
2	1	20	1	LTG - LOBBY 100 UPLIGHTS	1.88	3.67			1.79	LTG - LOCKER ROOMS	20	1	2	1
2	3	20	1	LTG - LOBBY 100 DOWNLIGHTS	1.88		2.01		0.13	LTG - RETAIL CAFÉ 104	20	1	4	1
	5	20	1	LTG - OC SENSORS	2.33			2.77	0.45	LTG - GEN. STORAGE 130	20	1	6	1
1	7	20	1	LTG - SECURITY RM 110	0.29	0.68			0.38	LTG - ELEC. RM 132	20	1	8	1
1	9	20	1	LTG - COR 111, 112, RM 108, 120	2.90		3.09		0.19	LTG - SHELL SPACE 122/SQ CT	20	1	10	1
1	11	20	1	LTG - FUT. CHILLER RM 137	0.51			1.09	0.58	LTG - BOILER RM 136	20	1	12	1
3	13	20	1	LTG - EXTERIOR BENCHES	1.00	2.50			1.50	LTG - SITE	20	1	14	3
	15	20	1	SPARE			0.00			SPARE	20	1	16	
	17	20	1	SPARE				0.00		SPARE	20	1	18	
	19	20	1	SPARE		0.00				SPARE	20	1	20	
	21	20	1	SPARE			0.00			SPARE	20	1	22	
	23	20	1	SPARE				0.00		SPARE	20	1	24	
	25			SPACE		0.00				SPACE			26	
	27			SPACE			0.00			SPACE			28	
	29			SPACE				0.00		SPACE			30	
				LOAD SUMMARY PER PHASE (KVA)		6.85	5.10	3.86						
				TOTAL CONNECTED LOAD (KVA)		15.81								

OPTIONS AND ACCESSORIES - (X) INDICATES SELECTION

[ ]	MULTIPLE SECTION PANEL	CONTACTOR CONTROLLED	[ ]
[ ]	RECESSED	FEED THRU LUGS	[ ]
[X]	SURFACE	SUB FEED MAIN LUGS (DOUBLE LUGS)	[ ]
[ ]	200% RATED NEUTRAL	CONTROLLABLE CIRCUIT BREAKER PANEL	[X]
[ ]	ISOLATED GROUND BUS	OTHER	[ ]

NOTES: 1. CONTROLLABLE BREAKER
2. CONTROLLABLE BREAKER CONTROLLED BY PHOTOCELL
3. CONTROLLABLE BREAKER CONTROLLED BY ROOF TOP PHOTOCELL

PANEL: ESLP-1-1
SECTION: 1 OF 1
LOCATION: EMERGENCY GENERATOR ROOM 133
FIRST FLOOR

VOLTAGE: 480/277V
PHASE & WIRE: 3 PH, 4W
MAIN (AMPS): 60A, M.L.O.

[X] NEW
[ ] EXISTING
KAIC RATING: 35
POLES: 30

NOTES	CKT NO.	C.B. A	C.B. P	DESCRIPTION	LOAD (KVA)	A	B	C	LOAD (KVA)	DESCRIPTION	C.B. A	C.B. P	CKT NO.	NOTES
	1	20	1	EMR, LTG- LOB 100 EXT SNS	0.52	1.39			0.87	EMR LTG- LOBBY 100 UPLGHTS	20	1	2	2
	3	20	1	EMR, LTG- STR S3, RM 102, 103	0.29		1.16		0.87	EMR LTG- LOBBY 100 DWNLGHTS	20	1	4	2
	5	20	1	EMR, LTG- CORR, RM 108-110, 122	1.89			2.41	0.51	EMR LTG- LKR RM, BTHRMS	20	1	6	
	7	20	1	EMR, LTG- ELEC/MECH RMS	1.88	2.66			0.79	EMR LTG- SHELL SPACE	20	1	8	
1	9	20	1	EMR, LTG- EXTERIOR	1.60		1.60			SPARE	20	1	10	
	11	20	1	SPARE				0.00		SPARE	20	1	12	
	13	20	1	SPARE		0.00				SPARE	20	1	14	
	15	20	1	SPARE			0.00			SPARE	20	1	16	
	17	20	1	SPARE				0.00		SPARE	20	1	18	
	19	20	1	SPARE		0.00				SPARE	20	1	20	
	21	20	1	SPARE			0.00			SPARE	20	1	22	
	23	20	1	SPARE				0.00		SPARE	20	1	24	
	25			SPACE		0.00				SPACE			26	
	27			SPACE			0.00			SPACE			28	
	29			SPACE				0.00		SPACE			30	
				LOAD SUMMARY PER PHASE (KVA)		4.06	2.76	2.41						
				TOTAL CONNECTED LOAD (KVA)		9.22								

OPTIONS AND ACCESSORIES - (X) INDICATES SELECTION

[ ]	MULTIPLE SECTION PANEL	CONTACTOR CONTROLLED	[ ]
[ ]	RECESSED	FEED THRU LUGS	[ ]
[X]	SURFACE	SUB FEED MAIN LUGS (DOUBLE LUGS)	[ ]
[ ]	200% RATED NEUTRAL	CONTROLLABLE CIRCUIT BREAKER PANEL	[X]
[ ]	CONTROLLABLE CIRCUIT BREAKER	OTHER	[ ]

NOTES: 1. CONTROLLABLE BREAKER BY PHOTOCELL.
2. CONTROLLABLE BREAKER BY ROOFTOP PHOTOCELL.

circuiting calculations

Each circuit was recalculated based on the new lighting load. For a voltage of 277 on 20A circuits, recommended engineering practice designates 3.55 KVA per circuit. All three of the exterior circuits adhere to these guidelines.

Emergency Lighting Panel ELP-1-1			
Circuit #	Type	Quantity	KVA
9	M1	14	1.11
9	M2	7	.25
9	N1	16	.39
9	N4	9	.16
Total KVA			1.91

Normal Lighting Panel LP-1-1			
Circuit #	Type	Quantity	KVA
13	M2	7	.25
13	N1	16	.39
13	N2	24	.91
13	N3	52ft	.25
13	N4	9	.16
Total KVA			1.91
14	M1	14	1.11
14	Z1	15	.26
Total KVA			1.37

The redesigned panelboard schedule for Panels LP-1-1 and ESLP-1-1 are provided below with their corresponding panelboard sizing worksheets. Modified circuits are indicated with a pink box.

PANELBOARD SCHEDULE

VOLTAGE: 480Y/277V,3PH,4W
SIZE/TYPE BUS: 80A
SIZE/TYPE MAIN: 80A/3P C/B

PANEL TAG: LP-1-1
PANEL LOCATION: ELEC. SWTCHGR RM. 132
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: PROVIDE FEED THROUGH LUGS FOR PANELBOARD 1L1B

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
LINEAR UPLTS	LOBBY	1786	20A/1P	1	*			2	20A/1P	1701	LKR RMS	FLUORESCENT
LINEAR DWNLTS	LOBBY	1786	20A/1P	3		*		4	20A/1P	124	RETAIL	DWNLTS
OC SENSOR	1ST FL	2214	20A/1P	5			*	6	20A/1P	428	STOR 130	INDUSTRIAL
FLUORESCENT	SEC 110	276	20A/1P	7	*			8	20A/1P	361	ELEC 132	INDUSTRIAL
DWNLTS	CORR	2755	20A/1P	9		*		10	20A/1P	181	SHELL 122	INDUSTRIAL
INDUSTRIAL	CHILL 137	485	20A/1P	11			*	12	20A/1P	551	BLR 136	INDUSTRIAL
LED/CFL	EXTR	1853	20A/1P	13	*			14	20A/1P	1343	EXTR	POLES
SPARE	-	2375	20A/1P	15		*		16	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	17			*	18	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	19	*			20	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	21		*		22	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	23			*	24	20A/1P	2375	-	SPARE
SPACE	-	0	20A/1P	25	*			26	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	27		*		28	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	29			*	30	20A/1P	0	-	SPACE

CONNECTED LOAD (KW) - A Ph.	12.07	TOTAL DESIGN LOAD (KW)	49.49
CONNECTED LOAD (KW) - B Ph.	14.35	POWER FACTOR	0.95
CONNECTED LOAD (KW) - C Ph.	13.18	TOTAL DESIGN LOAD (AMPS)	63

PANELBOARD SIZING WORKSHEET

Panel Tag---------->	LP-1-1	Panel Location:	ELEC. SWTCHGR RM. 132
Nominal Phase to Neutral Voltage------->	277	Phase:	3
Nominal Phase to Phase Voltage-------->	480	Wires:	4

Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	LINEAR UPLTS	1	LOBBY	1.88	KVA	0.95	1786	1880	
2	A	FLUORESCENT	1	LKR RMS	1.79	KVA	0.95	1701	1790	
3	B	LINEAR DWNLTS	1	LOBBY	1.88	KVA	0.95	1786	1880	
4	B	DWNLTS	1	RETAIL	0.13	KVA	0.95	124	130	
5	C	OC SENSOR	1	1ST FL	2.33	KVA	0.95	2214	2330	
6	C	INDUSTRIAL	1	STOR 130	0.45	KVA	0.95	428	450	
7	A	FLUORESCENT	1	SEC 110	0.29	KVA	0.95	276	290	
8	A	INDUSTRIAL	1	ELEC 132	0.38	KVA	0.95	361	380	
9	B	DWNLTS	1	CORR	2.9	KVA	0.95	2755	2900	
10	B	INDUSTRIAL	1	SHELL 122	0.19	KVA	0.95	181	190	
11	C	INDUSTRIAL	1	CHILL 137	0.51	KVA	0.95	485	510	
12	C	INDUSTRIAL	1	BLR 136	0.58	KVA	0.95	551	580	
13	A	LED/CFL	1	EXTR	1.91	KVA	0.97	1853	1910	
14	A	POLES	1	EXTR	1.37	KVA	0.98	1343	1370	
15	B	SPARE	2		2.5	KVA	0.95	2375	2500	
16	B	SPARE	2		2.5	KVA	0.95	2375	2500	
17	C	SPARE	2		2.5	KVA	0.95	2375	2500	
18	C	SPARE	2		2.5	KVA	0.95	2375	2500	
19	A	SPARE	2		2.5	KVA	0.95	2375	2500	
20	A	SPARE	2		2.5	KVA	0.95	2375	2500	
21	B	SPARE	2		2.5	KVA	0.95	2375	2500	
22	B	SPARE	2		2.5	KVA	0.95	2375	2500	
23	C	SPARE	2		2.5	KVA	0.95	2375	2500	
24	C	SPARE	2		2.5	KVA	0.95	2375	2500	
25	A	SPACE	3		0	W	1.00	0	0	
26	A	SPACE	3		0	W	1.00	0	0	
27	B	SPACE	3		0	W	1.00	0	0	
28	B	SPACE	3		0	W	1.00	0	0	
29	C	SPACE	3		0	W	1.00	0	0	
30	C	SPACE	3		0	W	1.00	0	0	
PANEL TOTAL								39.6	41.6	Amps= 50.0

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					12.1	12.6	30%	15.2
PHASE TOTAL	B					14.3	15.1	36%	18.2
PHASE TOTAL	C					13.2	13.9	33%	16.7

LOAD CATEGORIES			Connected			Demand				Ver. 1.04
			kW	kVA	DF	kW	kVA	PF		
1	LIGHTING		15.8	16.6		15.8	16.6	0.95		
2	SPARE		23.8	25.0		23.8	25.0	0.95		
3	SPACE		0.0	0.0		0.0	0.0			
Total Demand Loads						39.6	41.6			
Spare Capacity			25%			9.9	10.4			
Total Design Loads						49.5	52.0	0.95	Amps=	62.6

PANELBOARD SCHEDULE

VOLTAGE: 480Y/277V,3PH,4W
SIZE/TYPE BUS: 60A
SIZE/TYPE MAIN: 60A/3P C/B

PANEL TAG: ESLP-1-1
PANEL LOCATION: EMER. GEN. RM. 133
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: PROVIDE FEED THROUGH LUGS FOR PANELBOARD 1L1B

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
FLUOR/EXIT SGNS	LOBBY	494	20A/1P	1	*			2	20A/1P	827	LOBBY	LINEAR UPLTS
FLUOR	STR, 102, 103	276	20A/1P	3		*		4	20A/1P	827	LOBBY	LINEAR DWNLTS
DWNLTS	CORR,108-10	1796	20A/1P	5			*	6	20A/1P	485	LKR/REST	FLUORESCENT
INDUSTRIAL	ELEC/MECH	1786	20A/1P	7	*			8	20A/1P	361	ELEC 132	INDUSTRIAL
INDUSTRIAL	SHELL 122	751	20A/1P	9		*		10	20A/1P	1853	EXTR	POLES
SPARE	-	1425	20A/1P	11			*	12	20A/1P	1425	-	SPARE
SPARE	-	1425	20A/1P	13	*			14	20A/1P	1425	-	SPARE
SPARE	-	1425	20A/1P	15		*		16	20A/1P	1425	-	SPARE
SPARE	-	1425	20A/1P	17			*	18	20A/1P	1425	-	SPARE
SPARE	-	1425	20A/1P	19	*			20	20A/1P	1425	-	SPARE
SPARE	-	1425	20A/1P	21		*		22	20A/1P	1425	-	SPARE
SPARE	-	1425	20A/1P	23			*	24	20A/1P	1425	-	SPARE
SPACE	-	0	20A/1P	25	*			26	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	27		*		28	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	29			*	30	20A/1P	0	-	SPACE

CONNECTED LOAD (KW) - A Ph.	9.17	TOTAL DESIGN LOAD (KW)	36.75
CONNECTED LOAD (KW) - B Ph.	9.41	POWER FACTOR	0.95
CONNECTED LOAD (KW) - C Ph.	10.83	TOTAL DESIGN LOAD (AMPS)	46

PANELBOARD SIZING WORKSHEET

Panel Tag---------->	ESLP-1-1	Panel Location:	EMER. GEN. RM. 133
Nominal Phase to Neutral Voltage------->	277	Phase:	3
Nominal Phase to Phase Voltage-------->	480	Wires:	4

Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	FLUOR/EXIT SGNS	1	LOBBY	0.52	KVA	0.95	494	520	
2	A	LINEAR UPLTS	1	LOBBY	0.87	KVA	0.95	827	870	
3	B	FLUOR	1	STR, 102, 103	0.29	KVA	0.95	276	290	
4	B	LINEAR DWNLTS	1	LOBBY	0.87	KVA	0.95	827	870	
5	C	DWNLTS	1	CORR,108-10	1.89	KVA	0.95	1796	1890	
6	C	FLUORESCENT	1	LKR/REST	0.51	KVA	0.95	485	510	
7	A	INDUSTRIAL	1	ELEC/MECH	1.88	KVA	0.95	1786	1880	
8	A	INDUSTRIAL	1	ELEC 132	0.38	KVA	0.95	361	380	
9	B	INDUSTRIAL	1	SHELL 122	0.79	KVA	0.95	751	790	
10	B	POLES	1	EXTR	1.91	KVA	0.97	1853	1910	
11	C	SPARE	1		1.5	KVA	0.95	1425	1500	
12	C	SPARE	1		1.5	KVA	0.95	1425	1500	
13	A	SPARE	1		1.5	KVA	0.95	1425	1500	
14	A	SPARE	1		1.5	KVA	0.95	1425	1500	
15	B	SPARE	2		1.5	KVA	0.95	1425	1500	
16	B	SPARE	2		1.5	KVA	0.95	1425	1500	
17	C	SPARE	2		1.5	KVA	0.95	1425	1500	
18	C	SPARE	2		1.5	KVA	0.95	1425	1500	
19	A	SPARE	2		1.5	KVA	0.95	1425	1500	
20	A	SPARE	2		1.5	KVA	0.95	1425	1500	
21	B	SPARE	2		1.5	KVA	0.95	1425	1500	
22	B	SPARE	2		1.5	KVA	0.95	1425	1500	

23	C	SPARE	2		1.5	KVA	0.95	1425	1500		
24	C	SPARE	2		1.5	KVA	0.95	1425	1500		
25	A	SPACE	3		0	W	1.00	0	0		
26	A	SPACE	3		0	W	1.00	0	0		
27	B	SPACE	3		0	W	1.00	0	0		
28	B	SPACE	3		0	W	1.00	0	0		
29	C	SPACE	3		0	W	1.00	0	0		
30	C	SPACE	3		0	W	1.00	0	0		
PANEL TOTAL								29.4	30.9	Amps=	37.2

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					9.2	9.7	31%	11.6
PHASE TOTAL	B					9.4	9.9	32%	11.9
PHASE TOTAL	C					10.8	11.4	37%	13.7

LOAD CATAGORIES			Connected			Demand				Ver. 1.04
			kW	kVA	DF	kW	kVA	PF		
1	LIGHTING		15.2	15.9		15.2	15.9	0.95		
2	SPARE		14.3	15.0		14.3	15.0	0.95		
3	SPACE		0.0	0.0		0.0	0.0			
Total Demand Loads						29.4	30.9			
Spare Capacity			25%			7.4	7.7			
Total Design Loads						36.8	38.6	0.95	Amps=	46.5

feeder sizing

LP-1-1	
Voltage	480Y/277
Design Load (KW)	49.5
Power Factor	0.95
Calculated Design Load (Amps)	63
Feeder Protection Size (Amps)	80
Sets	1
Wire Sizes	
Phase	6
Neutral	6
Ground	8
Conduit Size	1”

ESLP-1-1	
Voltage	480Y/277
Design Load (KW)	36.8
Power Factor	0.95
Calculated Design Load (Amps)	46
Feeder Protection Size (Amps)	60
Sets	1
Wire Sizes	
Phase	6
Neutral	6
Ground	10
Conduit Size	1”

voltage drop calculations

VOLTAGE DROP – LP-1-1	
Voltage (V)	480
Ampacity (I)	85
Power Factor (See Note 1)	.95
Wire Size (14,12,10 … 1/0, 2/0 … 250,350)	3
# of conductors per phase	1
Type Conductor (A=Aluminum C=Copper)	C
Type Conduit (P=PVC; A=Aluminum S=Steel)	S
Length of Run (ft)	172
Voltage Drop	***1.06***
% Drop	***0.22***

VOLTAGE DROP – ESLP-1-1	
Voltage (V)	480
Ampacity (I)	65
Power Factor (See Note 1)	.95
Wire Size (14,12,10 … 1/0, 2/0 … 250,350)	6
# of conductors per phase	1
Type Conductor (A=Aluminum C=Copper)	C
Type Conduit (P=PVC; A=Aluminum S=Steel)	S
Length of Run (ft)	39
Voltage Drop	***2.13***
% Drop	***0.44***

large work space | fitness center

lighting redesign

The primary goal of the lighting design in the fitness center is to expose the core energy of the building with the RGB LED component in the linear fixtures. This interactive element is fed directly by the cardio equipment kinetic generation system and does not affect the electrical redesign. The fluorescent ambient/task lighting is provided by a minimalist, clean linear fixture. Architectural wall features are highlighted by recessed LED square downlights, and the space is lit primarily with daylight for a majority of day.

electrical redesign

Both the emergency and normal lighting panels that serve the fitness center are 480Y/277V 3 phase 4 wire panels, with the emergency sized at 60A and the normal sized at 80A. The use of energy efficient fluorescent and LED lighting keeps the overall load on the panel relatively consistent, although the circuiting has been adjusted for photocell control.

controls

The façade of the Drexel Recreation Center is a product of an extensive energy study to maximize daylighting and minimize solar gain. Since the fenestration faces directly south, desired light levels are met solely with daylight for a majority of the day. The Wattstopper digital lighting management control system will be utilized in the space to enable dimming to 1%, providing energy savings throughout the year. Using natural daylight in place of electric light during the day will not only save energy and money, but will have positive psychological effects on occupants. Daylighting used as an overall ambient lighting for the workout space will increase overall energy levels and provide a more energetic and dynamic lighting system. The selected Focal Point luminaires have been specified to incorporate the available integrated daylight sensor compatible with the Wattstopper controls. The daylighting sensor will be calibrated using a sliding setpoint algorithm in order to maintain the desired minimum of 20fc on the workplane (measured at cardio machine standing level of 1.5') at all times.

A dynamic component of the lighting in the fitness center is an Osram-Sylvania LED light tape component integrated into each of the linear pendant fixtures. This lighting is not included in the calculations and is strictly an addition to the fluorescent lighting. Power for this component will use the ReRev system to harness kinetic energy generated by the cardio equipment in the space in the form of DC power. The LEDs will use the Osram Sylvania _____ power modulator to provide consistent voltage to the LED component in each luminaire. This blue strip will create a blue glow to visibly show from the exterior where the power is being generated within the space, and will not be daylight controlled.

Fitness Center Control Schedule			
Type	Manufacturer	Product	Description
LMLS-305	Wattstopper	LightSaver Photocell	Closed loop photosensor provides the daylight data necessary for operation.
LMRC-201	Wattstopper	LightSaver Room Dimming Controller	Provides automatic dimming control for fluorescent fixtures. Closed loop control utilizes a photocell for single-zone dimming.
LMSW-100	Wattstopper	LightSaver Wall Switches	Allows occupants to temporarily override the daylighting control systems.

panelboards

existing

Below are the existing panelboard schedules for 480Y/277V normal lighting panels LP-2-1 and LP-3-1 and 480Y/277V emergency lighting panel ESLP-3-1. LP-2-1 is located on the second floor of the DRC in Electrical Room 202, and ESLP-3-1 is located on the first floor in the Emergency Generator Room 133. Modified circuits are indicated with a purple box.

PANEL: LP-2-1 | VOLTAGE: 480/277V | [X] NEW / [ ] EXISTING
SECTION: 1 OF 1 | PHASE & WIRE: 3 PH, 4W
LOCATION: ELEC. ROOM 202, SECOND FLOOR | MAIN (AMPS): 60A, M.C.B. | KAIC RATING: 14 | POLES: 30

NOTES	CKT NO.	C.B. A	C.B. P	DESCRIPTION	LOAD (KVA)	A	B	C	LOAD (KVA)	DESCRIPTION	C.B. A	C.B. P	CKT NO.	NOTES
1	1	20	1	LTG- UPLTS RM 215A, C, 201A, B	3.33	4.13			0.79	LTG- CLIMBING ROOM	20	1	2	2
1	3	20	1	LTG- DNLTS RM 215A, C, 201A, B	3.33		4.73		1.40	LTG- STR, COR NOT ON PC	20	1	4	2
2	5	20	1	LTG- GROUP EXERCISE ROOMS	3.26			4.09	0.83	LTG- ATHL. GALL. COVE	20	1	6	1
	7	20	1	SPARE		1.09			1.09	LTG- ATHL. GALL. PNDNTS	20	1	8	1
2	9	20	1	LTG- GYMNASIUM - UNDER TRACK	1.98		1.98			SPARE	20	1	10	
	11	20	1	SPARE				0.00		SPARE	20	1	12	
	13	20	1	SPARE		0.00				SPARE	20	1	14	
	15	20	1	SPARE			0.00			SPARE	20	1	16	
	17	20	1	SPARE				0.00		SPARE	20	1	18	
	19	20	1	SPARE		0.00				SPARE	20	1	20	
	21	20	1	SPARE			0.00			SPARE	20	1	22	
	23	20	1	SPARE				0.00		SPARE	20	1	24	
	25			SPACE		0.00				SPACE			26	
	27			SPACE			0.00			SPACE			28	
	29			SPACE				0.00		SPACE			30	
				SECTION 1 LOAD SUMMARY PER PHASE (KVA)		5.22	6.72	4.09						
				TOTAL CONNECTED LOAD (KVA)		16.02								

OPTIONS AND ACCESSORIES - (X) INDICATES SELECTION

[X]	MULTIPLE SECTION PANEL	CONTACTOR CONTROLLED	[ ]
[ ]	RECESSED	FEED THRU LUGS	[ ]
[X]	SURFACE	SUB FEED MAIN LUGS (DOUBLE LUGS)	[ ]
[ ]	200% RATED NEUTRAL	CONTROLLABLE CIRCUIT BREAKER PANEL	[X]
		OTHER	[ ]

PANEL: LP-3-1
SECTION: 1 OF 1
LOCATION: ELEC.ROOM 302 THIRD FLOOR

VOLTAGE: 480/277V
PHASE & WIRE: 3 PH, 4W
MAIN (AMPS): 60A, M.C.B.

[X] NEW
[ ] EXISTING
KAIC RATING: 14
POLES: 30

NOTES	CKT NO.	C.B. A	C.B. P	DESCRIPTION	LOAD (KVA)	A	B	C	LOAD (KVA)	DESCRIPTION	C.B. A	C.B. P	CKT NO.	NOTES
1	1	20	1	LTG - FITNESS 301 UPLIGHTS	1.88	3.88			2.00	LTG - GYMNASIUM	20	1	2	2
1	3	20	1	LTG - FITNESS 301 DOWNLIGHTS	1.88		3.88		2.00	LTG - GYMNASIUM	20	1	4	2
1	5	20	1	LTG - OC SENSORS LEVEL 3	2.26			4.26	2.00	LTG - GYMNASIUM	20	1	6	2
2	7	20	1	LTG - LEVEL 3 GENERAL	0.50	2.50			2.00	LTG - GYMNASIUM	20	1	8	2
2	9	20	1	LTG - GYM UPPER TRACK	2.00		2.00			SPARE	20	1	10	
	11	20	1	SPARE				0.00		SPARE	20	1	12	
	13	20	1	SPARE		0.00				SPARE	20	1	14	
	15	20	1	SPARE			0.00			SPARE	20	1	16	
	17	20	1	SPARE				0.00		SPARE	20	1	18	
	19	20	1	SPARE		0.00				SPARE	20	1	20	
	21	20	1	SPARE			0.00			SPARE	20	1	22	
	23	20	1	SPARE				0.00		SPARE	20	1	24	
	25			SPACE		0.00				SPACE			26	
	27			SPACE			0.00			SPACE			28	
	29			SPACE				0.00		SPACE			30	
				LOAD SUMMARY PER PHASE (KVA)		6.38	5.88	4.26						
				TOTAL CONNECTED LOAD (KVA)		16.52								

OPTIONS AND ACCESSORIES - (X) INDICATES SELECTION

	[ ]	MULTIPLE SECTION PANEL	CONTACTOR CONTROLLED	[ ]
	[ ]	RECESSED	FEED THRU LUGS	[ ]
	[X]	SURFACE	SUB FEED MAIN LUGS (DOUBLE LUGS)	[ ]
	[ ]	200% RATED NEUTRAL	CONTROLLABLE CIRCUIT BREAKER PANEL	[X]
	[ ]	ISOLATED GROUND BUS	OTHER	[ ]
	[2]	CONTROLLABLE CIRCUIT BREAKER	CONTROLLABLE CB BY PHOTOCELL	[1]

PANEL: ESLP-3-1
SECTION: 1 OF 1
LOCATION: ELEC. ROOM 302 THIRD FLOOR

VOLTAGE: 480/277V
PHASE & WIRE: 3 PH, 4W
MAIN (AMPS): 60A, M.C.S.

[X] NEW
[ ] EXISTING
KAIC RATING: 14
POLES: 30

NOTES	CKT NO.	C.B. A	C.B. P	DESCRIPTION	LOAD (KVA)	A	B	C	LOAD (KVA)	DESCRIPTION	C.B. A	C.B. P	CKT NO.	NOTES
2	1	20	1	EMERG LTG - ATH GALL, FITNESS	2.00	4.00			2.00	EMERG LTG - FITNESS 201 UP LIGHTS	20	1	2	1
2	3	20	1	EMERG LTG - GYMNASIUM 212 - TRACK	2.00		4.00		2.00	EMERG LTG - FITNESS 201 DWN LIGHTS	20	1	4	1
	5	20	1	EMERG LTG - ELEC/IT/2ND & 3RD FLRS	2.00			3.00	1.00	EMERG LTG - FITNESS 301 UP LIGHTS	20	1	6	1
2	7	20	1	EMERG LTG - GYMNASIUM	1.00	2.00			1.00	EMERG LTG - FITNESS 301 DWN LIGHTS	20	1	8	1
2	9	20	1	EMERG LTG - GYMNASIUM	1.00		1.00			EMERG LTG - THIRD FLOOR	20	1	10	
2	11	20	1	EMERG LTG - GYMNASIUM	1.00			2.00	1.00	ROOF LIGHTING	20	1	12	3
2	13	20	1	EMERG LTG - GYMNASIUM	1.00	1.00				SPARE	20	1	14	
	15	20	1	SPARE			0.00			SPARE	20	1	16	
	17	20	1	SPARE				0.00		SPARE	20	1	18	
	19	20	1	SPARE		0.00				SPARE	20	1	20	
	21	20	1	SPARE			0.00			SPARE	20	1	22	
	23	20	1	SPARE				0.00		SPARE	20	1	24	
	25			SPACE		0.00				SPACE			26	
	27			SPACE			0.00			SPACE			28	
	29			SPACE				0.00		SPACE			30	
				LOAD SUMMARY PER PHASE (KVA)		7.00	5.00	5.00						
				TOTAL CONNECTED LOAD (KVA)		17.00								

OPTIONS AND ACCESSORIES - (X) INDICATES SELECTION

	[ ]	MULTIPLE SECTION PANEL	CONTACTOR CONTROLLED	[ ]
	[ ]	RECESSED	FEED THRU LUGS	[ ]
	[X]	SURFACE	SUB FEED MAIN LUGS (DOUBLE LUGS)	[ ]
	[ ]	200% RATED NEUTRAL	CONTROLLABLE CIRCUIT BREAKER PANEL	[X]
	[ ]	ISOLATED GROUND BUS	CONTROLLABLE CB BY ROOFTOP PHOTOCELL	[3]
	[2]	CONTROLLABLE CIRCUIT BREAKER	CONTROLLABLE CB BY PHOTOCELL	[1]

The redesigned panelboard schedule for Panels LP-2-1, LP-3-1 and ESLP-3-1 are provided below with their corresponding panelboard sizing worksheets. Modified circuits are indicated with a purple box.

Normal Lighting Panel LP-2-1			
Circuit #	Type	Quantity	KVA
1	P12	3	.611
1	P16	8	2.17
Total KVA			2.78
3	P12	9	1.83
3	P16	2	.54
Total KVA			2.38
7	A1	6	.23
7	P4	1	.07
7	P8	4	.54
7	P12	4	.81
7	P16	1	.27
Total KVA			2.53
9	C1	12	.44
9	P4	6	.41
Total KVA			.85

Normal Lighting Panel LP-3-1			
Circuit #	Type	Quantity	KVA
1	P12	3	.611
1	P16	8	2.17
Total KVA			2.78
3	P12	9	1.83
3	P16	2	.54
Total KVA			2.38
10	A1	6	.23
10	P4	1	.07
10	P8	4	.54
10	P12	4	.81
10	P16	1	.27
Total KVA			2.53
11	C1	12	.44
11	P4	6	.41
Total KVA			.85

Emergency Lighting Panel ELP-3-1			
Circuit #	Type	Quantity	KVA
2	P4	2	.14
2	P8	1	.14
2	P12	6	1.22
2	P16	2	.54
Total KVA			2.04
4	P4	2	.14
4	P8	1	.14
4	P12	6	1.22
4	P16	2	.54
Total KVA			2.04

PANELBOARD SCHEDULE

VOLTAGE: 480Y/277V,3PH,4W
SIZE/TYPE BUS: 80A
SIZE/TYPE MAIN: 80A/3P C/B

PANEL TAG: LP-2-1
PANEL LOCATION: ELEC. ROOM 202
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: PROVIDE FEED THROUGH LUGS FOR PANELBOARD 1L1B

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
LINEAR FLUOR	FITNESS 201	2641	20A/1P	1	*			2	20A/1P	751	CLIMBING	INDUCTION
LINEAR FLUOR	FITNESS 201	2261	20A/1P	3		*		4	20A/1P	1330	STR, CORR	FLUORESCENT
FLUORESCENT	GRP EXER	3097	20A/1P	5			*	6	20A/1P	789	ATHL GAL	LED/CFL
LINEAR FLUOR	FITNESS 201	1828	20A/1P	7	*			8	20A/1P	1036	ATHL GAL	HID
LED/FLUOR	FITNESS 201	775	20A/1P	9		*		10	20A/1P	2375	0	SPARE
SPARE	0	2375	20A/1P	11			*	12	20A/1P	2375	0	SPARE
SPARE	0	2375	20A/1P	13	*			14	20A/1P	2375	0	SPARE
SPARE	-	2375	20A/1P	15		*		16	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	17			*	18	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	19	*			20	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	21		*		22	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	23			*	24	20A/1P	2375	-	SPARE
SPACE	-	0	20A/1P	25	*			26	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	27		*		28	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	29			*	30	20A/1P	0	-	SPACE

CONNECTED LOAD (KW) - A Ph.	15.75	TOTAL DESIGN LOAD (KW)	62.66
CONNECTED LOAD (KW) - B Ph.	16.24	POWER FACTOR	0.95
CONNECTED LOAD (KW) - C Ph.	18.14	TOTAL DESIGN LOAD (AMPS)	79

PANELBOARD SIZING WORKSHEET

Panel Tag---------->	LP-2-1	Panel Location:	ELEC. ROOM 202
Nominal Phase to Neutral Voltage------->	277	Phase:	3
Nominal Phase to Phase Voltage-------->	480	Wires:	4

Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	LINEAR FLUOR	1	FITNESS 201	2.78	KVA	0.95	2641	2780	
2	A	INDUCTION	1	CLIMBING	0.79	KVA	0.95	751	790	
3	B	LINEAR FLUOR	1	FITNESS 201	2.38	KVA	0.95	2261	2380	
4	B	FLUORESCENT	1	STR, CORR	1.4	KVA	0.95	1330	1400	
5	C	FLUORESCENT	1	GRP EXER	3.26	KVA	0.95	3097	3260	
6	C	LED/CFL	1	ATHL GAL	0.83	KVA	0.95	789	830	
7	A	LINEAR FLUOR	1	FITNESS 201	1.924	KVA	0.95	1828	1924	
8	A	HID	1	ATHL GAL	1.09	KVA	0.95	1036	1090	
9	B	LED/FLUOR	1	FITNESS 201	0.816	KVA	0.95	775	816	
10	B	SPARE	2		2.5	KVA	0.95	2375	2500	
11	C	SPARE	2		2.5	KVA	0.95	2375	2500	
12	C	SPARE	2		2.5	KVA	0.95	2375	2500	
13	A	SPARE	2		2.5	KVA	0.95	2375	2500	
14	A	SPARE	2		2.5	KVA	0.95	2375	2500	
15	B	SPARE	2		2.5	KVA	0.95	2375	2500	
16	B	SPARE	2		2.5	KVA	0.95	2375	2500	
17	C	SPARE	2		2.5	KVA	0.95	2375	2500	
18	C	SPARE	2		2.5	KVA	0.95	2375	2500	
19	A	SPARE	2		2.5	KVA	0.95	2375	2500	

20	A	SPARE	2		2.5	KVA	0.95	2375	2500	
21	B	SPARE	2		2.5	KVA	0.95	2375	2500	
22	B	SPARE	2		2.5	KVA	0.95	2375	2500	
23	C	SPARE	2		2.5	KVA	0.95	2375	2500	
24	C	SPARE	2		2.5	KVA	0.95	2375	2500	
25	A	SPACE	3		0	W	1.00	0	0	
26	A	SPACE	3		0	W	1.00	0	0	
27	B	SPACE	3		0	W	1.00	0	0	
28	B	SPACE	3		0	W	1.00	0	0	
29	C	SPACE	3		0	W	1.00	0	0	
30	C	SPACE	3		0	W	1.00	0	0	
PANEL TOTAL								50.1	52.8	Amps= 63.5

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					15.8	16.6	31%	20.0
PHASE TOTAL	B					16.2	17.1	32%	20.6
PHASE TOTAL	C					18.1	19.1	36%	23.0

LOAD CATEGORIES		Connected			Demand				Ver. 1.04
		kW	kVA	DF	kW	kVA	PF		
1	LIGHTING	14.5	15.3		14.5	15.3	0.95		
2	SPARE	35.6	37.5		35.6	37.5	0.95		
3	SPACE	0.0	0.0		0.0	0.0			
Total Demand Loads					50.1	52.8			
Spare Capacity		25%			12.5	13.2			
Total Design Loads					62.7	66.0	0.95	Amps=	79.4

PANELBOARD SCHEDULE

VOLTAGE: 480Y/277V,3PH,4W
SIZE/TYPE BUS: 80A
SIZE/TYPE MAIN: 80A/3P C/B

PANEL TAG: LP-3-1
PANEL LOCATION: ELEC. ROOM 302
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: PROVIDE FEED THROUGH LUGS FOR PANELBOARD 1L1B

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
LINEAR FLUOR	FITNESS 201	2641	20A/1P	1	*			2	20A/1P	1900	GYMNASIUM	CFL
LINEAR FLUOR	FITNESS 201	2261	20A/1P	3		*		4	20A/1P	1900	GYMNASIUM	CFL
OCC SENSOR	LEVEL 3	3097	20A/1P	5			*	6	20A/1P	1900	GYMNASIUM	CFL
FLUORESCENT	LEVEL 3	475	20A/1P	7	*			8	20A/1P	1900	GYMNASIUM	CFL
CFL DOWN	GYM TRACK	1900	20A/1P	9		*		10	20A/1P	2404	FITNESS 201	FLUORESCENT
LED/FLUOR	FITNESS 201	760	20A/1P	11			*	12	20A/1P	2375	0	SPARE
SPARE	0	2375	20A/1P	13	*			14	20A/1P	2375	0	SPARE
SPARE	-	2375	20A/1P	15		*		16	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	17			*	18	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	19	*			20	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	21		*		22	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	23			*	24	20A/1P	2375	-	SPARE
SPACE	-	0	20A/1P	25	*			26	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	27		*		28	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	29			*	30	20A/1P	0	-	SPACE

CONNECTED LOAD (KW) - A Ph.	16.42	TOTAL DESIGN LOAD (KW)	65.02
CONNECTED LOAD (KW) - B Ph.	17.96	POWER FACTOR	0.95
CONNECTED LOAD (KW) - C Ph.	17.63	TOTAL DESIGN LOAD (AMPS)	82

PANELBOARD SIZING WORKSHEET

Panel Tag---------->	LP-3-1	Panel Location:	ELEC. ROOM 302		
Nominal Phase to Neutral Voltage------->	277	Phase:	3		
Nominal Phase to Phase Voltage-------->	480	Wires:	4		

Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	LINEAR FLUOR	1	FITNESS 201	2.78	KVA	0.95	2641	2780	
2	A	CFL	1	GYMNASIUM	2	KVA	0.95	1900	2000	
3	B	LINEAR FLUOR	1	FITNESS 201	2.38	KVA	0.95	2261	2380	
4	B	CFL	1	GYMNASIUM	2	KVA	0.95	1900	2000	
5	C	OCC SENSOR	1	LEVEL 3	3.26	KVA	0.95	3097	3260	
6	C	CFL	1	GYMNASIUM	2	KVA	0.95	1900	2000	
7	A	FLUORESCENT	1	LEVEL 3	0.5	KVA	0.95	475	500	
8	A	CFL	1	GYMNASIUM	2	KVA	0.95	1900	2000	
9	B	CFL DOWN	1	GYM TRACK	2	KVA	0.95	1900	2000	
10	B	FLUORESCENT	1	FITNESS 201	2.53	KVA	0.95	2404	2530	
11	C	LED/FLUOR	1	FITNESS 201	0.8	KVA	0.95	760	800	
12	C	SPARE	2		2.5	KVA	0.95	2375	2500	
13	A	SPARE	2		2.5	KVA	0.95	2375	2500	
14	A	SPARE	2		2.5	KVA	0.95	2375	2500	
15	B	SPARE	2		2.5	KVA	0.95	2375	2500	
16	B	SPARE	2		2.5	KVA	0.95	2375	2500	
17	C	SPARE	2		2.5	KVA	0.95	2375	2500	
18	C	SPARE	2		2.5	KVA	0.95	2375	2500	
19	A	SPARE	2		2.5	KVA	0.95	2375	2500	
20	A	SPARE	2		2.5	KVA	0.95	2375	2500	
21	B	SPARE	2		2.5	KVA	0.95	2375	2500	
22	B	SPARE	2		2.5	KVA	0.95	2375	2500	
23	C	SPARE	2		2.5	KVA	0.95	2375	2500	
24	C	SPARE	2		2.5	KVA	0.95	2375	2500	
25	A	SPACE	3		0	W	1.00	0	0	
26	A	SPACE	3		0	W	1.00	0	0	
27	B	SPACE	3		0	W	1.00	0	0	
28	B	SPACE	3		0	W	1.00	0	0	
29	C	SPACE	3		0	W	1.00	0	0	
30	C	SPACE	3		0	W	1.00	0	0	
PANEL TOTAL								52.0	54.8	Amps= 65.9

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					16.4	17.3	32%	20.8
PHASE TOTAL	B					18.0	18.9	35%	22.8
PHASE TOTAL	C					17.6	18.6	34%	22.3

LOAD CATEGORIES			Connected			Demand				Ver. 1.04
			kW	kVA	DF	kW	kVA	PF		
1	LIGHTING		21.1	22.3		21.1	22.3	0.95		
2	SPARE		30.9	32.5		30.9	32.5	0.95		
3	SPACE		0.0	0.0		0.0	0.0			
Total Demand Loads						52.0	54.8			
Spare Capacity			25%			13.0	13.7			
Total Design Loads						65.0	68.4	0.95	Amps=	82.4

PANELBOARD SCHEDULE

VOLTAGE: 480Y/277V,3PH,4W
SIZE/TYPE BUS: 80A
SIZE/TYPE MAIN: 80A/3P C/B

PANEL TAG: ESLP-3-1
PANEL LOCATION: ELEC. ROOM 302
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS: PROVIDE FEED THROUGH LUGS FOR PANELBOARD 1L1B

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
FLUORESCENT	ATHL GALL	1900	20A/1P	1	*			2	20A/1P	1938	FITNESS 201	LINEAR FLUOR
CFL	GYM TRACK	1900	20A/1P	3		*		4	20A/1P	1938	FITNESS 201	LINEAR FLUOR
INDUSTRIAL	ELEC RMS	3097	20A/1P	5			*	6	20A/1P	2375		SPARE
CFL	GYMNASIUM	950	20A/1P	7	*			8	20A/1P	2375		SPARE
CFL	GYMNASIUM	950	20A/1P	9		*		10	20A/1P	475	LEVEL 3	FLUORESCENT
CFL	GYMNASIUM	950	20A/1P	11			*	12	20A/1P	950	ROOF	EXTERIOR
CFL	GYMNASIUM	950	20A/1P	13	*			14	20A/1P	2375	0	SPARE
SPARE	-	2375	20A/1P	15		*		16	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	17			*	18	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	19	*			20	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	21		*		22	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	23			*	24	20A/1P	2375	-	SPARE
SPACE	-	0	20A/1P	25	*			26	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	27		*		28	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	29			*	30	20A/1P	0	-	SPACE

CONNECTED LOAD (KW) - A Ph.	15.24	TOTAL DESIGN LOAD (KW)	58.59
CONNECTED LOAD (KW) - B Ph.	14.76	POWER FACTOR	0.95
CONNECTED LOAD (KW) - C Ph.	16.87	TOTAL DESIGN LOAD (AMPS)	74

PANELBOARD SIZING WORKSHEET

Panel Tag---------->	ESLP-3-1	Panel Location:	ELEC. ROOM 302	
Nominal Phase to Neutral Voltage------->	277	Phase:	3	
Nominal Phase to Phase Voltage-------->	480	Wires:	4	

Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	FLUORESCENT	1	ATHL GALL	2	KVA	0.95	1900	2000	
2	A	LINEAR FLUOR	1	FITNESS 201	2.04	KVA	0.95	1938	2040	
3	B	CFL	1	GYM TRACK	2	KVA	0.95	1900	2000	
4	B	LINEAR FLUOR	1	FITNESS 201	2.04	KVA	0.95	1938	2040	
5	C	INDUSTRIAL	1	ELEC RMS	3.26	KVA	0.95	3097	3260	
6	C	SPARE	2		2.5	KVA	0.95	2375	2500	
7	A	CFL	1	GYMNASIUM	1	KVA	0.95	950	1000	
8	A	SPARE	2		2.5	KVA	0.95	2375	2500	
9	B	CFL	1	GYMNASIUM	1	KVA	0.95	950	1000	
10	B	FLUORESCENT	1	LEVEL 3	0.5	KVA	0.95	475	500	
11	C	CFL	1	GYMNASIUM	1	KVA	0.95	950	1000	
12	C	EXTERIOR	1	ROOF	1	KVA	0.95	950	1000	
13	A	CFL	1	GYMNASIUM	1	KVA	0.95	950	1000	
14	A	SPARE	2		2.5	KVA	0.95	2375	2500	
15	B	SPARE	2		2.5	KVA	0.95	2375	2500	
16	B	SPARE	2		2.5	KVA	0.95	2375	2500	
17	C	SPARE	2		2.5	KVA	0.95	2375	2500	
18	C	SPARE	2		2.5	KVA	0.95	2375	2500	
19	A	SPARE	2		2.5	KVA	0.95	2375	2500	
20	A	SPARE	2		2.5	KVA	0.95	2375	2500	
21	B	SPARE	2		2.5	KVA	0.95	2375	2500	
22	B	SPARE	2		2.5	KVA	0.95	2375	2500	
23	C	SPARE	2		2.5	KVA	0.95	2375	2500	
24	C	SPARE	2		2.5	KVA	0.95	2375	2500	
25	A	SPACE	3		0	W	1.00	0	0	

26	A	SPACE	3		0	W	1.00	0	0		
27	B	SPACE	3		0	W	1.00	0	0		
28	B	SPACE	3		0	W	1.00	0	0		
29	C	SPACE	3		0	W	1.00	0	0		
30	C	SPACE	3		0	W	1.00	0	0		
PANEL TOTAL								46.9	49.3	Amps=	59.4

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					15.2	16.0	33%	19.3
PHASE TOTAL	B					14.8	15.5	31%	18.7
PHASE TOTAL	C					16.9	17.8	36%	21.4

LOAD CATEGORIES			Connected			Demand				Ver. 1.04
			kW	kVA	DF	kW	kVA	PF		
1	LIGHTING		16.0	16.8		16.0	16.8	0.95		
2	SPARE		30.9	32.5		30.9	32.5	0.95		
3	SPACE		0.0	0.0		0.0	0.0			
Total Demand Loads						46.9	49.3			
Spare Capacity			25%			11.7	12.3			
Total Design Loads						58.6	61.7	0.95	Amps=	74.2

feeder sizing

LP-2-1	
Voltage	480Y/277
Design Load (KW)	62.1
Power Factor	0.95
Calculated Design Load (Amps)	79
Feeder Protection Size (Amps)	80
Sets	1
Wire Sizes	
Phase	4
Neutral	4
Ground	8
Conduit Size	1 1/4”

LP-3-1	
Voltage	480Y/277
Design Load (KW)	74.2
Power Factor	0.95
Calculated Design Load (Amps)	94
Feeder Protection Size (Amps)	100
Sets	1
Wire Sizes	
Phase	3
Neutral	3
Ground	8
Conduit Size	1 1/4”

ESLP-3-1	
Voltage	480Y/277
Design Load (KW)	58.6
Power Factor	0.95
Calculated Design Load (Amps)	74
Feeder Protection Size (Amps)	80
Sets	1
Wire Sizes	
Phase	4
Neutral	4
Ground	8
Conduit Size	1 1/4”

voltage drop calculations

VOLTAGE DROP – LP-2-1	
Voltage (V)	480
Ampacity (I)	85
Power Factor (See Note 1)	.95
Wire Size (14,12,10 … 1/0, 2/0 … 250,350)	4
# of conductors per phase	1
Type Conductor (A=Aluminum C=Copper)	C
Type Conduit (P=PVC; A=Aluminum S=Steel)	S
Length of Run (ft)	158
Voltage Drop	***7.29***
% Drop	***1.52***

VOLTAGE DROP – LP-3-1	
Voltage (V)	480
Ampacity (I)	85
Power Factor (See Note 1)	.95
Wire Size (14,12,10 … 1/0, 2/0 … 250,350)	3
# of conductors per phase	1
Type Conductor (A=Aluminum C=Copper)	C
Type Conduit (P=PVC; A=Aluminum S=Steel)	S
Length of Run (ft)	172
Voltage Drop	***7.62***
% Drop	***1.59***

VOLTAGE DROP – ESLP-3-1	
Voltage (V)	480
Ampacity (I)	85
Power Factor (See Note 1)	.95
Wire Size (14,12,10 … 1/0, 2/0 … 250,350)	3
# of conductors per phase	1
Type Conductor (A=Aluminum C=Copper)	C
Type Conduit (P=PVC; A=Aluminum S=Steel)	S
Length of Run (ft)	172
Voltage Drop	***7.47***
% Drop	***1.56***

circulation space | lobby

lighting redesign

The lobby typically provides the initial and final impression of the Rec Center, and the lighting needs to orient someone both to the circulation within the space as well as the feel and aesthetics of the building itself. The task and ambient light levels are provided by an apparently random but intentionally spaced surface mounted LED downlight array. To counteract the closing effect of the downlights, custom LED luminaire fixtures are provided to bring visual interest and the appearance of a bright open ceiling while reinforcing the height of the space. The security desk is lit by the linear fluorescent "flying surface" luminaire to keep continuity through the space while providing the necessary light levels for facial recognition and task performance. Orientational wall features are highlighted by recessed LED square downlights, and the space is lit primarily with daylight for a majority of day.

electrical redesign

Both the emergency and normal lighting panels that serve the fitness center are 480Y/277V 3 phase 4 wire panels, with the emergency sized at 60A and the normal sized at 80A. The replacement of linear fluorescent with even more energy efficient LED lighting to provide the ambient lighting to the space greatly lowers the lighting load on the panels.

controls

The façade of the Drexel Recreation Center is a product of an extensive energy study to maximize daylighting and minimize solar gain. The lobby is the daylighting feature space of the rec center, and so is provided with consistent levels of daylight throughout the day, especially given the low lighting level requirement of 10fc. For a more consistent lighting level and in order to minimize possible issues involved with dimming the LEDs, the Wattstopper switching control system will be used on the LEDs, with dimming taking place only over the security desk. The daylighting sensor will be calibrated in order to maintain the desired minimum of 10fc on the ground at all times.

Fitness Center Control Schedule

Type	Manufacturer	Product	Description
LC-100	Wattstopper	Intelligent Power Pack	Power pack delivers 0-10V dimming control to lighting loads.
LMLS-305	Wattstopper	LightSaver Photocell	Closed loop photosensor provides the daylight data necessary for operation.
LMRC-201	Wattstopper	LightSaver Room Dimming Controller	Provides automatic dimming control for fluorescent fixtures. Closed loop control utilizes a photocell for single-zone dimming.
LMSW-100	Wattstopper	LightSaver Wall Switches	Allows occupants to temporarily override the daylighting control systems.

panelboards

existing

Below are the existing panelboard schedules for 480Y/277V normal lighting panel LP-1-1 and 480Y/277V emergency lighting panel ESLP-1-1. LP-1-1 is located on the first floor of the DRC in Electrical Switchgear Room 132, and ESLP-1-1 is located on the first floor in the Emergency Generator Room 133. Modified circuits are indicated with an aqua box.

PANEL: LP-1-1 | VOLTAGE: 480/277V | [X] NEW
SECTION: 1 OF 1 | PHASE & WIRE: 3 PH, 4W | [ ] EXISTING
LOCATION: ELEC. SWITCHGEAR ROOM 132 FIRST FLOOR | MAIN (AMPS): 60A, M.C.B. | KAIC RATING: 35
POLES: 30

NOTES	CKT NO.	C.B. A	C.B. P	DESCRIPTION	LOAD (KVA)	A	B	C	LOAD (KVA)	DESCRIPTION	C.B. A	C.B. P	CKT NO.	NOTES
2	1	20	1	LTG - LOBBY 100 UPLIGHTS	1.88	3.67			1.79	LTG - LOCKER ROOMS	20	1	2	1
2	3	20	1	LTG - LOBBY 100 DOWNLIGHTS	1.88		2.01		0.13	LTG - RETAIL CAFÉ 104	20	1	4	1
	5	20	1	LTG - OC SENSORS	2.33			2.77	0.45	LTG - GEN. STORAGE 130	20	1	6	1
1	7	20	1	LTG - SECURITY RM 110	0.29	0.68			0.38	LTG - ELEC. RM 132	20	1	8	1
1	9	20	1	LTG - COR 111, 112, RM 108, 120	2.90		3.09		0.19	LTG - SHELL SPACE 122/SQ CT	20	1	10	1
1	11	20	1	LTG - FUT. CHILLER RM 137	0.51			1.09	0.58	LTG - BOILER RM 136	20	1	12	1
3	13	20	1	LTG - EXTERIOR BENCHES	1.00	2.50			1.50	LTG - SITE	20	1	14	3
	15	20	1	SPARE			0.00			SPARE	20	1	16	
	17	20	1	SPARE				0.00		SPARE	20	1	18	
	19	20	1	SPARE		0.00				SPARE	20	1	20	
	21	20	1	SPARE			0.00			SPARE	20	1	22	
	23	20	1	SPARE				0.00		SPARE	20	1	24	
	25			SPACE		0.00				SPACE			26	
	27			SPACE			0.00			SPACE			28	
	29			SPACE				0.00		SPACE			30	
				LOAD SUMMARY PER PHASE (KVA)		6.85	5.10	3.86						
				TOTAL CONNECTED LOAD (KVA)		15.81								

OPTIONS AND ACCESSORIES - (X) INDICATES SELECTION

	[ ]	MULTIPLE SECTION PANEL	CONTACTOR CONTROLLED [ ]	
	[ ]	RECESSED	FEED THRU LUGS [ ]	
	[X]	SURFACE	SUB FEED MAIN LUGS (DOUBLE LUGS) [ ]	
	[ ]	200% RATED NEUTRAL	CONTROLLABLE CIRCUIT BREAKER PANEL [X]	
	[ ]	ISOLATED GROUND BUS	OTHER [ ]	

NOTES: 1. CONTROLLABLE BREAKER
2. CONTROLLABLE BREAKER CONTROLLED BY PHOTOCELL
3. CONTROLLABLE BREAKER CONTROLLED BY ROOF TOP PHOTOCELL

PANEL: ESLP-1-1 | VOLTAGE: 480/277V | [X] NEW
SECTION: 1 OF 1 | PHASE & WIRE: 3 PH, 4W | [ ] EXISTING
LOCATION: EMERGENCY GENERATOR ROOM 133 FIRST FLOOR | MAIN (AMPS): 60A, M.L.O. | KAIC RATING: 35
POLES: 30

NOTES	CKT NO.	C.B. A	C.B. P	DESCRIPTION	LOAD (KVA)	A	B	C	LOAD (KVA)	DESCRIPTION	C.B. A	C.B. P	CKT NO.	NOTES
	1	20	1	EMR, LTG- LOB 100 EXT SNS	0.52	1.39			0.87	EMR LTG- LOBBY 100 UPLGHTS	20	1	2	2
	3	20	1	EMR, LTG- STR S3, RM 102, 103	0.29		1.16		0.87	EMR LTG- LOBBY 100 DWNLGHTS	20	1	4	2
	5	20	1	EMR, LTG- CORR, RM 108-110, 122	1.89			2.41	0.51	EMR LTG- LKR RM, BTHRMS	20	1	6	
	7	20	1	EMR, LTG- ELEC/MECH RMS	1.88	2.66			0.79	EMR LTG- SHELL SPACE	20	1	8	
1	9	20	1	EMR, LTG- EXTERIOR	1.60		1.60			SPARE	20	1	10	
	11	20	1	SPARE				0.00		SPARE	20	1	12	
	13	20	1	SPARE		0.00				SPARE	20	1	14	
	15	20	1	SPARE			0.00			SPARE	20	1	16	
	17	20	1	SPARE				0.00		SPARE	20	1	18	
	19	20	1	SPARE		0.00				SPARE	20	1	20	
	21	20	1	SPARE			0.00			SPARE	20	1	22	
	23	20	1	SPARE				0.00		SPARE	20	1	24	
	25			SPACE		0.00				SPACE			26	
	27			SPACE			0.00			SPACE			28	
	29			SPACE				0.00		SPACE			30	
				LOAD SUMMARY PER PHASE (KVA)		4.06	2.76	2.41						
				TOTAL CONNECTED LOAD (KVA)		9.22								

OPTIONS AND ACCESSORIES - (X) INDICATES SELECTION

	[ ]	MULTIPLE SECTION PANEL	CONTACTOR CONTROLLED [ ]	
	[ ]	RECESSED	FEED THRU LUGS [ ]	
	[X]	SURFACE	SUB FEED MAIN LUGS (DOUBLE LUGS) [ ]	
	[ ]	200% RATED NEUTRAL	CONTROLLABLE CIRCUIT BREAKER PANEL [X]	
	[ ]	CONTROLLABLE CIRCUIT BREAKER	OTHER [ ]	

NOTES: 1. CONTROLLABLE BREAKER BY PHOTOCELL,
2. CONTROLLABLE BREAKER BY ROOFTOP PHOTOCELL.

circuiting calculations

Each circuit was recalculated based on the new lighting load. For a voltage of 277 on 20A circuits, recommended engineering practice designates 3.55 KVA per circuit. All three of the lobby circuits adhere to these guidelines.

Emergency Lighting Panel ELP-1-1			
Circuit #	Type	Quantity	KVA
2	C2	22	.35
4	C2	22	.35
Total KVA			.694

Normal Lighting Panel LP-1-1			
Circuit #	Type	Quantity	KVA
1	C2	120	.25
Total KVA			1.89
3	C1	8	.29
3	C2	27	.43
3	S1	6	.65
Total KVA			1.37
4	J2	73	.81
Total KVA			.81

The redesigned panelboard schedule for Panels LP-1-1 and ESLP-1-1 are provided below with their corresponding panelboard sizing worksheets. Modified circuits are indicated with an aqua box.

PANELBOARD SCHEDULE

VOLTAGE: 480Y/277V,3PH,4W | PANEL TAG: LP-1-1 | MIN. C/B AIC: 10K
SIZE/TYPE BUS: 80A | PANEL LOCATION: ELEC. SWTCHGR RM. 132 | OPTIONS:
SIZE/TYPE MAIN: 80A/3P C/B | PANEL MOUNTING: SURFACE

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
LED	LOBBY	1796	20A/1P	1	*			2	20A/1P	1701	LKR RMS	FLUORESCENT
LED/FL PERIMETER	LOBBY	1302	20A/1P	3		*		4	20A/1P	770	LOBBY	DECORATIVE LED
OC SENSOR	1ST FL	2214	20A/1P	5			*	6	20A/1P	428	STOR 130	INDUSTRIAL
FLUORESCENT	SEC 110	276	20A/1P	7	*			8	20A/1P	361	ELEC 132	INDUSTRIAL
DWNLTS	CORR	2755	20A/1P	9		*		10	20A/1P	181	SHELL 122	INDUSTRIAL
INDUSTRIAL	CHILL 137	485	20A/1P	11			*	12	20A/1P	551	BLR 136	INDUSTRIAL
LED/CFL	EXTR	1853	20A/1P	13	*			14	20A/1P	1343	EXTR	POLES
SPARE	-	2375	20A/1P	15		*		16	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	17			*	18	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	19	*			20	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	21		*		22	20A/1P	2375	-	SPARE
SPARE	-	2375	20A/1P	23			*	24	20A/1P	2375	-	SPARE
SPACE	-	0	20A/1P	25	*			26	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	27		*		28	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	29			*	30	20A/1P	0	-	SPACE

CONNECTED LOAD (KW) - A Ph.	12.08	TOTAL DESIGN LOAD (KW)	49.70
CONNECTED LOAD (KW) - B Ph.	14.51	POWER FACTOR	0.95
CONNECTED LOAD (KW) - C Ph.	13.18	TOTAL DESIGN LOAD (AMPS)	63

PANELBOARD SIZING WORKSHEET

Panel Tag---------->	LP-1-1	Panel Location:	ELEC. SWTCHGR RM. 132
Nominal Phase to Neutral Voltage------->	277	Phase:	3
Nominal Phase to Phase Voltage-------->	480	Wires:	4

Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	LED DWNLTS	1	LOBBY	1.89	KVA	0.95	1796	1890	
2	A	FLUORESCENT	1	LKR RMS	1.79	KVA	0.95	1701	1790	
3	B	LED/FL PERIMETER	1	LOBBY	1.37	KVA	0.95	1302	1370	
4	B	DECORATIVE LED	1	LOBBY	0.81	KVA	0.95	770	810	
5	C	OC SENSOR	1	1ST FL	2.33	KVA	0.95	2214	2330	
6	C	INDUSTRIAL	1	STOR 130	0.45	KVA	0.95	428	450	
7	A	FLUORESCENT	1	SEC 110	0.29	KVA	0.95	276	290	
8	A	INDUSTRIAL	1	ELEC 132	0.38	KVA	0.95	361	380	
9	B	DWNLTS	1	CORR	2.9	KVA	0.95	2755	2900	
10	B	INDUSTRIAL	1	SHELL 122	0.19	KVA	0.95	181	190	
11	C	INDUSTRIAL	1	CHILL 137	0.51	KVA	0.95	485	510	
12	C	INDUSTRIAL	1	BLR 136	0.58	KVA	0.95	551	580	
13	A	LED/CFL	1	EXTR	1.91	KVA	0.97	1853	1910	
14	A	POLES	1	EXTR	1.37	KVA	0.98	1343	1370	
15	B	SPARE	2		2.5	KVA	0.95	2375	2500	
16	B	SPARE	2		2.5	KVA	0.95	2375	2500	
17	C	SPARE	2		2.5	KVA	0.95	2375	2500	
18	C	SPARE	2		2.5	KVA	0.95	2375	2500	
19	A	SPARE	2		2.5	KVA	0.95	2375	2500	
20	A	SPARE	2		2.5	KVA	0.95	2375	2500	
21	B	SPARE	2		2.5	KVA	0.95	2375	2500	
22	B	SPARE	2		2.5	KVA	0.95	2375	2500	
23	C	SPARE	2		2.5	KVA	0.95	2375	2500	
24	C	SPARE	2		2.5	KVA	0.95	2375	2500	
25	A	SPACE	3		0	W	1.00	0	0	
26	A	SPACE	3		0	W	1.00	0	0	
27	B	SPACE	3		0	W	1.00	0	0	
28	B	SPACE	3		0	W	1.00	0	0	
29	C	SPACE	3		0	W	1.00	0	0	
30	C	SPACE	3		0	W	1.00	0	0	
PANEL TOTAL								39.8	41.8	Amps= 50.3

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					12.1	12.6	30%	15.2
PHASE TOTAL	B					14.5	15.3	37%	18.4
PHASE TOTAL	C					13.2	13.9	33%	16.7

LOAD CATEGORIES			Connected			Demand				Ver. 1.04
			kW	kVA	DF	kW	kVA	PF		
1	LIGHTING		16.0	16.8		16.0	16.8	0.95		
2	SPARE		23.8	25.0		23.8	25.0	0.95		
3	SPACE		0.0	0.0		0.0	0.0			
Total Demand Loads						39.8	41.8			
Spare Capacity			25%			9.9	10.4			
Total Design Loads						49.7	52.2	0.95	Amps=	62.8

PANELBOARD SCHEDULE

VOLTAGE: 480Y/277V,3PH,4W
SIZE/TYPE BUS: 60A
SIZE/TYPE MAIN: 60A/3P C/B

PANEL TAG: ESLP-1-1
PANEL LOCATION: EMER. GEN. RM. 133
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
FLUOR/EXIT SGNS	LOBBY	494	20A/1P	1	*			2	20A/1P	333	LOBBY	LED DWNLTS
FLUOR	STR, 102, 103	276	20A/1P	3		*		4	20A/1P	333	LOBBY	LED DWNLTS
DWNLTS	CORR,108-10	1796	20A/1P	5			*	6	20A/1P	485	LKR/REST	FLUORESCENT
INDUSTRIAL	ELEC/MECH	1786	20A/1P	7	*			8	20A/1P	361	ELEC 132	INDUSTRIAL
INDUSTRIAL	SHELL 122	751	20A/1P	9		*		10	20A/1P	1853	EXTR	POLES
SPARE	-	1425	20A/1P	11			*	12	20A/1P	1425	-	SPARE
SPARE	-	1425	20A/1P	13	*			14	20A/1P	1425	-	SPARE
SPARE	-	1425	20A/1P	15		*		16	20A/1P	1425	-	SPARE
SPARE	-	1425	20A/1P	17			*	18	20A/1P	1425	-	SPARE
SPARE	-	1425	20A/1P	19	*			20	20A/1P	1425	-	SPARE
SPARE	-	1425	20A/1P	21		*		22	20A/1P	1425	-	SPARE
SPARE	-	1425	20A/1P	23			*	24	20A/1P	1425	-	SPARE
SPACE	-	0	20A/1P	25	*			26	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	27		*		28	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	29			*	30	20A/1P	0	-	SPACE

CONNECTED LOAD (KW) - A Ph.	8.67	TOTAL DESIGN LOAD (KW)	35.52
CONNECTED LOAD (KW) - B Ph.	8.91	POWER FACTOR	0.95
CONNECTED LOAD (KW) - C Ph.	10.83	TOTAL DESIGN LOAD (AMPS)	45

PANELBOARD SIZING WORKSHEET

Panel Tag---------->	ESLP-1-1	Panel Location:	EMER. GEN. RM. 133
Nominal Phase to Neutral Voltage------->	277	Phase:	3
Nominal Phase to Phase Voltage-------->	480	Wires:	4

Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	FLUOR/EXIT SGNS	1	LOBBY	0.52	KVA	0.95	494	520	
2	A	LED DWNLTS	1	LOBBY	0.35	KVA	0.95	333	350	
3	B	FLUOR	1	STR, 102, 103	0.29	KVA	0.95	276	290	
4	B	LED DWNLTS	1	LOBBY	0.35	KVA	0.95	333	350	
5	C	DWNLTS	1	CORR,108-10	1.89	KVA	0.95	1796	1890	
6	C	FLUORESCENT	1	LKR/REST	0.51	KVA	0.95	485	510	
7	A	INDUSTRIAL	1	ELEC/MECH	1.88	KVA	0.95	1786	1880	
8	A	INDUSTRIAL	1	ELEC 132	0.38	KVA	0.95	361	380	
9	B	INDUSTRIAL	1	SHELL 122	0.79	KVA	0.95	751	790	

10	B	POLES	1	EXTR	1.91	KVA	0.97	1853	1910	
11	C	SPARE	1		1.5	KVA	0.95	1425	1500	
12	C	SPARE	1		1.5	KVA	0.95	1425	1500	
13	A	SPARE	1		1.5	KVA	0.95	1425	1500	
14	A	SPARE	1		1.5	KVA	0.95	1425	1500	
15	B	SPARE	2		1.5	KVA	0.95	1425	1500	
16	B	SPARE	2		1.5	KVA	0.95	1425	1500	
17	C	SPARE	2		1.5	KVA	0.95	1425	1500	
18	C	SPARE	2		1.5	KVA	0.95	1425	1500	
19	A	SPARE	2		1.5	KVA	0.95	1425	1500	
20	A	SPARE	2		1.5	KVA	0.95	1425	1500	
21	B	SPARE	2		1.5	KVA	0.95	1425	1500	
22	B	SPARE	2		1.5	KVA	0.95	1425	1500	
23	C	SPARE	2		1.5	KVA	0.95	1425	1500	
24	C	SPARE	2		1.5	KVA	0.95	1425	1500	
25	A	SPACE	3		0	W	1.00	0	0	
26	A	SPACE	3		0	W	1.00	0	0	
27	B	SPACE	3		0	W	1.00	0	0	
28	B	SPACE	3		0	W	1.00	0	0	
29	C	SPACE	3		0	W	1.00	0	0	
30	C	SPACE	3		0	W	1.00	0	0	
PANEL TOTAL								28.4	29.9	Amps= 35.9

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					8.7	9.1	31%	11.0
PHASE TOTAL	B					8.9	9.3	31%	11.2
PHASE TOTAL	C					10.8	11.4	38%	13.7

LOAD CATEGORIES			Connected			Demand				Ver. 1.04
			kW	kVA	DF	kW	kVA	PF		
1	LIGHTING		14.2	14.9		14.2	14.9	0.95		
2	SPARE		14.3	15.0		14.3	15.0	0.95		
3	SPACE		0.0	0.0		0.0	0.0			
Total Demand Loads						28.4	29.9			
Spare Capacity			25%			7.1	7.5			
Total Design Loads						35.5	37.3	0.95	Amps=	44.9

feeder sizing

LP-1-1	
Voltage	480Y/277
Design Load (KW)	49.8
Power Factor	0.95
Calculated Design Load (Amps)	62.8
Feeder Protection Size (Amps)	80
Sets	1
Wire Sizes	
Phase	4
Neutral	4
Ground	8
Conduit Size	1 1/4”

ESLP-1-1	
Voltage	480Y/277
Design Load (KW)	44.9
Power Factor	0.95
Calculated Design Load (Amps)	56.9
Feeder Protection Size (Amps)	60
Sets	1
Wire Sizes	
Phase	6
Neutral	6
Ground	10
Conduit Size	1”

voltage drop calculations

VOLTAGE DROP – LP-1-1	
Voltage (V)	480
Ampacity (I)	85
Power Factor (See Note 1)	.95
Wire Size (14,12,10 … 1/0, 2/0 … 250,350)	4
# of conductors per phase	1
Type Conductor (A=Aluminum C=Copper)	C
Type Conduit (P=PVC; A=Aluminum S=Steel)	A
Length of Run (ft)	23
Voltage Drop	***1.06***
% Drop	***0.22***

VOLTAGE DROP – ESLP-1-1	
Voltage (V)	480
Ampacity (I)	65
Power Factor (See Note 1)	.95
Wire Size (14,12,10 … 1/0, 2/0 … 250,350)	6
# of conductors per phase	1
Type Conductor (A=Aluminum C=Copper)	C
Type Conduit (P=PVC; A=Aluminum S=Steel)	A
Length of Run (ft)	39
Voltage Drop	***1.97***
% Drop	***0.41***

special purpose space | restaurant

lighting redesign

The sports bar and restaurant is a multi-faceted space that can be an exciting, engaging place to watch a football game or can be a more relaxing, intimate place to take a break and enjoy dinner and drinks with friends. The lighting throughout the space needs to be adjustable in order to establish the desired atmosphere and impression for specific events. In either mode, a restaurant/lounge area utilizes a non-uniform lighting design with lower light levels immediately surrounding the guest with higher levels away from the guest, providing a sensation of watching without being watched. The concept of the building's core energy is carried through the restaurant with the energy efficient LED cove. Fluorescent and LED lighting is used for energy efficiency, but halogen sources were used above tables and the above bar for color rendering of food and people.

electrical redesign

Both the emergency and normal lighting dimming panels that serve the restaurant are 208Y/120V 3 phase 4 wire panels, with the emergency and normal each sized at 175A. The removal of inefficient incandescent decorative pendants and excessive amounts of track lighting created space in which the power density was met but sufficient light levels are still present in dining and service areas.

controls

The bar and lounge are open for both lunch and dinner, as well as for sporting events and off-evenings. The lighting needs to have different scenes, as well as be highly reactive to the daylight that will influence the space through the glazing that makes up almost the entirety of the southern façade. An additional scene with high light levels needs to exist in order to facilitate the wait staff' in cleaning up at the end of the night.

Restaurant Control Schedule

Type	Manufacturer	Product	Description
LMLS-305	Wattstopper	LightSaver Photocell	Closed loop photosensor provides the daylight data necessary for operation.
LMRC-301	Wattstopper	LightSaver Room Dimming Controller	Provides automatic dimming control for multi-zone dimming control.
LMSW-105	Wattstopper	LightSaver Digital 5-Button Scene Switch	Allows occupant control by accessing four of the 16 scenes available on the local DLM network.

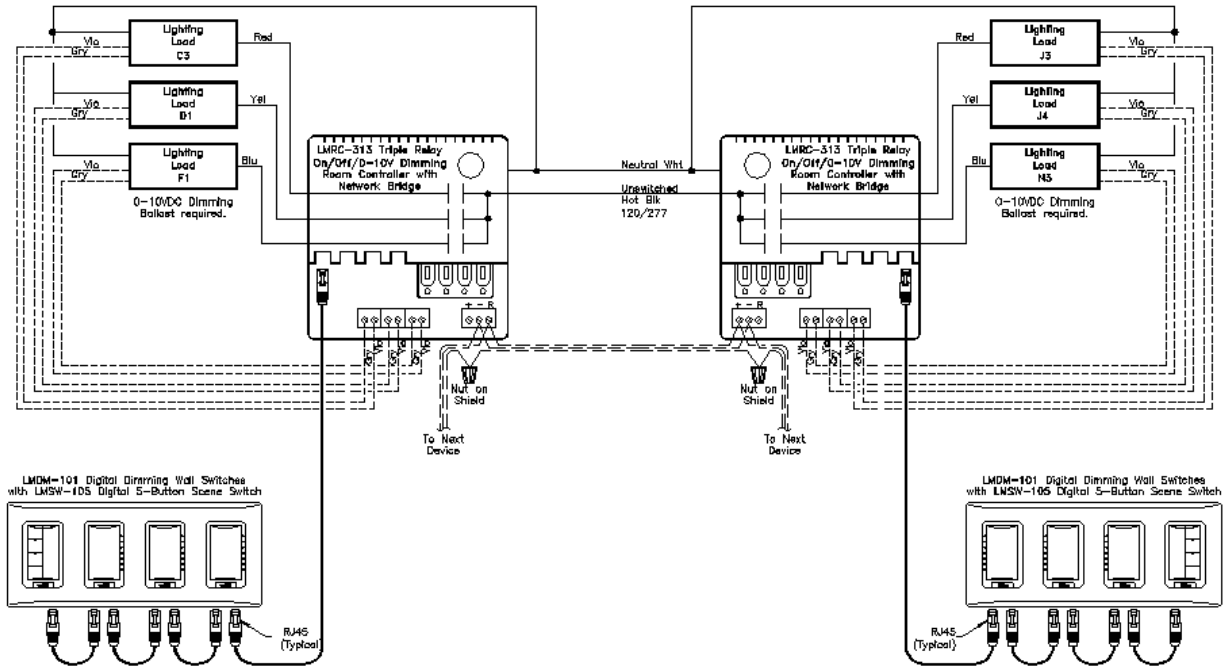


figure 26 – restaurant control diagram

panelboards

Below are the existing panelboard schedules for 208Y/120V normal dimming lighting panel NDP-L and 208Y/120V emergency lighting panel GDP-L. Both panels are located in the first floor restaurant electrical room. Modified circuits are indicated with a green box.

existing

NORMAL DIMMING PANEL SCHEDULE "NDP-L"

VOLTS: 208/120V | PHASE: 3 | LOCATION: ELECTRICAL ROOM | SHORT CIRCUIT RATING: 10 kAIC
AMPS: 175A MLO | WIRE: 4 | MOUNTING: SURFACE | TOTAL CONNECTED LOAD: 11.8 kVA

CIR. NO.	DESCRIPTION	LOAD VOLT AMP	WIRE SIZE	CIRCUIT BKR. AMPS	CIRCUIT BKR. POLES	CIRCUIT BKR. AMPS	CIRCUIT BKR. POLES	WIRE SIZE	LOAD VOLT AMP	DESCRIPTION	CIR. NO.
1	TRACK LIGHTING – ELEC LOW VOLTAGE – PDR BAR	1417	#12	20	1	20	1	#12	1200	EXTERIOR SIGNAGE – SWITCHING ONLY	13
2	PENDANT LIGHTING – INCANDESCENT – UPPER DINING	300	#12	20	1	20	1	#12	1200	EXTERIOR SIGNAGE – SWITCHING ONLY	14
3	DOWN LIGHTING – ELEC LOW VOLTAGE – UPPER DINING	450	#12	20	1	20	1			SPARE	15
4	PENDANT LIGHTING – INCANDESCENT – DINING	900	#12	20	1	20	1			SPARE	16
5	ROPE LIGHTING – LED – PATIO BAR	100	#12	20	1	20	1	#12	316	TRACK LIGHTING – ELEC LOW VOLTAGE – REAR BAR AREA	17
6	ROPE LIGHTING – LED – PDR BAR	100	#12	20	1	20	1			SPARE	18
7	PENDANT LIGHTING – INCANDESCENT – TOILET CORRIDOR	240	#12	20	1	20	1	#12	360	PENDANT LIGHTING – INCANDESCENT – PDR/ LOUNGE	19
8	DOWN LIGHTING – ELEC LOW VOLTAGE – DINNIG	1800	#12	20	1	20	1	#12	211	TRACK LIGHTING – ELEC LOW VOLTAGE – PDR/ LOUNGE	20
9	DOWN LIGHTING – ELEC LOW VOLTAGE – BAR AREA	369	#12	20	1	20	1	#12	480	PENDANT LIGHTING – INCANDESCENT – BAR	21
10	EXTERIOR SCONCES – HALOGEN – PATIO FREEZER WALL	50	#12	20	1	20	1	#12	100	ROPE LIGHTING – LED – PDR BAR AREA COVE	22
11	DOWN LIGHTING – ELEC LOW VOLTAGE – BAR AREA	1350	#12	20	1	20	1			SPARE	23
12	SPARE		#12	20	1	20	1	#12	900	DOWN LIGHTING – ELEC LOW VOLTAGE – BAR AREA ALCOVE	24

PANELBOARD NOTES:

1. THIS PANEL SHALL BE LUTRON "GRAFIK" SYSTEMS TYPE "LCP128" SPEC GRADE SERIES, MODEL #LCP24-1204-ML-20 WITH 20A BREAKERS (OR APPROVED EQUAL).
2. THIS PANEL SHALL BE FURNISHED WITH DUAL TAP LUGS.
3. THE LOAD SHOWN ON THIS PANEL INCLUDES THE LOAD FROM PANEL "DPL2-L"

GENERATOR DIMMING PANEL SCHEDULE "GDP-L"

VOLTS: 208/120V | PHASE: 3 | LOCATION: ELECTRICAL ROOM | SHORT CIRCUIT RATING: 10 kAIC
AMPS: 175A MLO | WIRE: 4 | MOUNTING: SURFACE | TOTAL CONNECTED LOAD: 6.1 kVA

CIR. NO.	DESCRIPTION	LOAD VOLT AMP	WIRE SIZE	CIRCUIT BKR. AMPS	CIRCUIT BKR. POLES	CIRCUIT BKR. AMPS	CIRCUIT BKR. POLES	WIRE SIZE	LOAD VOLT AMP	DESCRIPTION	CIR. NO.
1	TRACK LIGHTING – ELEC LOW VOLTAGE – UPPER DINING	221	#12	20	1	20	1	#12	105	DOWN LIGHTING – ELEC LOW VOLTAGE – BAR AREA ALCOVE	9
2	TRACK LIGHTING – ELEC LOW VOLTAGE – DINING	1032	#12	20	1	20	1	#12	421	DOWN LIGHTING – ELEC LOW VOLTAGE – DINING	10
3	TRACK LIGHTING – ELEC LOW VOLTAGE – BAR AREA	663	#12	20	1	20	1	#12	900	DOWN LIGHTING – ELEC LOW VOLTAGE – PATIO BAR	11
4	TRACK LIGHTING – ELEC LOW VOLTAGE – LOBBY	111	#12	20	1	20	1	#12	50	SCONCE LIGHTING – HALOGEN – PATIO BAR	12
5	TRACK LIGHTING – ELEC LOW VOLTAGE – BAR AREA	316	#12	20	1	20	1			SPARE	13
6	DOWN LIGHTING – ELEC LOW VOLTAGE – LOBBY	474	#12	20	1	20	1			SPARE	14
7	MONOPOINT LIGHTING – ELEC LOW VOLTAGE – BAR	526	#12	20	1	20	1			SPARE	15
8	DOWN LIGHTING – ELEC LOW VOLTAGE – PDR/ LOUNGE	1326	#12	20	1	20	1			SPARE	16

PANELBOARD NOTES:

1. THIS PANEL SHALL BE LUTRON "GRAFIK" SYSTEMS TYPE "LCP128" SPEC GRADE SERIES, MODEL #LCP16-1204-ML-20 WITH 20A BREAKERS (OR APPROVED EQUAL).

circuiting calculations

Each circuit was recalculated based on the new lighting load. For a voltage of 120 on 20A circuits, recommended engineering practice designates 1.54 KVA per circuit. All three of the lobby circuits adhere to these guidelines.

Emergency Dimming Panel GDP-L			
Circuit #	Type	Quantity	KVA
1	C3	16	.80
Total kVA			.80
2	C3	15	.75
Total kVA			.75
3	F1	24	.84
Total kVA			.84
5	F1	24	.84
Total kVA			.84

Normal Dimming Panel NDP-L			
Circuit #	Type	Quantity	KVA
1	B1	1	1.2
Total kVA			1.2
2	C3	8	.4
Total kVA			.4
3	D1	11	.39
Total kVA			.39
4	D1	11	.39
Total kVA			.39
8	D1	16	.58
Total kVA			.58
9	J3	50’	.27
Total kVA			.27
11	J4	198’	.89
Total kVA			.89
21	J4	198’	.89
Total kVA			.89
24	J4	199’	.90
Total kVA			.90

The redesigned panelboard schedule for Panels NDP-L and GDP-L are provided below with their corresponding panelboard sizing worksheets. Modified circuits are indicated with a green box.

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 80A
SIZE/TYPE MAIN: 80A/3P C/B

PANEL TAG: NDP-L
PANEL LOCATION: RESTAURANT ELEC ROOM
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
HAL PENDANT	BAR	1200	20A/1P	1	*			2	20A/1P	333	BAR	HAL DWNLT
FLUOR COVE	REST PER	371	20A/1P	3		*		4	20A/1P	333	REST PER	FLUOR COVE
LED ROPE LTG	PATIO	950	20A/1P	5			*	6	20A/1P	950	PATIO	LED ROPE LTG
INCAN PENDANT	RESTROOM	240	20A/1P	7	*			8	20A/1P	551	REST PER	FLUOR COVE
LED COVE	BAR	257	20A/1P	9		*		10	20A/1P	500	PATIO	HAL SCONCES
LED ACCENT COVE	REST CEILING	846	20A/1P	11			*	12	20A/1P	618	-	SPARE
SIGNAGE	EXTERIOR	1140	20A/1P	13	*			14	20A/1P	1140	EXTERIOR	SIGNAGE
SPARE	-	618	20A/1P	15		*		16	20A/1P	618	-	SPARE
TRACK LIGHTING	REAR BAR	1500	20A/1P	17			*	18	20A/1P	618	-	SPARE
INCAN PENDANT	PDR/LOUNGE	360	20A/1P	19	*			20	20A/1P	1500	PDR/LOUNGE	LV TRACK LTG
LED ACCENT COVE	REST CEILING	846	20A/1P	21		*		22	20A/1P	95	PDR/LOUNGE	LED ROPE LTG
SPARE	-	618	20A/1P	23			*	24	20A/1P	855	REST CEILING	LED ACCENT COVE
SPACE	-	0	20A/1P	25	*			26	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	27		*		28	20A/1P	0	-	SPACE
SPACE	-	0	20A/1P	29			*	30	20A/1P	0	-	SPACE

CONNECTED LOAD (KW) - A Ph.	6.53	TOTAL DESIGN LOAD (KW)	21.45
CONNECTED LOAD (KW) - B Ph.	3.67	POWER FACTOR	0.97
CONNECTED LOAD (KW) - C Ph.	6.95	TOTAL DESIGN LOAD (AMPS)	62

PANELBOARD SIZING WORKSHEET

Panel Tag---------->	NDP-L	Panel Location:	RESTAURANT ELEC ROOM	
Nominal Phase to Neutral Voltage------->	120	Phase:	3	
Nominal Phase to Phase Voltage-------->	208	Wires:	4	

Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	HAL PENDANT	1	BAR	1.2	KVA	1.00	1200	1200	
2	A	HAL DWNLT	1	BAR	0.4	KVA	1.00	400	400	
3	B	FLUOR COVE	1	REST PER	0.39	KVA	0.95	371	390	
4	B	FLUOR COVE	1	REST PER	0.39	KVA	0.95	371	390	
5	C	LED ROPE LTG	1	PATIO	1	KVA	0.95	950	1000	
6	C	LED ROPE LTG	1	PATIO	1	KVA	0.95	950	1000	
7	A	INCAN PENDANT	1	RESTROOM	0.24	KVA	1.00	240	240	
8	A	FLUOR COVE	1	REST PER	0.58	KVA	0.95	551	580	
9	B	LED COVE	1	BAR	0.27	KVA	0.95	257	270	
10	B	HAL SCONCES	1	PATIO	0.5	KVA	1.00	500	500	
11	C	LED ACCENT COVE	1	REST CEILING	0.89	KVA	0.95	846	890	
12	C	SPARE	2	-	0.65	KVA	0.95	618	650	
13	A	SIGNAGE	1	EXTERIOR	1.2	KVA	0.95	1140	1200	
14	A	SIGNAGE	1	EXTERIOR	1.2	KVA	0.95	1140	1200	

15	B	SPARE	2	-	0.65	KVA	0.95	618	650		
16	B	SPARE	2	-	0.65	KVA	0.95	618	650		
17	C	TRACK LIGHTING	1	REAR BAR	1.5	KVA	1.00	1500	1500		
18	C	SPARE	2	-	0.65	KVA	0.95	618	650		
19	A	INCAN PENDANT	1	PDR/LOUNGE	0.36	KVA	1.00	360	360		
20	A	LV TRACK LTG	1	PDR/LOUNGE	1.5	KVA	1.00	1500	1500		
21	B	LED ACCENT COVE	1	REST CEILING	0.89	KVA	0.95	846	890		
22	B	LED ROPE LTG	1	PDR/LOUNGE	0.1	KVA	0.95	95	100		
23	C	SPARE	2	-	0.65	KVA	0.95	618	650		
24	C	LED ACCENT COVE	1	REST CEILING	0.9	KVA	0.95	855	900		
25	A	SPACE	3		0	W	1.00	0	0		
26	A	SPACE	3		0	W	1.00	0	0		
27	B	SPACE	3		0	W	1.00	0	0		
28	B	SPACE	3		0	W	1.00	0	0		
29	C	SPACE	3		0	W	1.00	0	0		
30	C	SPACE	3		0	W	1.00	0	0		
PANEL TOTAL								17.2	17.8	Amps=	49.3

PHASE LOADING		kW	kVA	%	Amps
PHASE TOTAL	A	6.5	6.7	38%	18.6
PHASE TOTAL	B	3.7	3.8	22%	10.7
PHASE TOTAL	C	7.0	7.2	41%	20.1

LOAD CATEGORIES			Connected			Demand				Ver. 1.04
			kW	kVA	DF	kW	kVA	PF		
1	LIGHTING		14.1	14.5		14.1	14.5	0.97		
2	SPARE		3.1	3.3		3.1	3.3	0.95		
3	SPACE		0.0	0.0		0.0	0.0			
Total Demand Loads						17.2	17.8			
Spare Capacity			25%			4.3	4.4			
Total Design Loads						21.4	22.2	0.97	Amps=	61.7

PANELBOARD SCHEDULE

VOLTAGE: 208Y/120V,3PH,4W
SIZE/TYPE BUS: 60A
SIZE/TYPE MAIN: 60A/3P C/B

PANEL TAG: GDP-L
PANEL LOCATION: RESTAURANT ELEC ROOM
PANEL MOUNTING: SURFACE

MIN. C/B AIC: 10K
OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	A	B	C	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
HAL DWNLT	REST	800	20A/1P	1	*			2	20A/1P	333	REST	HAL DWNLT
HAL CABLE	REST PER	840	20A/1P	3		*		4	20A/1P	333	LOBBY	LV TRACK
HAL CABLE	REST PER	840	20A/1P	5			*	6	20A/1P	480	LOBBY	LV DWNLTS
SPARE		618	20A/1P	7	*			8	20A/1P	1300	PDR/LOUNGE	LV DWNLTS
SPARE	-	618	20A/1P	9		*		10	20A/1P	618	-	SPARE
LV DWNLTS	REST CEILING	650	20A/1P	11			*	12	20A/1P	500	-	HAL SCONCE
SPARE	EXTERIOR	618	20A/1P	13	*			14	20A/1P	618	EXTERIOR	SPARE
SPARE	-	618	20A/1P	15		*		16	20A/1P	618	-	SPARE

CONNECTED LOAD (KW) - A Ph.	4.75	TOTAL DESIGN LOAD (KW)	13.30
CONNECTED LOAD (KW) - B Ph.	3.42	POWER FACTOR	0.98
CONNECTED LOAD (KW) - C Ph.	2.47	TOTAL DESIGN LOAD (AMPS)	38

PANELBOARD SIZING WORKSHEET

Panel Tag---------->	GDP-L	Panel Location:	RESTAURANT ELEC ROOM
Nominal Phase to Neutral Voltage------->	120	Phase:	3
Nominal Phase to Phase Voltage-------->	208	Wires:	4

Pos	Ph.	Load Type	Cat.	Location	Load	Units	I. PF	Watts	VA	Remarks
1	A	HAL DWNLT	1	REST	0.8	KVA	1.00	800	800	
2	A	HAL DWNLT	1	REST	0.8	KVA	1.00	800	800	
3	B	HAL CABLE	1	REST PER	0.84	KVA	1.00	840	840	
4	B	LV TRACK	1	LOBBY	0.11	KVA	1.00	110	110	
5	C	HAL CABLE	1	REST PER	0.84	KVA	1.00	840	840	
6	C	LV DWNLTS	1	LOBBY	0.48	KVA	1.00	480	480	
7	A	SPARE	1	-	0.65	KVA	0.95	618	650	
8	A	LV DWNLTS	1	PDR/LOUNGE	1.3	KVA	1.00	1300	1300	
9	B	SPARE	2	-	0.65	KVA	0.95	618	650	
10	B	SPARE	2	-	0.65	KVA	0.95	618	650	
11	C	LV DWNLTS	1	BAR	0.65	KVA	1.00	650	650	
12	C	HAL SCONCE	1	PATIO	0.5	KVA	1.00	500	500	
13	A	SPARE	2	-	0.65	KVA	0.95	618	650	
14	A	SPARE	2	-	0.65	KVA	0.95	618	650	
15	B	SPARE	2	-	0.65	KVA	0.95	618	650	
16	B	SPARE	2	-	0.65	KVA	0.95	618	650	
PANEL TOTAL								10.6	10.9	Amps= 30.2

PHASE LOADING						kW	kVA	%	Amps
PHASE TOTAL	A					4.8	4.9	45%	13.5
PHASE TOTAL	B					3.4	3.6	33%	9.9
PHASE TOTAL	C					2.5	2.5	23%	6.9

LOAD CATEGORIES		Connected			Demand				Ver. 1.04
		kW	kVA	DF	kW	kVA	PF		
1	LIGHTING	6.9	7.0		6.9	7.0	1.00		
2	SPARE	3.7	3.9		3.7	3.9	0.95		
3	SPACE	0.0	0.0		0.0	0.0			
Total Demand Loads					10.6	10.9			
Spare Capacity		25%			2.7	2.7			
Total Design Loads					13.3	13.6	0.98	Amps=	37.7

feeder sizing

NDP-L	
Voltage	208Y/120
Design Load (KW)	21.4
Power Factor	0.97
Calculated Design Load (Amps)	61.7
Feeder Protection Size (Amps)	80
Sets	1
Wire Sizes	
Phase	4
Neutral	4
Ground	8
Conduit Size	1 1/4”

GDP-L	
Voltage	208Y/120
Design Load (KW)	13.3
Power Factor	0.98
Calculated Design Load (Amps)	37.7
Feeder Protection Size (Amps)	60
Sets	1
Wire Sizes	
Phase	6
Neutral	6
Ground	10
Conduit Size	1”

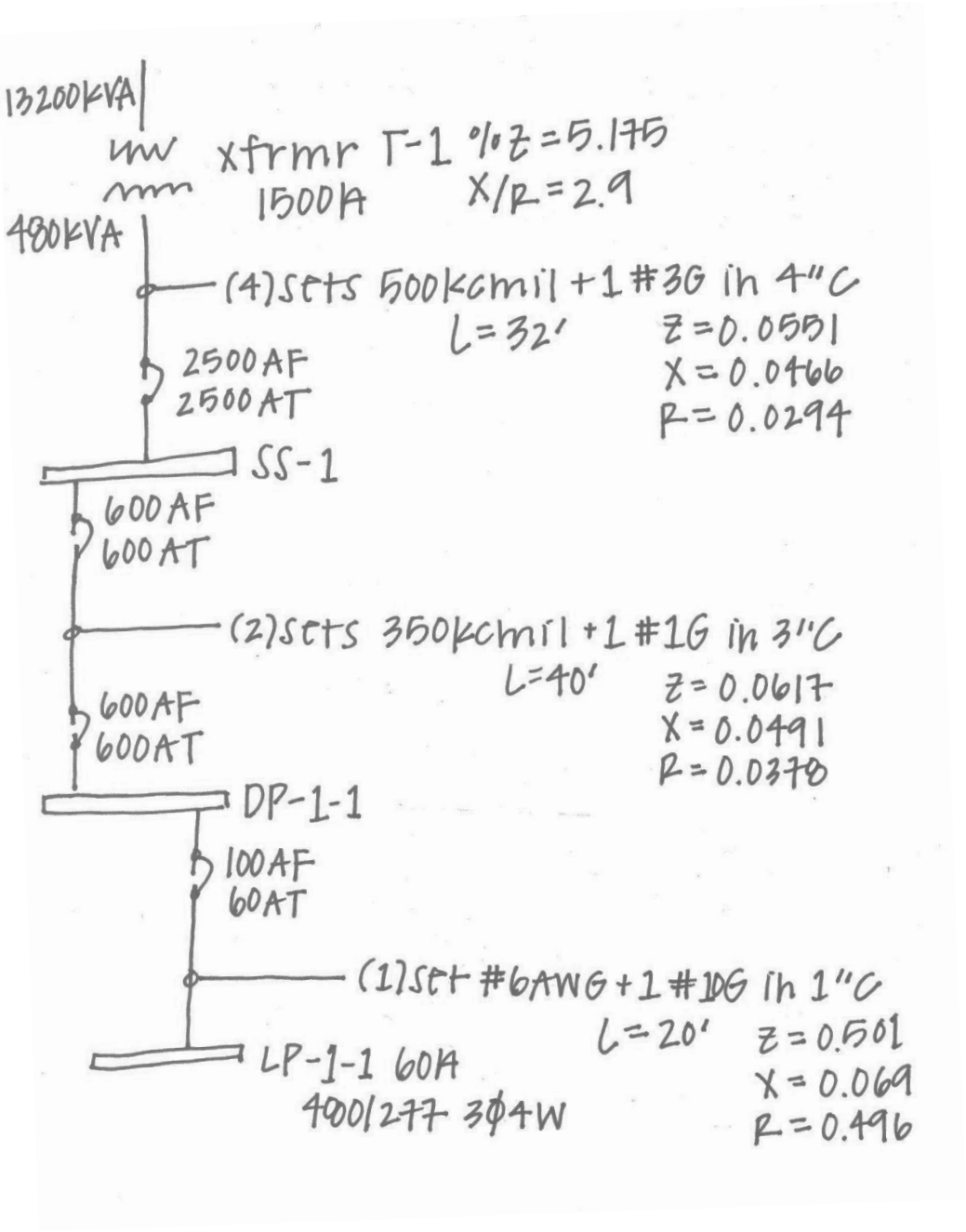
voltage drop calculations

VOLTAGE DROP – NDP-L	
Voltage (V)	208
Ampacity (I)	85
Power Factor (See Note 1)	.95
Wire Size (14,12,10 … 1/0, 2/0 … 250,350)	4
# of conductors per phase	1
Type Conductor (A=Aluminum C=Copper)	C
Type Conduit (P=PVC; A=Aluminum S=Steel)	S
Length of Run (ft)	20
Voltage Drop	***0.92***
% Drop	***0.44***

VOLTAGE DROP – GDP-L	
Voltage (V)	208
Ampacity (I)	65
Power Factor (See Note 1)	.95
Wire Size (14,12,10 … 1/0, 2/0 … 250,350)	6
# of conductors per phase	1
Type Conductor (A=Aluminum C=Copper)	C
Type Conduit (P=PVC; A=Aluminum S=Steel)	A
Length of Run (ft)	20
Voltage Drop	***1.09***
% Drop	***0.53***

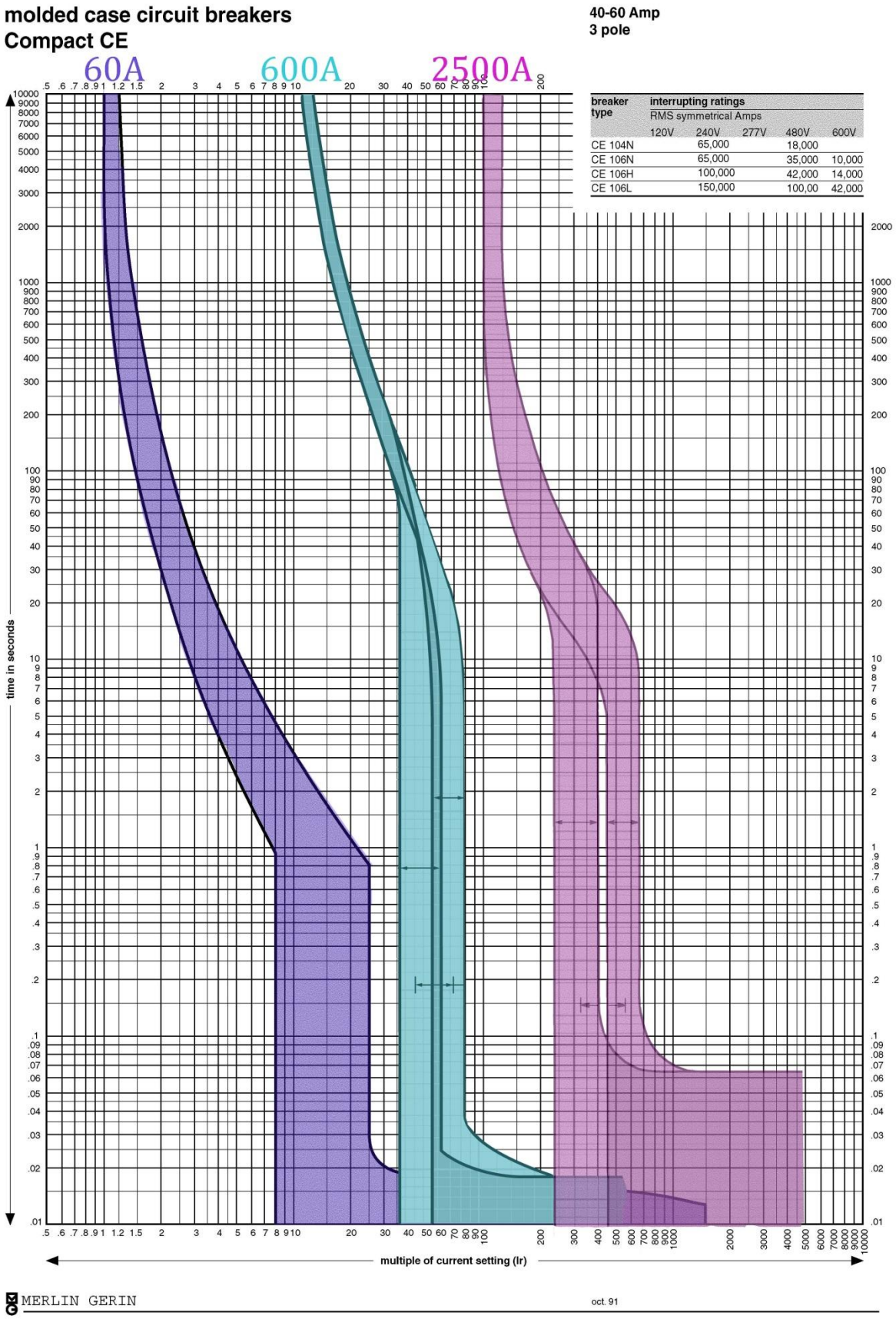
protective device coordination study and short circuit analysis

A protective device coordination study was conducted along a single path of the electrical distribution system, extending from the utility entrance through the main switchboard to distribution panel DP-1-1, and down to panel LP-1-1 (see Figure below). For the 2500A, two 600A, and 60A circuit breakers, the trip curves were superimposed to determine whether the devices were correctly coordinated. Calculation of the short circuit current at each step along the distribution path and determined standard AIC rating are shown in the tables on the following pages.



Fault Current Analysis (Per Unit Method)							
Utility Transformer Base kVA			13,200	ΣX	ΣR	ΣZ	I_{sc} (A)
Available Utility Fault (kVA)			100,000				
System kV			0.48				
Utility Transformer Primary							
		X(p.u.) = KVAbase / Utility S.C. KVA =	0.132				4,373
		R(p.u.) =	0				
Utility Transformer Secondary							
%Z =	5.175	X(p.u.) = %X * kVAbase / 100 * kVA_{xfrmr} =	0.326	0.426	0.112	0.463	27,038
Avg. X/R =	2.9	R(p.u.) = %R * kVAbase / 100 * kVA_{xfrmr} =	0.112				
%X =	4.89						
%R =	1.68						
kVA_{xfrmr} =	1,500						
Unit Substation SS-1							
Wire =	500	X = (L/1,000) * XL * (1/sets) =	0.0162	0.442	0.123	0.464	13,234
Length =	32'	R = (L/1,000) * RL * (1/sets) =	0.0102				
Sets =	4						
X =	0.0466						
R =	0.0294						
Main Distribution Panel DP-1-1							
Wire =	350	X = (L/1,000) * XL * (1/sets) =	0.0426	0.458	0.133	0.483	8,431
Length =	40'	R = (L/1,000) * RL * (1/sets) =	0.0328				
Sets =	2						
X =	0.0491						
R =	0.0378						
Branch Circuit Lighting Panel LP-1-1							
Wire =	6	X = (L/1,000) * XL * (1/sets) =	0.0594	0.518	0.563	0.918	5,130
Length =	20'	R = (L/1,000) * RL * (1/sets) =	0.5178				
Sets =	1						
X =	0.0685						
R =	0.496						

Fault Current Analysis Summary		
Switchgear	**Available Fault (A)**	**Standard Breaker Rating (A)**
Utility Transformer Secondary	27,038	35,000
Substation SS-1	13,234	18,000
Distribution Panel DP-1-1	8,431	14,000
Lighting Panel LP-1-1	5,130	14,000


molded case circuit breakers
Compact CE
40-60 Amp
3 pole
60A
600A
2500A
breaker type
interrupting ratings
RMS symmetrical Amps
120V 240V 277V 480V 600V
CE 104N 65,000 18,000
CE 106N 65,000 35,000 10,000
CE 106H 100,000 42,000 14,000
CE 106L 150,000 100,00 42,000
time in seconds
multiple of current setting (Ir)
MERLIN GERIN
oct. 91

conclusion

According to the over-current protection analysis, the breakers along the selected path are coordinated correctly. For an instantaneous fault there is some overlap, however they are offset enough that they should still trip in consecutive order. If there is a spike high enough to instantaneously trip all devices along this distribution, all of the equipment will be taken out regardless. Two 600A breakers of the same size between two switchgear elements could cause some shortage overlap, but no matter which one trips first, the equipment upstream will be protected.

depth one: kinetic energy harnessing system

Kinetic energy is being constantly generated. Most circumstances make it uneconomical to harness due to inconsistent generation or difficult collection. At a fitness center, people are there specifically to create kinetic energy, providing the perfect opportunity to capture a large amount of kinetic energy. The proposed system will harness human energy and convert it into usable electricity to power an LED component of the lighting system. Additional energy will be transferred directly to the utility grid via a utility interactive and the AC main panel.

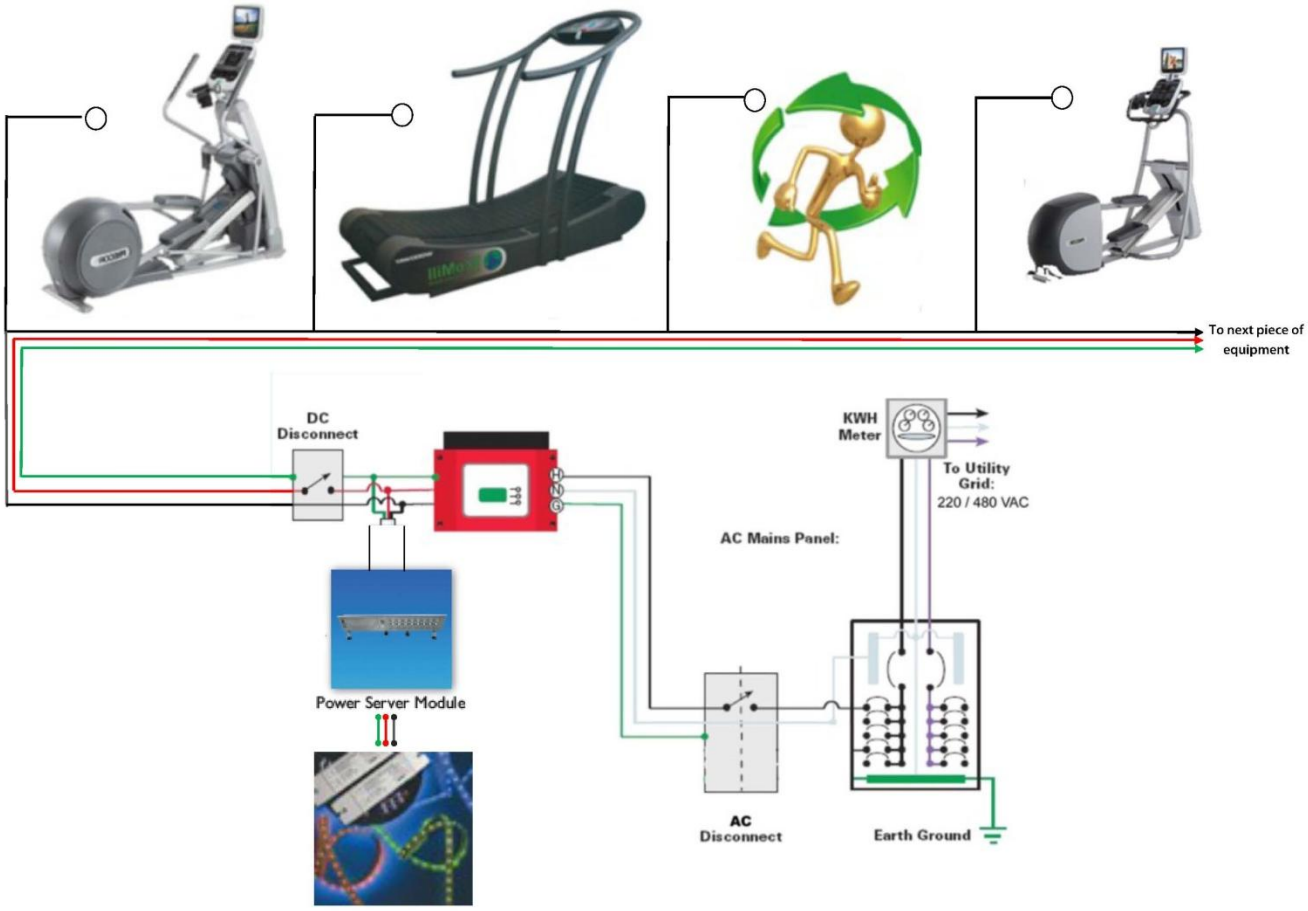
design concept

Sasaki Associates took care to expose the core energy of the building. The facility is fueled by the energy of the occupants as they move within the space just as the body is fueled by core energy during a workout. The minimalist design of the architecture with its structurally exposed concrete, straight lines, clean materials, and strong angles allow the energy and active users to become the feature of the space.

A bright, uniform lighting layout will create a spacious, energizing environment for the occupants within the fitness center. To further reinforce the energy of the building, a blue uplight LED component will be added to the linear fixtures throughout the space so that the energy being exerted is actually visible both to those creating it and to those viewing the fitness center from the exterior. The fluorescent component is controlled by photocell, but the glowing energy created by the exercisers will be visible even during the day when the remainder of the lighting is turned off in the space.

system overview

ReRev™ is a patent-pending system that converts human energy into a usable form of renewable energy. It substitutes the typical fan that disperses excess heat from cardio equipment into the space with a small generator and CPU that converts the power to utility grade electricity. Each outfit feeds through a central processing unit which then feeds through the inverter tapped directly into the AC mains panel. The processing units are prepared to handle up to twenty-five machines without overload, so there will be separate processor on each floor of the fitness center. ReRev is currently designed to equip Precor elliptical machines and Ecomill self-powered treadmills with a converter to harness, regulate, and disperse the power in a practical electric form that will be used to power the LEDs. The sample wiring diagram on the following page shows a configuration in which DC power will be tied directly to the LEDs before carrying the remaining power to the grid. A Nextek Power Server Module can accept 24-24.5VDC at a maximum of 65A and provides modulated consistent quality power to the LED lighting load.



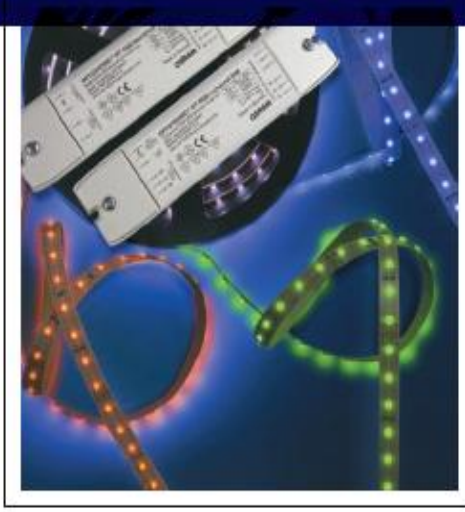
The average 30 minute elliptical workout produces 50 watt-hours of energy, while the average treadmill workout produces up to 100 watt-hours. The blue LEDs will only be lit while the energy is being produced, and so all excess energy will be utilized elsewhere throughout the power system.

Sylvania LINEARlight FLEX Top Colormix, a flexible colormixing LED module, will be fixed directly to the linear Lightolier fixtures. Full cutsheets for both the lighting tape and linear fixture are found in Appendix A.

www.sylvania.com

LINEARlight FLEX® Top Colormix

Flexible Colormixing LED Module



Key Features & Benefits

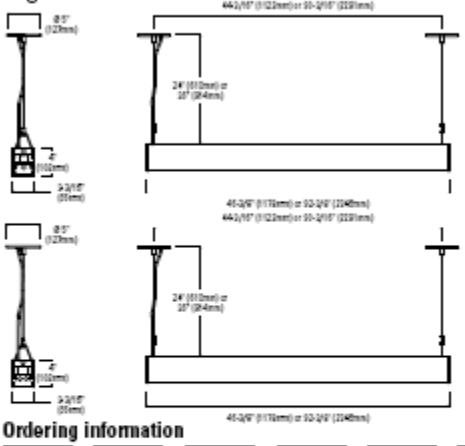
- Flexible circuit board with self-adhesive backing allows for easy installation in complex contours
- Low profile module enables mounting in compact spaces
- Each Multi LED contains an individually powered red, green and blue chip; this unique method of colormixing achieves excellent color consistency and uniformity
- 13 foot module decreases complexity of wiring and programming simplifying installation for long linear runs
- Modules can be field cut to 7.9 inches (20mm) to achieve a customized fit
- LEDs are closely spaced to minimize hot spots in shallow installations
- Dimmable by pulse width modulation, a method that maintains consistent lumen output and color

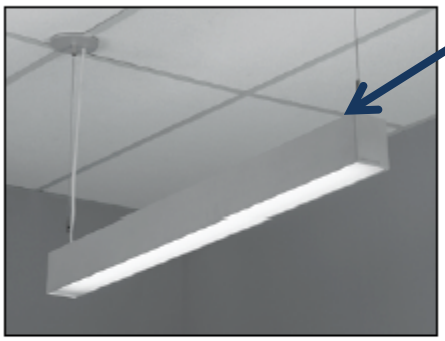
LIGHTOLIER

Spectral H-Profile Direct/Indirect Lens

Page 1 of 4

1 lamp T5 UP, 1 or 2 lamp T5 DOWN per 4' section





Flex light adheres here

Ordering information

SL			K						
Family	Luminaire Length	Pendant Finish	Optics	Wiring	Lamp Qty is a cross section	Lamp	Voltage	Ballast	Options
SL: Spectral H-Profile	4: 4'	W: Textured White finish	K: Flat Frosted Acrylic Lens Down / Indirect Up	S: Double Circuit Ready[1]	2	2: 28WT5	U: UNV 120-277V	PG: Electronic Program Start T5/T5HO	E: T5/T5HO Emergency Lighting System (Canada) (n/a in 347V)
	8: 8'	A: Ano textured metallic paint finish		N: Double Circuit Network Ready (DALI or Dimming)	3	5: 54WT5HO	1: 120V	DA: IGEN DALI Addressable T5/T5HO (120V or 277V only)	D: Double Switching
				I: Individual Feed			2: 277V	NW: IGEN EZ Sensor Integral Daylight Sensor Control with 1-10VDC ballast (120V or 277V only)	EM: T5/T5HO Emergency Lighting System (USA)
				G: Group Feed			3: 347V		

[1] Double Circuit Ready: all 2-lamp luminaires are shipped with single switching (one ballast). All 3-lamp luminaires are shipped with double switching (two ballasts).

The maximum luminaire length is 16', so at 4w/ft the maximum LED power a machine would need to produce during a workout is 32 watt-hours (enough to illuminate the LEDs for the duration of the 30 minute workout) plus ten additional hours to power the machine itself.

If a treadmill workout were used at maximum capacity to produce 150 watt-hours, a workout could produce up to 112 watt-hours of power for usage elsewhere throughout the building!

conclusion

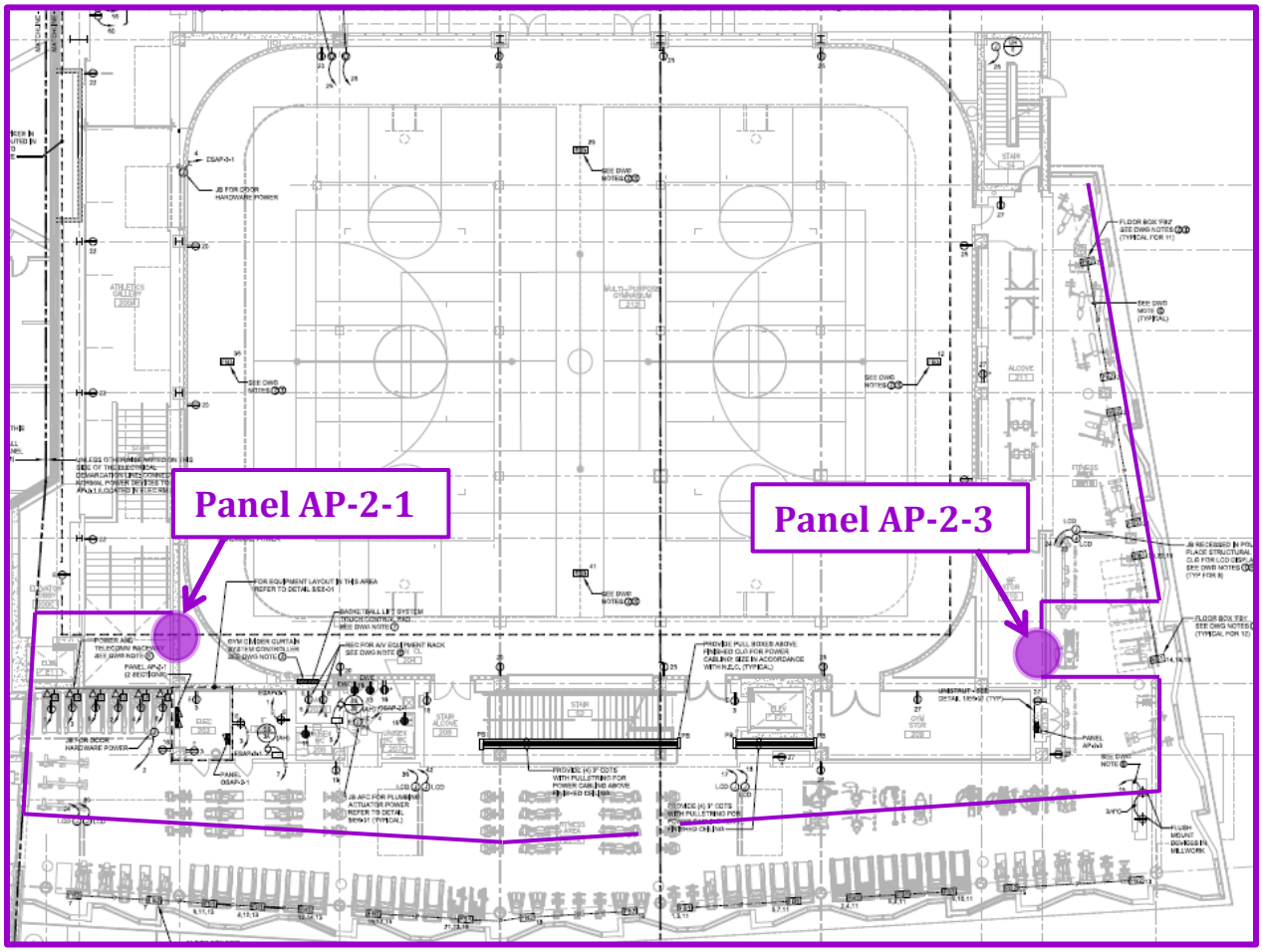
44 machines on the second floor and 20 machines on the floor will be installed using ReRev technology to power the colored component of the lighting fixtures. Remaining unutilized power will return energy to the power grid. Not only will this save Drexel money and provide an interesting and exciting visible component of energy production within this space, it will also give back to the students knowing that they are not only getting in shape, but helping the environment in a tangible way.

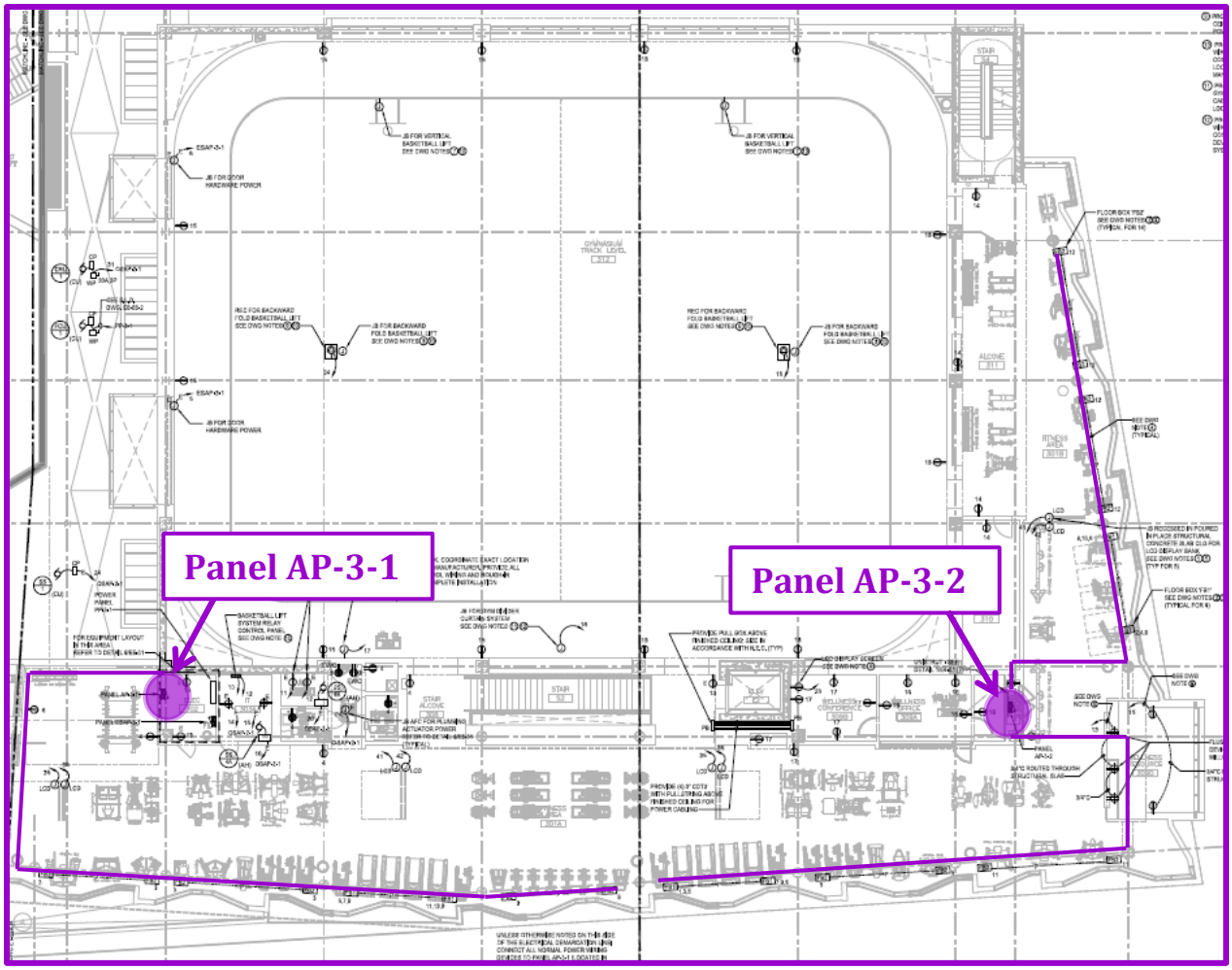
depth two: branch circuit cabling comparison

The existing branch circuiting distribution system in the DRC's fitness center utilizes PVC conduit with combination power and telecommunications boxes located within the floor slab. In order to provide flexibility in the fitness equipment layout, an economic analysis was performed comparing an alternative solution of exposed unventilated metal cable tray on the floors below with poke throughs in place of the floor boxes for the two cardio equipment circuits on the second and third floors. All costs are based on the RS Means Building Construction Cost Data 2011. The following pages show a detailed comparison of PVC conduit and unventilated metal cable tray.

design concept

Two panels on each floor handle all of the treadmill and cardio equipment loads: the figures below denote the locations of these panels and the respective conduit they feed. Additional equipment that is fed by wall-mounted receptacles is not considered in this analysis. Existing Wiremold floor boxes are cost compared with Wiremold recessed poke-thru devices for use with cable tray.





Panel AP-2-1	
Distance	160’
Elbow joints	3
Floor boxes	9
Cardio circuits served	13
Panel AP-2-3	
Distance	210’
Elbow joints	3
Floor boxes	13
Cardio circuits served	17

Panel AP-3-1	
Distance	160’
Elbow joints	3
Floor boxes	8
Cardio circuits served	10
Panel AP-3-2	
Distance	210’
Elbow joints	3
Floor boxes	12
Cardio circuits served	10

Cost Analysis #1 : Existing Branch Circuiting in PVC Conduit

LP-2-1										
Circuit	# of sets	Wire size – Phase	Wire Size – Neutral	Wire Size- Ground	Distance	Phase Cost/100'	Neutral Cost/100'	Ground Cost/100'	Conduit Cost/LF	Total Cost
7	1	12AWG	12AWG	10AWG	80	$48.45	$48.45	$59.50	-	$ 125.12
8	1	12AWG	12AWG	10AWG	97	$48.45	$48.45	$59.50	-	$ 151.71
9	1	12AWG	12AWG	10AWG	90	$48.45	$48.45	$59.50	-	$ 140.76
10	1	12AWG	12AWG	10AWG	97	$48.45	$48.45	$59.50	-	$ 151.71
11	1	12AWG	12AWG	10AWG	90	$48.45	$48.45	$59.50	-	$ 140.76
12	1	12AWG	12AWG	10AWG	105	$48.45	$48.45	$59.50	-	$ 164.22
13	2	12AWG	12AWG	10AWG	105	$48.45	$48.45	$59.50	-	$ 164.22
14	3	12AWG	12AWG	10AWG	105	$48.45	$48.45	$59.50	-	$ 164.22
15	4	12AWG	12AWG	10AWG	116	$48.45	$48.45	$59.50	-	$ 181.42
17	5	12AWG	12AWG	10AWG	116	$48.45	$48.45	$59.50	-	$ 181.42
19	6	12AWG	12AWG	10AWG	159	$48.45	$48.45	$59.50	-	$ 248.68
21	7	12AWG	12AWG	10AWG	132	$48.45	$48.45	$59.50	-	$ 206.45
23	8	12AWG	12AWG	10AWG	132	$48.45	$48.45	$59.50	-	$ 206.45
PVC Conduit in Concrete Slab: 13 sets of .5"					159	-	-	-	$2.21	$4,568.07

AP-2-3										
Circuit	# of sets	Wire size – Phase	Wire Size – Neutral	Wire Size- Ground	Distance	Phase Cost/100'	Neutral Cost/100'	Ground Cost/100'	Conduit Cost/LF	Total Cost
1	1	12AWG	12AWG	10AWG	119	$48.45	$48.45	$59.50	-	$ 186.12
2	1	12AWG	12AWG	10AWG	93	$48.45	$48.45	$59.50	-	$ 145.45
3	1	12AWG	12AWG	10AWG	119	$48.45	$48.45	$59.50	-	$ 186.12
4	1	12AWG	12AWG	10AWG	93	$48.45	$48.45	$59.50	-	$ 145.45
5	1	12AWG	12AWG	10AWG	102	$48.45	$48.45	$59.50	-	$ 159.53
6	1	12AWG	12AWG	10AWG	84	$48.45	$48.45	$59.50	-	$ 131.38
7	1	12AWG	12AWG	10AWG	102	$48.45	$48.45	$59.50	-	$ 159.53
8	1	12AWG	12AWG	10AWG	84	$48.45	$48.45	$59.50	-	$ 131.38
9	1	12AWG	12AWG	10AWG	77	$48.45	$48.45	$59.50	-	$ 120.43
10	1	12AWG	12AWG	10AWG	77	$48.45	$48.45	$59.50	-	$ 120.43
11	1	12AWG	12AWG	10AWG	119	$48.45	$48.45	$59.50	-	$ 186.12
13	1	12AWG	12AWG	10AWG	68	$48.45	$48.45	$59.50	-	$ 106.35
14	1	12AWG	12AWG	10AWG	32	$48.45	$48.45	$59.50	-	$ 50.05
16	1	12AWG	12AWG	10AWG	32	$48.45	$48.45	$59.50	-	$ 50.05
19	1	12AWG	12AWG	10AWG	50	$48.45	$48.45	$59.50	-	$ 78.20
20	1	12AWG	12AWG	10AWG	50	$48.45	$48.45	$59.50	-	$ 78.20
21	1	12AWG	12AWG	10AWG	102	$48.45	$48.45	$59.50	-	$ 159.53
22	1	12AWG	12AWG	10AWG	50	$48.45	$48.45	$59.50	-	$ 78.20
PVC Conduit in Concrete Slab: 18 sets of .5"					221	-	-	-	$2.21	$8,791.38

AP-3-1										
Circuit	# of sets	Wire size – Phase	Wire Size – Neutral	Wire Size-Ground	Distance	Phase Cost/100'	Neutral Cost/100'	Ground Cost/100'	Conduit Cost/LF	Total Cost
3	1	12AWG	12AWG	10AWG	107	$48.45	$48.45	$59.50	-	$ 167.35
5	1	12AWG	12AWG	10AWG	113	$48.45	$48.45	$59.50	-	$ 176.73
7	1	12AWG	12AWG	10AWG	113	$48.45	$48.45	$59.50	-	$ 176.73
9	1	12AWG	12AWG	10AWG	158	$48.45	$48.45	$59.50	-	$ 247.11
11	1	12AWG	12AWG	10AWG	130	$48.45	$48.45	$59.50	-	$ 203.32
13	1	12AWG	12AWG	10AWG	130	$48.45	$48.45	$59.50	-	$ 203.32
PVC Conduit in Concrete Slab: 6 sets of .5"					158	-	-	-	$2.21	$2,095.08

AP-3-2										
Circuit	# of sets	Wire size – Phase	Wire Size – Neutral	Wire Size-Ground	Distance	Phase Cost/100'	Neutral Cost/100'	Ground Cost/100'	Conduit Cost/LF	Total Cost
1	1	12AWG	12AWG	10AWG	121	$48.45	$48.45	$59.50	-	$ 189.24
2	1	12AWG	12AWG	10AWG	37	$48.45	$48.45	$59.50	-	$ 57.87
3	1	12AWG	12AWG	10AWG	121	$48.45	$48.45	$59.50	-	$ 189.24
4	1	12AWG	12AWG	10AWG	37	$48.45	$48.45	$59.50	-	$ 57.87
5	1	12AWG	12AWG	10AWG	102	$48.45	$48.45	$59.50	-	$ 159.53
6	1	12AWG	12AWG	10AWG	46	$48.45	$48.45	$59.50	-	$ 71.94
7	2	12AWG	12AWG	10AWG	105	$48.45	$48.45	$59.50	-	$ 164.22
8	3	12AWG	12AWG	10AWG	46	$48.45	$48.45	$59.50	-	$ 71.94
9	4	12AWG	12AWG	10AWG	105	$48.45	$48.45	$59.50	-	$ 164.22
10	5	12AWG	12AWG	10AWG	46	$48.45	$48.45	$59.50	-	$ 71.94
11	6	12AWG	12AWG	10AWG	70	$48.45	$48.45	$59.50	-	$ 109.48
12	7	12AWG	12AWG	10AWG	98	$48.45	$48.45	$59.50	-	$ 153.27
PVC Conduit in Concrete Slab: 12 sets of .5"					219	-	-	-	$2.21	$5,807.88

Total Cost: $21,262.41

Cost Analysis #2 : Closed bottom 6" aluminum cable tray

LP-2-1										
Circuit	# of sets	Wire size – Phase	Wire Size – Neutral	Wire Size-Ground	Distance	Phase Cost/100'	Neutral Cost/100'	Ground Cost/100'	Conduit Cost/LF	Total Cost
7	1	12AWG	12AWG	10AWG	80	$48.45	$48.45	$59.50	-	$ 125.12
8	1	12AWG	12AWG	10AWG	97	$48.45	$48.45	$59.50	-	$ 151.71
9	1	12AWG	12AWG	10AWG	90	$48.45	$48.45	$59.50	-	$ 140.76
10	1	12AWG	12AWG	10AWG	97	$48.45	$48.45	$59.50	-	$ 151.71
11	1	12AWG	12AWG	10AWG	90	$48.45	$48.45	$59.50	-	$ 140.76
12	1	12AWG	12AWG	10AWG	105	$48.45	$48.45	$59.50	-	$ 164.22
13	2	12AWG	12AWG	10AWG	105	$48.45	$48.45	$59.50	-	$ 164.22
14	3	12AWG	12AWG	10AWG	105	$48.45	$48.45	$59.50	-	$ 164.22
15	4	12AWG	12AWG	10AWG	116	$48.45	$48.45	$59.50	-	$ 181.42
17	5	12AWG	12AWG	10AWG	116	$48.45	$48.45	$59.50	-	$ 181.42
19	6	12AWG	12AWG	10AWG	159	$48.45	$48.45	$59.50	-	$ 248.68
21	7	12AWG	12AWG	10AWG	132	$48.45	$48.45	$59.50	-	$ 206.45
23	8	12AWG	12AWG	10AWG	132	$48.45	$48.45	$59.50	-	$ 206.45
Galvanized Steel Closed-Bottom Cable Tray: 6"					159	-	-	-	$ 19.15	$3,044.85

AP-2-3										
Circuit	# of sets	Wire size – Phase	Wire Size – Neutral	Wire Size-Ground	Distance	Phase Cost/100'	Neutral Cost/100'	Ground Cost/100'	Cable Tray Cost/LF	Total Cost
1	1	12AWG	12AWG	10AWG	119	$48.45	$48.45	$59.50	-	$ 186.12
2	1	12AWG	12AWG	10AWG	93	$48.45	$48.45	$59.50	-	$ 145.45
3	1	12AWG	12AWG	10AWG	119	$48.45	$48.45	$59.50	-	$ 186.12
4	1	12AWG	12AWG	10AWG	93	$48.45	$48.45	$59.50	-	$ 145.45
5	1	12AWG	12AWG	10AWG	102	$48.45	$48.45	$59.50	-	$ 159.53
6	1	12AWG	12AWG	10AWG	84	$48.45	$48.45	$59.50	-	$ 131.38
7	1	12AWG	12AWG	10AWG	102	$48.45	$48.45	$59.50	-	$ 159.53
8	1	12AWG	12AWG	10AWG	84	$48.45	$48.45	$59.50	-	$ 131.38
9	1	12AWG	12AWG	10AWG	77	$48.45	$48.45	$59.50	-	$ 120.43
10	1	12AWG	12AWG	10AWG	77	$48.45	$48.45	$59.50	-	$ 120.43
11	1	12AWG	12AWG	10AWG	119	$48.45	$48.45	$59.50	-	$ 186.12
13	1	12AWG	12AWG	10AWG	68	$48.45	$48.45	$59.50	-	$ 106.35
14	1	12AWG	12AWG	10AWG	32	$48.45	$48.45	$59.50	-	$ 50.05
16	1	12AWG	12AWG	10AWG	32	$48.45	$48.45	$59.50	-	$ 50.05
19	1	12AWG	12AWG	10AWG	50	$48.45	$48.45	$59.50	-	$ 78.20
20	1	12AWG	12AWG	10AWG	50	$48.45	$48.45	$59.50	-	$ 78.20
21	1	12AWG	12AWG	10AWG	102	$48.45	$48.45	$59.50	-	$ 159.53
22	1	12AWG	12AWG	10AWG	50	$48.45	$48.45	$59.50	-	$ 78.20
Galvanized Steel Closed-Bottom Cable Tray: 6"					221	-	-	-	$ 19.15	$ 4,232.15

AP-3-1										
Circuit	# of sets	Wire size – Phase	Wire Size – Neutral	Wire Size-Ground	Distance	Phase Cost/100'	Neutral Cost/100'	Ground Cost/100'	Cable Tray Cost/LF	Total Cost
3	1	12AWG	12AWG	10AWG	107	$48.45	$48.45	$59.50	-	$ 167.35
5	1	12AWG	12AWG	10AWG	113	$48.45	$48.45	$59.50	-	$ 176.73
7	1	12AWG	12AWG	10AWG	113	$48.45	$48.45	$59.50	-	$ 176.73
9	1	12AWG	12AWG	10AWG	158	$48.45	$48.45	$59.50	-	$ 247.11
11	1	12AWG	12AWG	10AWG	130	$48.45	$48.45	$59.50	-	$ 203.32
13	1	12AWG	12AWG	10AWG	130	$48.45	$48.45	$59.50	-	$ 203.32
Galvanized Steel Closed-Bottom Cable Tray: 6"					158	-	-	-	$ 19.15	$ 3,025.70

AP-3-2										
Circuit	# of sets	Wire size – Phase	Wire Size – Neutral	Wire Size-Ground	Distance	Phase Cost/100'	Neutral Cost/100'	Ground Cost/100'	Cable Tray Cost/LF	Total Cost
1	1	12AWG	12AWG	10AWG	121	$48.45	$48.45	$59.50	-	$ 189.24
2	1	12AWG	12AWG	10AWG	37	$48.45	$48.45	$59.50	-	$ 57.87
3	1	12AWG	12AWG	10AWG	121	$48.45	$48.45	$59.50	-	$ 189.24
4	1	12AWG	12AWG	10AWG	37	$48.45	$48.45	$59.50	-	$ 57.87
5	1	12AWG	12AWG	10AWG	102	$48.45	$48.45	$59.50	-	$ 159.53
6	1	12AWG	12AWG	10AWG	46	$48.45	$48.45	$59.50	-	$ 71.94
7	2	12AWG	12AWG	10AWG	105	$48.45	$48.45	$59.50	-	$ 164.22
8	3	12AWG	12AWG	10AWG	46	$48.45	$48.45	$59.50	-	$ 71.94
9	4	12AWG	12AWG	10AWG	105	$48.45	$48.45	$59.50	-	$ 164.22
10	5	12AWG	12AWG	10AWG	46	$48.45	$48.45	$59.50	-	$ 71.94
11	6	12AWG	12AWG	10AWG	70	$48.45	$48.45	$59.50	-	$ 109.48
12	7	12AWG	12AWG	10AWG	98	$48.45	$48.45	$59.50	-	$ 153.27
Galvanized Steel Closed-Bottom Cable Tray: 6"					219	-	-	-	$ 19.15	$ 4,193.85

Total Cost: $14,496.52

conclusion

Not only does specifying cable tray instead of conduit within the slab save money, it is also provides flexibility for the upgrade and/or rearranging of the fitness equipment on both the second and third floors. An architectural concern, six inch cable tray run along the windown will not be noticeable or unattractive, especially when considering the high ceiling heights and newly designed lighting in the lobby.

breadth one (MAE): daylighting

Gymnasiums are an ideal design space for daylight integration into the lighting system. Daylight is primarily introduced into the Drexel gymnasium by the façade glazing on the Northern wall. A redesign of the daylighting in the space created additional energy savings by incorporating skylights to increase uniformity and increase daylight penetration further in the space. The integration of daylighting into my gymnasium is the study that involves coursework specific to the M.A.E. program. Techniques and information learned in AE 565 – "Daylighting", taught by Dr. Richard Mistrick, will be applied to the study and analysis of the daylight in the space. The Daysim computer software is able to perform annual energy studies and calculate energy savings from a dimming system utilizing daylight sensors, taking into account real-time annual sky condition data.

description

The bi-level gymnasium is located on the second and third floors of the Northern face of the Athletic Center addition and can be entered from the fitness area, or for special events from the courtyard. The space serves as the practice facility for the Drexel Dragons basketball team and has an elevated running track around the perimeter of the second level. The northern wall is composed almost entirely of glass providing natural light to the space. The gymnasium measures 103 x 130' and spans a total of 13,420sf.

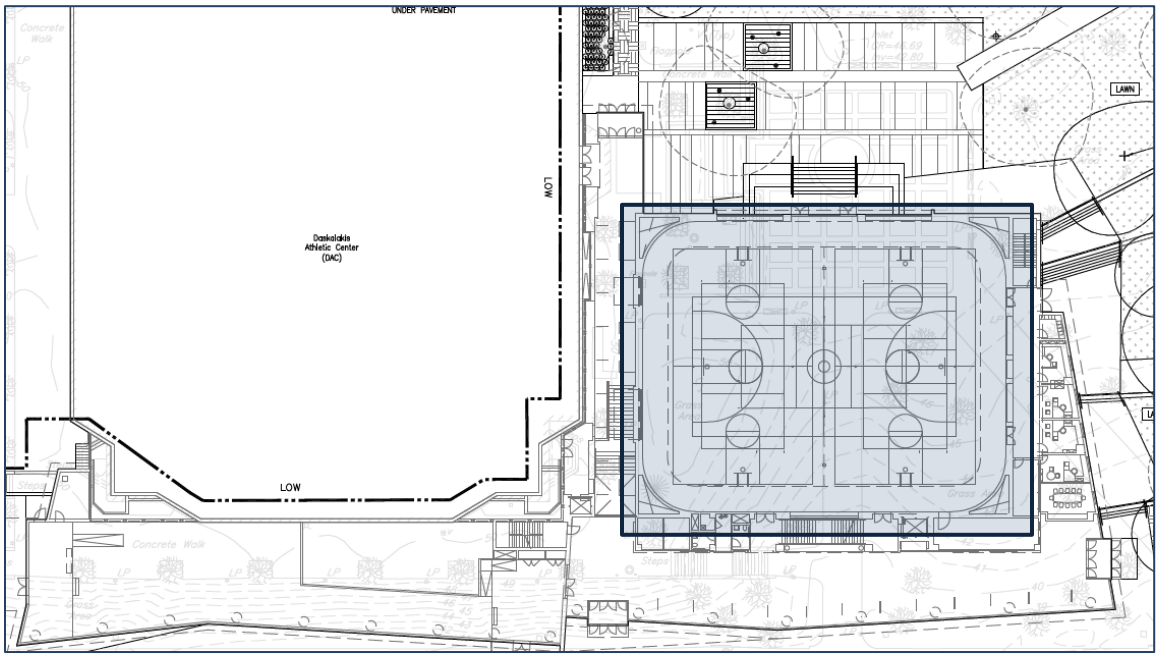


figure d.1 – orientation of gymnasium in building

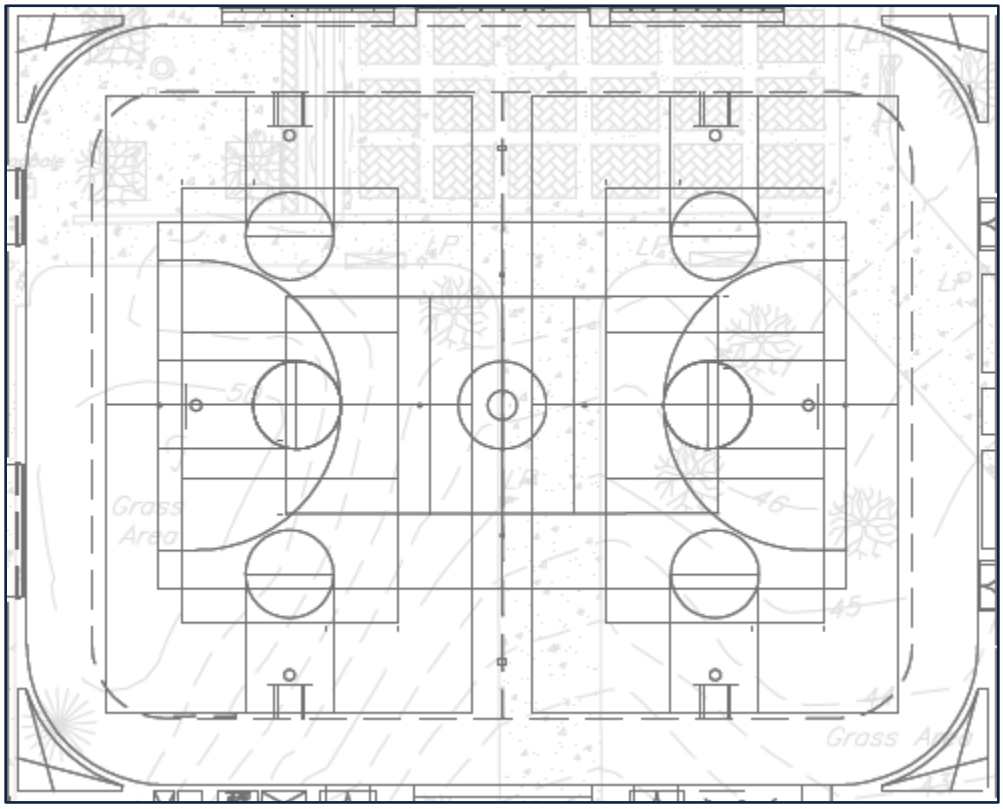


figure d.2 – gymnasium plan

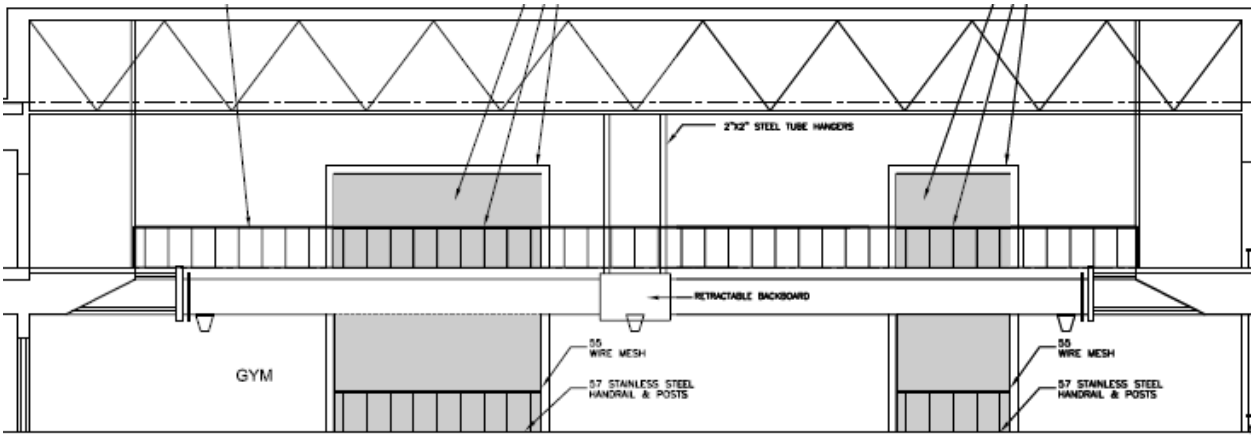


figure d.3 – gymnasium section

Materials and Finishes		
Surface	**Description**	**Reflectance**
floor	Northern Hard Maple wood flooring system	0.24
ceiling	exposed structural steel painted white	0.60
track	12mm Mondo light blue rubber track	0.25
walls above track	GWB painted Sherwin Williams Useful Grey	0.24
walls below track	CMU painted Sherwin Williams Useful Grey	0.27
glazing	Viracon insulating laminated glass VRE 1-54	t = 0.46
skylights	OldCastle Building Envelope insulated N-series	t = 0.57

table d.1 – gymnasium materials and finishes

system overview

desired illuminance levels and design goals

A gymnasium is the perfect place in which to integrate and control the amounts of daylighting within a space. Daylighting can be tricky in a space where uniformity is desired, so a northern facing façade is preferred in order to avoid strong shadows and bright spots in the early and late parts of the day. Dimming of the luminaires using a photocell to monitor the light levels within the space is the most successful way to utilize daylight to control both light levels and energy costs. The desired high illuminance levels in a multi-purpose gymnasium make this a space in which daylight addition and dimming can be produce substantial energy cost savings.

gymnasium- basketball class III, training facility:
horizontal – **50fc**

gymnasium- volleyball class III, training facility:
horizontal – **50fc**

This multi-purpose space should always feel public and open, giving an impression of visual clarity both for the players and anyone who is watching from the track or from one of the fitness centers. A bright, uniform lighting layout is appropriate, with the possibility of some perimeter lighting to accentuate ceiling height and push out the walls. Light finishes should be used to make the space appear brighter and provide a comfortable environment where players can feel energized and focused at practice.

The existing lighting design employs compact fluorescent high-bay fixtures, and provides an even illumination to the gymnasium floor. Electric light levels provided in the gymnasium are above the desired level, making energy savings possible even during non-daylight hours.

Luminaire Schedule									
Type	Description	Manufacturer	Catalog Number	Lamp		V	Power Supply	Input Watts	PF
				No	Type				
C2	10" compact fluorescent down light with recessed housing and impact resistant polycarbonate lens.	Gotham	AF-232TRT-10AR-PCL-277	2	PLT-32 4100 85 MIN CRI	277	GE T5 HE Ballast 99655-GE228MVPPS-A	36	.95
GP1	Compact fluorescent highbay sports lighting pendant fixture with drop lens and wireguard.	Sportlite	LX800-T42-35K-21PRL-21DLCP-277-4SL-3PEN-21XWG-21AL	8	PLT-32 4100 85 MIN CRI	277	Integral universal LED driver	33	.9

table d.2 – gymnasium luminaire schedule

Light Loss Factors				
Lamp Type	LLD	LDD	BF	Total
C6	.86	.90	1.0	.75
PB1	.86	.90	1.0	.75

table d.3 – gymnasium light loss factors

**The above light loss factors were calculated using the new method in the 2010 IESNA handbook. The Room Surface Dirt Depreciation (RSDD) was neglected and the Luminaire Dirt Depreciation (LDD) was calculated using the updated calculation outlined in the book. A lamp maintenance schedule of twelve months was assumed.*

skylight layout and design

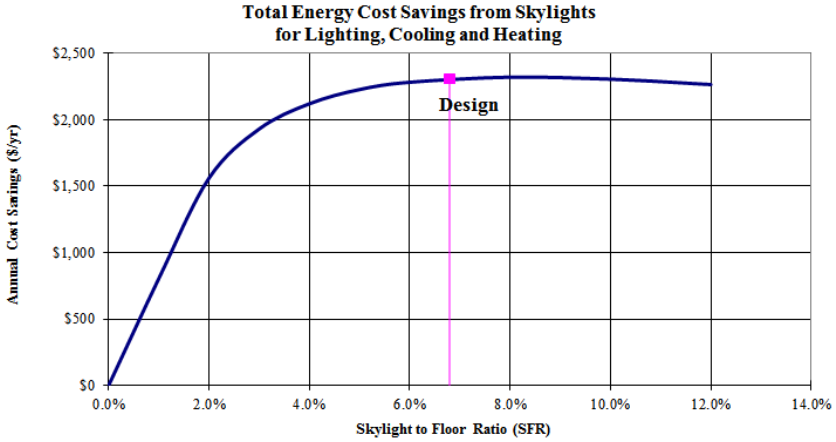
The OldCastle Building Envelope "N"Series Skylight System triple glazed skylight units are ENERGY STAR certified and provide optimal performance with minimal heat gain, and provide opportunities not only to maximize energy savings, but to receive ENERGY STAR rebates.

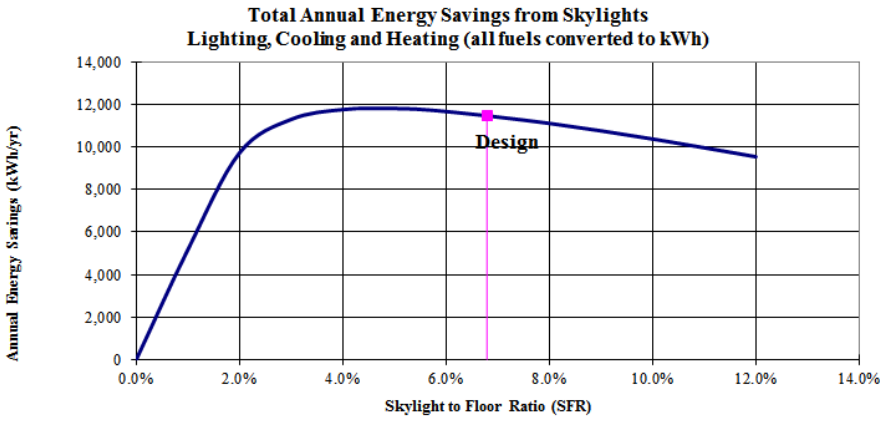
Skylight Data	
Manufacturer	OldCastle Building Envelope
System	"N" Series insulated Skylight System
Total Number	12
Dimensions	8' x 10' x 6"
t	.34
U	.27
SHGC	.20
Skylight/floor ratio	6.8%- ratio dictated by SkyCalc results

table d.4 – skylight data

figure d.4 – gymnasium skylight example

SkyCalc software was used as a guide to select an efficient skylight-to-floor ratio. A skylight size of 8' x 10' was selected based on the analysis of energy and cost savings. A lower ratio would have saved more heating energy but less money overall, and so 6.8% was determined ideal. (*See figures below for description of SkyCalc results).*





The final skylight layout was determined based on truss location and position of the existing lighting system. Although the maximum energy savings would be resultant of a skylight-to-floor ratio of 4%, the maximum energy cost savings is a higher priority to the owner, and so a ratio of proximately seven percent was achieved based on the results of the SkyCalc study.

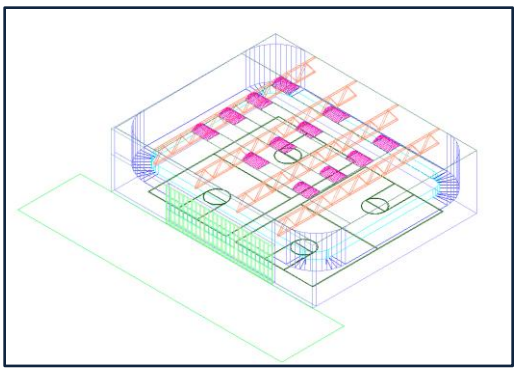


figure d.5 –isometric of skylight design

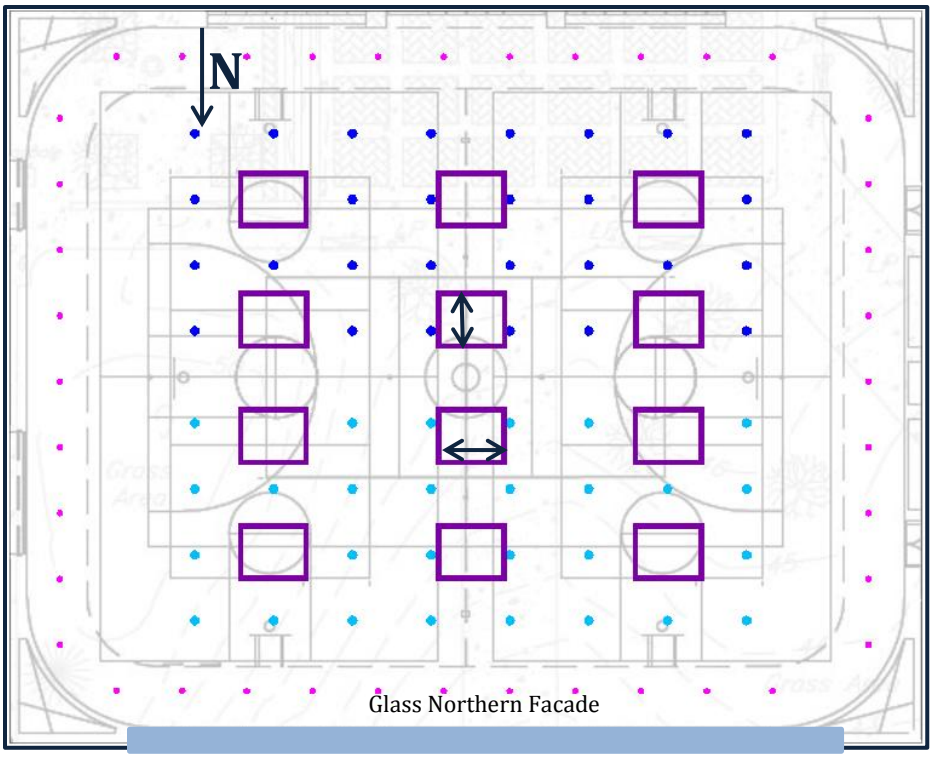
controls

The gymnasium lighting will be controlled using three separate zones. The first zone is the perimeter lighting below the suspended track, which will be always on throughout the day to provide consistent light levels and avoid shadows on the floor, as well as to regulate the luminance levels on the wall surfaces as the daylight condition changes. The high-bay fluorescent lighting is dimmed in two separate zones to maximize energy savings and uniformity, as the northern half of the gymnasium has higher light levels throughout the day due to the fenestration that makes up a majority of the Northern façade.

A Wattstopper daylighting control dimming system is specified for automatic dimming control of the fluorescent luminaires. Each zone has a separate daylight sensor on the ceiling, facing down to optimize energy savings and provide consistent light levels throughout the space.

Gymnasium Control Schedule			
Type	Manufacturer	Product	Description
LMLS-305	Wattstopper	LightSaver Photocell	Closed loop photosensor provides the daylight data necessary for operation.
LMRC-202	Wattstopper	LightSaver Room Dimming Controller	Provides automatic dimming control for fluorescent fixtures. Closed loop control utilizes a single photocell for multi-zone dimming.
LMSW-100	Wattstopper	LightSaver Wall Switches	Allows occupants to temporarily override the daylighting control systems.

table d.5 – gymnasium control schedule



Zoning diagram and skylight layout plan. Please note that in order to provide consistency with Daysim graphics, North is depicted at the bottom of the drawing, instead of the traditional orientation.

performance analysis - DAYSIM

Using DAYSIM to perform an hour by hour year-long analysis, a two-zone dimming analysis was performed to calculate energy savings per zone. To get the most accurate results possible, Zone 1 and 2 were tested separately. Zone 1, the interior zone was tested with Zone 2 turned off to minimize interference because for the majority of the day the northern façade provides enough daylight to the northern half of the gymnasium. Zone 2, the exterior zone near the window was tested with the interior zone turned on, because the dimming level is almost always lower in Zone 1, and the electric light will be affecting the calculations. Zone 3 was left on for all calculations.

occupancy

The Drexel Recreation Center has extensive hours throughout the year- operating from 6am-midnight throughout the school year and from 8am-10pm in the summer. For this analysis, I wanted to see how much savings the daylight would provide for the daylight hours, and so the analysis is only for operated daylight hours of 8am-8pm.

photo sensor placement

The photocells for each zone were placed on the exposed trusses, at a height of 25', facing down in order to effectively monitor the daylight levels.

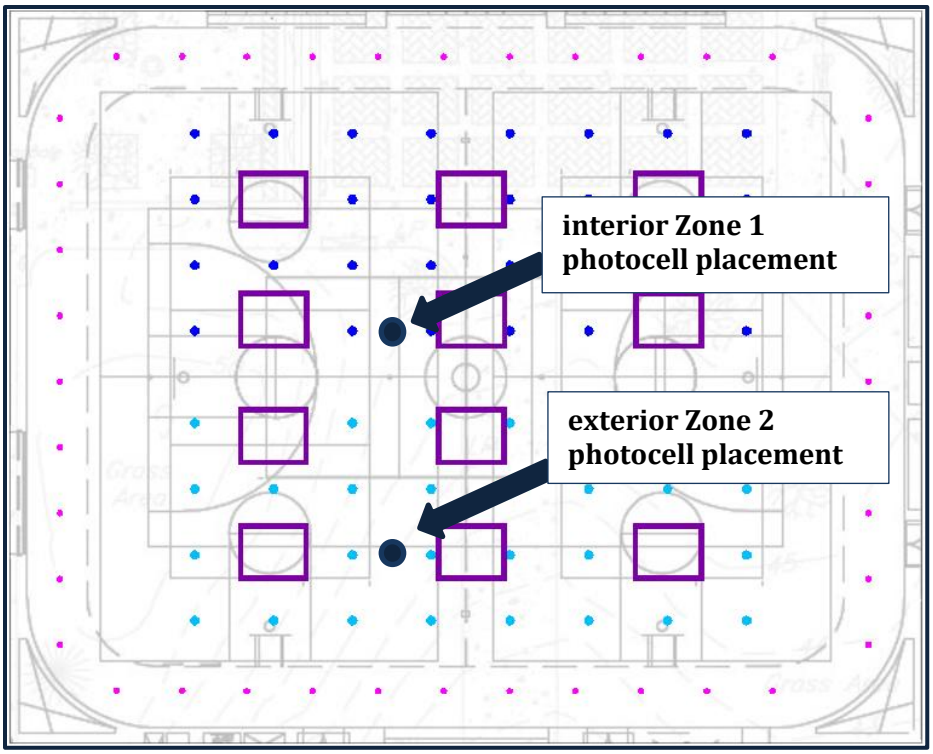


figure d.6– daylight photosensor placement

critical point selection

The critical point is exactly as it sounds: critical to a well-designed daylight dimming system. To locate that perfectly placed critical point, the analysis point was selected where the highest dimming level for that zone of electric light was needed. For the interior zone, Zone 1, the critical point was selected with Zone 2 off, and for the exterior zone, Zone 2, it was selected with Zone 1 on as the dimming levels are typically higher and will contribute to the light that Zone 2 sees throughout the day. See below for the locations of the critical points for zones one and two.

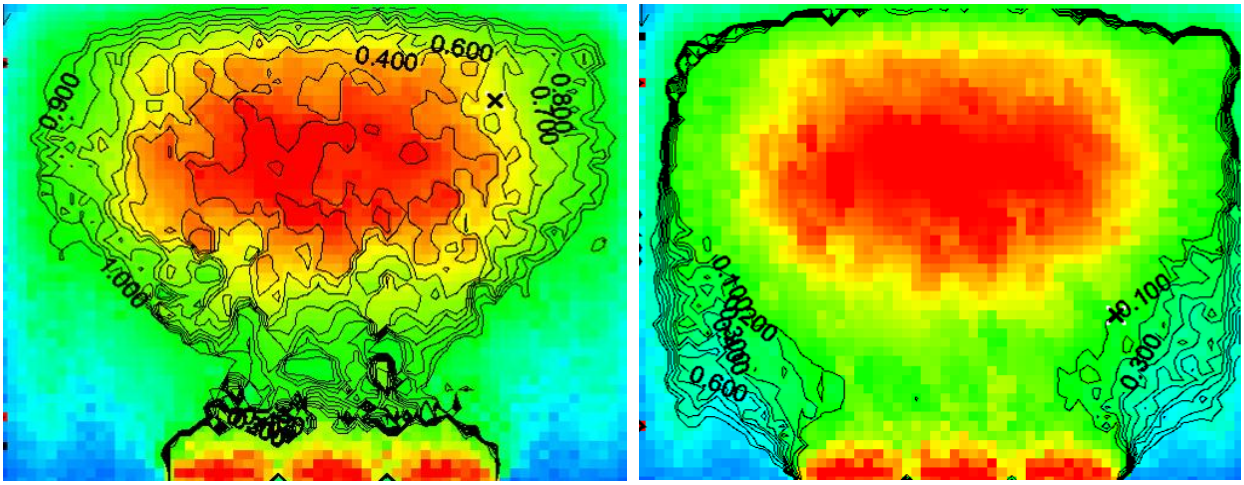


figure d.7– Critical point placement for Zone 1, left and Zone 2, right

control algorithm settings

The photo sensors were calibrated selected using a closed loop proportional algorithm. An overcast Philadelphia sky on January 12 was selected in order to provide the most accurate signals to the sensor. A target value of 500 lux was set, and for additional energy savings the luminaires are set to turn off when they reach the lowest ballast output of 5%.

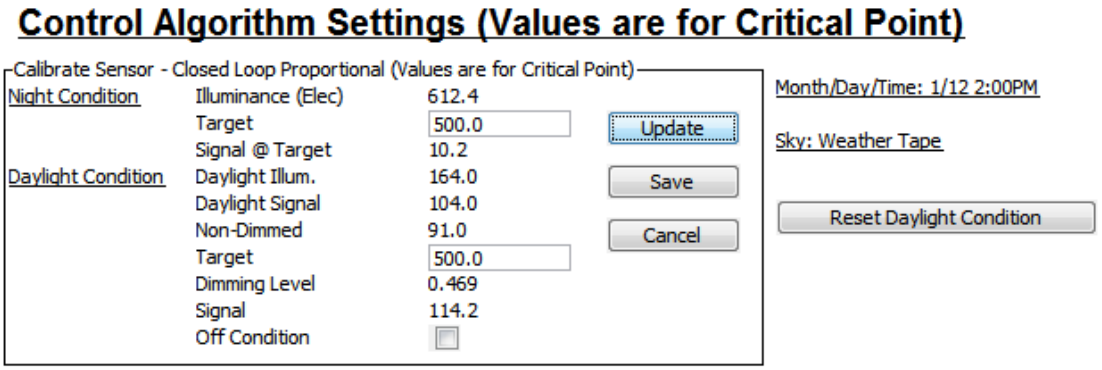


figure d.8- control algorithm settings for Zone 1

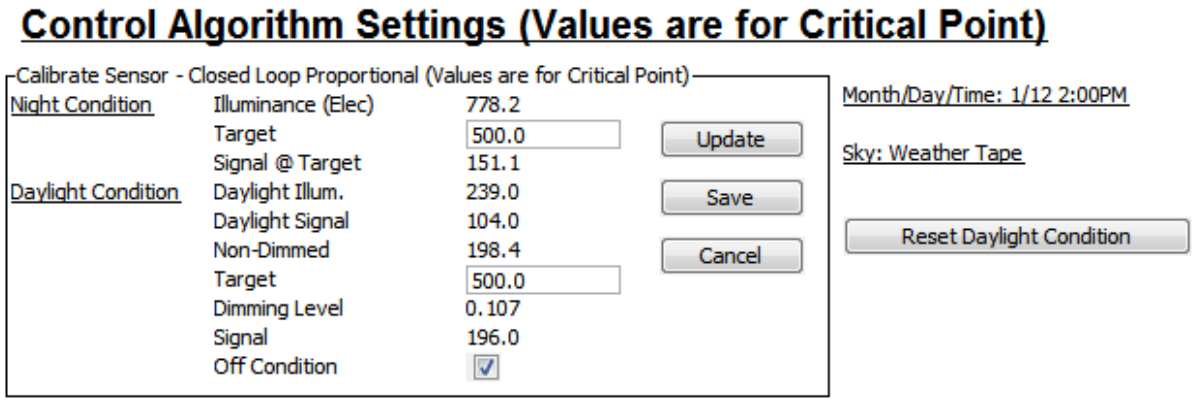


figure d.9- control algorithm settings for Zone 2

results

Hour by hour calculations show you exactly how a space is affected by daylight at each hour of the day. Below are hour by hour results for each zone on the spring/fall equinox, the summer solstice, and winter solstice.

spring/fall equinox hour by hour results

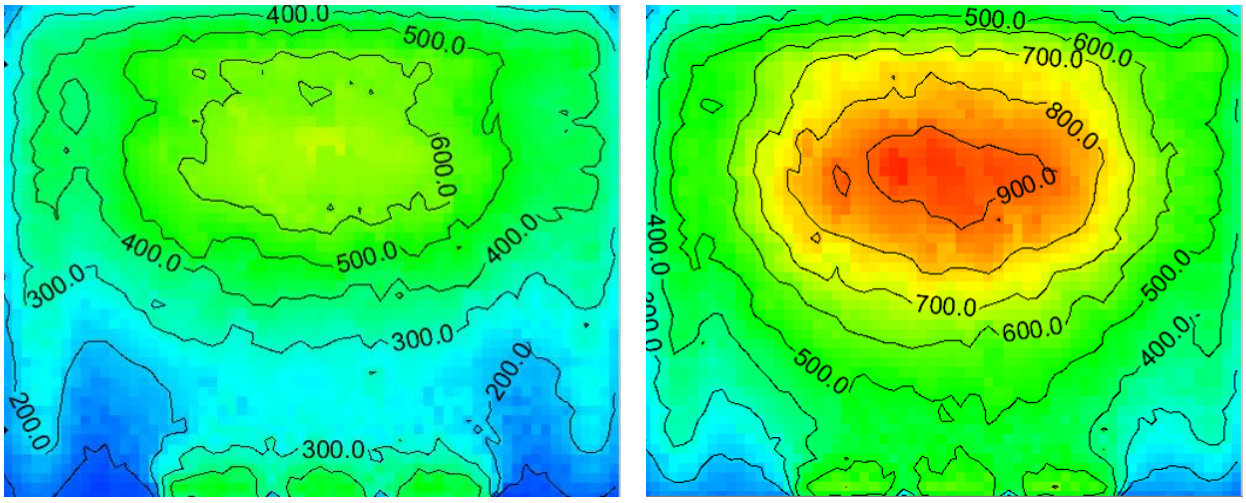


Figure E.1 – 8am Zone 1 dimmed to .787, Zone 2 dimmed to .341

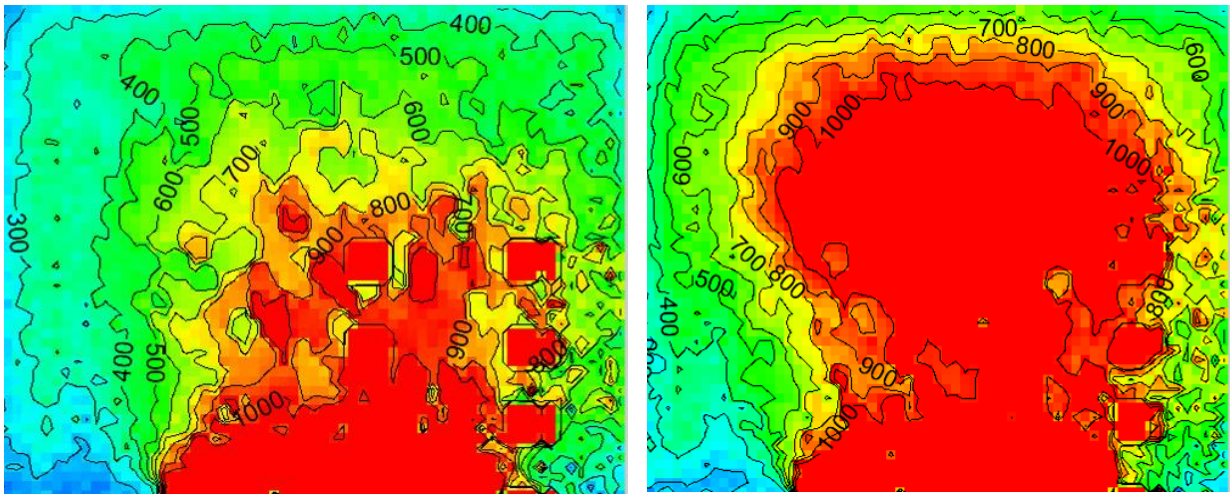


Figure E.2 – 9am Zone 1 dimmed t o.236, Zone 2 off

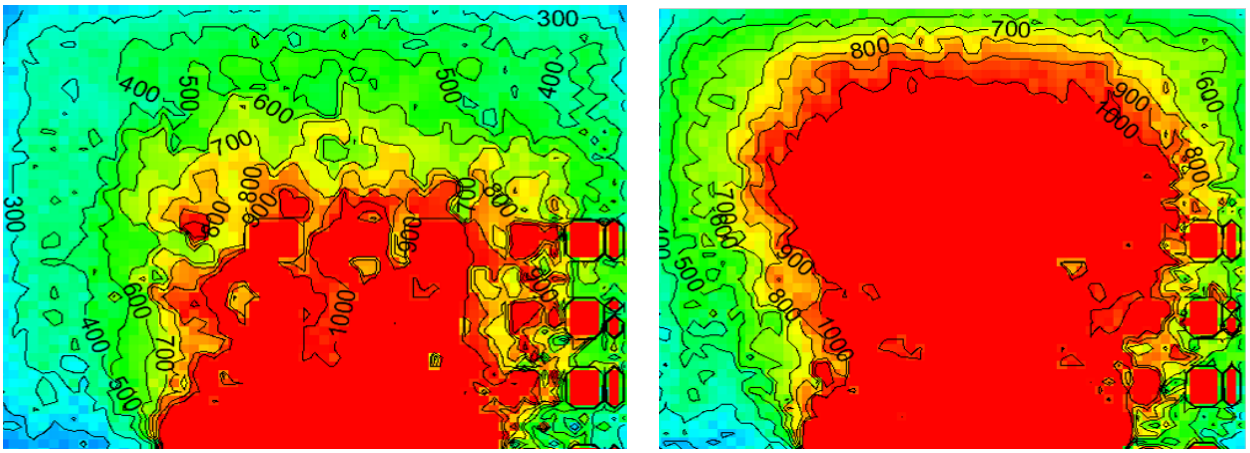


Figure E.3 – 10am Zone 1 dimmed to .173, Zone 2 off

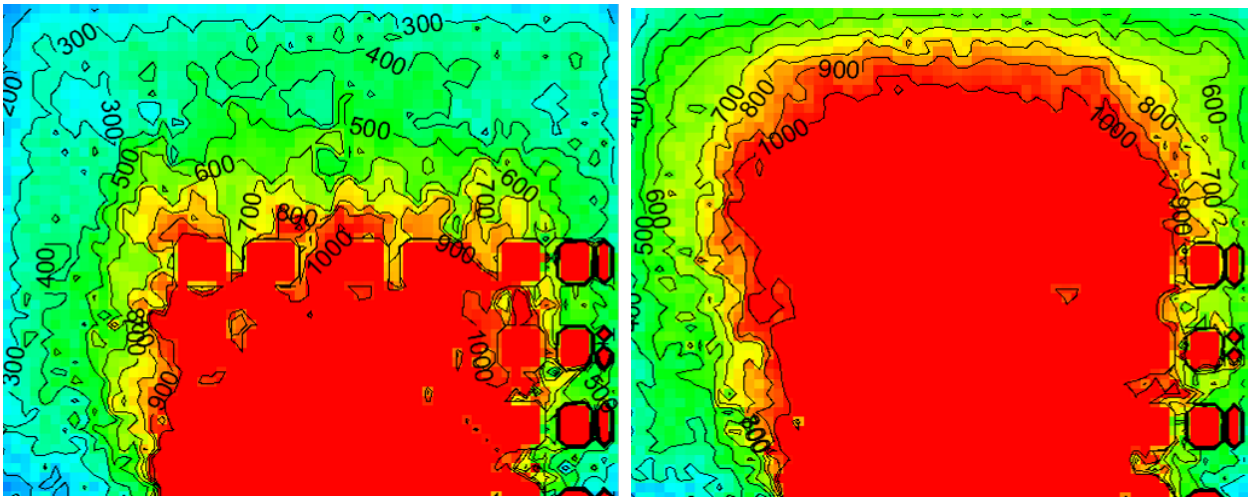


Figure E.4 – 11am Zone 1 off, Zone 2 off

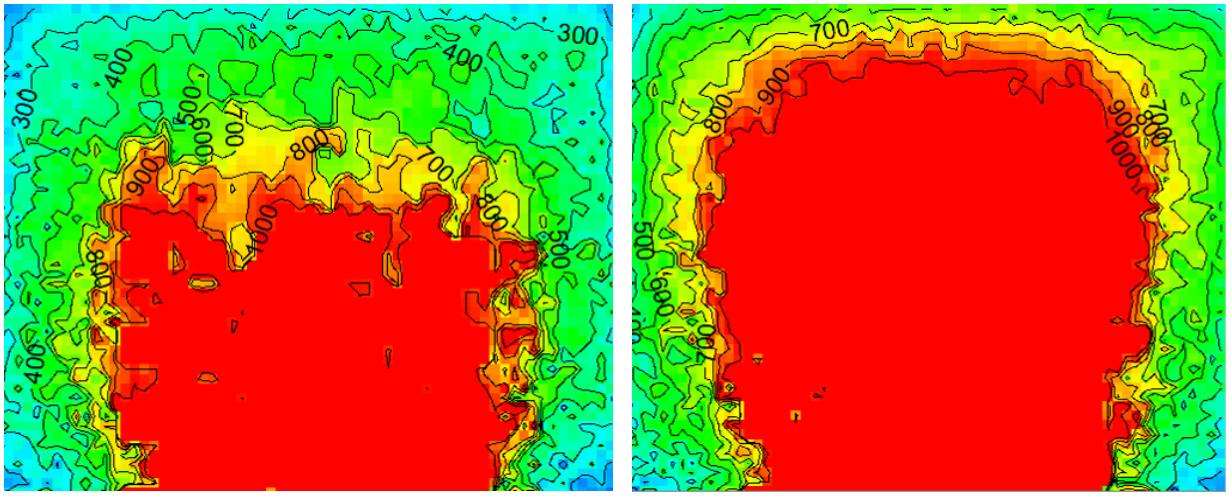


Figure E.5 – 12pm Zone 1 dimmed t o.051 , Zone 2 off

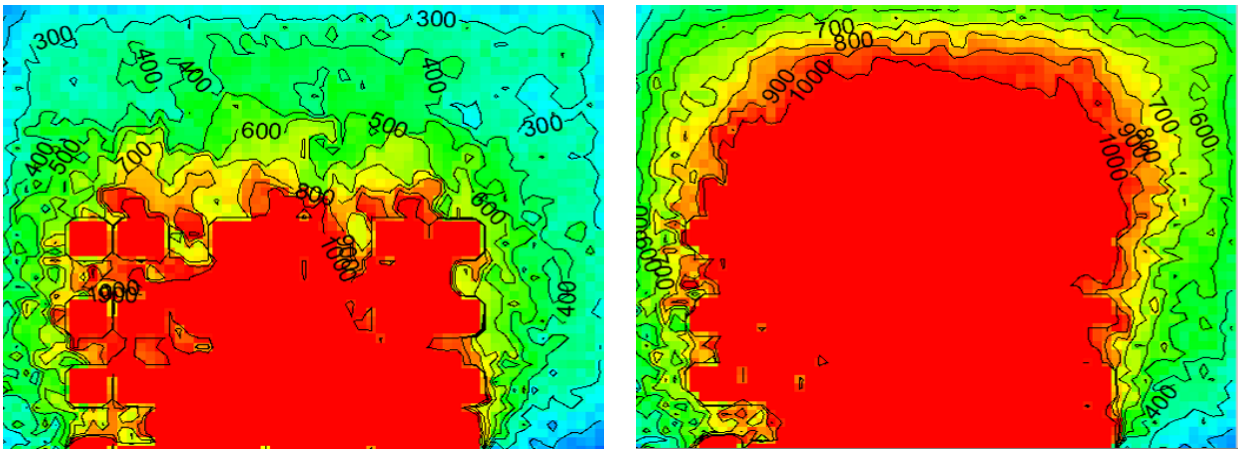


Figure E.6 – 1pm Zone 1 off, Zone 2 off

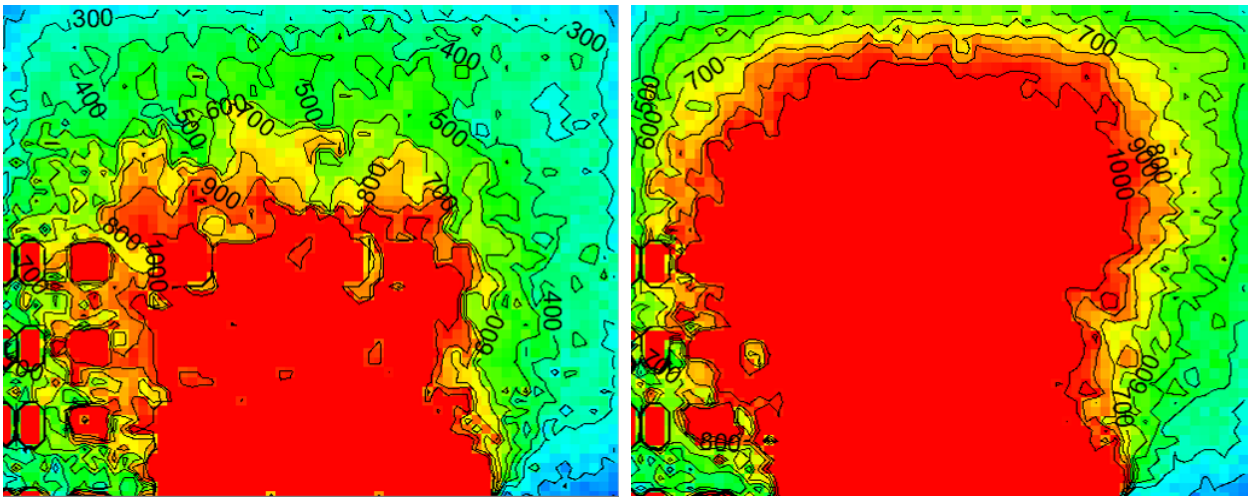


Figure E.7 – 2pm Zone 1 dimmed to .056, Zone 2 off

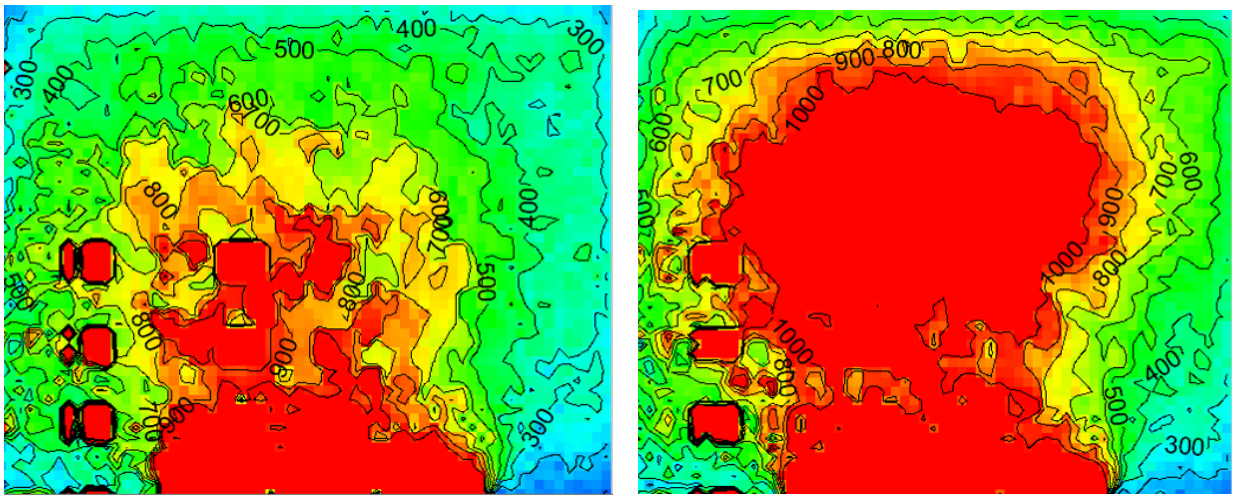


Figure E.8 – 3pm Zone 1 dimmed t o .227, Zone 2 off

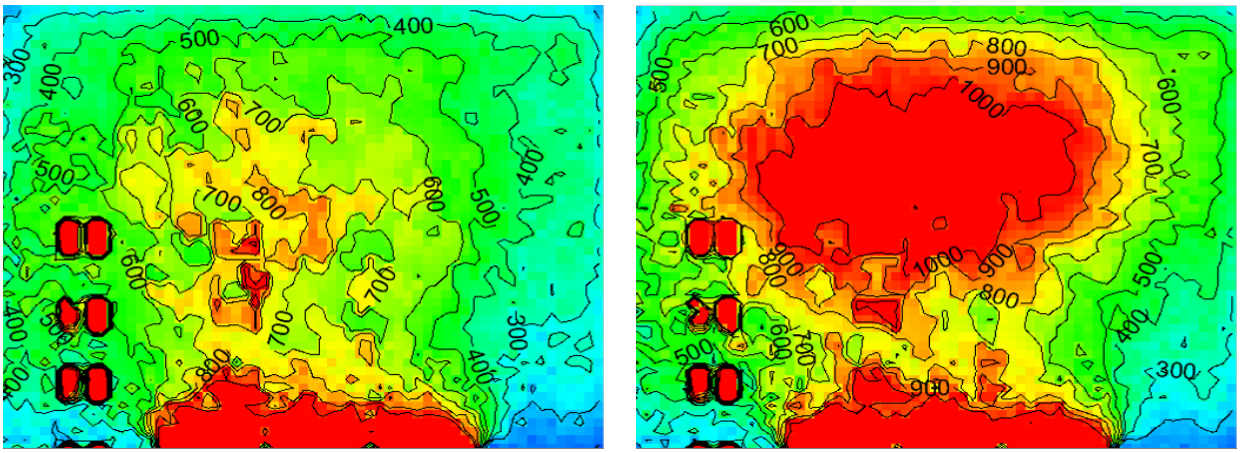


Figure E.9 – 4pm Zone 1dimmed to 0.385, Zone 2 off

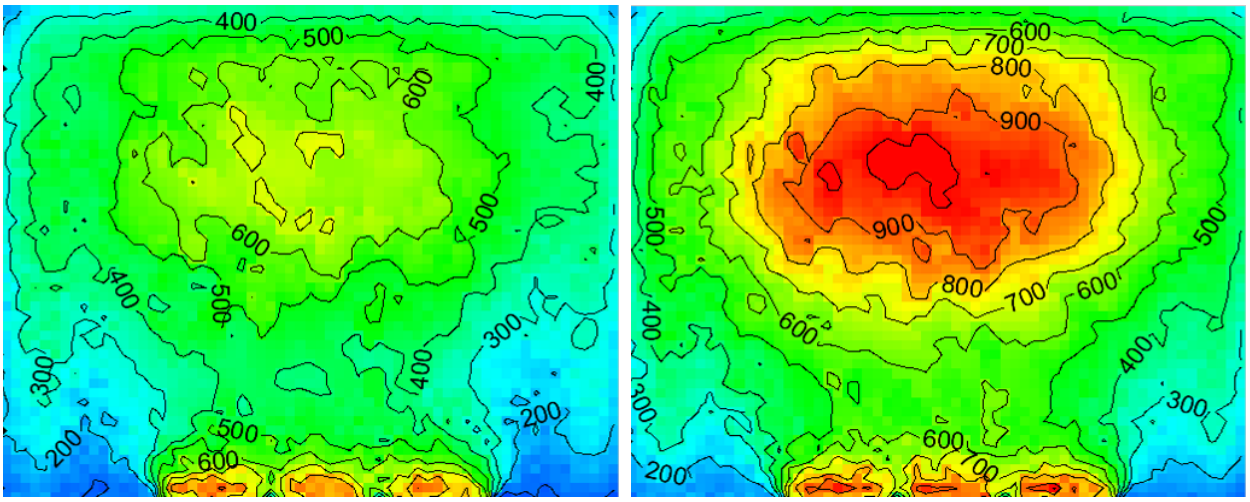


Figure E.10 – 5pm Zone 1 dimmed to .619, Zone 2 dimmed to .167

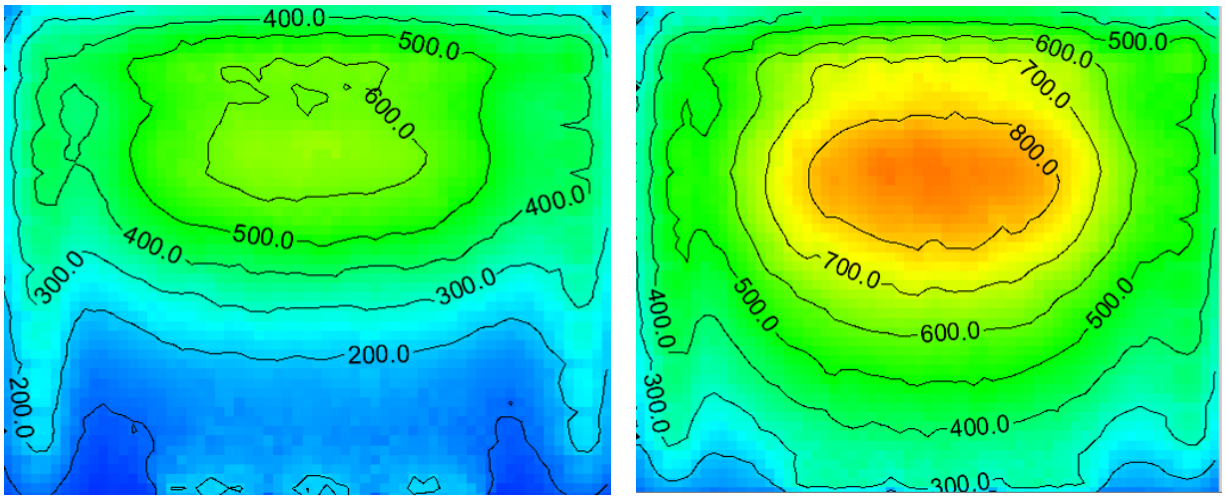


Figure E.11 – 6pm Zone 1 dimmed t o .813 , Zone 2 dimmed to .452

summer solstice hour by hour results

The Northern façade receives high levels of light throughout the summer, and so the exterior zone is able to be switched off for the entirety of the day. For this reason, only the calculations from Zone 1 are shown as they are calculated with Zone 2 switched off.

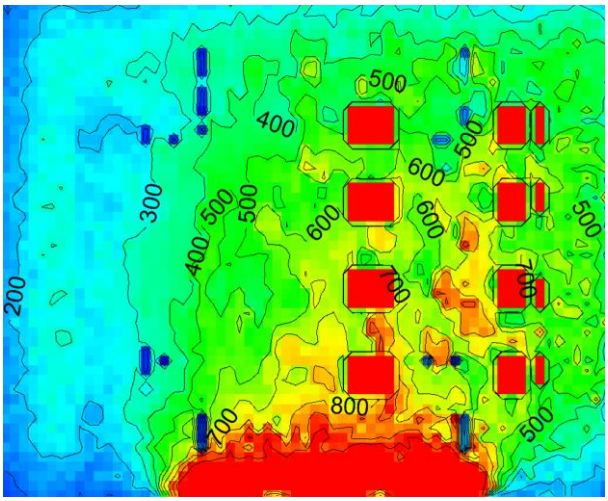


Figure E.12 – 8am Zone 1 off, Zone 2 off

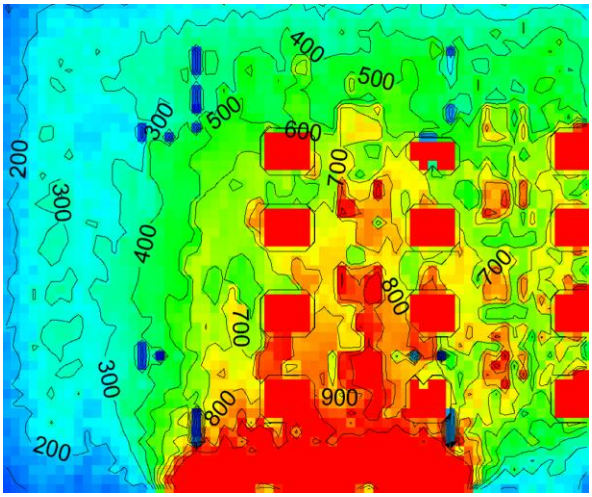


Figure E.13 – 9am Zone 1 dimmed t o .227, Zone 2 off

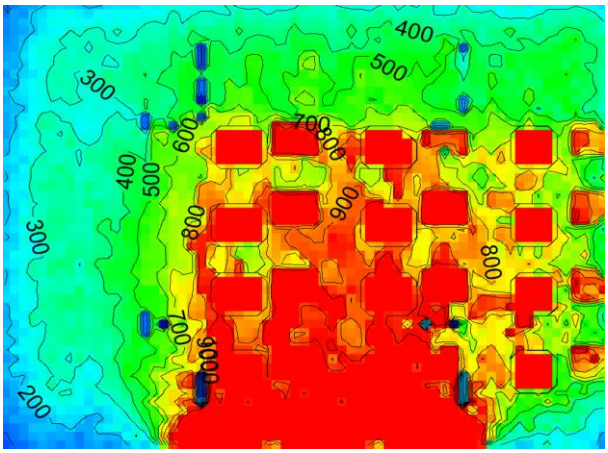


Figure E.14 – 10am Zone 1 off, Zone 2 off

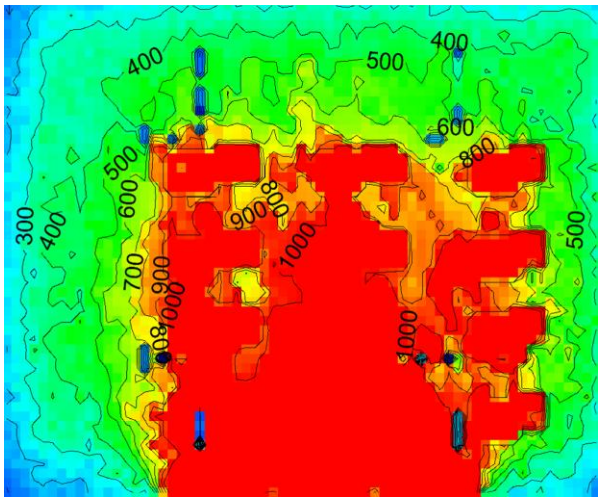


Figure E.13 – 11am Zone 1 off, Zone 2 off

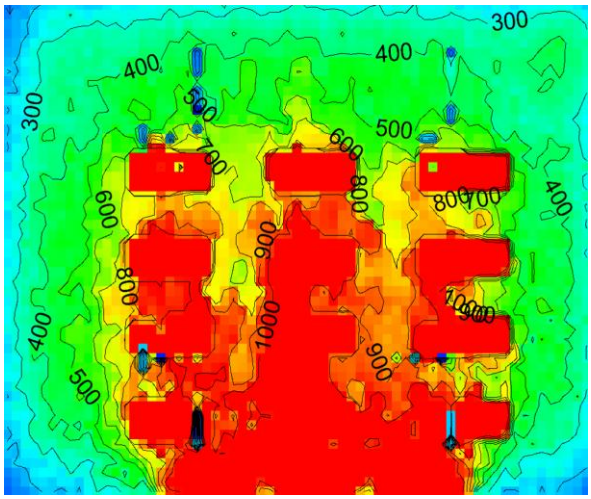


Figure E.14 – 12pm Zone 1 off, Zone 2 off

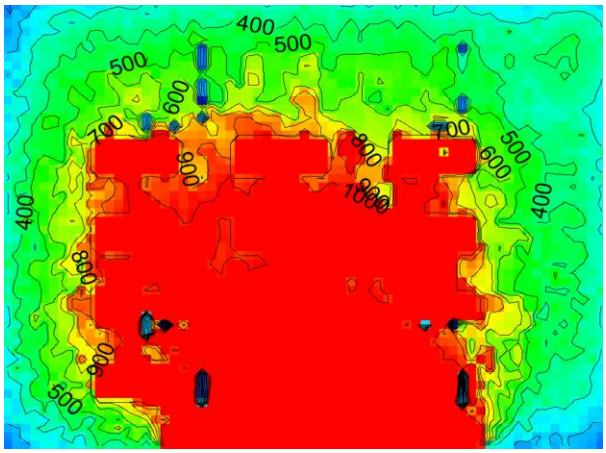


Figure E.15 – 1pm Zone 1 off, Zone 2 off

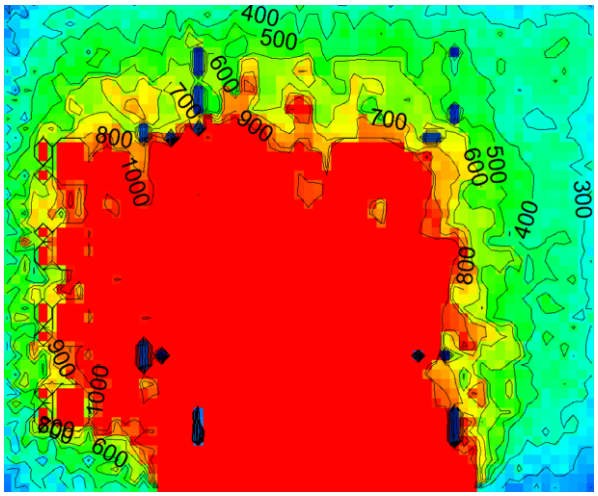


Figure E.16 – 2pm Zone 1 off, Zone 2 off

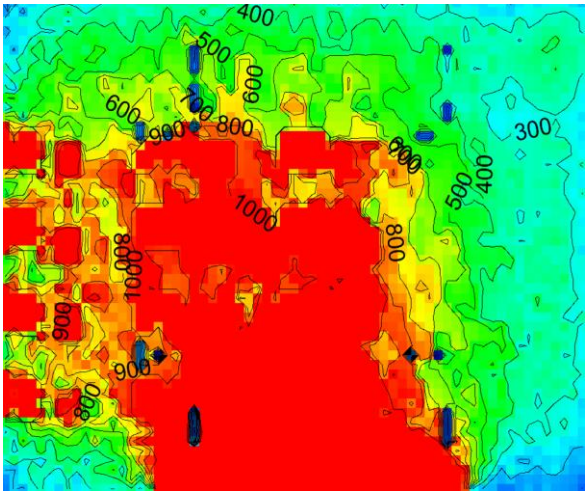


Figure E.17 – 3pm Zone 1 off, Zone 2 off

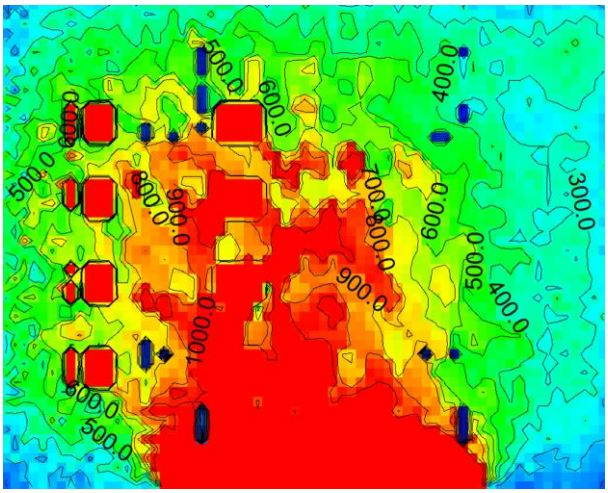


Figure E.18 – 4pm Zone 1 off, Zone 2 off

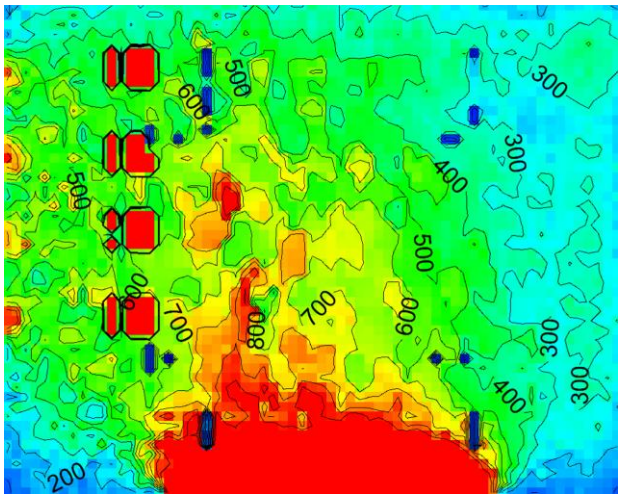


Figure E.19 – 5pm Zone 1 off, Zone 2 off

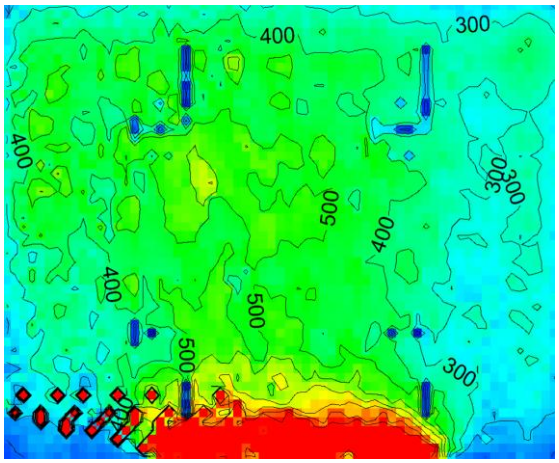


Figure E.20 – 6pm Zone 1 dimmed to .273, Zone 2 off

winter solstice hour by hour results

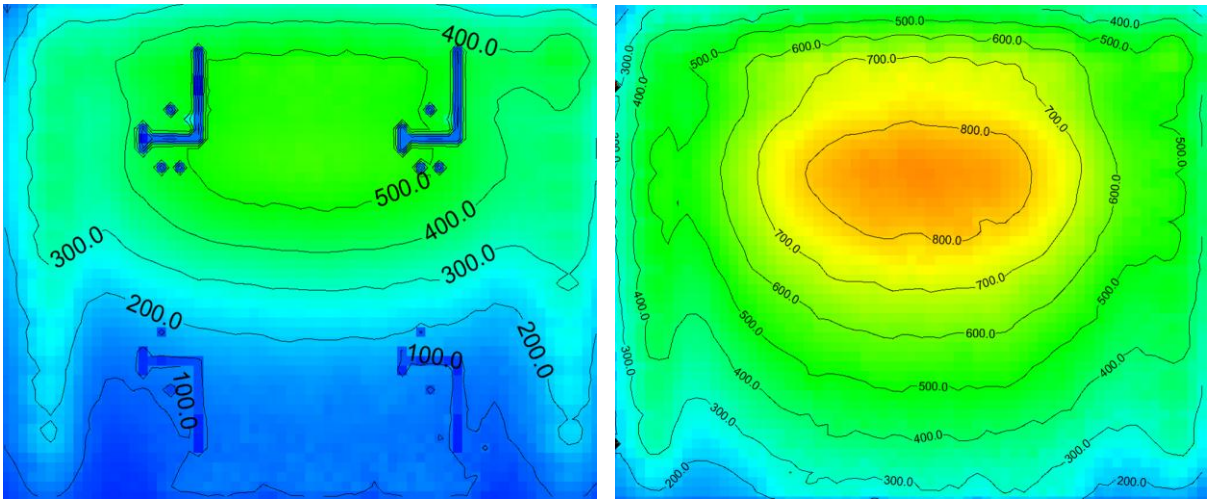


Figure E.21 – 8am Zone 1 dimmed to .754, Zone 2 dimmed to .468

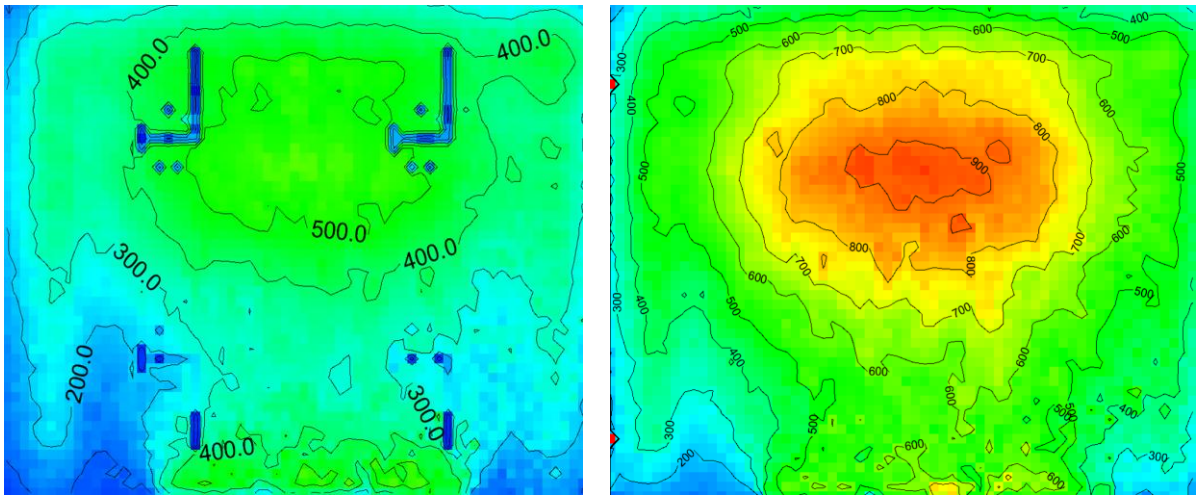


Figure E.22 – 9am Zone 1 dimmed t o .62, Zone 2 dimmed to .274

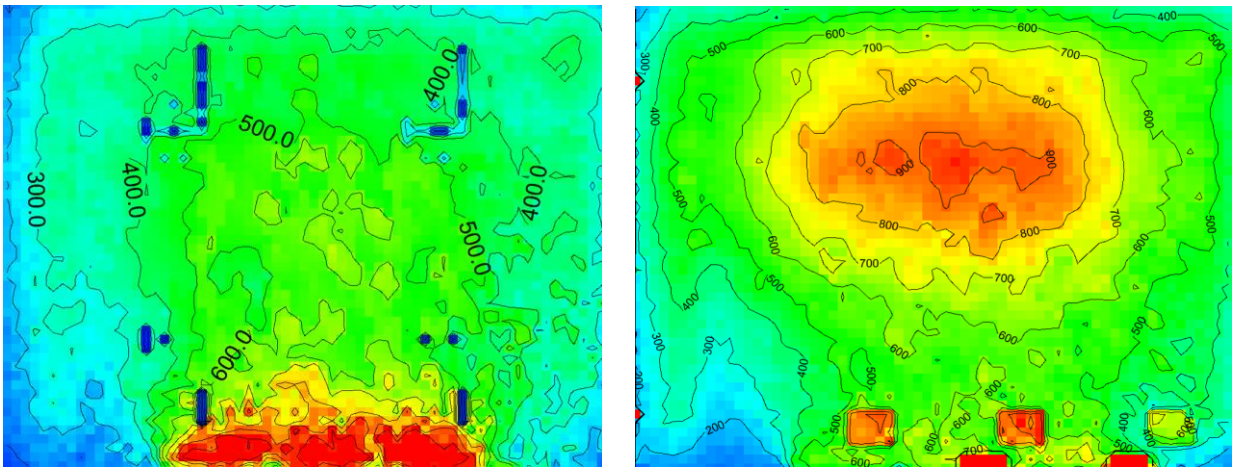


Figure E.23 – 10am Zone 1 dimmed to 0.348, Zone 2 dimmed to .171

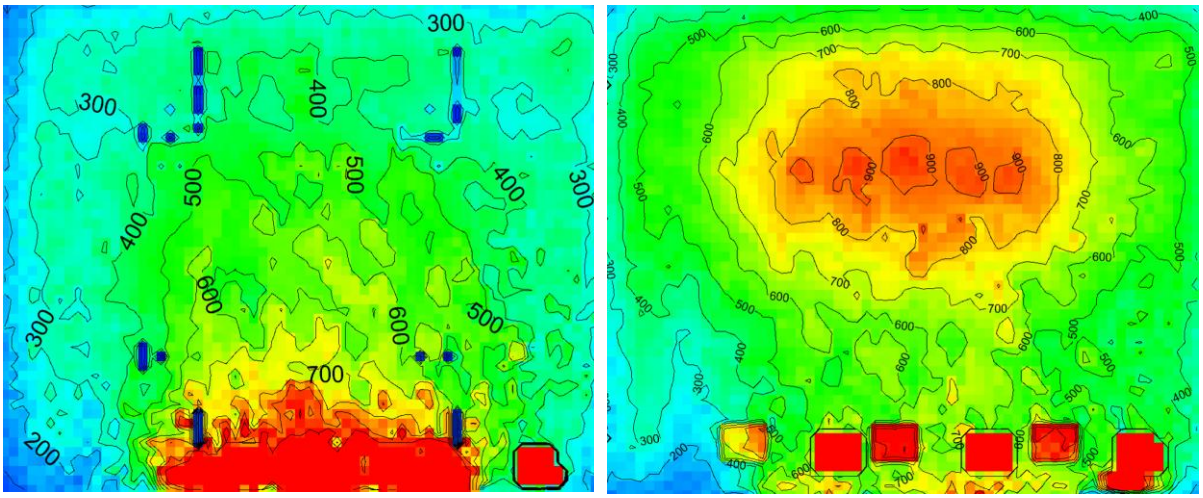


Figure E.24 – 11am Zone 1 dimmed to .2, Zone 2 dimmed to .05

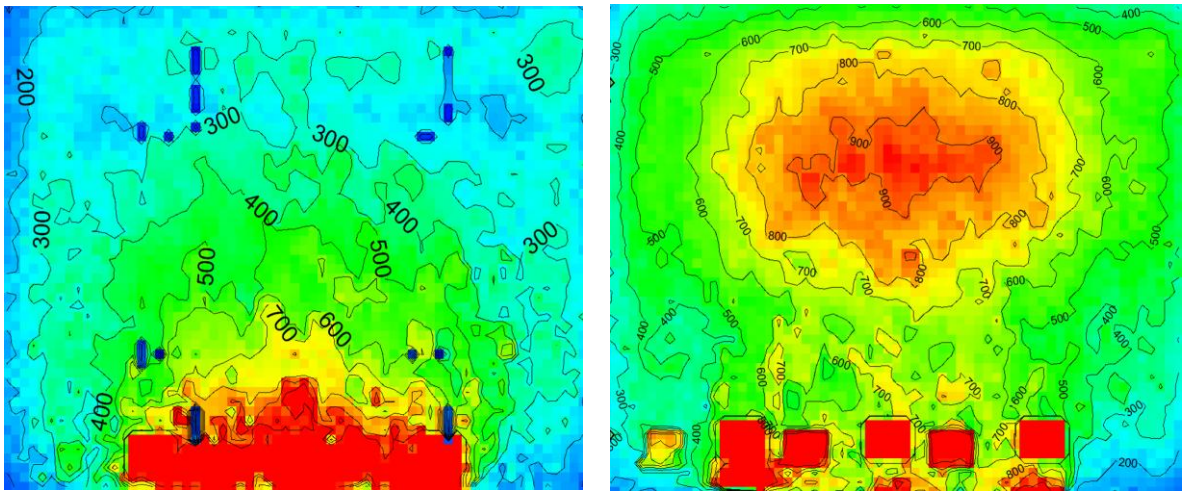


Figure E.25 – 12pm Zone 1 of, Zone 2 off

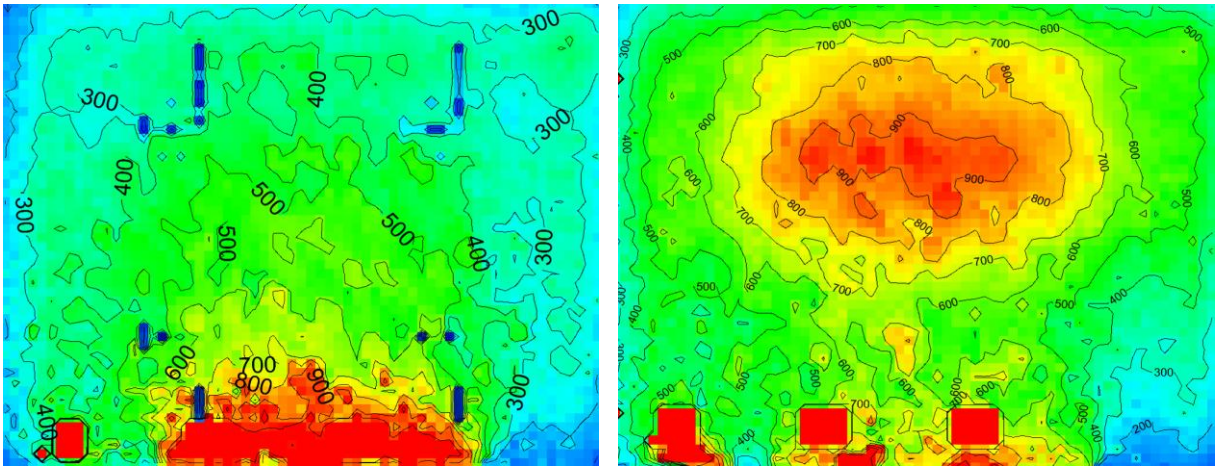


Figure E.26 – 1pm Zone 1 dimmed to 0.212, Zone 2 off

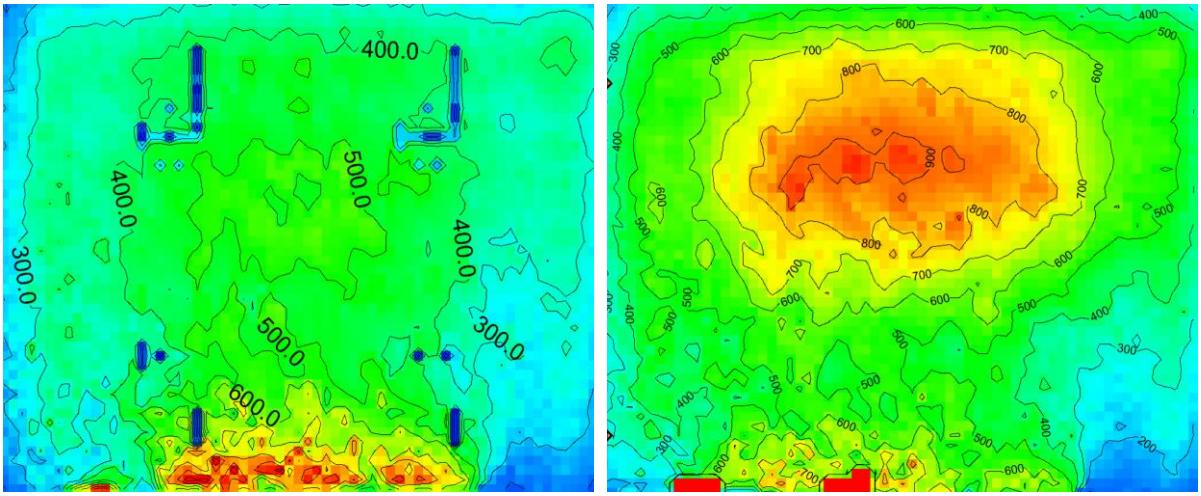


Figure E.27 – 2pm Zone 1 dimmed to .403, Zone 2 off

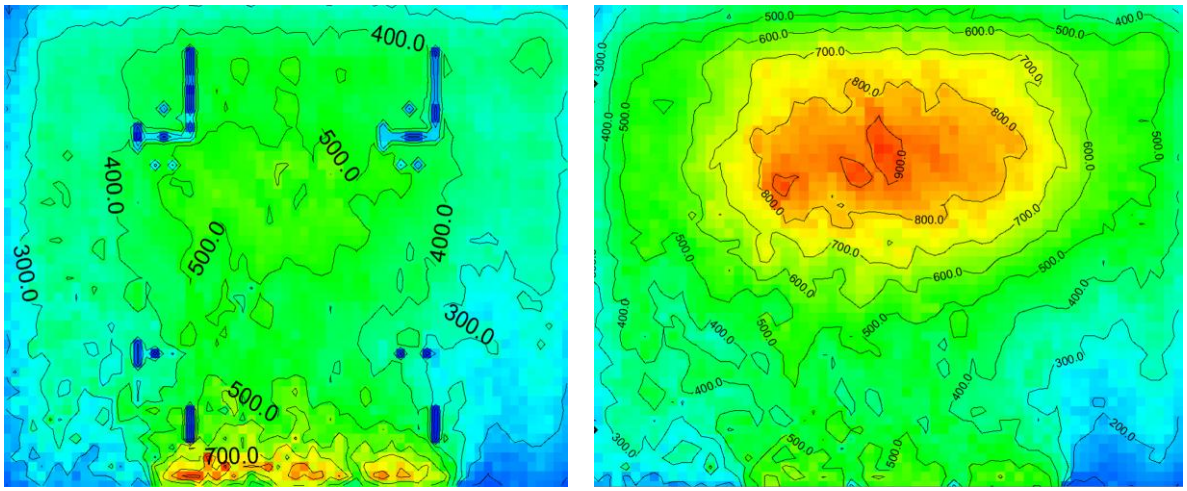


Figure E.28 – 3pm Zone 1 dimmed to .448, Zone 2 off

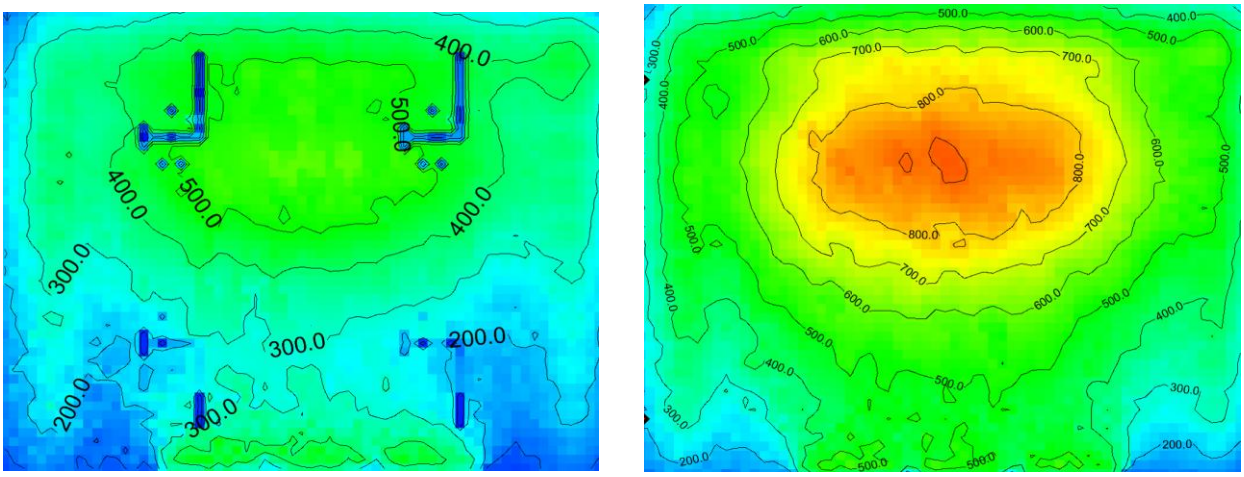


Figure E.29 – 4pm Zone 1 dimmed to 0.636, Zone 2 dimmed to .321

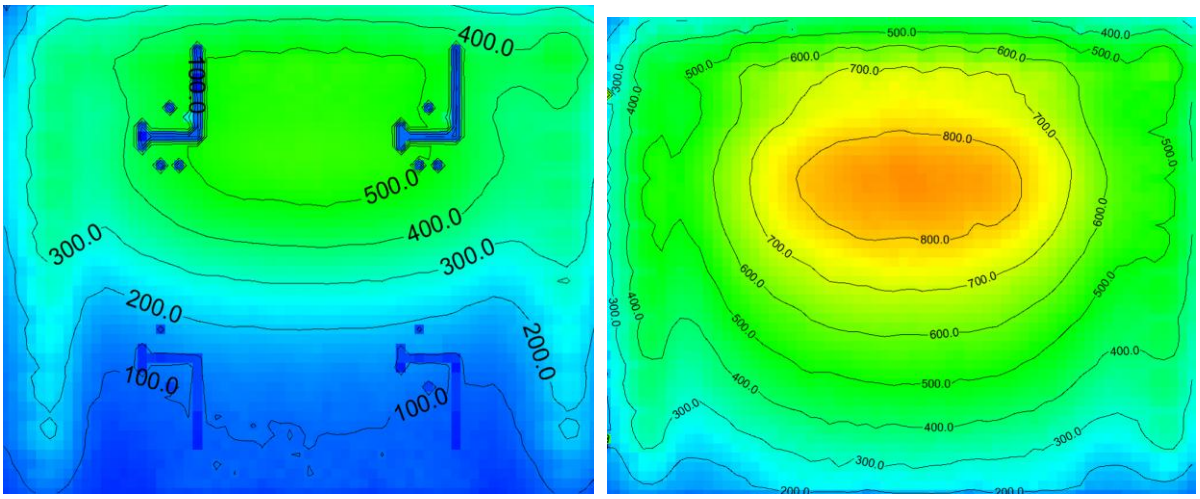


Figure E.28 – 5pm Zone 1 dimmed to .766, Zone 2 dimmed to .488

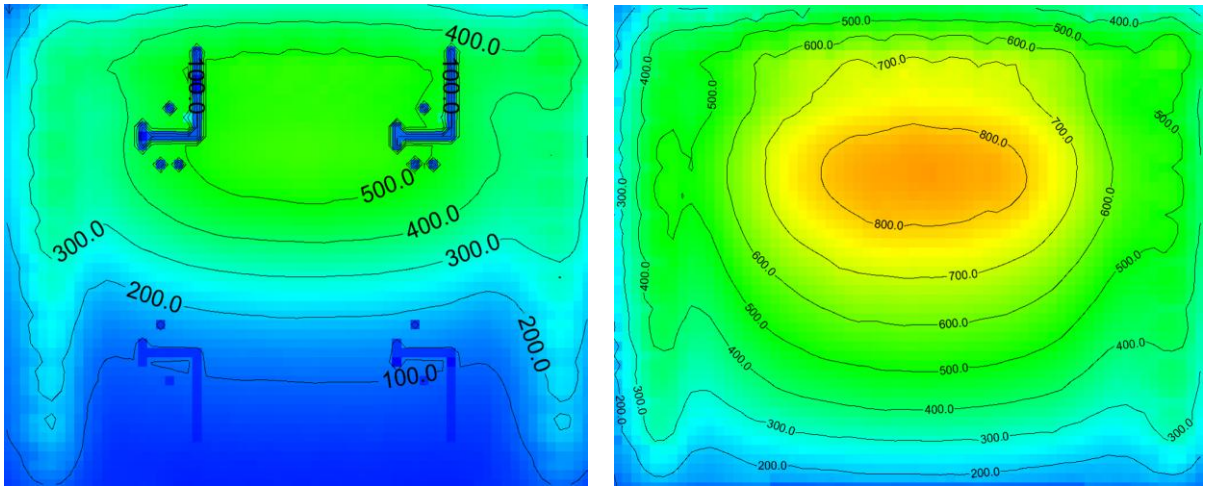


Figure E.29 – 6pm Zone 1 dimmed to .784, Zone 2 dimmed to .52

daylight autonomy

Daylight autonomy and continuous daylight autonomy are useful annual daylight performance metrics that are used to evaluate the performance of daylight in a space. Daylight autonomy shows the fraction of occupied hours that the daylight levels are sufficient in a space to eliminate the need for electric lighting, and is an effective metric when considering whether to use a switching system in the design space. Continuous daylight autonomy allows partial credit, so if a point is daylit to half of the desired illuminance level, half an hour credit is given. This metric is particularly useful for estimating the energy savings for a dimming system. The figures below show daylight autonomy and continuous daylight autonomy for 500 lux, or 50fc.

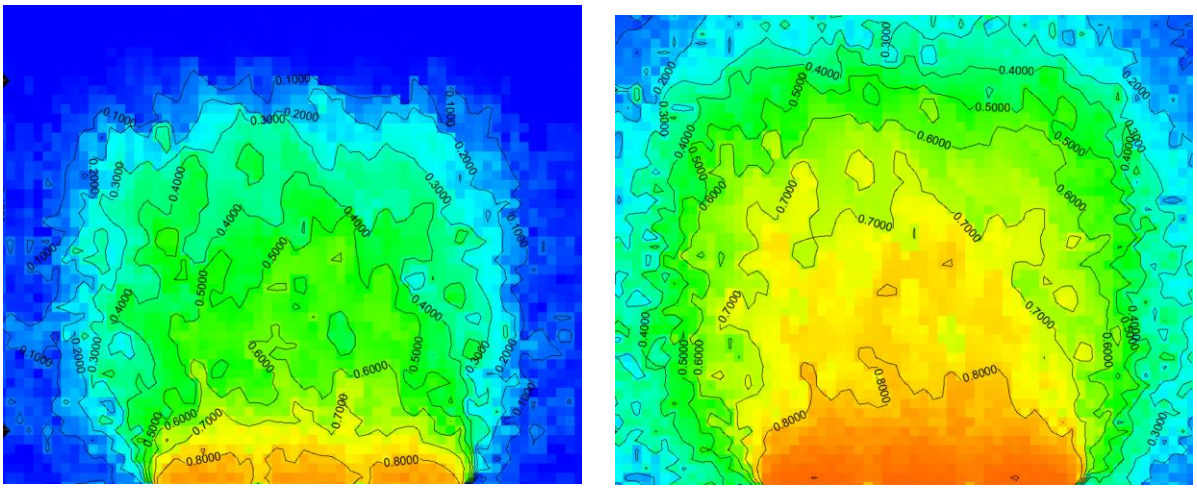


Figure – daylight autonomy and continuous daylight autonomy at 50fc (500lux)

conclusion

Although the light levels appear to be very bright throughout the spring and fall, in order to accurately calculate multi-zone dimming in DAYSIM, both dimmed zones must be calculated separately. This means that for example, in E.11 above, at 6pm, the illuminance levels throughout the gymnasium would be uniform and consistent. When Zone 2 is switched off, the left image of Zone 1 is the accurate portrayal of what is taking place within the space. Although illuminance levels can reach over 100fc during the day, occuppants have a much higher tolerance for daylight than electric light and will improve and brighten the ambient energy level in the gymnasium.

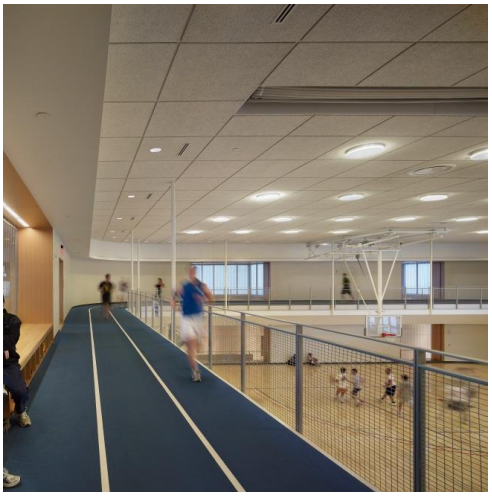
Light levels remain high enough in the gymnasium throughout the summer to almost eliminate the need for electric light during daylight hours. The addition of skylights increases daylight penetration into the space enough to keep Zone 1 almost completely dimmed during the day as well. Although there is some direct sunlight penetration in the summer, this will actually be appreciated by the occupants. Philadelphia is very humid through the summer and this way, they can experience the sunshine and summery environment while exercising and playing sports with their friends in a pleasant way, in the air conditioning.

Not only does adding skylights to the gymnasium increase the aesthetic experience in the space, it also saves over 50% of the energy that would be supplied to the electric lighting system.

breadth two: acoustical

The existing gymnasium ceiling height in the Drexel Recreation Center is 27' with a reflective, high performance acoustical ceiling. Incorporating the new daylight design required the removal of the perforated co-polymer panels, which altered the acoustic performance of the space. The ceiling height is increased from 27' to 35' with the removal of the dropped panels, exposing the structural steel ceiling composed of trusses and metal decking. The following calculations determined whether the acoustical performance resulted in desirable reverberation times and echo levels and investigated the need for sound absorbing or reflecting materials.

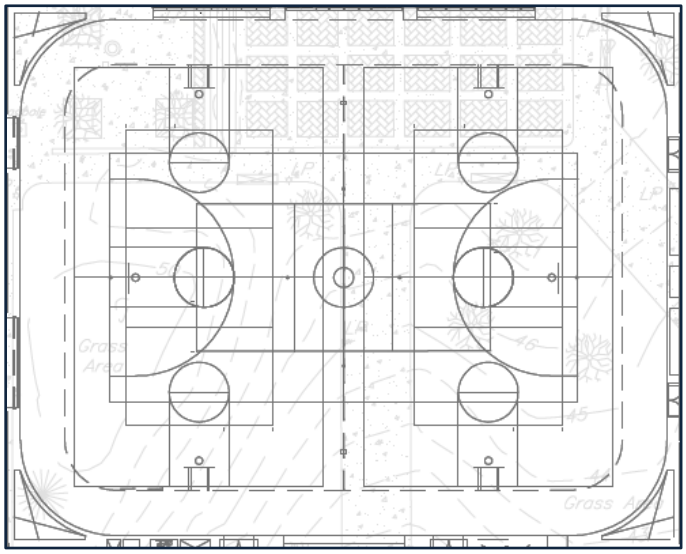
space description

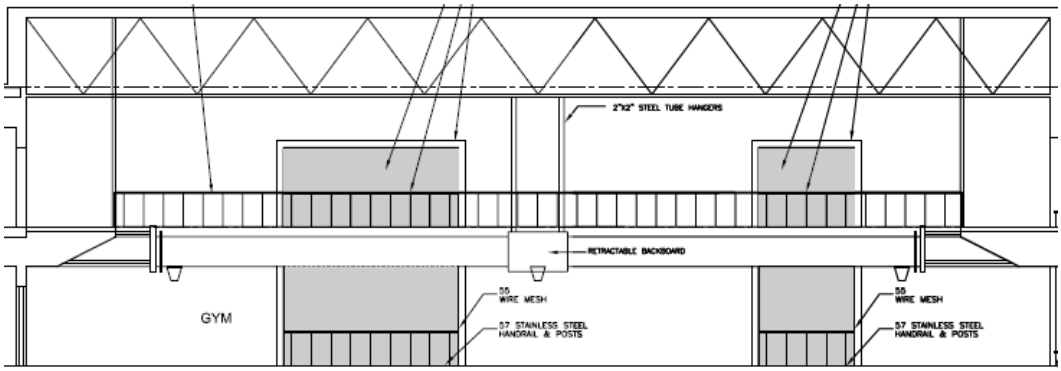


The bi-level gymnasium is located on the second and third floors of the Northern face of the Athletic Center addition and can be entered from the fitness area or for special events from the courtyard. The space serves as the practice facility for the Drexel Dragons basketball team and has an elevated running track around the perimeter of the second level. A divider is enclosed within the dropped ceiling to section off the gymnasium for classes and different sports teams practice times. The northern wall is composed almost entirely of glass providing natural light to the space.

dimensions

The gymnasium measures 103 x 130' and spans a total of 13,420sf.





acoustic criteria

Reverberation time is the most common method of measuring the acoustic performance in an environment. The size of the space and the amount of reflective and absorptive materials determine the length of time it takes for sound to be absorbed in a space. The preferred value of reverberation time at mid-frequency (the average of reverberation time at 500 and 1,000Hz) is under 2 seconds. Because the Drexel gymnasium is used for a variety of sports practices and functions, a slightly lower reverberation time of 1.8 is the acoustic performance goal of this study.

calculation methods

Using the Sabine method, the absorptive co-efficients of materials applied across the space were compiled by unit surface area in order to obtain the reverberation time for common frequencies. The formula following formula was then used to calculate the reverberation time for each frequency.

$$T = 0.05 * \frac{v}{\alpha}$$

where T= reverberation time required for sound to decay 60db after time has stopped (seconds)
v = room volume (cf)
a = total sf of room absorption (sabins)

These values and results are shown in the table below.

Gymnasium Reverberation Analysis

Surface	Description	Area (sf)	Sα - sabins by Frequency (Hz)											
			125Hz		250Hz		500Hz		1,000Hz		2,000Hz		4,000Hz	
east and west walls	high performance painted gypsum wall board	466	0.55	256.3	0.14	65.2	0.08	37.3	0.04	18.6	0.12	55.9	0.11	51.3
north and south walls	high performance painted gypsum wall board	769	0.55	423.0	0.14	107.7	0.08	61.5	0.04	30.8	0.55	423.0	0.55	423.0
north wall	Viracon insulated laminated glazing	710	0.35	248.5	0.25	177.5	0.18	127.8	0.12	85.2	0.07	49.7	0.09	63.9
elevated track level	12 mm rubber track surface	3,200	0.02	64.0	0.02	64.0	0.03	96.0	0.03	96.0	0.03	96.0	0.02	64.0
gymnasium flooring	bio channel wood flooring system	13,390	0.02	0.0	0.14	1,874.6	0.08	1,071.2	0.04	535.6	0.55	7,364.5	0.55	7,364.5
ceiling beneath track	painted gypsum wall board	3,200	0.55	1,760.0	0.14	448.0	0.08	256.0	0.04	128.0	0.55	1,760.0	0.55	1,760.0
gymnasium ceiling	exposed structural steel painted white	12,430	0.73	9,073.9	0.69	8,576.7	0.99	12,305.7	0.89	11,062.7	0.52	6,463.6	0.31	3,853.3
skylights	OldCastle Builing Envelope insulated skylights	1,152	0.35	403.2	0.25	288.0	0.18	207.4	0.12	138.2	0.07	80.6	0.04	46.1
air	values per 1000cf	469	0.09	42.2	0.2	93.8	0.49	229.8	1.2	562.8	2.9	1,360.1	7.4	3,470.6
people	values per 1/10 person	250	0.25	62.5	0.35	87.5	0.42	105.0	0.46	115.0	0.5	125.0	0.5	125.0
Total Sα				12,333.6		11,783.0		14,497.7		12,772.9		17,778.4		17,221.6
Reverberation Time				1.90		1.99		1.62		1.83		1.32		1.36

conclusion

All reverberation times are below the recommended level of 2 seconds. The additional criteria of 1.8 seconds based on the average of 500 and 1,000Hz is also met with a value of 1.71 seconds. The removal of the dropped tile ceiling to incorporate daylight into the space will successfully increase energy savings and the aesthetics and environment in the gymnasium without sacrificing acoustic performance.

breadth three: structural

The modification of the ceiling for daylight integration adjusted the structural loading on the steel truss system supporting the roof. The loading distribution due to design modifications, including the rearranging of the mechanical equipment was be recalculated using STAAD, and the resulting stresses on the truss were analyzed to ensure that the existing truss was sufficiently designed to support the distributed weight.

breadth scope

The existing mechanical equipment layout needed to be adjusted as the rooftop air handling units and their mounting pads were distributed across the center of the space, hindering a uniform skylight layout.

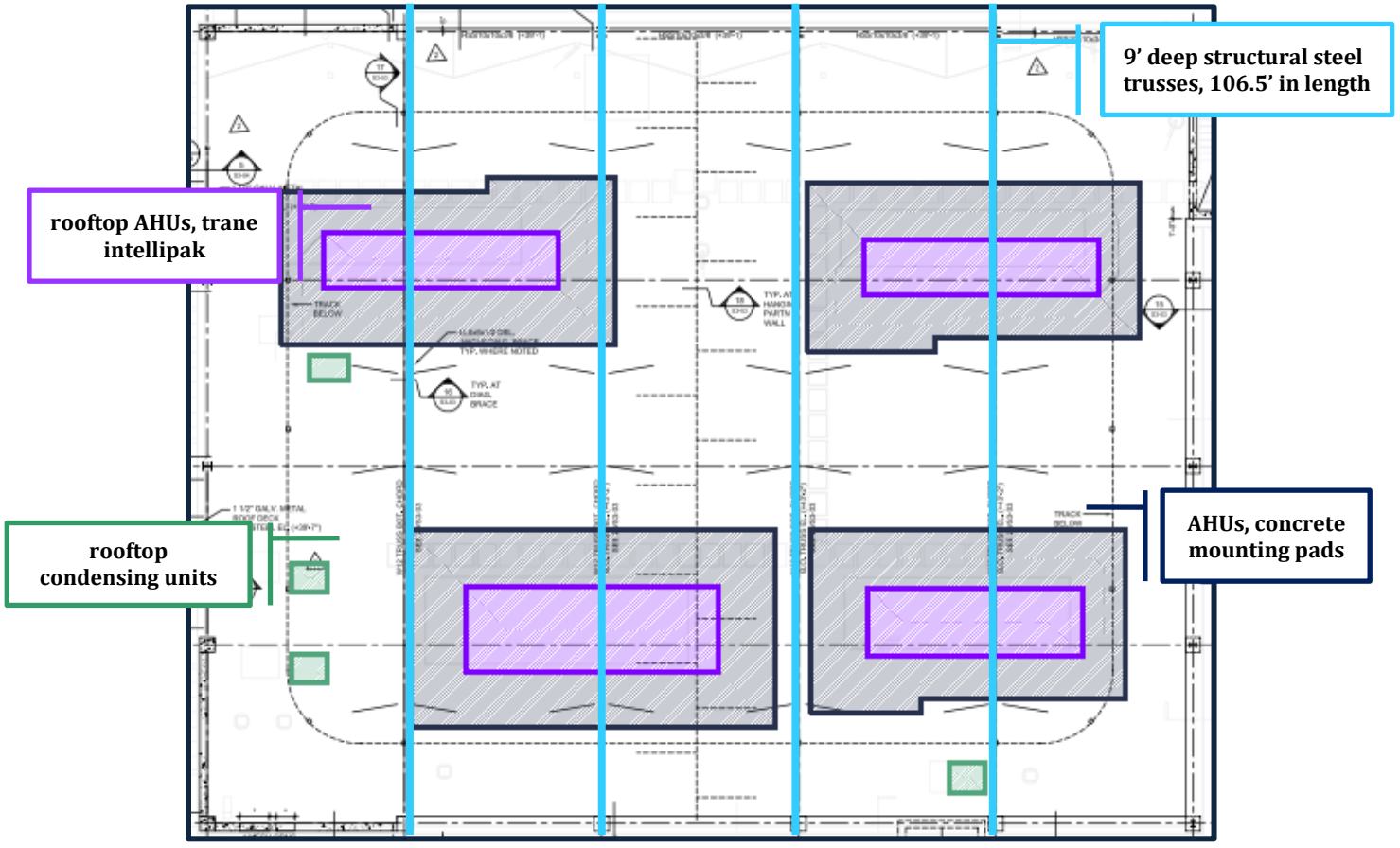


figure s.1- Existing rooftop mechanical layout

The rooftop air handling units and their supporting concrete mounting pads were manipulated in order to accommodate the centralized skylight layout allowing maximum uniform daylight in the space. This required the displacement of the rooftop condensing units to make room along the perimeters for the AHUs and their mounting pads.

figure s.2 -Updated Roof Mechanical Equipment Plan

All four trusses shown above are identical, with a 26.5' spacing. The truss highlighted above with two red arrows is the most heavily loaded after the mechanical equipment shifts, and so was the one selected for analysis.

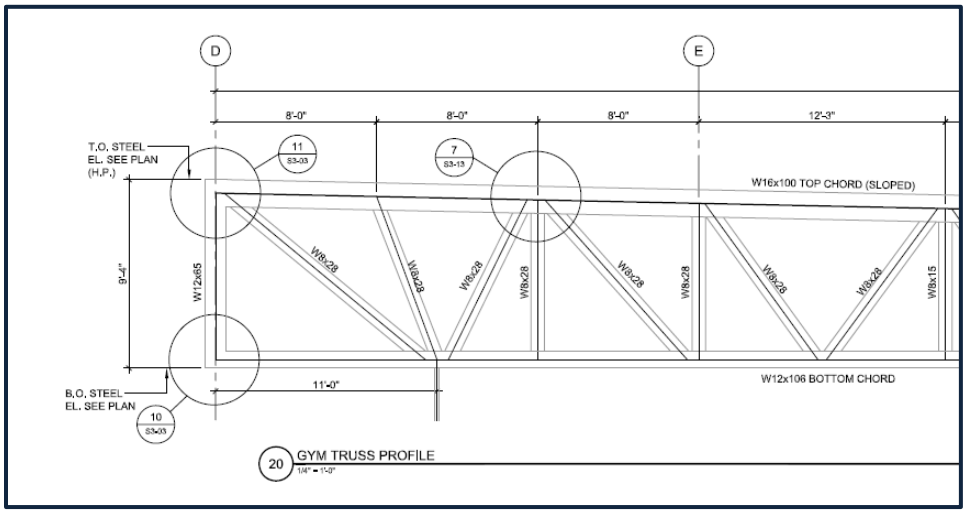


figure s.1 - Structural Profile of Existing Trusses

loading calculation

A combination of loads provided by the structural engineer, assumptions from ASCE 7-05 and IBC 2006, and actual calculations based on the weight of actual Trane mechanical equipment from cut sheets were used to determine the loading on the selected truss. Outlined below is a breakdown by load type.

snow load- criteria

snow exposure factor, C_e	1
roof exposure	partially
exposure category	B
snow thermal factor, C_t	1
snow importance factor, I_s	1.1
ground snow load, P_g	30

$Pf = 0.7C_eC_tI_sP_g = 23.1$

For general design, a snow load of 25psf was selected.

live load

A superimposed live load of 25psf was assumed, taken from ASCE 7-05, table 4-1.

dead load

roof deck: 3" 20-gage galvanized roof deck	5 psf
Oldcastle Building Envelope insulated skylights	12 psf
ceiling/mechanical	13 psf
AHU concrete mounting pads	145csf
AHUs, Trane Intellipak 55-75 tons	44,550lbs
condensing units, rooftop	138.9lbs

The applied load case was ***(1.6) live/snow + (1.2) dead*** which resulted in the following loadings when considering the tributary area of 26.5'

Unified loading of (1.6)*622.5plf + (1.2)*477plf across the entire beam, with the dead load increasing to (1.2)*622.5 at skylight locations.
Point loads of 138.9lbs and 557 lbs at 30' and 98.5' respectively.
Distributed loads of 232plf for the concrete mounting pads and 3,205plf for the two AHUs.

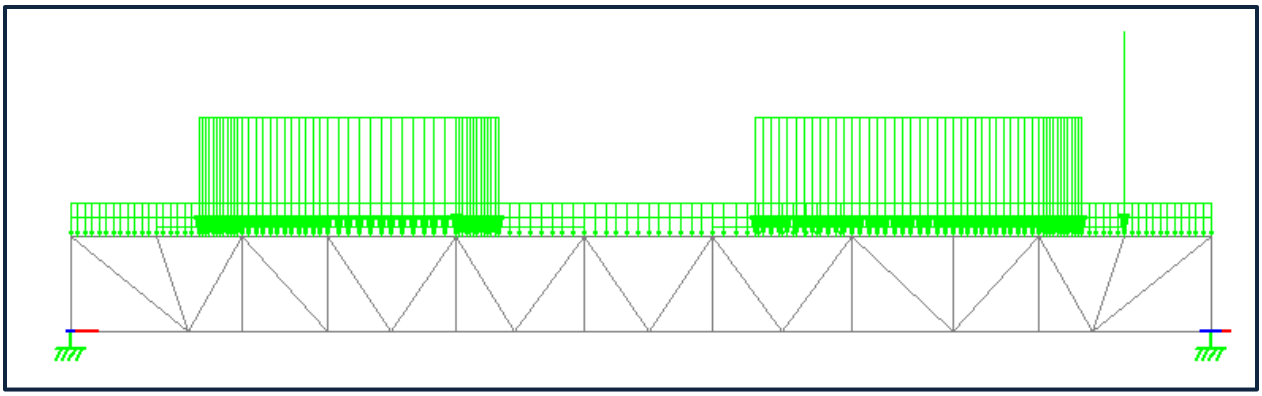


figure s.2 - Diagram of load application in STAAD

truss analysis

supports

Support one was modeled as a pinned connection, fixed but released for moments in z, and support two was modeled as a roller, fixed but released for moments in z and forces in x.

members

top chord: *W14x120*
bottom chord: *W12x106*
end supports: *W12x65*
truss members: *W8x28 and W8x15, as designed.*

spot checks

top chord- compression member

available strength in axial compression (Fy=50ksi)	807kips
maximum axial compression from load	587kips

bottom chord- tensile member

available shear strength in tension (Fy=50ksi)	236kips
maximum shear forces in y from load	48kips

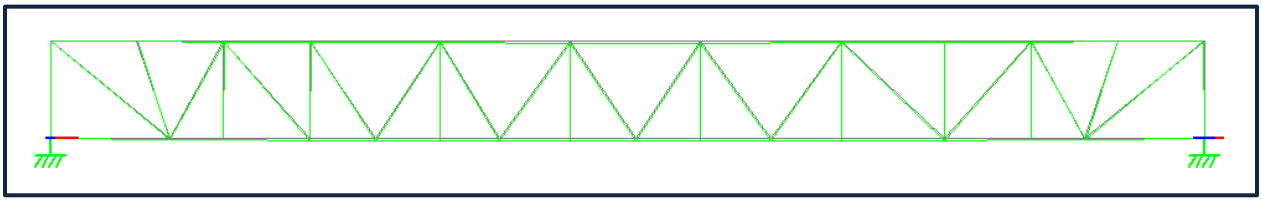


Figure s.3-Displacement diagrom from resulting loads

max stress checks

beam 18: W8x28

available shear strength (Fy=50ksi)	68.9kips
maximum shear forces in y from load	.41kips
available moment	102kip-ft
maximum moment from load case	41.2kip-ft

beam 25: W8x28

available shear strength (Fy=50ksi)	68.9kips
maximum shear forces in y from load	13.1kips
available moment	102kip-ft
maximum moment from load case	61.1kip-ft

beam 13: W8x15

available shear strength (Fy=50ksi)	59.6kips
maximum shear forces in y from load	4.3kips
available moment	51kip-ft
maximum moment from load case	27.9kip-ft

beam 29: W8x28

available shear strength (Fy=50ksi)	68.9kips
maximum shear forces in y from load	21.5kips
available moment	102kip-ft
maximum moment from load case	78kip-ft

conclusion

Based on the above calculations and analysis, the truss does not need to be redesigned for the addition of skylights. Even with the new layout of the system, the existing truss is sized substantially to support the mechanical loading on the roof with skylights both in tensile and compressive stresses.

summary and conclusions

The purpose of the AE senior thesis is not only to perform design and analysis in lighting and electrical studies, but to further comprehend the integration of all building systems and their effects on the total energy consumption, cost savings, system efficiency, and aesthetics and other effects on a project. The result of extensive research, design development, and analysis, this thesis presents a set of new concepts and ideas that enhance the sustainability, aesthetics, and performance of the Drexel Recreation Center.

The exterior space was transformed into a courtyard full of visual interest and safety. The fitness center utilizes the core energy of the building by interacting with the energy created by the user and exposing the source of the power generation to the exterior. The lobby provides a highly energy efficient lighting solution while directly complementing the lines of the architecture. The restaurant creates an enticing new venue in University City, continuing the design concepts of the fitness center while differentiating itself as a separate space entirely.

To incorporate the new lighting designs, the electrical system was also redesigned at the branch circuit level, with a short circuit and protective device coordination study to guarantee the safety of the overcurrent protection through the distribution center. An alternative to cast-in-place distribution to the fitness equipment branch circuits, an option of cable tray was presented as a cost-effective and feasible solution providing future flexibility.

Introducing skylights into the gymnasium enhanced the ambient energy within the space and provided over 50% electricity cost savings throughout the year. A structural and acoustical analysis of this solution concluded that the addition of skylights is in fact a feasible and beneficial addition to the delighting in the space.

The structural design of the Recreation Center presented the primary lighting challenges in that no fixtures could be recessed into the architecture in the fitness center or lobby, but this resulted in lighting designs that fully fulfilled the goal of exposing the energy of the building by exposing the lighting and providing innovative, aesthetically pleasing solutions to a complex design problem.

references

texts

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software

3DStudioMAX, Adobe Photoshop CS5, AGI32, Autodesk AutoCAD 2011, DAYSIM 2.1, STAAD.Prov8i

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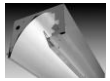
Dr. Richard Mistrick
Professor Ted Dannerth
Professor Sean Good
Professor Robert Holland

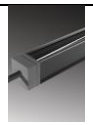
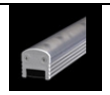
All of the amazing designers and engineers at EwingCole, but especially
Mary Alcaraz, Mike Ginder, Don Jones, Bob Ghisu

My FABULOUS, incredible, and supporting family and friends, and especially all of my lighting girls, without whom I never would have made it through all of these crazy all nighters in the lab <3

appendix a - full lighting fixture schedule and cut sheets

Luminaire Schedule

Type		Description	Manufacturer	Catalog Number	Lamp		V	Power Supply	Input Watts	PF
					No	Type				
	A1	3”x4’ recessed linear fluorescent luminaire with extruded aluminum finish and frosted acrylic flush lens.	Focal Point	FAVB-FL-1T5-1C-277-S-F-WH-4’	1	F28W/T5/841/ECO 4100 85 MIN CRI	277	GE T5 HE Ballast 99655-GE228MVPPS-A	36	.95
	B1	24’ x 8’ ceiling mounted decorative indirect halogen over-bar fixture with polished chrome finish.	Artemide	Mercury Cluster	8	Q150T3/Cl/CD 2950K 85 MIN CRI	277	-	1200	1.0
	C1	4” square 4100K LED downlight with remote phosphor lens, color mixing chamber, and integrated heat sink and power supply.	Indy	SDSQ4-20-40-WTSF	-	LED 4100K 85 MIN CRI	277	Integral universal LED driver	33	.9
	C2	8” square surface mounted 4000K Energy Star qualified LED downlight with aluminum housing, 2” square luminous area and 65`° beam spread.	Color Kinetics	523-000011-02	-	LED 523-000009-07 4000K 85 MIN CRI	277	integrated 277 VAC 523-000010-01	15	.95
	C3	2” low voltage halogen adjustable directional flush mount pinhole downlight with 40° beam spread.	Kurt Versen	K7401FM-ET2	1	Q50WMR16/C/FL/40 3050K 92 MIN CRI	12	Integral electronic transformer 277V to 12V	50	1.0
	D1	Linear fluorescent high performance perimeter open wall wash fixture with extruded aluminum finish and reflector.	Focal Point	FW4-NS-1T8-1C-277-D-RC	1	F28W/T5/841/ECO 3000 85 MIN CRI	277	GE T5 HE Ballast 99655-GE228MVPPS-A	36	.95
	F1	Low voltage halogen cable light system with adjustable ring mounting, integral louver, and satin aluminum finish.	Tech Lighting	700KHELLO	1	Q35MR16/C/FL40 3000K 92 MIN CRI	12	Tech Lighting Integral electronic transformer	35	1.0
	J1	Flexible RGB LED color tape with RGB LEDs integrated into each LED package mounted on self-adhesive tape. See figure below for mounting details.	Osram	L41LFE/24V/RGB2/B7/13FT	-	LED RGB	24	Nextek Power Systems Model 1600-C2-24VALT	3W/ ft	.95
	J2A	2x2 3form Chroma® square suspended custom LED luminaire with HF² Narrow Stick LEDs and aluminum housing. Color: chroma white out.	Osram/ 3form	L4LRE/24V/840/NS /24IN	132	LED 4000K 85 MIN CRI	277	Osram Optotronic LED Driver OT25/120-277/12	10.6	.95
	J2B	2x2 3form Chroma® square suspended custom LED luminaire with HF² Narrow Stick LEDs and aluminum housing. Color: chroma surf.	Osram/ 3form	L4LRE/24V/840/NS /24IN	132	LED 4000K 85 MIN CRI	277	Osram Optotronic LED Driver OT25/120-277/12	10.6	.95

	J2C	2x2 3form Chroma® square suspended custom LED luminaire with HF2 Narrow Stick LEDs and aluminum housing. Color: chroma cobalt.	Osram/ 3form	L4LRE/24V/840/NS /24IN	132	LED 4000K 85 MIN CRI	277	Osram Optotronic LED Driver OT25/120-277/12	10.6	.95
	J3	.75" linear surface mounted LED accent fixture with aluminum housing and 45° beam spread.	Cooper io	0/03/3KMO/45/100/1/02/277	-	IO LED 3000K 85 MIN CRI	277	LED-277A-0700C-28-F-O	5.3W/ft	0.9
	J4	1.3" linear LED cove fixture with 130° beam spread, extruded aluminum body and nylon mount clip.	Winona	WCV-204-1FT-130-30K-DM24V	-	Nichia 123B LED 3000K	277	LED-277A-0700C-28-F-O	4.5W/ft	0.9
	M1	13.7' indirect pole-top ceramic metal halide luminaire with square top reflector and asymmetrical distribution	Bega	8230	1	CMH70/TD/UVC/942/RX7s 4200 88 CRI	277	GEMH70-SLF-MV	77	.97
	M2	Aluminum alloy bollard fixture with 180° distribution with crystal glass optical lens	Bega	8847	1	F26TBX/841/A/ECO 4100 82 MIN CRI	277	GE Electronic Ballast 75948 – GEC140MAX-A	34	.95
	N1	Recessed LED step luminaire with aluminum housing and white safety glass	Bega	2235	1	F13DBX/841/ECO 4100 82 MIN CRI	277	GE ProLine CFL 71428-GEC213	16	1.0
	N2	4' linear fluorescent wet location listed surface mounted steplight with aluminum housing and white safety glass	Bega	2006	1	F28W/T5/841/ECO 4100 85 MIN CRI	277	GE T5 HE Ballast 99655-GE228MVPPS-A	36	.95
	N3	4000K Linear LED cove mounted strip fixture with 110° beam spread	Winona	WSL-103W-48-110-40K-ND24V-A-NAA	-	LED 4000K	277	LED-INTA-0024V-28-F-O	67	1.0
	N4	Ceramic metal halide exterior wall washing luminaire with two-sided light output and 10' mounting height	Bega	6602	1	CMH35/T/UVC/U/G12 4200 88 CRI	277	BLS/E/35W/CMH/R	43	1.0
	P4-16	3" wide direct/indirect continuous linear fluorescent luminaire with titanium silver finish, flush satin lens and integrated daylighting sensor. Luminaire length indicated in type and on drawings (I.E. P4 = 4'-0" long).	Focal Point	FAVDS-FL-1A1T5-1C-277-D-C24-WY1-TS-WYSR	2	F28W/T5/841/ECO 4100 85 MIN CRI	277	Philips Advance IDA-2S28-D@277V	63	.98
	S1	2'x2' tubular fluorescent suspended fixture with textile lensing for symmetrical distribution, PVC base and steel housing.	DeltaLight	Jeti Plano 271-54-160	1	55W/840 C-T5 4100 85 MIN CRI	277	Philips Advance IZT-3S32-SC@277V	108	.99
	Z1	4" metal halide floodlight with aluminum housing and clear safety glass	Bega	7502	-	LED 4000K	277	Integral power supply	17	0.99

fixture type: A1

Armstrong® Tech Zone®

avenue® 6

FOCAL POINT

features

Avenue® 6 is Armstrong® TechZone® compatible and also functions with other specialty 6" ceiling systems.

1 and 2 lamp energy efficient fluorescent T5/T5HO or T8.

Shielding options include corrugated or solid regressed trim, flush lens or parabolic louver.

Avenue® 6 provides an integrated lighting solution that compliments the ceiling and entire space while providing comfortable general illumination.

shielding options

solid regress trim | flush lens | parabolic louver

microglow™ lens

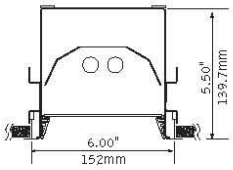
companion luminaire

mr16 | suspended | twelve with MicroGlow™

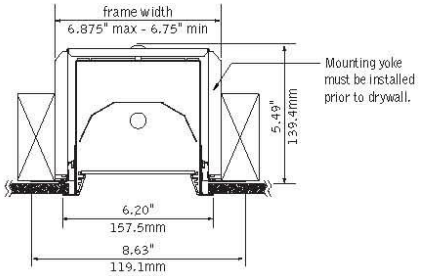
december 2010 E

dimensional data

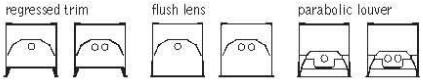
grid mount



drywall flange

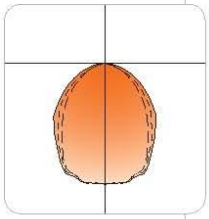


lamping/shielding options



performance

1–Lamp T5HO
67% Efficiency
1392 cd @ 125°



Visit focalpointlights.com for complete photometric data.

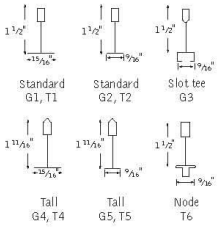
www.focalpointlights.com | 1.773.247.9494

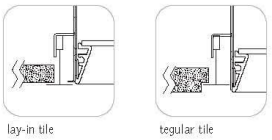
fixture:

project:

mounting information

grid





Luminaire always rests at level of tile.

drywall

4' unit (cutout dimension: 5.625" x 47.6")

5' unit (cutout dimension: 5.625" x 59.6")

specifications

construction

One-piece 20 Ga. steel housing

Corrugated and solid regress trim constructed of 6063-T5 extruded aluminum finished in Matte Satin White.

20 Ga. steel, universal flange rail finished in Matte Satin White.

Earthquake brackets supplied as standard.

4' unit weight: 15 lbs.

5' unit weight: 22 lbs.

optic

22 Ga. steel reflectors finished in High Reflectance White powder coat.

Acrylic lens diffuser .118" thick, frosted clear.

Parabolic louver: .75"H x 1.5" frequency fabricated of low iridescent, semi-specular premium grade aluminum.

Louver can be specified with matte white finish.

electrical

Luminaires are individually wired for specified circuits.

Thru-wiring not available.

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

Consult factory for dimming specifications and availability.

UL and cUL listed.

finish

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

ordering

luminaire series		FAV6
Avenue 6	FAV6	
shielding		
Corrugated Regressed Trim Frst. Lns	CR	
Solid Regressed Trim Frosted Lens	SR	
Flush Frosted Lens	FL	
Parabolic Louver (T5/T5HO only)	PL	
White Painted Parabolic Louver (T5/T5HO only)	PW	
Corrugated Regressed Trim with MicroGlow™	CRM Lens	
Solid Regressed Trim with MicroGlow™	SRM Lens	
Flush MicroGlow™ Lens	FLM	
lamping		
One Lamp T5	1T5	
One Lamp T5HO	1T5HO	
One Lamp T8	1T8	
Two Lamp T5	2T5	
Two Lamp T5HO	2T5HO	
Two Lamp T8	2T8	
circuits		
Single Circuit	1C	
Dual Circuit	2C	
voltage		
120 Volt	120	
277 Volt	277	
347 Volt	347	
ballast		
Electronic Program Start <10% THD	S	
Electronic Dimming Ballast*	D	
ceiling configurations (Avenue® 6 is Armstrong® TechZone® compatible and also functions with other specialty 6" ceiling systems. For other ceiling systems consult factory)		
Drywall Flange	F	
Std. 15/16" Lay-in	G1	
Std. 15/16" Tegular	T1	
Std. 9/16" Lay-in	G2	
Std. 9/16" Tegular	T2	
9/16" Slot-tee Tegular	G3	
Tall 15/16" Lay-in	G4	
Tall 15/16" Tegular	T4	
Tall 9/16" Lay-in	G5	
Tall 9/16" Tegular	T5	
Node 9/16" Tegular	T6	
factory options		
Chicago Plenum	CP	
Emergency Battery Pack* (4' Luminaires Only)	EM	
HLR/GLR Fuse	FU	
Include 3000K Lamp*	L830	
Include 3500K Lamp*	L835	
Include 4100K Lamp*	L841	
Lutron™ Sensor Feed* (EcoSystem ballast required) (Consult factory for Occupancy & Daylight Sensor availability)	SF	
finish		WH
Matte White Housing & Trim Plate	WH	
luminaire length		
4' Nominal Housing	4'	
5' Nominal Housing (Dimming not available with 5' lamps) (For continuous row mount, in drywall ceiling, T5/T5HO only, specify luminaire run length, ie 24'.)	5'	

* for more information see Reference section.

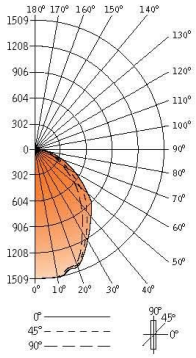
Armstrong

recessed

avenue® 6

Filename: FAV6SR1T5H.IES
Catalog #: FAV6-SR-1T5HO-1C-120-S-G1-WH-4'
Efficiency: 67%
Test #: 13928.0

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	1499	1499	1499	1499	1499	
5°	1499	1499	1499	1497	1497	143
15°	1452	1449	1442	1435	1432	409
25°	1324	1316	1292	1265	1248	597
35°	1096	1082	1030	965	938	643
45°	911	889	798	713	684	619
55°	637	603	513	451	429	471
65°	400	363	294	257	247	307
75°	190	16	129	113	109	146
85°	42	31	22	21	19	29
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

Spacing 1.2
Criterion: 1.1

LUMEN SUMMARY

	Zone	Lumens	% Lamp	% Fixt
	0°-30°	1149	23.0	34.2
	0°-40°	1792	35.8	53.3
	0°-60°	2882	57.6	84.7
	0°-90°	3364	67.3	100
Total Luminaire	0°-180°	3364	67.3	100

LUMINANCE DATA (CD/M²)

Vertical Angle	0°	45°	90°
45°	8876	7775	6665
55°	7652	6162	5153
65°	6521	4793	4027
75°	5058	3434	2902
85°	3320	1739	1502

CO-EFFICIENTS OF UTILIZATION

Floor		80			70		20	50	30	10	00
Ceiling		70	50	30	10	70	50	10	50	10	50	10	00	00
Wall														
RCR	0	80	80	80	80	78	78	78	75	75	72	72	69	69	67
	1	75	72	69	67	73	70	66	68	64	65	62	63	60	59
	2	69	61	60	57	67	63	56	61	55	59	54	57	53	51
	3	64	58	53	49	62	58	49	55	48	53	47	51	46	45
	4	59	52	47	43	57	51	42	49	42	48	41	46	41	39
	5	54	46	41	37	53	46	37	44	36	46	36	42	35	34
	6	50	42	36	32	49	41	32	40	32	39	32	38	31	30
	7	46	38	32	29	45	37	28	36	28	35	28	34	28	27
	8	43	34	29	25	42	34	25	33	25	32	25	31	24	23
	9	39	31	25	22	39	30	22	30	22	29	22	28	21	20
	10	37	28	23	19	36	28	19	27	19	26	19	26	19	18

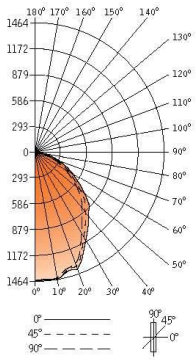
Numbers indicate percentage values of

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

avenue® 6

Filename: FAV6FL1T5H.IES
Catalog #: FAV6-FL-1T5HO-1C-120-G1-WH-4'
Efficiency: 67%
Test #: 13929.0

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	1464	1464	1464	1464	1464	
5°	1462	1460	1459	1457	1456	139
15°	1406	1402	1390	1380	1376	394
25°	1298	1268	1242	1211	1197	574
35°	1046	1029	985	942	925	619
45°	859	837	784	740	721	610
55°	592	572	532	498	486	480
65°	368	354	330	308	301	329
75°	175	170	158	150	146	169
85°	41	41	39	38	38	43
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

Spacing 1.2
Criterion: 1.1

LUMEN SUMMARY

	Zone	Lumens	% Lamp	% Fixt
	0°-30°	1107	22.1	330
	0°-40°	1726	34.5	51.4
	0°-60°	2817	56.3	83.9
	0°-90°	3358	67.2	100
Total Luminaire	0°-180°	3358	67.2	100

LUMINANCE DATA (CD/M²)

Vertical Angle	0°	45°	90°
45°	8370	7639	7025
55°	7111	6390	5838
65°	5999	5380	4907
75°	4658	4206	3886
85°	3241	3083	3004

CO-EFFICIENTS OF UTILIZATION

Floor		80			70		20	50	30	10	00
Ceiling		70	50	30	10	70	50	10	50	10	50	10	00	00
Wall														
RCR	0	80	80	80	80	78	78	78	75	75	74	74	69	69	67
	1	74	71	69	67	72	70	66	67	64	65	62	62	60	58
	2	68	64	60	56	67	62	56	60	54	58	53	56	52	51
	3	63	57	50	48	62	56	48	54	47	52	46	51	45	44
	4	58	51	46	42	57	50	41	49	41	47	40	46	40	38
	5	53	46	40	36	52	45	36	43	35	42	35	41	35	33
	6	49	41	35	31	48	40	31	39	31	35	31	37	31	29
	7	46	37	32	28	45	37	28	36	27	35	27	34	27	26
	8	42	33	28	4	41	33	24	32	24	31	24	30	24	22
	9	39	30	25	21	38	30	21	29	21	28	21	28	21	20
	10	36	27	22	19	35	27	19	26	19	26	19	25	18	17

Numbers indicate percentage values of

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

fixture type: B1

Artemide

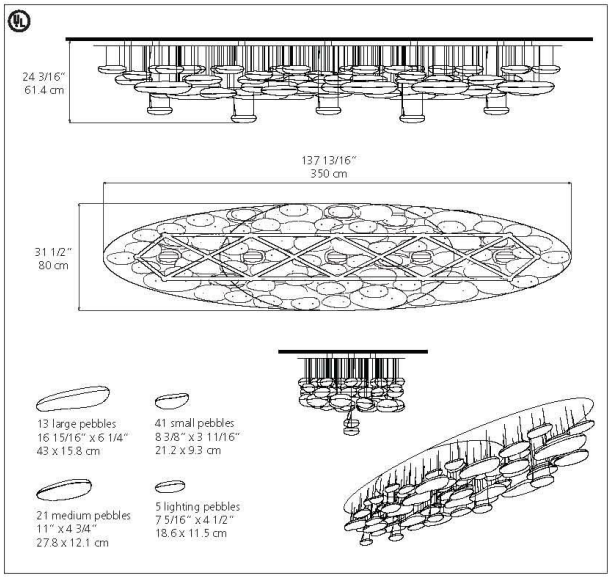
Mercury Cluster

Ross Lovegrove 2009

A series of pebbles form a cluster reflecting the light that bounces on its biomorphic surfaces. Mercury Cluster is a sectional unit that enables numerous elements to be added.

Cable suspended or ceiling mounted luminaire for indirect halogen lighting. Custom configurations available.

- illuminated reflective units (pebbles) made of molded thermoplastic with polished chrome finish
- unilluminated reflective units (pebbles) in die cast aluminum polished chrome finish
- disc in die cast aluminum in pale grey finish
- grey thermoplastic canopy with clear electrical cord and stainless steel cables
- mounting directly to rigid ceiling surface (hardware by others) over standard electrical junction boxes



Mercury Cluster suspension

halogen source

- 5 x 200W (R7S/T3) supplied.....

www.artemide.us

fixture type: C1

indy

K13.1.4

ENVIRONMENTALLY FRIENDLY, ENERGY EFFICIENT

- Comparable light output to 26W and 42W CFL while consuming 18 and 34 watts.
- No harmful ultraviolet or infrared wavelengths
- No lead or mercury

EcoLEDgy™ Driven

DESIGNER SERIES
4" 1100/2000 LUMEN LED SQUARE DOWNLIGHT
OPEN APERTURE
SDSQ4 SERIES

ENERGY STAR

Type Cat. No.

Project:

Notes:

PRODUCT SPECIFICATIONS

Optics

Trim: Self-flanged, clear Alzak® (SASF) trim • Alzak® trim with low iridescent finish is standard • Others Alzak finishes are available; see trim options
• Computer-optimized reflector maximizes fixture efficiency
• Deep regression of source produces a very low glare system • Lensed mixing chamber conceals the LEDs to produce uniform aperture luminance

Electrical

LED Light Engine: Innovative light engine utilizes remote phosphor lens and mixing chamber to ensure perfectly mixed light, resulting in uniform colors and superior color consistency from fixture to fixture • 3000K, 3500K and 4100K color temperatures available • CRI>80 • Cast aluminum heat sink integrated directly with housing provides superior thermal management with LEDs operating below manufacturer's published junction temperature to ensure attainment of rated life of the LEDs • Light engine mounts directly to heat sink and is easily replaceable
Dimming: Dimmable via 0-10V protocol, increasing efficiency up to 30% while dimming • For a list of compatible dimmers, see LED-DIM.
LED Driver: Universal driver accommodates 120V to 277V input volts AC at 50/60Hz • Consult factory for 347V • Power factor >0.9 • Easily replaceable from above or below the ceiling.
Life: Rated for 50,000 hours at 70% lumen maintenance

Mechanical

Housing: Heavy gauge cold rolled steel with black finish • Universal housing design installs in suspended grid, plaster or drywall • Integral cast aluminum heat sink conducts heat away from LED light engine • Light engine and driver are accessible from above and below ceiling and can be upgraded to accommodate future technology improvements.
Mounting Frame: Heavy gauge steel lower housing ring with factory installed spring steel friction clips securely holds cones in ceiling
• Accommodates ceilings up to 3/4" thick • For thicker ceilings; consult factory
Mounting Bracket: Mounting brackets have 3" vertical adjustment and accept 1-1/2" C-channel mounting bars • Indy TRU-LOCK bar hangers are supplied standard • For non-accessible ceiling add suffix "825" for 28" 'C' channel mounting bars • One-piece Tru-Lock bar hangers have integral T-bar locking screws and alignment notches for locating and locking fixture in the center or 1/4" tile increments
Junction Box: Junction box rated for eight No. 12 AWG 90° C branch circuit conductors (4-in, 4-out)

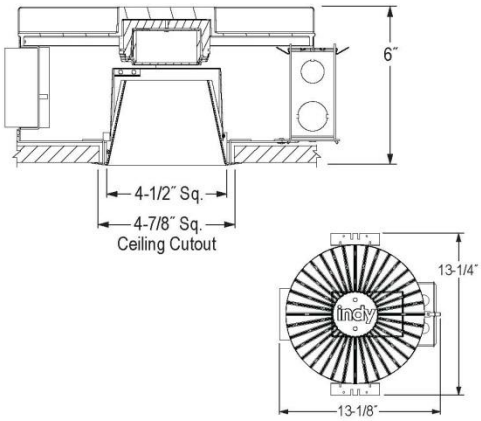
Labels and Listings

- UL listed for feed through and damp locations • I.B.E.W. Union made
- Energy Star qualified when used with select trims
- Wet Location listing available by adding "-WL" option
- UL and cUL, RoHS complaint • EMI complies with FCC 47, Part 15, Class A

Warranty: 5 years when used in accordance with manufacturing guidelines.

Product specifications subject to change without notice.

DIMENSIONS



ENGINEERING DATA

Voltage	120V		277V	
Fixture Lumens	1100	2000	1100	2000
CCT	41K/35K/3K	41K/35K/3K	41K/35K/3K	41K/35K/3K
Input Current	0.15	0.34	0.08	0.15
Input Wattage	17W/18W/19W	33W/34W/36W	17W/18W/19W	33W/34W/36W
Input Frequency	50/60Hz	50/60Hz	50/60Hz	50/60Hz
Power Factor	0.9	0.9	0.9	0.9

347 Volt available, consult factory.

ORDERING INFORMATION: Rough-in, reflector and accessories each ordered separately.

Example: **SDSQ4-2035-SASF2-PF**

Cat. #	Light Engine Lumens	Color Temp.	Trim Options	Generation	Options
SDSQ4 -			-	2	-

SDSQ4

Light Engine Lumens:
- **11** 1100 Lumens
- **20** 2000 Lumens

Color Temp.:
- **30** 3000K
- **35** 3500K
- **40** 4100K

Alzak® Finish Options:

	Satin	Specular
Clear	▲SASF	▲SAF
Champagne Gold	CGSF	CGF
Black	BASF	BAF
Pewter	PASF	PAF
Wheat	WTSF	WTF
Bronze	BRSF	BRF
Painted Finish Options		
White	WHF	

Options:

PF	Painted Flange Only (White)
F	Fuse and Fuse Holder
BP	120/277V Emergency Battery Pack with Remote Test Switch
†347	347 Volt
†CP	Chicago Plenum
825	28" 'C' Channel Mounting Bars, Pair
WL	Wet Location (Clear glass lens standard)

† Consult Factory for Availability

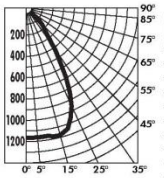
▲Energy Star qualified for use with any Lumen/Color Temperature combination.

2/11 Rev.6

Juno Lighting Group by Schneider Electric
1300 South Wolf Road • Des Plaines, Illinois 60018
PHONE 800-367-5866 • FAX 888-708-6578
www.junolightinggroup.com

K13.1.4

3000K, 3500K & 4100K CCT
Catalog Number: **SDSQ4-2030-SAF2**
PHOTOMETRIC REPORT
Test Number: LTL19128
Total Lumen Output: 1362 Lumens
Luminaire Efficacy: 41 lm/w (4100K), 40 lm/w (3500K), 38 lm/w (3000K)
Luminaire Spacing Criteria: 1.04
Luminaire: Clear specular Alzak® reflector. Open bottom.
CIE-Type: Direct



Candlepower Distribution (Candelas)

Angle	Candela	Lumens
0°	1166	
5°	1165	111
15°	1191	333
25°	951	456
35°	441	321
45°	134	107
55°	26	26
65°	6	6
75°	1	2
85°	0	0

Initial Footcandles

Distance to Illuminated Plane (Feet)	Footcandles Beam Center	Footcandles Beam Edge	Beam Diameter
6′	32.4	10.1	7.5′
7′	23.8	7.4	8.8′
8′	18.2	5.7	10.0′
9′	14.4	4.5	11.3′
10′	11.7	3.6	12.5′
11′	9.6	3.0	13.8′
12′	8.1	2.5	15.1′
13′	6.9	2.1	16.3′
14′	5.9	1.8	17.6′
15′	5.2	1.6	18.8′

Luminance Data

Angle in Degrees	Candela/M²
45°	14523
55°	3437
65°	1031
75°	354
85°	132

Zonal Lumen Summary

Zone	Lumens%	%Fixture
0-30°	900	66.1
0-40°	1221	89.7
0-60°	1354	99.4
0-90°	1362	100.0
90-180°	0	0.0
0-180°	1362	100.0

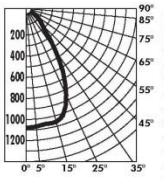
AVERAGE INITIAL FOOTCANDLES
Reflectances: 80% Ceiling, 50% Walls, 30% Floors

Luminaire Spacing	Room Cavity Ratio RCR1	RCR4	RCR8
5′ x 5′	60	48	37
6′ x 6′	42	33	25
7′ x 7′	31	24	19
8′ x 8′	23	19	14
9′ x 9′	18	15	11
10′ x 10′	15	12	9
11′ x 11′	12	10	8
12′ x 12′	10	8	6

COEFFICIENTS OF UTILIZATION - % (Zonal Cavity Method)
Effective Floor Reflectance 20%

PCC	80				70				50				30				10				0
PW	70	50	30	10	70	50	30	10	50	30	10		50	30	10		50	30	10		0
0	119	119	119	119	116	116	116	116	111	111	111		106	106	106		102	102	102		100
1	113	110	108	105	111	108	106	104	104	102	101		100	99	98		97	96	95		93
2	107	102	98	94	105	101	97	93	97	94	91		94	92	89		91	89	88		86
3	102	95	90	85	100	93	89	85	91	87	83		88	85	82		86	83	81		79
4	96	88	82	78	94	87	82	77	85	80	77		83	79	76		81	78	75		73
5	91	82	76	71	89	81	75	71	79	74	70		78	73	70		76	72	69		68
6	86	77	70	66	84	76	70	66	74	69	65		73	68	65		71	67	64		63
7	81	72	65	61	80	71	65	61	70	64	60		68	64	60		67	63	60		58
8	77	67	61	57	76	67	61	56	65	60	56		64	60	56		63	59	56		54
9	73	63	57	53	72	63	57	53	62	56	52		61	56	52		60	55	52		51
10	70	59	53	49	68	59	53	49	58	53	49		57	52	49		57	52	49		47

3000K, 3500K & 4100K CCT
Catalog Number: **SDSQ4-2030-SASF2**
PHOTOMETRIC REPORT
Test Number: LTL19129
Total Lumen Output: 1293 Lumens
Luminaire Efficacy: 39 lm/w (4100K), 38 lm/w (3500K), 38 lm/w (3000K)
Luminaire Spacing Criteria: 1.02
Luminaire: Clear satin Alzak® reflector. Open bottom.
CIE-Type: Direct



Candlepower Distribution (Candelas)

Angle	Candela	Lumens
0°	1093	
5°	1081	102
15°	1060	296
25°	858	406
35°	423	303
45°	160	125
55°	49	45
65°	11	12
75°	2	3
85°	0	1

Initial Footcandles

Distance to Illuminated Plane (Feet)	Footcandles Beam Center	Footcandles Beam Edge	Beam Diameter
6′	30.4	9.2	7.6′
7′	22.3	6.7	8.9′
8′	17.1	5.2	10.1′
9′	13.5	4.1	11.4′
10′	10.9	3.3	12.6′
11′	9.0	2.7	13.9′
12′	7.6	2.3	15.2′
13′	6.5	2.0	16.4′
14′	5.6	1.7	17.7′
15′	4.9	1.5	19.0′

Luminance Data

Angle in Degrees	Candela/M²
45°	17359
55°	6488
65°	2005
75°	619
85°	394

Zonal Lumen Summary

Zone	Lumens%	%Fixture
0-30°	804	62.2
0-40°	1107	85.6
0-60°	1277	98.8
0-90°	1293	100.0
90-180°	0	0.0
0-180°	1293	100.0

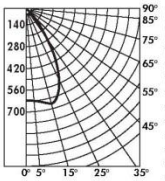
AVERAGE INITIAL FOOTCANDLES
Reflectances: 80% Ceiling, 50% Walls, 30% Floors

Luminaire Spacing	Room Cavity Ratio RCR1	RCR4	RCR8
5′ x 5′	57	45	34
6′ x 6′	40	31	23
7′ x 7′	29	23	17
8′ x 8′	22	18	13
9′ x 9′	18	14	10
10′ x 10′	14	11	8
11′ x 11′	12	9	7
12′ x 12′	10	8	6

COEFFICIENTS OF UTILIZATION - % (Zonal Cavity Method)
Effective Floor Reflectance 20%

PCC	80				70				50				30				10				0
PW	70	50	30	10	70	50	30	10	50	30	10		50	30	10		50	30	10		0
0	119	119	119	119	116	116	116	116	111	111	111		106	106	106		102	102	102		100
1	113	110	107	105	110	108	105	103	104	102	100		100	99	97		97	95	94		92
2	107	102	97	93	105	100	96	92	96	93	90		93	91	88		91	89	87		85
3	101	94	88	84	99	92	87	83	90	86	82		87	84	81		85	82	80		78
4	95	87	81	76	93	86	80	76	83	79	75		81	77	74		80	76	73		72
5	90	81	74	70	88	80	74	69	78	73	69		76	72	68		75	71	67		66
6	85	75	69	64	83	74	68	64	73	67	63		71	66	63		70	66	62		61
7	80	70	64	59	79	69	63	59	68	62	58		67	62	58		66	61	58		56
8	76	65	59	55	74	65	59	54	64	58	54		63	58	54		62	57	54		52
9	72	61	55	51	71	61	55	51	60	54	50		59	54	50		58	53	50		49
10	68	58	51	47	67	57	51	47	56	51	47		56	51	47		55	50	47		45

3000K, 3500K & 4100K CCT
Catalog Number: **SDSQ4-1130-SAF2**
PHOTOMETRIC REPORT
Test Number: LTL15471
Total Lumen Output: 764 Lumens
Luminaire Efficacy: 45 lm/w (4100K), 42 lm/w (3500K), 40 lm/w (3000K)
Luminaire Spacing Criteria: 1.0
Luminaire: Clear specular Alzak® reflector. Open bottom.
CIE-Type: Direct



Candlepower Distribution (Candelas)

Angle	Candela	Lumens
0°	617	
5°	623	60
15°	667	187
25°	533	261
35°	253	185
45°	74	58
55°	10	10
65°	2	2
75°	1	1
85°	0	0

Initial Footcandles

Distance to Illuminated Plane (Feet)	Footcandles Beam Center	Footcandles Beam Edge	Beam Diameter
6′	17.1	5.6	7.5′
7′	12.6	4.1	8.8′
8′	9.6	3.2	10.1′
9′	7.6	2.5	11.3′
10′	6.2	2.0	12.6′
11′	5.1	1.7	13.8′
12′	4.3	1.4	15.1′
13′	3.7	1.2	16.3′
14′	3.1	1.0	17.6′
15′	2.7	0.9	18.8′

Luminance Data

Angle in Degrees	Footlamberts	Candela/M
45°	1892	6483
55°	297	1019
65°	79	271
75°	58	199
85°	0	0

Zonal Lumen Summary

Zone	Lumens%	%Fixture
0-30°	508	66.5
0-40°	694	90.7
0-60°	761	99.6
0-90°	764	100.0
90-180°	0	0.0
0-180°	764	100.0

AVERAGE INITIAL FOOTCANDLES
Reflectances: 80% Ceiling, 50% Walls, 30% Floors

Luminaire Spacing	Room Cavity Ratio RCR1	RCR4	RCR8
5′ x 5′	31	24	18
6′ x 6′	21	17	13
7′ x 7′	16	12	9
8′ x 8′	12	9	7
9′ x 9′	9	7	6
10′ x 10′	8	6	5
11′ x 11′	6	5	4
12′ x 12′	5	4	3

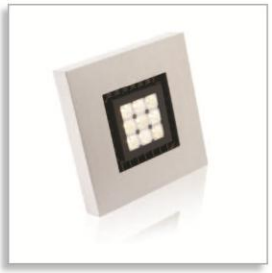
COEFFICIENTS OF UTILIZATION - % (Zonal Cavity Method)
Effective Floor Reflectance 20%

PCC	80				70				50				30				10				0
PW	70	50	30	10	70	50	30	10	50	30	10		50	30	10		50	30	10		0
0	119	119	119	119	116	116	116	116	111	111	111		106	106	106		102	102	102		100
1	113	110	108	106	111	108	106	104	104	102	101		101	99	98		97	97	95		93
2	107	102	98	95	105	101	97	94	97	94	92		94	92	90		92	90	88		86
3	102	95	90	86	100	94	89	85	91	87	84		89	85	82		86	83	81		79
4	96	88	83	78	94	87	82	78	85	80	77		83	79	76		81	78	75		73
5	91	82	76	72	89	81	76	71	80	75	71		78	74	70		76	73	70		68
6	86	77	71	66	85	76	70	66	75	69	65		73	68	65		72	68	65		63
7	82	72	66	61	80	71	65	61	70	65	61		69	64	60		68	63	60		59
8	77	67	61	57	76	67	61	57	66	60	56		65	60	56		64	59	56		55
9	73	63	57	53	72	63	57	53	62	56	53		61	56	52		60	56	52		51
10	70	60	53	49	69	59	53	49	58	53	49		57	53	49		57	52	49		48

Fixtures tested to IES recommended standard for solid state lighting per LM-79-08. Photometric performance on a single unit represents a baseline of performance for the fixture. Results may vary in the field.

Juno Lighting Group by Schneider Electric
1300 S. Wolf Road • Des Plaines, IL 60018 • Phone (800) 367-5866 • Fax (888) 708-6578
Visit us at www.junolightinggroup.com

fixture type: C2



Date: _____ Type: _____

Firm Name: _____

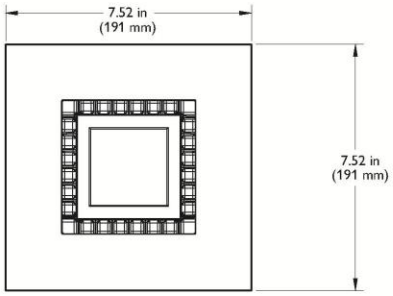
Project: _____

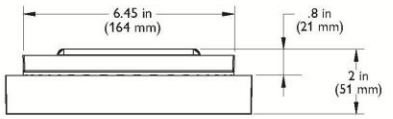
eW Downlight Powercore

4000 K

Energy-efficient LED downlight

eW® Downlight Powercore is a low-profile, surface-mounted LED downlight for basic white general illumination. This easy-to-install, dimmable fixture uses standard mounting and direct line voltage connection without the need for remote transformers. Suitable for common spaces, elevators, conference rooms, kitchenettes, and interiors in commercial, hospitality, retail, and residential environments, eW Downlight Powercore is especially appropriate where recessed installation is not possible.





- Integrates patented Powercore® technology—Powercore technology rapidly, efficiently, and accurately controls power output to eW Downlight Powercore fixtures directly from line voltage, eliminating transformers and other external power supplies.
- Simple, standard installation — Contractor-friendly installation uses standard wiring and mounting to dramatically simplify installation and help lower total system cost.
- High-quality light at substantially lower cost — Provides light level and quality comparable to CFL downlights with no wasted energy, light, or heat. Offers total cost of ownership reduction of up to 58% as compared with CFL downlights.
- ENERGY STAR® qualified — As an ENERGY STAR qualified LED luminaire, eW Downlight Powercore uses 80% less energy and can last over 40 times longer than incandescent lighting — up to 85,000 hours of use at 70% lumen maintenance.
- Flexible mounting options — Mounts to a standard junction box or directly to a flat mounting surface where allowed. Slotted through-holes in the mounting plate provide adjustment in surface mount applications. Swivel bracket for 120 and 277 VAC units allows precise adjustment during installation.
- Warm and cool color temperatures — Available in two color temperatures, a warm 2700 K appropriate for intimate, open environments such as restaurants, hotel lobbies, and homes, and a cool 4000 K for lighting clean and efficient spaces such as offices, classrooms, and hospitals.
- Two available beam angles — Available with a 30° beam angle for high ceilings or spotlighting, and a 65° beam angle for floodlighting and low-ceiling environments such as corridors.
- Four available voltages — Power modules of 100 VAC, 120 VAC, 220 – 240 VAC, and 277 VAC are available for consistent installation and operation in multiple locations.
- Unobtrusive, sleek design — Low-profile fixture is ideal for surface mounting and semi-recessed applications. Metal bezel is available in white, black, or brushed aluminum.
- Dimming capability — Patented DIMand® technology offers smooth dimming capability with many ELV-type dimmers.

For detailed product information, please refer to the eW Downlight Powercore Product Guide at www.colorkinetics.com/ls/essentialwhite/ewdownlight/

ENERGY STAR

PHILIPS

Specifications

Due to continuous improvements and innovations, specifications may change without notice

Item	Specification	4000 K*
Output	Beam Angle	30° FWHM / 65° FWHM ENERGY STAR
	Lumens†	420 (30° beam angle) 525 (65° beam angle)
	Efficacy (lm / W)	28.0 (30° beam angle) 35.0 (65° beam angle)
	CRI	85
	Lumen Maintenance‡	85,000 hours L_{70} @ 25° C 50,000 hours L_{70} @ 50° C
Electrical	Input Voltage	100 / 120 / 220 – 240 / 277 VAC, 50 / 60 Hz
	Power Consumption	15 W maximum at full output, steady state
	Power Factor	0.95 @ 120 V
Control	Dimming	Compatible with many commercially available ELV, trailing edge, or reverse-phase control dimmers.§
Physical	Dimensions *(Height x Width x Depth)*	7.5 × 7.5 × 2 in (191 × 191 × 51 mm)
	Weight	3.1 lb (1.4 kg)
	Housing	Die-cast aluminium chassis and bezel with black, white, or brushed aluminum finish
	Lens	Clear polycarbonate
	Fixture Connections	6 in (152 mm) flying leads (100 / 120 / 277 VAC) Terminal block (220 – 240 VAC)
	Temperature Ranges	-4° – 122° F (-20° – 50° C) Operating -4° – 122° F (-20° – 50° C) Startup -40° – 176° F (-40° – 80° C) Storage
	Humidity	0 – 95%, non-condensing
Certification and Safety	Certification	UL / cUL, FCC Class B for 120 / 277 VAC, CE
	Environment	Dry / Damp Location, IP50
	Energy Efficiency	ENERGY STAR

* Color temperatures conform to nominal CCTs as defined in ANSI Chromaticity Standard C78.377A.

† Lumen measurement complies with IES LM-79-08 testing procedures.

‡ L70 = 70% maintenance of lumen output (when light output drops below 70% of initial output). Ambient temperatures specified.

§ Refer to www.colorkinetics.com/support/appnotes/ for specific details.

Fixtures and Accessories

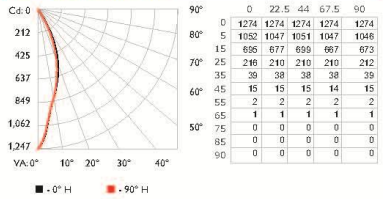
Item	Type		Item Number	Philips 12NC
Power Modules	100 VAC		523-000010-02	910503700235
	120 VAC		523-000010-00	910503700233
	220 – 240 VAC		523-000010-03	910503700236
	277 VAC		523-000010-01	910503700234
Lamp Modules *100 / 120 / 277 VAC*	65° beam angle ENERGY STAR		523-000009-07	910503700561
	30° beam angle		523-000009-09	910503700563
Bezel Modules	White		523-000011-00	910503700237
	Black		523-000011-01	910503700238
	Brushed Aluminum		523-000011-02	910503700239
Complete Fixture Kit *220 – 240 VAC only*	White	65° beam angle	523-000031-07	910503700347
		30° beam angle	523-000031-01	910503700341
	Black	65° beam angle	523-000031-09	910503700349
		30° beam angle	523-000031-03	910503700343
	Brushed Aluminum	65° beam angle	523-000031-11	910503700351
		30° beam angle	523-000031-05	910503700345

Use Item Number when ordering in North America.

Photometrics

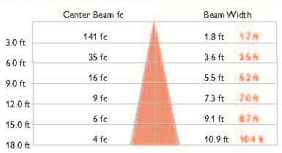
4000 K, 30° (narrow) beam angle

Polar Candela Distribution



	0	22.5	44	67.5	90
0	1274	1274	1274	1274	1274
5	1052	1047	1051	1047	1046
15	696	677	699	667	673
25	216	210	210	210	212
35	39	38	38	38	39
45	15	15	15	14	15
55	2	2	2	2	2
65	1	1	1	1	1
75	0	0	0	0	0
85	0	0	0	0	0
90	0	0	0	0	0

Illuminance at Distance



35.7 ft (10.9 m)
1 fc maximum distance

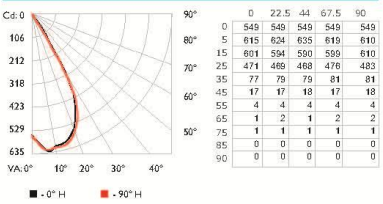
Vert. Spread: 33.8°
Horiz. Spread: 32.3°

Lumens	420
Efficacy	28.0 lm / W

For lux multiply fc by 10.7

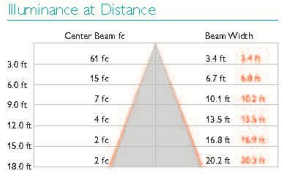
4000 K, 65° (wide) beam angle

Polar Candela Distribution



	0	22.5	44	67.5	90
0	549	549	549	549	549
5	615	624	635	619	610
15	601	594	590	599	610
25	471	469	468	476	483
35	77	79	79	81	81
45	17	17	18	17	18
55	4	4	4	4	4
65	1	2	1	2	2
75	1	1	1	1	1
85	0	0	0	0	0
90	0	0	0	0	0

Illuminance at Distance



23.4 ft (7.1 m)
1 fc maximum distance

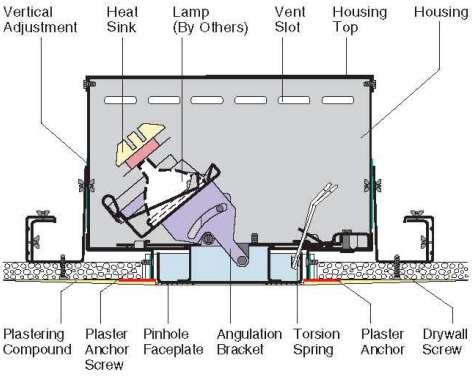
Vert. Spread: 58.6°
Horiz. Spread: 58.9°

Lumens	525
Efficacy	35.0 lm / W

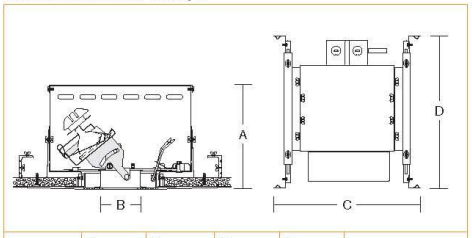
Philips Color Kinetics
3 Burlington Woods Drive
Burlington, Massachusetts 01803 USA
Tel 888.385.5742
Tel 617.423.9999
Fax 617.423.9998
www.philipscolorkinetics.com

DAS-000011-02 R04 12-10

fixture type: C3



Dimensions and Lamps



Number	A Depth	B Aperture	C Width	D Length	Lamps
K7401FM	6⅛" 156mm	2" 50mm	15" 381mm	14¼" 362mm	20-75W MR-16 Low voltage

K7401FM

FM 2-1

Flush Mount Directional Pinhole
MR-16 Lamps to 75W
2" Pinhole Aperture

Flush Mount
Kurt Versen's flush mount fixtures eliminate overlapping edges and lock into the ceiling for a unique, finished appearance. A clean, uncluttered ceiling emphasizes the attention to detail, enhancing the impact of the interior environment. It is a factory installed option with a proven installation technique.

Optics and Applications
A variety of beam patterns is available. Use when MR-16 lamps are specified and a pinhole aperture is preferred.

Design Features
The lamp rotates 360°, tilts 40° and locks into position. A proprietary lampholder features a ceramic socket, aluminum heat sink and reflective heat shield. It accepts two accessories and tilts for relamping while maintaining its aiming position. Stainless steel springs retain the lamp. Flush mount design resists cracking and chipping by mechanically fastening fixture to drywall. To simplify installation, three adjustment mechanisms adapt the fixture to ceiling conditions. Adjustable mounting rails fit different support systems and accommodate ceilings from ⅜" to ⅞" thick. Maximum extension is 26".
Top or bottom service.

Finish
The faceplate is standard matte white enamel. Housing and structural parts are optical matte black.

Transformer
Each fixture has a magnetic transformer for MR-16 lamps up to 75W. The primary lead is 120V with a 12V secondary. The transformer is rated 180°C Class H with a built-in 150°C thermal reset. It is accessible through the aperture. Maximum fixture draw is 85W.

General
Fixture is pre-wired and thermally protected, UL and C-UL listed for damp location and eight wire 75°C branch circuit wiring. Union made IBEW.

Accessories

HL	Hexcell louver.
LL	Linear spread lens.
LP	Large prism lens.
MP	Microprism lens.
DP	Fixed downlight position.
UV	Ultraviolet filter.
OV	Oval aperture faceplate.
SA	Satin aluminum faceplate.
BAK	Brushed aluminum faceplate.
V277	277 volt primary magnetic transformer.
FR	Frosted lens. Example: LLFR for linear lens frosted.
CC	Custom color faceplate, contact factory.
WRL	Wattage restriction label, specify wattage.
FMW	Flush mount wood, contact the factory.
PA1	1¼" pinhole aperture faceplate.
ET1	Electronic transformer 120V to 12V.
ET2	Electronic transformer 277V to 12V.

kurt versen
Kurt Versen Company Point Source Lighting
Westwood, New Jersey 07675

FM 2-1 K7401FM

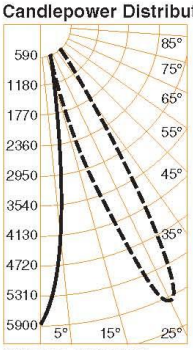
Footcandle Values

Distance		5'					10'					15'					20'				
		Nadir	5°		10°		Nadir	5°		10°		Nadir	5°		10°		Nadir	5°		10°	
MR-16 Lamps	CBCP	FC	FC	Diam	FC	Diam	FC	FC	Diam	FC	Diam	FC	FC	Diam	FC	Diam	FC	FC	Diam	FC	Diam
35W NSP/8/FRB 8°	11000	333	193	1'	8	2'	83	48	2'	2	4'	37	21	3'	1	5'	21	12	3'	1	7'
50W NSP/15/EXT 14°	10200	235	165	1'	61	2'	59	41	2'	15	4'	26	18	3'	7	5'	15	10	3'	4	7'
65W NSP/10/FPA 10°	14000	408	241	1'	12	2'	102	60	2'	3	4'	45	27	3'	1	5'	26	15	3'	1	7'
75W NSP/15/EYF 14°	12000	315	204	1'	17	2'	79	51	2'	4	4'	35	23	3'	2	5'	20	13	3'	1	7'

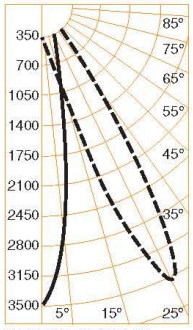
Distance		5'					10'					15'					20'				
		Nadir	10°		15°		Nadir	10°		15°		Nadir	10°		15°		Nadir	10°		15°	
MR-16 Lamps	CBCP	FC	FC	Diam	FC	Diam	FC	FC	Diam	FC	Diam	FC	FC	Diam	FC	Diam	FC	FC	Diam	FC	Diam
35W FL/35/FMW 35°	1400	39	39	2'	24	3'	10	10	4'	6	5'	4	4	5'	3	8'	2	2	7'	1	11'
50W FL/40/EXN 40°	2000	67	66	2'	36	3'	17	17	4'	9	5'	7	7	5'	4	8'	4	4	7'	2	11'
65W FL/40/FPB 40°	2100	67	64	2'	19	3'	17	16	4'	5	5'	7	7	5'	2	8'	4	4	7'	1	11'
75W NFL/25/EYJ 25°	4900	154	102	2'	22	3'	39	25	4'	5	5'	17	11	5'	2	8'	10	6	7'	1	11'

See note 2.

Candlepower Distribution



K7401FM 50W MR-16
NSP/15/EXT 14°
Eff. 50% S/M .25



K7401FM 50W MR-16
NFL/25/EXZ 27°
Eff. 37% S/M .27

Candelas

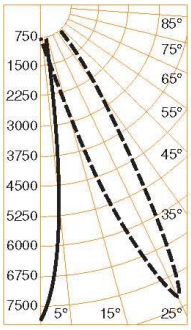
°	EXT 10200*	EXZ 3400*
0	5863	3476
5	4164	2575
10	1593	1236
15	379	404
20	17	41
25	4	3
30	0	0
35	0	0
40	0	0
45	0	0
50	0	0
55	0	0
60	0	0
65	0	0
70	0	0
75	0	0
80	0	0
85	0	0
90	0	0

°Vertical Angles
*Center Beam Candlepower

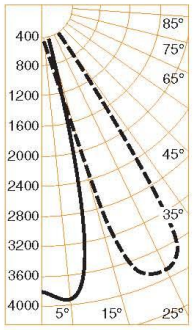
Notes

1 Candlepower distribution curves: the solid lines show horizontal distribution at nadir, the dotted lines show horizontal distribution at 25° lamp tilt.

2 Pattern diameters are determined from each side of nadir with 0° lamp tilt. The diameter includes both sides, so a 10° diameter represents a total 20° pattern width at the floor. Footcandles are measured at the diameter edge. Tilting the lamp changes all data.



K7401FM 75W MR-16
NSP/15/EYF 14°
Eff. 85% S/M .23



K7401FM 75W MR-16
NFL/25/EYJ 25°
Eff. 54% S/M .40

°	EYF 12000*	EYJ 4900*
0	7869	3854
5	5150	3983
10	1786	2660
15	361	608
20	193	42
25	6	7
30	0	0
35	0	0
40	0	0
45	0	0
50	0	0
55	0	0
60	0	0
65	0	0
70	0	0
75	0	0
80	0	0
85	0	0
90	0	0

°Vertical Angles
*Center Beam Candlepower

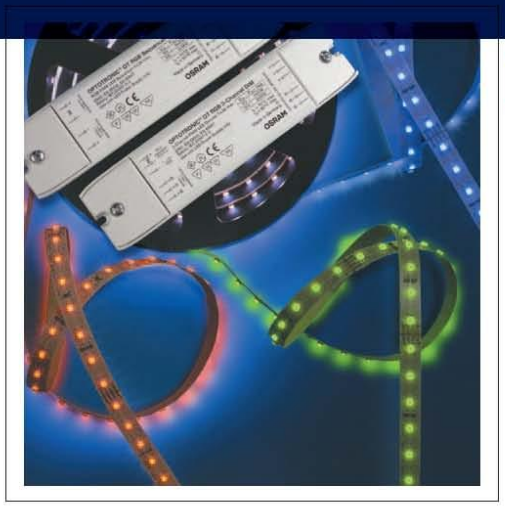
Kurt Versen Company, Westwood, New Jersey

fixture type: J1

www.sylvania.com

LINEARlight FLEX® Top Colormix

Flexible Colormixing LED Module



Key Features & Benefits

- Flexible circuit board with self-adhesive backing allows for easy installation in complex contours
- Low profile module enables mounting in compact spaces
- Each Multi LED contains an individually powered red, green and blue chip; this unique method of colormixing achieves excellent color consistency and uniformity
- 13 foot module decreases complexity of wiring and programming simplifying installation for long linear runs
- Modules can be field cut to 7.9 inches (20mm) to achieve a customized fit
- LEDs are closely spaced to minimize hot spots in shallow installations
- Dimmable by pulse width modulation, a method that maintains consistent lumen output and color

LINEARlight FLEX Top Colormix modules provide dynamic control of colored illumination. Each individual LED contains red, green and blue chips in one LED package. LINEARlight FLEX Top Colormix module is optimally paired with 24Vdc power supplies, OPTOTRONIC® OT RGB 3CH DIM and OT RGB Sequencer dimming controllers to yield an infinite choice of colors, including white. This unique method of colormixing within each LED, achieves better color consistency and uniformity than by combining separate, colored LEDs. The LINEARlight FLEX Top Colormix module is mounted on a flexible self-adhesive tape that can be conveniently field cut with scissors. These dynamic and flexible features enable the systems to be used in a wide range of large scale applications, including edge lighting of transparent and diffusing materials, illuminating facades and coves and architectural applications. These modules can be used wherever high voltage concerns or space limitations prevent use of conventional means of illumination.

Product Offering

Ordering Abbreviation	Color
L41LFE/24V/RGB2/B7/13FT	RGB2
L55LFE/24V/RGB/B7/13FT	RGB

Application Information

Applications

- Accent lighting
- Colormixing
- Controlled color sequencing
- Cove lighting
- Custom color applications
- Edge lighting

Specifications and Certifications

c UL us LISTED

The SYLVANIA LINEARlight FLEX Top Colormix module is UL2108 Listed for US and Canada Class 2 Unit. (UL file # E258264)

RoHS compliant

This light source meets restrictions on hazardous substances.

SEE THE WORLD IN A NEW LIGHT SYLVANIA

LED017R9 6/10

Specification Data

Catalog #	Type
Project	
Comments	
Prepared by	Date

Ordering Information

Item Number	Ordering Abbreviation	Module Length	No. of LEDs	Power* (W)	Voltage (Vdc)	Current (Amps)	Wavelength	Initial Lumens	Watts/ft.
70198	L41LFE/24V/RGB2/B7/13FT	13.1 ft.	200						
	Red Channel			8.5	24	0.35	625nm	385	0.6
	Green Channel			24.0	24	1.0	525nm	770	1.8
	Blue Channel			8.5	24	0.35	469nm	130	0.6
70127	L55LFE/24V/RGB/B7/13FT	13.1 ft.	200						
	Red Channel			12	24	0.5	617nm	213	0.9
	Green Channel			24.0	24	1.0	525nm	336	1.8
	Blue Channel			19.2	24	0.8	467nm	54	1.5

*All data is related to entire module measured at Tc point of 25°C. Data reflects statistical mean values. Actual data may differ depending on variances in the manufacturing process. End users need to take into account the lumen depreciation as the temperature rises with various thermal management solutions installed.

Ordering Guide

L	55	L	F	E	/	24V	/	RGB	/	B7	/	13FT
LED	Wattage	Linear	Flexible	Engine		Voltage		Colormix Red, Green, Blue		Style		Length

Power Supply Information

	OT 20W (51512)			OT 50W (51598)			OT 75W (51514)		
LED Item Number	# of parallel branches (max. feet)	Max. feet per branch	Max. SEU's per branch	# of parallel branches (max. feet)	Max. feet per branch	Max. SEU's per branch	# of parallel branches (max. feet)	Max. feet per branch	Max. SEU's per branch
70198	1 (5.9)	5.9	9	2 (15.7)	13.1; 2.6	20; 4	2 (23.6)	13.1; 10.5	20; 16
70127	1 (4.6)	4.6	7	1 (12.4)	11.8	18	2 (17.7)	13.1; 4.6	20; 7

	OT 96W (51510, 51626)			OT 240W (51627)		
LED Item Number	# of parallel branches (max. feet)	Max. feet per branch	Max. SEU's per branch	# of parallel branches (max. feet)	Max. feet per branch	Max. SEU's per branch
70198	3 (30.9)	13.1; 13.1; 4.6	20; 20; 7	2 (25.5)*	13.1; 12.4	20; 19
70127	2 (22.3)	13.1; 9.2	20; 14	2 (18.3)*	13.1; 5.2	20; 8

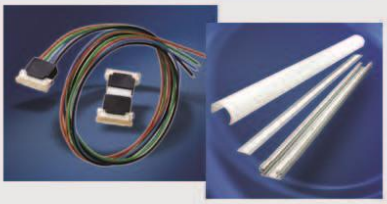
All branches to be connected in parallel.
SEU = Smallest Electrical Unit
*The OT240 has 3 output channels. Data is given for loading one 80W channel only.
Notes:
1. OPTOTRONIC power supplies are optimally paired with SYLVANIA LED modules and are specifically designed with protection features for safe operation.
2. The module is designed to work with with constant voltage power supplies only. Reference the power supply PIB #ECS050 for product specific information.

Minimum and Maximum Ratings

Parameter	Values
Operating Temperature at Tc point	-30 to +75°C (-22 to +162°F)
Storage Temperature Range	-30 to +80°C (-22 to +176°F)
Voltage Range	23 – 25Vdc
Reverse Voltage	25Vdc

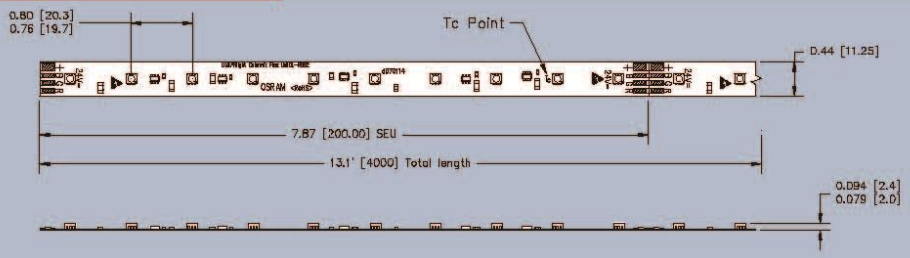
Notes:
1. Exceeding maximum ratings may damage the LED module and pose potential safety hazards.
2. Elevated operating temperatures can be expected to negatively impact the service life in terms of lumen output.
3. Incorrect wiring may damage the LED module.
4. Not intended for use with constant current power supplies.

Accessories

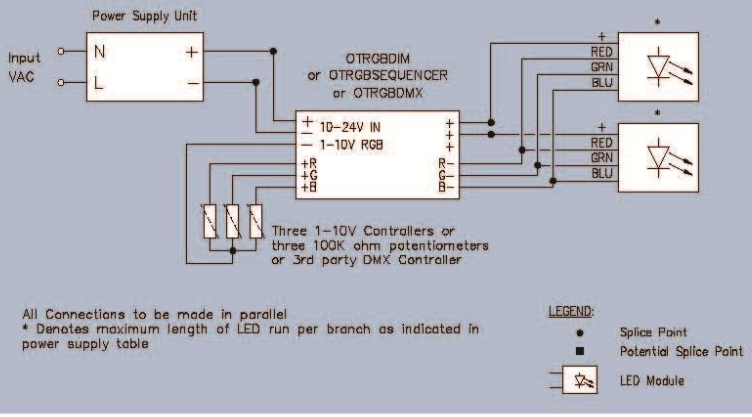


Item Number	Ordering Description	Length (in)	Description
70183	LAC-C/FT/1C/4P/20IN	20	Input Connector
70263	LAC-C/SD/BB/10mm	1.4	Board to Board Connector
70131	LAC-C/SD/BB/6IN	5.91	Board to Board Connector
71236	LAC-T/LNRLT/P/2FT	18.0	Prismatic Mounting Track
71237	LAC-T/LNRLT/P/5FT	56.0	Prismatic Mounting Track
71238	LAC-T/LNRLT/D/2FT	18.0	Diffused Mounting Track
71239	LAC-T/LNRLT/D/5FT	56.0	Diffused Mounting Track

Assembly Diagram



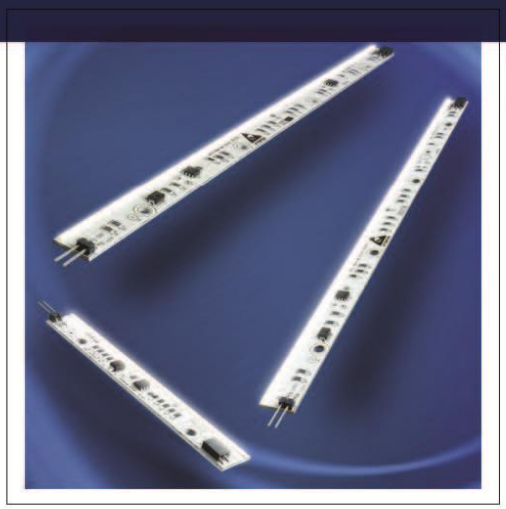
Wiring Diagram



fixture type: J2

www.sylvania.com/LED

HF²Narrow Stick
Compact High Intensity LED Module



Key Features & Benefits

- Highly dense LED spacing creates a virtually linear light source
- Narrow profile allows for easy installation in tight spaces
- Available in full and half output versions allowing for choice and customization
- Dimmable by pulse width modulation, a method that maintains consistent lumen output and color
- Long life: up to 50,000 hours (L_{70}) when temperature at Tc point is maintained below 85°C
- IES files are available at www.sylvania.com and Photopia files are available at www.ltioptics.com/sylvania

The SYLVANIA HF²Narrow Stick LED module is an innovative module comprised of a closely packed array of small, discrete LEDs on boards under 5/8" wide. The module is designed to provide highly uniform, intense illumination and is available in 4" and 10". The module is also available in a half power version for most lengths and color temperatures.

HF²Narrow Stick modules may be conveniently connected end-to-end through the integrated 2-pin connectors. These modules are optimally paired with SYLVANIA OPTOTRONIC® 24 Vdc power supplies and may be dimmed using the OPTOTRONIC OT-DIM control interface.

Product Offering

Ordering Abbreviation	Wattage	Color
L2LRE/24V/830/NS/4IN	1.7	3000K
L2LRE/24V/835/NS/4IN	1.7	3500K
L2LRE/24V/840/NS/4IN	1.7	4000K
L3LRE/24V/830/NS/4IN	3.4	3000K
L3LRE/24V/835/NS/4IN	3.4	3500K
L3LRE/24V/840/NS/4IN	3.4	4000K
L4LRE/24V/830/NS/10IN	4.2	3000K
L4LRE/24V/835/NS/10IN	4.2	3500K
L4LRE/24V/840/NS/10IN	4.2	4000K
L8LRE/24V/830/NS/10IN	8.4	3000K
L8LRE/24V/835/NS/10IN	8.4	3500K
L8LRE/24V/840/NS/10IN	8.4	4000K

Application Information

Applications

- Accent lighting
- Cove lighting
- Edge lighting
- Under cabinet lighting

Specifications and Certifications

The SYLVANIA HF²Narrow Stick is UL2108 Recognized for US and Canada Class 2 Unit (UL file # E247649)

This light source meets restrictions on hazardous substances.

SEE THE WORLD IN A NEW LIGHT SYLVANIA

LED085R3 6/10

Specification Data

Catalog #	Type
Project	
Comments	
Prepared by	Date

Ordering Information

Item Number	Ordering Abbreviation	Length (in.)	No. of LEDs	Power (W)	Voltage (Vdc)	Current (mA)	Color Temperature	Initial Lumens	Beam Angle	CRI
70392	L2LRE/24V/830/NS/4IN	4	24	1.7	24	70	3000K	86	120°	85
70393	L2LRE/24V/835/NS/4IN	4	24	1.7	24	70	3500K	88	120°	85
70394	L2LRE/24V/840/NS/4IN	4	24	1.7	24	70	4000K	102	120°	85
70492	L3LRE/24V/830/NS/4IN	4	42	3.4	24	140	3000K	172	120°	85
70473	L3LRE/24V/835/NS/4IN	4	42	3.4	24	140	3500K	176	120°	85
70493	L3LRE/24V/840/NS/4IN	4	42	3.4	24	140	4000K	205	120°	85
70495	L4LRE/24V/830/NS/10IN	10	54	4.2	24	175	3000K	215	120°	85
70496	L4LRE/24V/835/NS/10IN	10	54	4.2	24	175	3500K	220	120°	85
70497	L4LRE/24V/840/NS/10IN	10	54	4.2	24	175	4000K	257	120°	85
70436	L8LRE/24V/830/NS/10IN	10	102	8.4	24	350	3000K	430	120°	85
70472	L8LRE/24V/835/NS/10IN	10	102	8.4	24	350	3500K	441	120°	85
70422	L8LRE/24V/840/NS/10IN	10	102	8.4	24	350	4000K	514	120°	85

Notes:

1. All data is related to the entire module. Data reflects statistical mean values. Actual data may differ depending on variences in the manufacturing process.
2. Delivered lumens per board subject to change based on shipments of lumens per LED of 3 to 9 lumens.
3. Color coordinates for the 3000K (x=.4562, y=.4260), (x=.4299, y=.4165), (x=.4147, y=.3814), (x=.4373, y=.3893). Color coordinates for the 3500K (x=.4299, y=.4165), (x=.3996, y=.4015), (x=.3889, y=.3690), (x=.4147, y=.3814). Color coordinates for the 4000K (x=.4006, y=.4044), (x=.3736, y=.3874), (x=.3670, y=.3578), (x=.3898, y=.3716).
4. **Dry location** use only.

Ordering Guide

L	2	L	R	E	/	24V	/	8	30	/	NS	/	4IN
LED	Wattage	Linear	Rigid	Engine		Voltage		CRI>80	Color Temperature 3000K		Product Family HF²Narrow Stick		Length

Power Supply Information

Maximum Number of Modules per Power Supply

	OT17 (51622)	OT20 (51512)	OT50 (51598)	OT75 (51514)	OT96D (51510)	OT96 (51626*)	OT240 (51627**)
All 10" (102 LEDs) Item Numbers	1	2	5	8	10	10	8 / chnl
All 4" (42 LEDs) Item Numbers	4	5	13	20	25	25	21 / chnl
All 10" (H, 54 LEDs) Item Numbers	3	4	10	16	20	20	17 / chnl
All 4" (H, 24 LEDs) Item Numbers	9	10	26	40	51	51	42 / chnl

*NAED # 51626 has replaced NAED # 51511.
**NAED # 51627 has replaced NAED # 51515.

Notes:

1. For the 10" 102 LED version, 5 LED modules can be operated on a single feed. For the 10" 54 LED version and the 4" 42 LED version, 10 LED modules can be operated on a single feed. For the 4" 24 LED version, 24 LED modules can be operated on a single feed.
2. OPTOTRONIC® power supplies are optimally paired with SYLVANIA LED modules and are specifically designed with protection features for safe operation.
3. The module is designed to work with Constant Voltage power supplies only. Reference the Power Supply PIB #ECS050 for product specific information.
4. These values are an approximation based on the typical "power" values listed under the "Ordering Information" parameters. To accurately determine the maximum LED load, evaluate the application based on the application note "Determining the Maximum LED Load on a Constant Voltage Power Supply" LED026. This document can be found at www.sylvania.com.
5. HF²Narrow Stick modules can be dimmed when used with the OT DIM, or OTRGBDIM controllers. Because of the power consumed by these controllers, an additional de-rating of the overall "maximum" load must be factored into the above chart. To determine this de-rating (wattage) value please reference Step 8 of this same App. Note #LED026.

Accessories

Item Number	Ordering Abbreviation	Description	Length (in.)	Order Quantity
70440	LAC-C/NS/BB/2P/2IN	Board to Board Connector	2	10
70441	LAC-C/NS/BB/2P/4IN	Board to Board Connector	4	10
70442	LAC-C/NS/BB/2P/8IN	Board to Board Connector	8	10
70443	LAC-C/NS/IC/2P/60IN	Input Connector	60	5
70444	LAC-C/NS/IC/2P/24IN	Input Connector	24	10

fixture type: J2

3form chroma®

Product Description

3form Chroma is produced from optical grade engineered resin. Chroma is available in thick-gauge formats which lends itself well for use in many horizontal applications. Chroma is a highly functional material that brings impact when color is introduced. Chroma is produced with brilliant colors that can be layered (up to five colors) to create an enormous range of hues, opacities and amazing effects. The surface of Chroma features a durable renewable matte texture that can be easily refinished throughout its lifetime. Chroma incorporates 40% pre-consumer recycled content without compromising its amazing clarity.

Chroma XT is exterior grade Chroma suitable for use as signage, lighting, awnings, tables or canopies. Use Chroma XT to bring amazing color and design to your exterior applications.

FEATURES AND BENEFITS

- Surface is able to be completely refinished to maintain product "newness"
- Great for edge lighting – tremendous optical properties and high light transmission
- Rigid - stable and sturdy material for horizontal applications
- Qualifies for 3form Reclaim™ – keeping end-of-life material out of landfills
- Combine up to five colors to create any color imaginable

AVAILABLE COLORS

3form Chroma comes in a variety of translucent warm and cool colors. Colors can be made opaque with the addition of the color - White Out.

(Visit www.3-form.com for the complete list of available color options.)

CHROMA REFLECT

3form Chroma Reflect™ pairs beautiful 3form colors with a reflective opaque mirror. The result is a breathtaking panel that glows and radiates color like you've never seen. Chroma Reflect panels are 1-sided and opaque. Chroma Reflect can only be paired with one Chroma color. The back finish of Chroma Reflect is left unfinished to allow for more versatility during fabrication. Chroma Reflect adds an extra 1/8" (3 mm) to the standard thickness of Chroma panels. Additionally, Chroma Reflect is not suitable for exterior use and requires special fabrication techniques.

TEXTURES/PATTERNS/FINISHES

All Chroma sheets come standard with a Renewable matte finish on the front face that allows the product to be continually rejuvenated if ever desired or necessary during the service life of the material. The back side of 3form Chroma in translucent colors is finished with a matte finish, but this side should not be renewed. Chroma Clear comes standard with renewable matte surfaces on front and back.

Chroma panels can be ordered with an optional Renewable Matte Back Finish, that allows refinishing of both sides of the panel. The Renewable Matte Back Finish increases the thickness by an extra 1/16" (1.5 mm).

Chroma panels that are opaque (unless specified differently) are finished with a gloss backside texture to allow for more versatility during fabrication. Chroma is also available with an optional Patent finish. Patent is a high gloss finish with the highest light transmittance, but does not allow for refinishing. (Chroma Reflect is not available with Patent finishes)

PANEL SIZES AND TOLERANCES

All dimensions and squareness (standard or custom) are subject to a +1/4" or - 3/16" (+6 mm or -5 mm) tolerance. Squareness (standard or custom) is subject to a 1/8" (3.1 mm) tolerance.

Chroma is available in 1/2 inch (12.7 mm), 1 inch (25.4 mm) and 2 inch (50.8 mm) thicknesses.

PANEL SIZE TABLE

NOMINAL GAUGE	PANEL DIMENSIONS
1/2" (12.7 mm)	48" x 96" (122 cm x 243.8 cm), 48" x 120" (122 cm x 304.8 cm)
1" (25.4 mm)	48" x 96" (122 cm x 243.8 cm), 48" x 120" (122 cm x 304.8 cm)
2" (50.8 mm)	48" x 96" (122 cm x 243.8 cm)

Gauge tolerances are an inherent part of working with resin. Given the unique manufacturing process for 3form Chroma, a given gauge is subject to a +/- 10% thickness tolerance. Thickness tolerance readings are based on measurements along both long edges of each panel.

THICKNESS TOLERANCE TABLE

STANDARD CHROMA PANELS

GAUGE*	MINIMUM ALLOWANCE	MAXIMUM ALLOWANCE
1/2" (12.7 mm)	0.450" (11.4 mm)	0.585" (14.9 mm)
1" (25.4 mm)	0.900" (22.9 mm)	1.100" (27.9 mm)
2" (50.8 mm)	1.800" (45.7 mm)	2.200" (55.9 mm)

REFLECT, XT AND PANELS WITH RENEWABLE MATTE BACK FINISH

GAUGE*	MINIMUM ALLOWANCE	MAXIMUM ALLOWANCE
5/8" (15.9 mm)	0.515" (13.1 mm)	0.710" (18.0 mm)
1-1/8" (28.6 mm)	0.965" (24.5 mm)	1.225" (31.1 mm)
2-1/8" (53.9 mm)	1.865" (47.4 mm)	2.325" (59.1 mm)

*Chroma Reflect adds 1/8" (3 mm) and Chroma XT, HighRes and renewable matte back finish materials add 1/16" (1.5 mm) to overall thickness.

fixture type: J3

line™ .75
SYMMETRIC

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

series .75 is a low voltage linear accent luminaire that may be ordered in incremental nominal lengths that range from 6" to 96". Optional beam spreads along the perpendicular axis of the fixture include 10˚, 45˚ and 65˚. For details on the asymmetric beam spread, see dedicated specification sheet. **io** ensures that each LED is provided thermal and electrical management properties in accordance with the LED manufacturers recommendations. Projected average rated life is 50,000 hours at 70% of lamp lumen output. Contact factory for IES LM-80 compliance. To ensure proper performance, architectural details should allow for ventilation and air flow around the fixture. Ambient temperature surrounding the fixture shall not exceed 120˚F *(48.9˚C)*.

Light Output
line series .75 is available with three lumen outputs for white light only. Red, green, blue and amber are available in high output only. All values below are initial lumens per foot. IES LM-79 format files may be obtained from the factory or downloaded from **www.iolighting.com**. Consult factory for High CRI options and availability.

	Standard Output	Mid Output	High Output
2700K White:	68 lms/ft	126 lms/ft	180 lms/ft
3000K White:	68 lms/ft	126 lms/ft	180 lms/ft
5000K White:	91 lms/ft	168 lms/ft	240 lms/ft

Construction
Extruded aluminum housing coupled with a patented optical assembly may not be disassembled for re-lamping. Customized acrylic optics offer very high transmissivity, UV stability and excellent longevity. Three mounting bracket options include: surface, side surface and field adjustable. Bracket material is composed of stainless steel for ease of installation and removal as required.

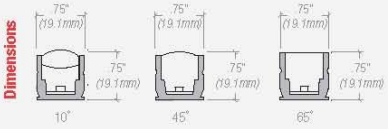
Electrical
Field adjustable 4'-0" 22 AWG, 300 volt rated power cords are supplied with strain reliefs. 24 volt 96 watt power supply will be provided as a standard if not specified otherwise. For detailed information regarding daisy chain limitations, remote distance limitations, power supply options, and dimming options consult the **io** website, the **io** catalog (pages 98-100) or an **io** representative.

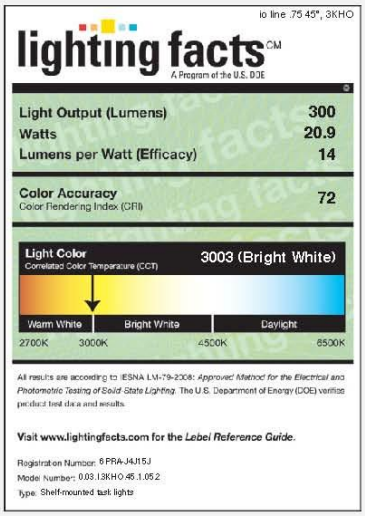
Power Consumption
Standard Output: 2.92 w/ft **Mid Output: 5.34 w/ft** **High Output: 7.62 w/ft**

Power consumption does not include power supply losses.

Finish
Anodized aluminum finish is standard. Custom finishes may be available upon request.

Dimensions



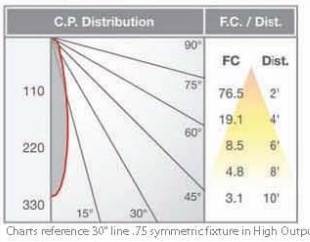


Label references 30" **line .75** symmetric fixture with a 45˚ beam spread in High Output 3000K. Lighting Facts for additional beam spreads and light output levels may be obtained from **io** Lighting.

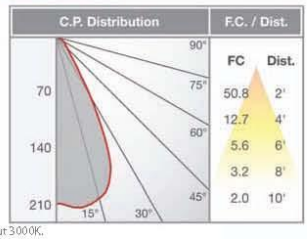
io Lighting 1100 Busch Pkwy Buffalo Grove, IL 60089 T 847.777.3900 F 847.777.3901 E info@iolighting.com W iolighting.com

Light Output / Distributions / Electrical Feed Options

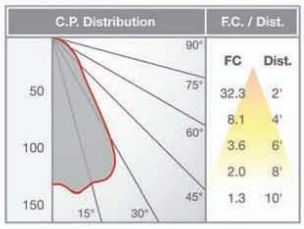
3KHO 10 DEGREE



3KHO 45 DEGREE



3KHO 65 DEGREE



Charts reference 30° line .75 symmetric fixture in High Output 3000K.

LIGHT OUTPUT CONVERSION TABLE

White Light Output	3000K S.O.	3000K M.O.	3000K H.O.	5000K S.O.	5000K M.O.	5000K H.O.
Light Output Multiplier	0.38[1]	0.70[1]	1.0[1]	0.51[1]	0.93[1]	1.33[1]

Color Light Output	RED	GREEN	BLUE	AMBER
Light Output Multiplier	0.53[2]	0.51[2]	0.30[2]	0.51[2]

IES format photometrics may be downloaded from ***www.iolighting.com***.

Note: 2700K and 3000K have same light output.

NEW FIELD CONFIGURABLE ELECTRICAL FEED

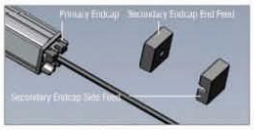

End feed


Right side feed


Left side feed

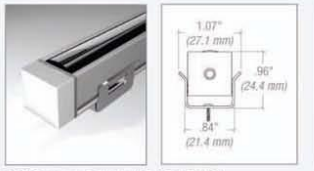

Top feed

Note: Electrical contractor may adjust orientation of electrical feed in the field.

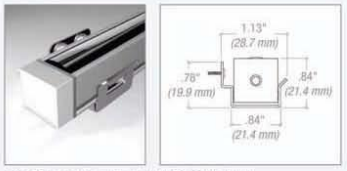


Secondary End Cap

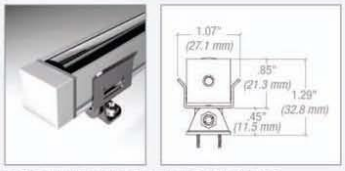
Mounting Options



100 Surface (**io** part #: SA.BK.SURF)



101 Side surface (**io** part #: SA.BK.WALL)



102 Field adjustable (**io** part #: SA.BK.ADJMT)

Order Code

0	.	03	.	I	.		.		.		.		.		.		.		.	
io		1		2		3		4		5		6		7		8		9		10

1. LINE SERIES
03 .75 SO, MO or HO

2. LOCATION
I Interior

3. COLOR

27K	White 2700K (Standard)[1]
27KMO	White 2700K (Mid Output)[1]
27KHO	White 2700K (High Output)[1]
3K	White 3000K (Standard)[1]
3KMO	White 3000K (Mid Output)[1]
3KHO	White 3000K (High Output)[1]
5K	White 5000K (Standard)[1]
5KMO	White 5000K (Mid Output)[1]
5KHO	White 5000K (High Output)[1]
R	Red[2]
G	Green[2]
B	Blue[2]
A	Amber[2]

4. DISTRIBUTION

10	10 Degree
45	45 Degree
65	65 Degree

5. MOUNTING

100	Surface
101	Side surface
102	Field adjustable

6. FINISH

1	Anodized aluminum
2	Anodized custom color

7. LENGTH

UNITS	(ACTUAL)	
01	6"	(6.53")
02	12"	(12.22")
03	18"	(17.97")
04	24"	(23.53")
05	30"	(29.22")
06	36"	(34.97")
07	42"	(40.53")
08	48"	(46.22")
09	54"	(51.97")
10	60"	(57.53")
11	66"	(63.22")
12	72"	(68.97")
13	78"	(80.22")[3]
14	84"	(85.97")[3]
15	90"	(91.53")[3]
16	96"	(97.22")[3]

8. ELECTRICAL FEED
2 One end feed
22 Double end feed
Note: Electrical contractor may adjust orientation of electrical feed in the field.

9. VOLTAGE / DIMMING
1 120v
2 277v
3 120v w/dim
4 277v w/dim
5 Other

10. SPECIFY DRIVER / DIMMING
Note: If not specified otherwise, ***io*** *will supply 96 watt drivers. Refer to pages 98-100 for Power Supply options or download Power Supply specification sheet from* ***www.iolighting.com***.

SSL Chromaticity Standard: ANSI C78.377		
Color	Nominal CCT	Target CCT & Tolerance (K)
White	2700K	2725 ±145
White	3000K	3045 ± 175
White	5000K	5028 ± 283

For Metric Conversion		
1"	1"	1'
25.4mm	2.54cm	0.3m

Footnotes

1. White light variance between LEDs within a single fixture will not exceed ANSI Binning Standards.
2. Refer to conversion table for output. Only available in 7.6 wift.
3. High Output only available in lengths up to 72".

c UL us

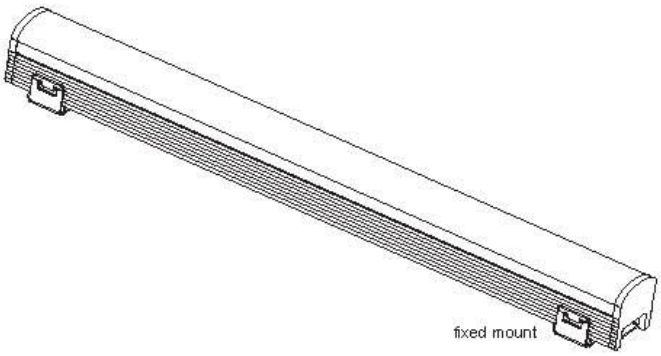
io Lighting 1100 Busch Pkwy Buffalo Grove, IL 60089 T 847.777.3900 F 847.777.3901 E info@iolighting.com W iolighting.com

fixture type: J4

WinonaLED Project:_____ Qty:_____ Type:

winline cove 204 dry

Quick Find #: 2043



The **Winline 200 Series** are small scale linear LED luminaires and were designed to be the most powerful, reliable, and easiest to implement linear LED solution available. The model 204 is a high performance luminaire with robust construction suitable for small cove illumination.

Beam Spreads: The model 204 is available in one beam spread of 130 degrees. See page 4 for photometric data.

Color & Light Output: The 200 Series utilizes Nichia 123B white LEDs in five standard colors. Model 204 features (24) LEDs/ft.

Color	Model 204
ANSI-2700K White	128 lm/ft
ANSI-3000K White	151 lm/ft
ANSI-3500K White	157 lm/ft
ANSI-4000K White	168 lm/ft
non-ANSI-5000K White	212 lm/ft

Results based on BALL test 15389
130° beam spread
Note:
LM79 Tests- see page 4.

Power: Power consumption is 4.5W/ft. The Winline 200 series operates on 24VAC using Magnetic Transformers. A wide range of remote transformers are available in 120V and 277V primary.

Dimming: Used with remote mounted 24VAC magnetic transformers which can be dimmed with commonly available low voltage magnetic dimming equipment.

Mounting & Adjusting: A unique 1-piece mount combined with an integral wire tray allows the 200 Series to be easily installed. The installer locates and fastens the mount clip, runs power feed lines inside the clips, connects the fixture's wire leads to the feed lines and snaps the fixture in place. The integral wire cover of the 204 keeps wiring hidden and organized. See pages 2-3 for more mounting information.

Operating Temperature: Minimum and Maximum ambient air temperatures around this luminaire shall not exceed -22°F to 122°F (-30°C to 50°C). Any application of this product should also take into consideration air flow and ventilation to ensure performance and reliability.

Weight:

12" - .65 lbs	36" - 1.85 lbs
18" - .94 lbs	42" - 2.15 lbs
24" - 1.25 lbs	48" - 2.45 lbs
30" - 1.55 lbs	

Listing: 3150395
Winline 204 is ETL listed for dry location.
Complies with UL Standard 2108

RoHS COMPLIANT

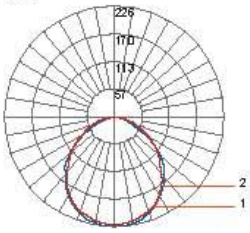
Winline Cove - **WCV**	**WCV**	series
model 204 dry - **204**	**204**	model
Total Run Length in Feet 204 offered in 6" increments starting at 12" *ex. 60FT = 60 foot run* *or* **Preconfigured Run Length Code** *see page 5* *or* **To Be Determined** *TBD when run length unknown*		run length code
130° - **130**	**130**	beam spread
ANSI-binned 2700K - **27K** ANSI-binned 3000K - **30K** ANSI-binned 3500K - **35K** ANSI-binned 4000K - **40K** non-ANSI-binned 5000K - **50K**		LED code
non-dimming 24 volt AC - **ND24V** dimming 24 volt AC - **DM24V**		voltage
fixed - **F**	**F**	mount
natural type III anodized aluminum - **NAA**	**NAA**	finish
surface end feed - **SE** recessed bottom feed - **RB**		power feed
standard - **STD** modified - **MOD**		special

Describe Modification:

winonaLED

winline cove 204 dry — photometrics

130°



Maximum Candela = 226 Located At Horizontal Angle = 0, Vertical Angle = 5
#1 - Vertical Plane Through Horizontal Angles (0-180) (Through Max. Cd.)
#2 - Vertical Plane Through Horizontal Angles (90-270)

BALL Test Report: 15389 Catalog Number: WCV-204-48-130-30K
Description: 96 Nichia 1238 3000K LEDs / 48" Winline 204 Dry Luminaire / Extruded Aluminum Housing / Acrylic Lens

LM79 Data - Based on WCV204/130° Test Results

Color	Total Lumens	Lamp Watts	Lumens per Watt	CRI	Power Factor
ANSI-binned 2700K	513	15.7	32.7	84.3	.97
ANSI-binned 3000K	604	16.7	36.2	86.8	1.00
ANSI-binned 3500K	628	16.7	37.6	83.0	.98
ANSI-binned 4000K	670	16.7	40.1	87.0	.98
non-ANSI-binned 5000K	846	16.7	50.7	70.3	.98

Zonal Lumen Summary
Nichia 1238 3000K

Zone	Lumens	%Fixture
0-30	173	28.7
0-40	282	46.7
0-60	478	79.2
0-90	590	97.6
Total Luminaire 0-180	604	100.0

Candlepower Distribution 3000K

Angle	Horizontal Plane 0	22.5	45	67.5	90
0	222	222	222	222	222
10	223	218	217	218	216
15	218	214	212	212	210
20	211	206	205	206	205
25	200	198	197	199	197
30	188	186	187	187	184
35	175	173	174	173	170
40	158	158	160	154	152
45	143	142	140	133	132
50	121	124	118	118	118
60	73	76	79	84	83
70	28	40	49	53	53
80	5	17	26	32	32
90	0	5	12	13	13
100	0	2	5	7	7
120	0	0	2	4	4
140	0	0	0	1	1
160	0	0	0	0	0
180	0	0	0	0	0

Winline

lighting facts℠
A Program of the U.S. DOE

Light Output (Lumens)	604
Watts	16.7
Lumens per Watt (Efficacy)	36
Color Accuracy Color Rendering Index (CRI)	87

Light Color
Correlated Color Temperature (CCT) — 3030 (Bright White)

Warm White | Bright White | Daylight
2700K 3000K 4500K 6500K

All results are according to IESNA LM-79-2008: *Approved Method for the Electrical and Photometric Testing of Solid-State Lighting*. The U.S. Department of Energy (DOE) verifies product test data and results.

Visit www.lightingfacts.com for the *Label Reference Guide*.

Registration Number: 84Q4-ECSVRH
Model Number: WCV-204-4-130-30K
Type: Cove light

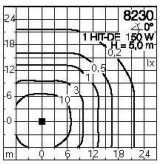
fixture type: M1

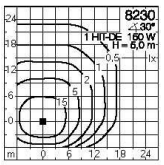
06.11 · Technische Änderungen vorbehalten · Technical amendments reserved · Sous réserve de modifications techniques

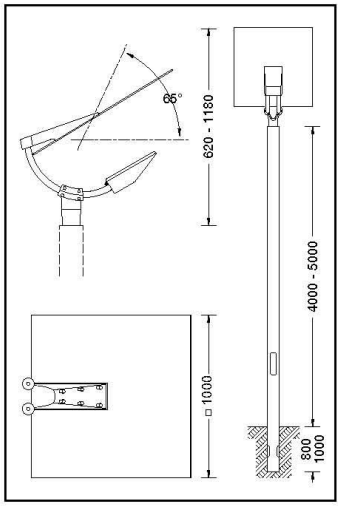
BEGA Lichttechnische Spezialfabrik
Hennenbusch · D - 58708 Menden

BEGA

Gebrauchsanweisung Instructions for use Fiche d'utilisation	Aufsatzleuchte Pole top luminaire Luminaire tête de mât	IP 65	**8230**







Anwendung
Mastaufsatzleuchte für flächige indirekte Beleuchtung.
Das Licht des Hochleistungsscheinwerfers wird über einen quadratischen Dachreflektor umgelenkt. Diese Umlenkung bewirkt eine besonders weiche und gleichmäßige Lichtstärkeverteilung und eine optimale Entblendung.
Symmetrische Lichtstärkeverteilung bei waagerecht eingestelltem Dachreflektor und asymmetrische Lichtstärkeverteilung bei geschwenktem Dachreflektor 0 - 65°.
Für Lichtpunkthöhen von 4000 - 5000 mm.

Application
Pole top luminaire for flat, indirect lighting.
The light from the high-power floodlight is redirected by a square top reflector, producing a particularly soft and uniform light distribution and optimum glare suppression.
Symmetrical light distribution is produced when the top reflector is set in a horizontal position and asymmetrical light distribution when the top reflector is swiveled 0 - 65°.
For mounting heights 4000 - 5000 mm.

Utilisation
Luminaire tête de mât pour éclairage indirect extensif.
Le faisceau puissant du projecteur est dirigé sur un réflecteur carré qui procure une lumière douce et uniforme avec un confort visuel optimal.
Un réglage progressif de 0 - 65 ° permet une répartition lumineuse symétrique lorsque le réflecteur est horizontal et asymétrique lorsqu'il est incliné.
Pour hauteurs de feu de 4000 - 5000 mm.

Produktbeschreibung
Leuchte besteht aus Aluminiumguss, Aluminium und Edelstahl
Sicherheitsglas klar
Silikondichtung
Reflektor aus eloxiertem Reinst-Aluminium
Schwenkbereich Dachreflektor 0-65°
Für Mastzopf ø 76 mm
Einstecktiefe 105 mm
Leuchte mit fest angeschlossener Verbindungsleitung H05RN-F 3x1 □
Leitungslänge 5 m
Fassung RX 7s
Vorschaltgerät 230/240/250 V ∿ 50 Hz umschaltbar · Versandschaltung 230 V
Zündgerät mit Timer bis 250 V ∿ 50/60 Hz
Befestigungsmöglichkeit für Kompensationskondensator
Schutzklasse I
Schutzart IP 65
Staubdicht und Schutz gegen Strahlwasser
CE – Konformitätszeichen
Windangriffsfläche: 0,91 m²
bei 65° geschwenktem Dachreflektor
Gewicht: 33,0 kg

Product description
Luminaire made of aluminium alloy, aluminium and stainless steel
Clear safety glass
Silicone gasket
Reflector made of anodised pure aluminium
Swivel range of square-top-reflector 0 - 65°.
For pole top ø 76 mm
Slip fitter insert depth 105 mm
Luminaire with fixed connecting cable H05RN-F 3x1 □
Cable length 5 m
Lampholder RX 7s
Ballast 230/240/250 V ∿ 50 Hz tapped · Dispatch connection 230 V
Ignitor with timer up to 250 V ∿ 50/60 Hz
Prepared for PF correction capacitor
Safety class I
Protection class IP 65
Dust tight and protection against water jets
CE – Conformity mark
Wind catching area: 0.91 m²
with swivelled square-top-reflector at 65°.
Weight: 33.0 kg

Description du produit
Luminaire fabriqué en fonte d'alu, aluminium et acier inoxydable
Verre de sécurité clair
Joint silicone
Réflecteur en aluminium pur anodisé
Inclinaison du toit réflecteur 0-65°.
Pour tête de mât ø 76 mm
Profondeur d'embout 105 mm
Luminaire livré avec câble raccordé H05RN-F 3x1 □
Longueur de câble 5 m
Douille RX 7s
Ballast 230/240/250 V ∿ 50 Hz permutable · Branchement d'usine 230 V
Amorceur temporisé max. 250 V ∿ 50/60Hz
Fixation prévue pour condensateur de compensation
Classe de protection I
Degré de protection IP 65
Etanche à la poussière et protégé contre les jets d'eau
CE – Sigle de conformité
Prise au vent: 0,91 m²
si le toit réflecteur est incliné de 65°
Poids: 33,0 kg

Sicherheit
Für die Installation und für den Betrieb dieser Leuchte sind die nationalen Sicherheitsvorschriften zu beachten.
Der Hersteller übernimmt keine Haftung für Schäden, die durch unsachgemäßen Einsatz oder Montage entstehen.
Werden nachträglich Änderungen an der Leuchte vorgenommen, so gilt derjenige als Hersteller, der diese Änderungen vornimmt.

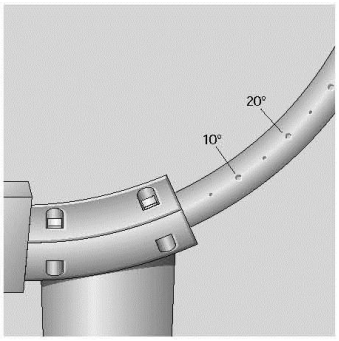
Montage
Die Leuchte darf ohne Sicherheitsglas nicht betrieben werden.
Zum Lampeneinbau Leuchte öffnen:
Schrauben lösen. Abdeckrahmen mit Sicherheitsglas und Reflektor abhängen.
Zwei Seile sichern den Abdeckrahmen.
Lampe einsetzen:
Lampenkolben nicht mit den Fingern berühren.
Lampe beim Einsetzen nicht verkanten.
Bruchgefahr. Lampe in eine Fassungsseite soweit eindrücken, bis sich die andere Seite einsetzen läßt. Auf gute Kontaktgabe achten, Lampe leicht hin und herdrehen.
Auf richtigen Sitz der Dichtung achten.
Abdeckrahmen aufsetzen und Schrauben über Kreuz gleichmäßig anziehen.
Verbindungsleitung in den Mastzopf einführen und Leuchte aufsetzen.
Leuchte ausrichten und befestigen.
Anzugsdrehmoment = 12 Nm.
Beim Kürzen der Verbindungsleitung ist für den Verstellbereich der Leuchte eine Leitungsreserve von 0,5 m vorzusehen.
Die Verbindungsleitung darf nur in einem Anschlusskasten entsprechender Schutzart und Schutzklasse angeschlossen werden.

Safety indices
The installation and operation of this luminaire are subject to national safety regulations.
The manufacturer is then discharged from liability when damage is caused by improper use or installation.
If any luminaire is subsequently modified, the persons responsible for the modification shall be considered as manufacturer.

Installation
The luminaire must not be operated without the safety glass.
To insert lamp open the luminaire:
Undo screws. Hang down cover frame with safety glass and reflector.
Two steel cable secure the cover frame.
Insert lamp:
Do not touch lamp bulb with fingers.
When inserting the lamp do not cant it.
Risk of breakage.
Push the lamp into one side of the lampholders until it can be slipped into the other one.
Make sure contact is good by gently moving the lamp back and forth.
Make sure that gasket is positioned correctly.
Install the cover frame and tighten the screws crosswise evenly.
Lead luminaire connecting cable into the pole top and put on luminaire.
Align luminaire and fix it.
Torque = 12 Nm.
When shortening the connecting cable provide a cable reserve of 0.5 m for the adjustable range of the luminaire.
The connecting cable must only be connected in a connection box with corresponding protection class and safety class.

Sécurité
Pour l'installation et l'utilisation de ce luminaire, respecter les normes de sécurité nationales.
Le fabricant décline toute responsabilité résultant d'une mise en œuvre ou d'une installation inappropriée du produit.
Toutes les modifications apportées au luminaire se feront sous la responsabilité exclusive de celui qui les effectuera.

Installation
Le luminaire ne doit fonctionner sans verre de sécurité.
Pour installer la lampe, ouvrir le luminaire:
Desserrer les vis. Ouvrir le cadre avec le verre de sécurité et le réflecteur.
Deux filins en acier retiennent le cadre.
Installer la lampe:
Ne pas toucher la lampe avec les doigts.
Ne pas forcer la lampe lors de sa mise en place afin de ne pas la briser.
Enfoncer un culot de la lampe dans une douille jusqu'au moment où le deuxième culot se laisse facilement mettre en place.
Assurer un parfait contact de la lampe en la manœuvrant légèrement à l'intérieur des douilles.
Veiller au bon emplacement du joint.
Reposer le cadre et serrer en croix et régulièrement les vis.
Introduire le câble de raccordement du luminaire dans l'ouverture au sommet du mât et placer le luminaire sur le mât.
Ajuster le luminaire et fixer.
Moment de serrage = 12 Nm.
Lors du raccourcissement du câble de raccordement une réserve de câble de 0,5 m doit être prévue pour la plage de réglage du luminaire.
Le câble de raccordement ne doit être branché que dans une boîte de connexion dont le degré et la classe de protection sont appropriés protégée.



Ausstrahlrichtung einstellen:
Das gesamte System ist in den Lagerschalen der Aufsatzmuffe stufenlos einstellbar.
Einer der beiden Rohrbögen ist auf der Innenseite mit einer Skalierung versehen, die den Anstellwinkel des Leuchtensystems in 5° Schritten anzeigt.
Zum Einstellen - Innensechskantschrauben M8 - in den Lagerschalen gleichmäßig lösen.
Für eine symmetrische Lichtstärkeverteilung - waagerechte Position des Dachreflektors - liegt das Leuchtengehäuse direkt an der Lagerschale an.
Bitte beachten Sie:
Die Verschraubung des Metall-Wellschlauches an der Aufsatzmuffe wurde werkseitig nicht angezogen.
Nach Einstellung der Ausstrahlrichtung ist der Längenausgleich des Metall-Wellschlauches in die Aufsatzmuffe zurückzuschieben und die Leitungsverschraubung fest anzuziehen.

Adjustment of the beam angle:
The complete system is infinitely adjustable in the bearings of the pole cap.
On the inside of one of the bent tubes a scaling showing the angle of attack is marked for the luminaire system in steps of 5°.
For positioning undo evenly the hexagon socket head screw M8 in the bearings.
For a symmetrical light distribution - horizontal position of the top reflector - the luminaire housing is fixed next to the bearing flange.
Please note:
The screw connection of the metal corrugated tube at the pole cap has not been tightened in the factory.
After adjustment of the beam angle push back the length adjustment of the metal corrugated tube into the pole cap and tighten the screw cable gland firmly.

Réglage de la répartition lumineuse.
Les cerceaux supportant le luminaire coulissent de façon continue dans un berceau situé en tête de mât.
L'intérieur d'un des tubes est gradué tous les 5 ° pour permettre un réglage précis.
Le réglage se fait en desserrant uniformément les vis M8 situées sur les demi coquilles du berceau.
La répartition lumineuse est symétrique lorsque le boîtier du projecteur est en butée sur le berceau.
Attention:
Le vissage de la gaine flexible métallique au manchon n'est pas serré à l'usine.
Après l'orientation du faisceau, la gaine flexible métallique doit être repoussée dans le manchon et le presse-étoupe bien serré.

fixture type: M2

Drive-over in-grade luminaires to illuminate ground surfaces

Housing: Constructed of .125" thick machined stainless steel welded to a stainless steel bottom mounting plate. Trim/Clamping ring is heavy, machined bronze.

Enclosure: Top enclosure is constructed of copper free die-cast aluminum alloy secured by two (2) captive socket head stainless steel screws. Clear, borosilicate focusing lens with molded one piece, high temperature silicone rubber gasket. Symmetrical reflector and internal lamp shield are included.

Electrical: G4, bi-pin lampholder with a ceramic insulator and high temperature leads. Luminaires pre-wired with two (2) ten (10) foot lengths of #12 AWG solid THHN wire (longer lengths of wire are available upon request) and a water tight cable gland that connects to ½" threaded conduit. These luminaires require a remotely located 12V class 2 safety transformer (by others). Lamp supplied.

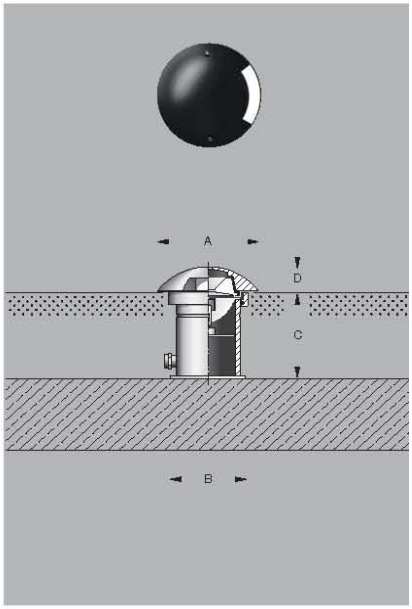
Note: Lamps supplied with luminaire pre-wired at factory. A separate waterproof wiring box for power supply must be provided (by contractor).

Finish: Standard finish is an eight step process consisting of two coats of graphite gray high solids, UV stabilized polyurethane, one with light texture over a phosphate base. Custom colors are not available.

UL Listed, suitable for wet locations and vehicle drive over. Protection class: IP67.

Note: A foundation and proper drainage must be supplied by the contractor. These luminaires are designed to bear pressure loads up to 2,200lbs. from vehicles with pneumatic tires. The luminaires must not be used for traffic lanes where they are subject to horizontal pressure from vehicles braking, accelerating and changing direction.

Type:
BEGA Product:
Project:
Voltage:
Color:
Options:
Modified:



Single 60° port

	Lamp	Lumen	A	B	C	D
8778	1 20W T3 G4,12V	320	4¾	3½	4⅜	1⅛

BEGA-US 1000 BEGA Way, Carpinteria, CA 93013 (805)684-0533 FAX (805)566-9474 www.bega-us.com

fixture type: N1

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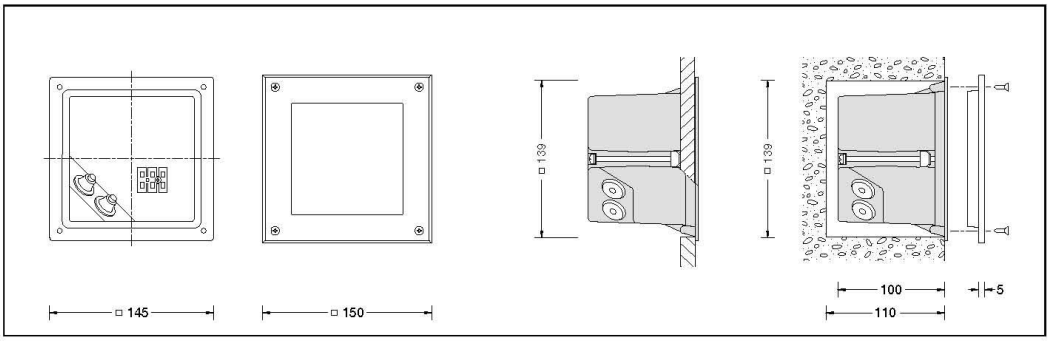
Gebrauchsanweisung
Instructions for use
Fiche d'utilisation

LED Einbauleuchte
LED Recessed luminaire
Luminaire à encastrer à LEDs

IP 65

2204



Anwendung
LED-Einbauleuchte für orientierende Beleuchtungsaufgaben.
Hohe Wirtschaftlichkeit durch lange Wartungsintervalle und hohe Lichtleistung bei niedrigem elektrischen Anschlusswert.

Application
Recessed LED luminaire for orientating lighting tasks.
High operating efficiency because of long maintenance intervals and high light output with low connected load.

Utilisation
Luminaire à encastrer à LEDs pour un éclairage d'orientation.
Installation économique grâce à une faible maintenance et un rendement élevé pour une faible consommation.

Lampe
LED 10 W 440 lm
Anschlussleistung 24 W
Farbtemperatur 3000 K

Lamp
LED 10 W 440 lm
Connected wattage 24 W
Colour temperature 3000 K

Lampe
LED 10 W 440 lm
Puissance de raccordement 24 W
Température de lumière 3000 K

Produktbeschreibung
Leuchte besteht aus Aluminiumguss, Aluminium und Edelstahl
Sicherheitsglas weiß
Silikondichtung
Befestigung über zwei keilförmig angebrachte, verstellbare Krallen
Europäisches Patent EP 0 686 806
2 Leitungseinführungen zur Durchverdrahtung der Netzanschlussleitung
bis ø 10,5 mm max. 3 x 1,5□
Anschlussklemme und
Schutzleiterklemme 2,5□
Elektronisches Netzteil
220-240 V ∿0/50-60 Hz
Schutzklasse I
Schutzart IP 65
Staubdicht und Schutz gegen Strahlwasser
▽ Zeichen – Leuchte ist für die Montage auf normal entflammbaren Befestigungsflächen geeignet
CE – Konformitätszeichen
Gewicht: 1,0 kg

Product description
Luminaire made of aluminium alloy, aluminium and stainless steel
White safety glass
Silicone gasket
Fixing is achieved by using two adjustable wedge-shaped claws
European patent EP 0 686 806
2 cable entries for through-wiring of mains supply cable up to ø 10.5 mm max. 3 x 1.5□
Connecting terminal and
earth conductor terminal 2.5□
Electronic power supply unit
220-240 V ∿0/50-60 Hz
Safety class I
Protection class IP 65
Dust tight and protection against water jets
▽ Symbol – Luminaire is suitable for mounting on normal inflammable fixing surfaces
CE – Conformity mark
Weight: 1.0 kg

Description du produit
Luminaire fabriqué en fonte d'alu, aluminium et acier inoxydable
Verre de sécurité blanc
Joint silicone
La fixation s'effectue par deux griffes réglables en forme de clavette
Brevet européen EP 0 686 806
2 entrées de câble pour branchement en dérivation d'un câble de raccordement jusqu'à ø 10,5 mm max. 3 x 1,5□
Bornier et borne de mise à la terre 2,5□
Bloc d'alimentation électronique
220-240 V ∿0/50-60 Hz
Classe de protection I
Degré de protection IP 65
Etanche à la poussière et protégé contre les jets d'eau
▽ Sigle – Luminaire approprié à l'installation sur des surfaces de fixation normalement inflammables
CE – Sigle de conformité
Poids: 1,0 kg

Einbau
Die Leuchte darf nicht dauerhaft mit aggressiven Medien in Kontakt kommen. Aggressive Medien können durch Wasser aus Baustoffen gewaschen werden und das Gehäuse der Leuchte zerstören. Bei unbekannter Zusammensetzung der Baustoffe ist daher vor der Montage eine Materialanalyse vorzunehmen. Aggressive Medien können auch von der Oberfläche ausgehend auf die Leuchte einwirken, daher ist ein übermäßiger Einsatz von chemischen Reinigungsmitteln im Umfeld der Leuchte zu vermeiden.

Installation
The luminaire must not permanently get in contact with aggressive media.
Aggressive media might be washed out of the building material and might corrode the housing of the luminaire. In case of an unknown composition of the building material an analysis of the material should be made before installation. Aggressive media that is outgoing from the installation surface might also affect the luminaire. Thus an overuse of chemical cleansing agents in the surroundings of the luminaire should be avoided.

Installation
Le luminaire ne doit pas être durablement en contact avec des substances corrosives. Des suintements corrosifs provenant des matériaux de construction peuvent altérer le boîtier. Si on ne connait pas la nature des matériaux de construction, il faut les analyser avant l'installation du luminaire.
Certaines substances corrosives pouvant également attaquer la surface du luminaire, il faut donc limiter l'utilisation de produits chimiques de nettoyage aux abords de l'appareil.

fixture type: N2

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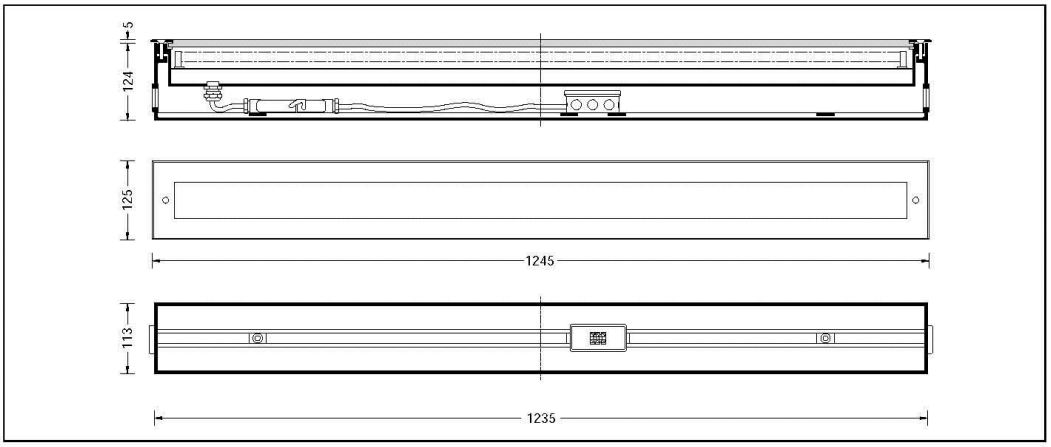
Gebrauchsanweisung Instructions for use Fiche d'utilisation	Einbauleuchte Recessed luminaire Luminaire à encastrer	IP 67/65	**2006**



Anwendung
Einbauleuchte mit hoher Schutzart für eine Vielzahl von Beleuchtungsaufgaben.
Für den Einbau in Wände im Innen- und Außenbereich.
Einbau in waagerechter oder in senkrechter Brennlage möglich.

Application
Recessed luminaire with high protection class for a variety of lighting functions.
For recessed installation in walls in interior and exterior application.
Installation possible in horizontal or vertical burning position.

Utilisation
Luminaire à encastrer avec un degré de protection élevé pour diverses applications d'éclairages.
Pour encastrement dans des murs à l'intérieur et l'extérieur.
Installation possible en position verticale ou horizontale.

Produktbeschreibung
Leuchte besteht aus Aluminium und Edelstahl
Frontplatte besteht aus Edelstahl
Werkstoff-Nr. 1.4301
Sicherheitsglas weiß
Einbaugehäuse aus Aluminium,
mit 2 gegenüberliegenden Einführungen für Installationsrohre bis ø 30 mm
Silikondichtung
2 Schiebemuttern M6 zur Aufnahme der beiliegenden Gewindestangen für eine zusätzliche Fixierung des Einbaugehäuses während der Montage
Zentrierplatte aus verzinktem Stahl
mit 6 Befestigungslöchern ø 4 mm
und 2 Bohrungen ø 8,5 mm
Sie dient zur Positionierung des Einbaugehäuses auf der Verschalung und schützt es während der Bauzeit vor Verschmutzung
Anschlusskasten mit Zugentlastungsschelle und 3-poliger Klemme 4□
zur Durchverdrahtung der Netzanschlussleitung max. 3 x 2,5□
Elektrische Verbindung zwischen Leuchten- und Einbaugehäuse über eine Steckverbindung
Fassung G 5
Elektronisches Vorschaltgerät
EVG 220-240 V ∿ 0/50-60 Hz
Schutzklasse I
Leuchtengehäuse: Schutzart IP 67
Staubdicht und Schutz gegen zeitweiliges Untertauchen
Anschlusskasten: Schutzart IP 65
Staubdicht und Schutz gegen Strahlwasser
▽ Zeichen – Leuchte ist für die Montage auf normal entflammbaren Befestigungsflächen geeignet
CE – Konformitätszeichen
Gewicht: 13,0 kg

Product description
Luminaire made of aluminium and stainless steel
Front plate made of stainless steel
Steel grade no. 1.4301
White safety glass
Recess housing made of aluminium,
with 2 opposite insertions
for installation conduits of up to ø 30 mm
Silicone gasket
2 sliding nuts M6 suitable for the enclosed threaded rods for an additional fixation of the recess housing during installation
Centre-plate made of hot-dip galvanized steel
with 6 fixing holes ø 4 mm
and 2 holes ø 8,5 mm
It supports centering and positioning of the recess housing on the sheathing and also protects it during building activity against soiling
Connection box with strain relief clamp and 3-pole terminal 4□ for through-wiring of mains supply cable
max. 3 x 2.5□
Electrical connection between luminaire housing and recess housing by means of a plug connection
Lampholder G 5
Electronic ballast 220-240 V ∿ 0/50-60 Hz
Safety class I
Luminaire housing: Protection class IP 67
Dust tight and protection against temporary immersion
Connection box: Protection class IP 65
Dust tight and protected against water jets
▽ Symbol – Luminaire is suitable for mounting on normal inflammable fixing surfaces
CE – Conformity mark
Weight: 13.0 kg

Description du produit
Luminaire fabriqué en aluminium et acier inoxydable
Façade en acier inoxydable
Matériau No. 1.4301
Verre de sécurité blanc
Boîtier d'encastrement fabriqué en aluminium, avec 2 entrées opposées pour gaines d'installation jusqu'à ø 30 mm
Joint silicone
2 écrous coulissants M6 pour l'installation des tiges filetées fournies pour une fixation additionnelle du boîtier d'encastrement pendant le montage
Gabarit de centrage en acier zingué
avec 6 trous de fixation ø 4 mm
pour le marquage du positionnement
et 2 trous ø 8,5 mm
Il sert à positionner le boîtier d 'encastrement sur le coffrage
Pendant la phase de construction, il protège également le boîtier contre les salissures et les éclaboussures
Boîte de connexion avec collier anti-traction et avec bornier tri-polaire 4□ pour branchement en dérivation des câble de raccordement 3 x 2,5□
Connexion électrique entre le boîtier du luminaire et le boîtier d'encastrement à l'aide du connecteur embrochable.
Douille G 5
Ballast électronique
220-240 V ∿ 0/50-60 Hz
Classe de protection I
Boîtier du luminaire:
degré de protection IP 67
Etanche à la poussière et protégé contre l'immersion momentanée
Boîte de connexion:
degré de protection IP 65
Etanche à la poussière et protégé contre les jets d'eau
▽ Sigle – Luminaire approprié à l'installation sur des surfaces de fixation normalement inflammables
CE – Sigle de conformité
Poids: 13,0 kg

Sicherheit
Für die Installation und für den Betrieb dieser Leuchte sind die nationalen Sicherheitsvorschriften zu beachten.
Der Hersteller übernimmt keine Haftung für Schäden, die durch unsachgemäßen Einsatz oder Montage entstehen.
Werden nachträglich Änderungen an der Leuchte vorgenommen, so gilt derjenige als Hersteller, der diese Änderungen vornimmt.

Einbau
Die Leuchte darf nicht dauerhaft mit aggressiven Medien in Kontakt kommen.
Aggressive Medien können durch Wasser aus Baustoffen gewaschen werden und das Gehäuse der Leuchte zerstören. Bei unbekannter Zusammensetzung der Baustoffe ist daher vor der Montage eine Materialanalyse vorzunehmen. Aggressive Medien können auch von der Oberfläche ausgehend auf die Leuchte einwirken, daher ist ein übermäßiger Einsatz von chemischen Reinigungsmitteln im Umfeld der Leuchte zu vermeiden.

Montage
Leuchte aus dem Einbaugehäuse ausbauen.
Dazu Schrauben im Edelstahlrahmen lösen.
Leuchte aus dem Einbaugehäuse heben.
Gebrauchslage des Einbaugehäuses »Pfeil unten« beachten.

Safety indices
The installation and operation of this luminaire are subject to national safety regulations.
The manufacturer is then discharged from liability when damage is caused by improper use or installation.
If any luminaire is subsequently modified, the persons responsible for the modification shall be considered as manufacturer.

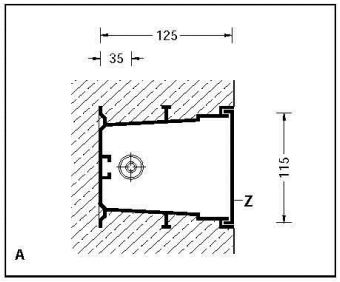
Installation
The luminaire must not permanently get in contact with aggressive media.
Aggressive media might be washed out of the building material and might corrode the housing of the luminaire. In case of an unknown composition of the building material an analysis of the material should be made before installation. Aggressive media that is outgoing from the installation surface might also affect the luminaire. Thus an overuse of chemical cleansing agents in the surroundings of the luminaire should be avoided.

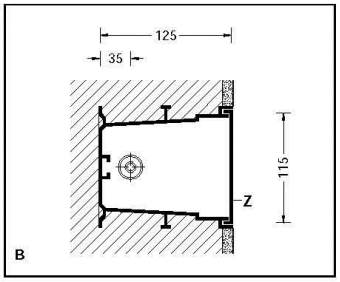
Installation
Dismantle luminaire from the recess housing.
For this purpose undo screws in the stainless steel frame. Lift luminaire out of the recess housing. **For installation note the position of application »arrow down«.**

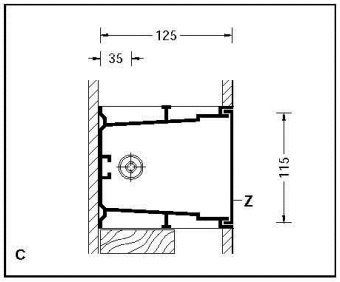
Sécurité
Pour l'installation et l'utilisation de ce luminaire, respecter les normes de sécurité nationales.
Le fabricant décline toute responsabilité résultant d'une mise en œuvre ou d'une installation inappropriée du produit.
Toutes les modifications apportées au luminaire se feront sous la responsabilité exclusive de celui qui les effectuera.

Installation
Le luminaire ne doit pas être durablement en contact avec des substances corrosives.
Des suintements corrosifs provenant des matériaux de construction peuvent altérer le boîtier. Si on ne connaît pas la nature des matériaux de construction, il faut les analyser avant l'installation du luminaire.
Certaines substances corrosives pouvant également attaquer la surface du luminaire, il faut donc limiter l'utilisation de produits chimiques de nettoyage aux abords de l'appareil.

Installation
Démonter le luminaire du châssis de montage.
Pour cela desserrer les vis du cadre.
Extraire le luminaire du châssis de montage.
Vérifier la position d'utilisation »flèche en bas«.







A: Einbau in Sichtbeton
Einbaugehäuse einmessen.
Zentrierplatte **Z** auf der Schalung anbringen.
Sie dient der Positionierung des Einbaugehäuses und soll auch während der Bauzeit das Einbaugehäuse vor Verschmutzung schützen.
Die M6 Schiebemuttern für die Aufnahme der beiliegenden Gewindestangen ermöglichen eine Fixierung des Einbaugehäuses auf der Verschalung.
Einbaugehäuse über die Zentrierplatte setzen und befestigen.
Gegebenenfalls abdichten.
Leitungseinführungen entsprechend den verlegten Installationsrohren ausschneiden.
Installationsrohre in das Einbaugehäuse einführen.

B: Putzbündiger Einbau
Leitungseinführungen entsprechend den verlegten Installationsrohren ausschneiden.
Installationsrohre in das Einbaugehäuse einführen.
Die Zentrierplatte **Z** einsetzen.
Sie soll das Einbaugehäuse während der Bauzeit vor Verschmutzung schützen.
Zentrierplatte ggf. mit den beiliegenden Gewindestangen im Einbaugehäuse befestigen.
Gegebenenfalls abdichten.
Einbaugehäuse in der vorgesehenen Position einmauern.
Dabei ist zu beachten, daß die Vorderkante des Einbaugehäuses mit der Putzoberfläche bündig abschließt.

C: Einbau in Leichtbauwände:
Bei Erstellung der Leichtbauwand ist eine rückseitige Stützkonstruktion zur Befestigung des Einbaugehäuses anzubringen.
Es ist eine Einbauöffnung von 1235 x 115 mm mit einer Mindesttiefe von 125 mm erforderlich.
Einbauöffnung ausschneiden und Einbaugehäuse befestigen.

A: Installation in fair-faced concrete
Calibrate the mounting position.
Fix centre-plate **Z** on sheathing.
It supports centering and positioning of the recess housing and also protects it during building activity against soiling.
The M6 sliding nuts suitable for the enclosed threaded rods allow a fixation of the recess housing on the sheathing.
Place the recess housing over the centre-plate and fix it.
If necessary seal.
Cut out the cable entries according to the installed conduits.
Lead conduits into the installation housing.

B: Flush mounted installation with plaster
Cut out the cable entries according to the installed conduits and lead conduits into the recess housing.
Insert centre-plate **Z**.
During building activity the centre-plate protects the recess housing against soiling.
Fix centre-plate with enclosed threaded rods in the recess housing.
If necessary seal.
Wall in the recess housing into the intended position.
Make sure that the leading edge of the recess housing is flush with the plaster surface.

C: Installation into wall panels:
When preparing a light-weight wall a support construction must be mounted on the backside to fix the recess housing.
A recessed opening of 1235 x 115 mm with a minimum recessed depth of 125 mm is required.
Cut out the recess opening and fix the recess housing.

A: Encastrement dans le béton brut
Marquer le positionnement du boîtier d'encastrement.
Fixer le gabarit de centrage **Z** sur le coffrage.
Il sert à positionner le boîtier d'encastrement.
Pendant la phase de construction il protège également le boîtier d'encastrement contre les salissures. Les écrous coulissants M6 pour l'installation des tiges filetées fournies permettent la fixation du boîtier d'encastrement sur le coffrage.
Placer le boîtier d'encastrement sur le gabarit de centrage et fixer.
Le cas échéant étancher.
Découper les entrées de câble en fonction des gaines de passage de câble installées.
Introduire les gaines de passage dans le boîtier d'encastrement.

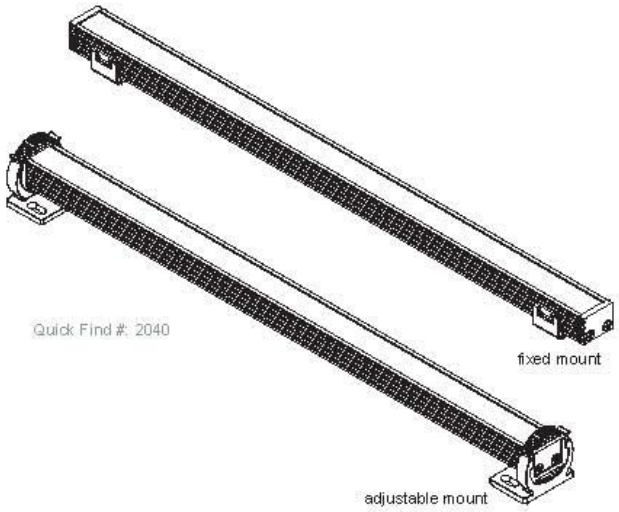
B: Encastrement à fleur d'enduit
Découper les entrées de câble en fonction des gaines de passage de câble installées et introduire les gaines de passage dans le boîtier d'encastrement.
Installer le gabarit de centrage **Z**.
Pendant la phase de construction, il protège le boîtier contre les salissures. Le cas échéant fixer le gabarit de centrage avec les tiges filetées fournies dans le boîtier d'encastrement.
Le cas échéant étancher.
Maçonner le boîtier d'encastrement dans la position prévue.
Dans ce cas veiller à ce que le bord antérieur du boîtier d'encastrement se trouve à fleur de l'enduit

C: Encastrement dans les parois creuses:
Pendant la réalisation de la paroi creuse prévoir une pièce d'appui dans le fond pour fixer le boîtier d'encastrement.
Une réservation de 1235 x 115 mm avec une profondeur minimale de 125 mm est nécessaire.
Découper la réservation et fixer le boîtier d'encastrement.

fixture type: N3

WinonaLED Project:_____ Qty:_____ Type:

winline surface linear 103W damp/wet



The **Winline 100 Series** are small scale linear LED luminaires and were designed to be the most powerful, reliable, and easiest to implement linear LED solution available. The model 103W is a high performance luminaire with robust construction suitable for exterior illumination.

Beam Spreads: Winline 103W is available in two beam spreads of 30 and 110 degrees. See page 4 for photometric data.

Color & Light Output: The 100 Series utilizes Nichia 123B white LEDs in five standard colors. Model 103W features (24) LEDs/ft.

Color	Model 103W
ANSI-2700K White	101 lm/ft
ANSI-3000K White	119 lm/ft
ANSI-3500K White	123 lm/ft
ANSI-4000K White	132 lm/ft
non-ANSI- 5000K White	166 lm/ft

Results based on BALL test 15450
110° beam spread
Note:
LM79 Tests- see page 4.

Power: Power consumption is 4.5W/ft. The Winline 100 series operates on 24VAC using Magnetic Transformers. A wide range of remote transformers are available in 120V and 277V primary.

Dimming: Used with remote mounted 24VAC magnetic transformers which can be dimmed with commonly available low voltage magnetic dimming equipment..

Mounting & Adjusting: Both fixed and adjustable mounts allow the 100 Series to be used almost anywhere. The installer locates and fastens the mount clip, runs power feed lines, connects the fixture's wire leads to the feed lines and snaps the fixture in place. The low profile fixed mount is only 1/8" high and the adjustable mount allows full 300 degree rotation around the centerline of the fixture. See pages 2-3 for more mounting and adjustment information.

Operating Temperature: Minimum and Maximum ambient air temperatures around this luminaire shall not exceed -22°F to 122°F (-30°C to 50°C).
Any application of this product should also take into consideration air flow and ventilation to ensure performance and reliability.

Weight:

12" - .31 lbs
18" - .44 lbs
24" - .58 lbs
30" - .71 lbs
36" - .84 lbs
42" - .98 lbs
48" - 1.11 lbs

Listing: 3150866
Winline 103W is ETL listed for wet location.
Complies with UL Standard 2108

RoHS COMPLIANT

IP66

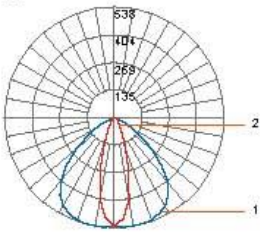
Winline Surface Linear - **WSL**	**WSL**	series
model 103 damp/wet - **103W**	103W	model
Total Run Length in Feet 103W offered in 6" increments starting at 12" *ex. 60FT = 60 foot run* *or* **Preconfigured Run Length Code** *see page 5* *or* **To Be Determined** *TBD when run length unknown*	48	run length code
30° - **30** 110° - **110**	110	beam spread
ANSI-binned 2700K - **27K** ANSI-binned 3000K - **30K** ANSI-binned 3500K - **35K** ANSI-binned 4000K - **40K** non-ANSI-binned 5000K - **50K**	35K	LED code
non-dimming 24 volt AC - **ND24V** dimming 24 volt AC - **DM24V**	ND24V	voltage
fixed - **F** adjustable - **A**	A	mount
natural (type III) anodized aluminum - **NAA** semi gloss black paint - **SGB** semi gloss white paint - **SGW** custom paint finish - **CPF**	NAA	finish
none - **X**	X	options
standard - **STD** modified - **MOD**	STD	special

Describe Modification:

winonaLED

winline surface linear 103W wet — photometrics

30°



Maximum Candela = 538 Located At Horizontal Angle = 0, Vertical Angle = 5
#1 - Vertical Plane Through Horizontal Angles (0-180) (Through Max. Cd.)
#2 - Vertical Plane Through Horizontal Angles (90-270)

BALL Test Report: 15403 Catalog Number: WSL-102-48-30-30K
Description: 96 Nichia 123B 3000K LEDs / 48" Winline 102 Dry Luminaire / Extruded Aluminum Housing / Acrylic Lens

LM79 Data - Based on WSL102/30° Test Results

Color	Total Lumens	Lamp Watts	Lumens per Watt	CRI	Power Factor
ANSI-binned 2700K	410	15.7	26.1	84.3	.97
ANSI-binned 3000K	482	15.8	30.5	86.4	.97
ANSI-binned 3500K	501	15.8	31.7	83.0	.98
ANSI-binned 4000K	535	15.8	33.9	87.0	.98
non-ANSI-binned 5000K	675	15.8	42.7	70.3	.98

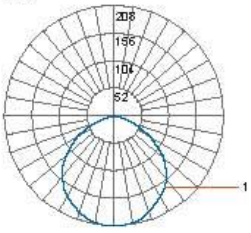
Zonal Lumen Summary — Nichia 123B 3000K

Zone	Lumens	%Fixture
0-30	263	52.3
0-40	346	68.8
0-60	444	88.4
0-90	491	97.8
Total Luminaire 0-180	502	100.0

Candlepower Distribution 3000K

Angle	Horizontal Plane 0	22.5	45	67.5	90
0	531	531	531	531	513
5	538	530	514	510	494
10	536	516	466	432	405
15	536	486	362	297	271
20	530	425	248	178	154
25	518	336	153	105	89
30	500	245	99	64	56
35	462	167	65	44	38
40	407	110	45	32	30
45	329	76	33	26	25
50	244	53	25	23	21
55	164	39	20	18	18
60	101	29	18	17	18
65	58	21	15	17	17
70	30	17	14	17	18
75	15	12	13	15	17
80	7	11	12	14	15
85	2	7	11	12	12
90	0	5	8	11	11

110°



Maximum Candela = 208 Located At Horizontal Angle = 0, Vertical Angle = 0
#1-Vertical Plane Through Horizontal Angles (0-180) (Through Max Cd.)

BALL Test Report: 15450 Catalog Number: WSL-103W-48-110-30K
Description: 96 Nichia 123B LEDs / 48" Winline 103 Wet Luminaire / Extruded Aluminum Housing / Acrylic Lens

LM79 Data - Based on WSL103W/110° Test Results

Color	Total Lumens	Lamp Watts	Lumens per Watt	CRI	Power Factor
ANSI-binned 2700K	403	15.7	25.7	84.3	.97
ANSI-binned 3000K	474	15.9	29.8	86.5	.97
ANSI-binned 3500K	493	15.9	31.0	83.0	.97
ANSI-binned 4000K	526	15.9	33.1	87.0	.97
non-ANSI-binned 5000K	663	15.9	41.7	70.3	.97

Zonal Lumen Summary — Nichia 123B 3000K

Zone	Lumens	%Fixture
0-30	160	33.7
0-40	258	54.4
0-60	423	89.2
0-90	474	100.0
Total Luminaire 0-180	474	100.0

Candlepower Distribution 3000K

Angle	Horizontal Plane 0	22.5	45	67.5	90
0	208	208	208	208	208
5	210	210	207	210	203
10	208	207	205	205	201
15	203	202	198	198	194
20	198	196	192	189	186
25	187	186	179	178	173
30	177	176	167	164	163
35	163	163	154	152	150
40	150	148	140	138	136
45	133	128	124	117	111
50	114	107	104	92	87
55	92	87	81	68	62
60	72	67	58	48	42
65	51	48	38	29	24
70	30	32	24	18	14
75	16	19	11	8	6
80	8	8	3	3	3
85	0	1	0	0	0
90	0	0	0	0	0

Winline

lighting factsCM
A Program of the U.S. DOE

Light Output (Lumens)	474
Watts	15.9
Lumens per Watt (Efficacy)	30
Color Accuracy — Color Rendering Index (CRI)	86
Light Color — Correlated Color Temperature (CCT)	3091 (Bright White)

Warm White | Bright White | Daylight
2700K 3000K 4500K 6500K

All results are according to IESNA LM-79-2008: *Approved Method for the Electrical and Photometric Testing of Solid-State Lighting*. The U.S. Department of Energy (DOE) verifies product test data and results.

Visit www.lightingfacts.com for the *Label Reference Guide*.

Registration Number: 84Q4-2B4XVA
Model Number: WSL-103W-4-110-30K
Type: Other

fixture type: N4

08.11 · Technische Änderungen vorbehalten · Technical amendments reserved · Sous réserve de modifications techniques

BEGA Lichttechnische Spezialfabrik
Hennenbusch · D - 58708 Menden

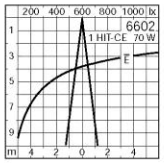
BEGA

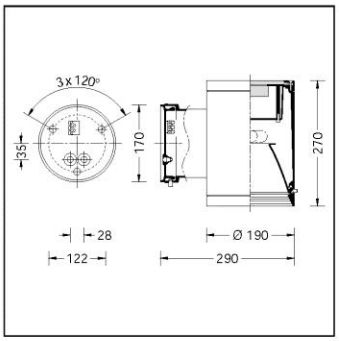
Gebrauchsanweisung
Instructions for use
Fiche d'utilisation

Wandleuchte
Wall luminaire
Applique

IP 65

6602





Anwendung
Wandfluter mit zweiseitigem Lichtaustritt.
Für Beleuchtungs- und Gestaltungsaufgaben in der Lichtarchitektur.
Das nach unten gerichtete Licht ist für die Beleuchtung der Wand und der davor liegenden Flächen bestimmt.
Das nach oben gerichtete Licht wird mit Hilfe einer optischen Linse stark gebündelt und dient vornehmlich gestalterischen Zwecken.
Für Innen- und Außenbereiche.

Application
Wall washer with two-sided light output.
This luminaire can solve a host of lighting and design tasks in architecture.
The light directed downwards is intended to illuminate the wall and the horizontal surface in front of it.
The light directed upwards is very highly concentrated by an optical glass lens and primarily serves design purposed.
For interior and exterior lighting application.

Utilisation
Lèche-muraille à diffusion bilatérale.
Pour des applications de l'éclairage architectural et décoratif.
La lumière dirigée vers le bas est destinée à l'éclairage des murs et des abords immédiats devant le mur.
La lumière dirigée vers le haut est très concentrée par une lentille. Il en résulte un faisceau extrêmement pincé pour effet décoratif.
Pour l'intérieur et l'extérieur.

Lampe
Halogen-Metalldampflampe
HIT-CE 70 W · G 12

Osram: HCI-T 70 W /...	7300 lm
Philips: CDM-T 70 W /...	6600 lm

Bitte beachten Sie die Betriebshinweise der Lampenhersteller.

Lamp
Metal halide discharge lamp
HIT-CE 70 W · G 12

Osram: HCI-T 70 W /...	7300 lm
Philips: CDM-T 70 W /...	6600 lm

Please note the lamp manufacturers' operating instructions.

Lampe
Lampe aux halogénures métalliques
HIT-CE 70 W · G 12

Osram: HCI-T 70 W /...	7300 lm
Philips: CDM-T 70 W /...	6600 lm

Veuillez respecter les instructions des fabricants de lampes.

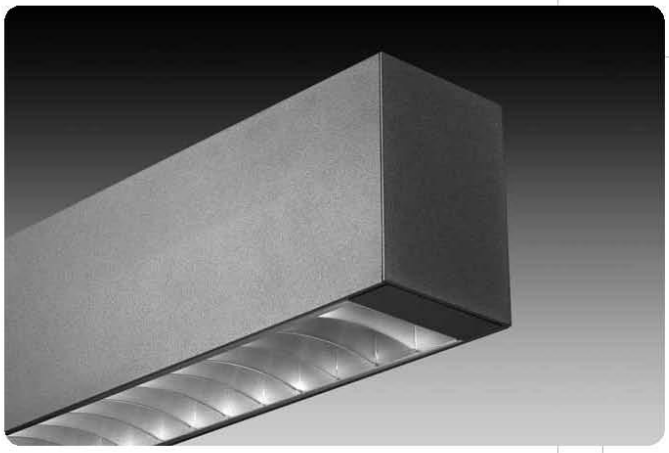
Produktbeschreibung
Leuchte besteht aus Aluminiumguss, Aluminium und Edelstahl
2 Sicherheitsgläser
Silikondichtung
Plankonvexlinse aus Pressglas
Reflektor aus eloxiertem Reinst-Aluminium
Montageplatte mit 3 Befestigungsbohrungen 6,5 mm · Teilkreisdurchmesser 122 mm
2 Leitungseinführungen zur Durchverdrahtung der Netzanschlussleitung bis ø 10,5 mm max. 3 x 1,5□
Anschlussklemme 2,5□
Schutzleiteranschluss
Fassung G 12
Vorschaltgerät 230/240/250 V ∿ 50 Hz umschaltbar · Versandschaltung 230 V
Zündgerät mit Timer
Befestigungsmöglichkeit für Kompensationskondensator
Schutzklasse I
Schutzart IP 65
Staubdicht und Schutz gegen Strahlwasser
▽ Zeichen – Leuchte ist für die Montage auf normal entflammbaren Befestigungsflächen geeignet
– Sicherheitszeichen
CE – Konformitätszeichen
Gewicht: 6,9 kg

Product description
Luminaire made of aluminium alloy, aluminium and stainless steel
2 safety glasses
Silicone gasket
Plano-convex lens made of pressed glass
Reflector made of anodised pure aluminium
Mounting plate with 3 fixing holes 6.5 mm
Pitch circle diameter 122 mm
2 cable entries for through-wiring of mains supply cable up to ø 10.5 mm max. 3 x 1.5□
Connecting terminal 2.5□
Earth conductor connection
Lampholder G 12
Ballast 230/240/250 V ∿ 50 Hz tapped · Dispatch connection 230 V
Ignitor with timer
Prepared for PF correction capacitor
Safety class I
Protection class IP 65
Dust tight and protection against water jets
▽ Symbol – Luminaire is suitable for mounting on normal inflammable fixing surfaces
– Safety mark
CE – Conformity mark
Weight: 6.9 kg

Description du produit
Luminaire fabriqué en fonte d'alu, aluminium et acier inoxydable
2 verres de sécurité
Joint silicone
Lentille plan-convexe en verre pressé
Réflecteur en aluminium pur anodisé
Contre plaque avec 3 trous de fixation 6,5 mm sur un cercle de ø 122 mm
2 entrées de câble pour branchement en dérivation d'un câble de raccordement jusqu'à ø 10,5 mm max. 3 x 1,5□
Bornier 2,5□
Raccordement de mise à la terre
Douille G 12
Ballast 230/240/250 V ∿ 50 Hz permutable · Branchement d'usine 230 V
Amorceur temporisé
Fixation prévue pour condensateur de compensation
Classe de protection I
Degré de protection IP 65
Etanche à la poussière et protégé contre les jets d'eau
▽ Sigle – Luminaire approprié à l'installation sur des surfaces de fixation normalement inflammables
– Sigle de sécurité
CE – Sigle de conformité
Poids: 6,9 kg

fixture type: P4-16

avenue® d



FOCAL POINT

features

Extruded aluminum, suspended direct/ indirect or direct linear T5/T5HO fluorescent luminaire.

3" aperture rectilinear profile creates sleek aesthetic.

Avenue® D makes an exceptional aesthetic statement in conference rooms, private offices, reception areas or other high-end applications.

shielding options


concave parabolic louver


solid regress


flush satin lens

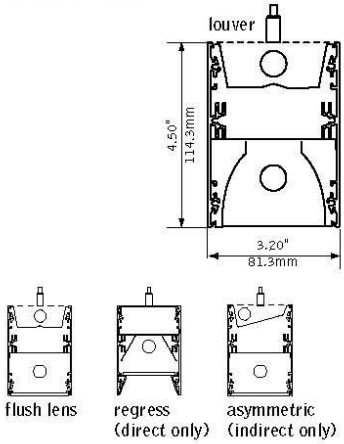

corrugated regress

sensor options

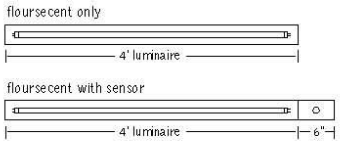

daylight/ occupancy sensor

january 2011 D

dimensional data



4' example

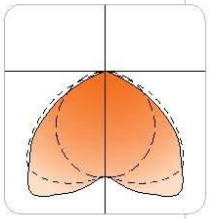


note: Sensors may be installed in any module length. Sensor location in run must be specified. Sensors are placed on opposite end of power feed. Consult factory for additional placement options

performance

Solid Regress
1-Lamp T5
82% Efficiency
818 cd @ 25°

everGreen



Visit focalpointlights.com for complete photometric data.

www.focalpointlights.com | 1.773.247.9494

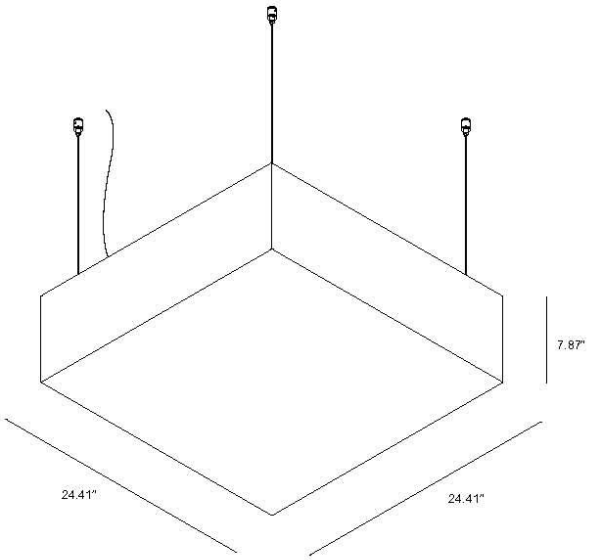
fixture type: S1

DELTALIGHT®

Delta Light USA
4850 West Prospect Road, Fort Lauderdale, FL 33309
T: (954) 677-9800 F: (954) 677-1007
www.deltalight.us

Jeti Plano H 160 C

JETI PLANO H 160 C
271 54 160
INCL 4 X CABLE SUSP. SINGLE AUTO. 9.84ft
INCL 1 X POWER CABLE
2GX13 / 120-277V / 60Hz / 1 X 1~ELECT. BALLAST
1 X T5-R 55W
15A IP20



LEGEND

◇ = A - Aluminum Gray Powder Coat
◇ = ALU - Brushed Aluminum
◇ = ANO - Anodized Aluminum
◇ = AP - Aluminum Pure (Soft Sandblasted)
◇ = B - Black
◇ = C - Chrome
◇ = CMAT - Matte Chrome
◇ = INOX - Stainless Steel
◇ = G - Grey Brown
◇ = M - Gold
◇ = MMAT - Matte Gold
◇ = PRIM - Primer
◇ = RAL - RAL Powder Coat
◇ = W - White (RAL 9003)
◇ = BAP - Parabolic Louver
◇ = SBL - Sandblasted Lens (Glass)
◇ = ESG - Safety Glass

IMPORTANT

See further for US installation instruction sheets and installation kits, such as:

-Back Plate
-Stealth Kit
-EMT Connection

FOR ARCHITECT USE

PROJECT NAME: _____ FIXTURE TYPE: _____

SPECIFIER NAME: _____ DATE: _____

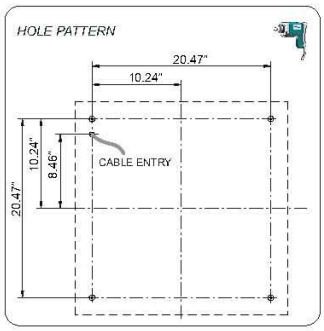
1

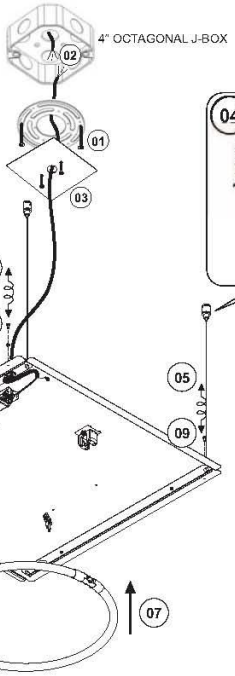
DELTALIGHT®

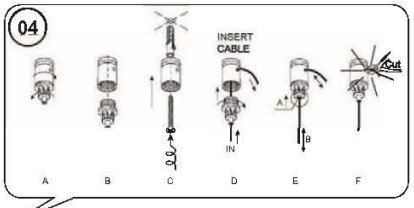
Delta Light USA
4850 West Prospect Road, Fort Lauderdale, FL 33309
T: (954) 677-9800 F: (954) 677-1007
www.deltalight.us

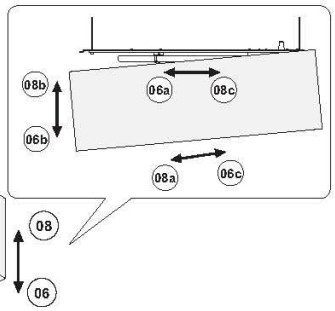
BACKPLATE INSTALLATION INSTRUCTIONS

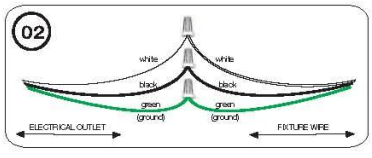
01. REMOVE UNIVERSAL MOUNTING RING FROM FIXTURE AND ATTACH TO J BOX
02. MAKE THE ELECTRICAL CONNECTION INSIDE JUNCTION BOX
03. ATTACH FIXTURE BACKPLATE TO THE UNIVERSAL MOUNTING RING
04. PLACE CABLE SUSPENSION
05. LOOSEN SCREWS
06. REMOVE COVER
07. (RE)PLACE LAMP
08. PLACE COVER
09. FASTEN SCREWS
10. SWITCH ON











fixture type: Z1

Small scale floodlights

Housing: One piece die-cast aluminum with integral cooling fins.

Enclosure: Lamp enclosure/optical system consists of a die-cast aluminum clamping ring, clear tempered glass. Fully gasketed for weather tight operation in any mounting orientation using a molded silicone rubber gasket.

Mounting: Provided with two piece die-cast aluminum canopy supplied with universal mounting bracket for direct attachment to 3½" or 4" octagonal wiring box. Die-cast aluminum swivel.

Electrical: H.I.D. lampholders are G8.5, bi-pin with nickel plated contacts. Ballasts are integral and electronic, universal voltage 120 V through 277 V.

Finish: These luminaires are available in four standard BEGA colors: Black (BLK); White (WHT); Bronze (BRZ); Silver (SLV). To specify, add appropriate suffix to catalog number. Custom colors supplied on special order.

UL listed, suitable for wet locations. Protection class: IP65.

Type:
BEGA Product:
Project:
Voltage:
Color:
Options:
Modified:

Floodlights with **mounting canopy**

	Lamp	β	Lumen	A	B	C	D
7514MH	1 39W T4 G8.5 MH	20°	3300	6⅛	11⅜	7¾	4⅝

265	**130**	**131**	**132**	**316**	**315**

180° glare shield Color effect filters Exchangeable lenses Wide beam Flat beam β = Beam angle

BEGA-US 1000 BEGA Way, Carpinteria, CA 93013 (805) 684-0533 FAX (805) 566-9474 www.bega-us.com

appendix b – ballast and driver cut sheets

fixture type: A1, D1

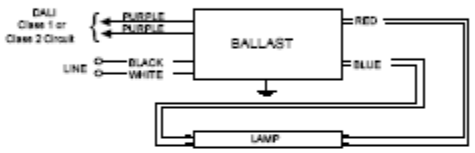
PHILIPS ADVANCE

IDA-128-D@277V	
Brand Name	ROVR
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts) (min/max)	Ballast Factor (min/max)	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
F14T5	1	14	50/10	0.07	06/19	0.03/1.00	10	0.98	1.7	5.26
F21T5	1	21	50/10	0.09	06/25	0.03/1.00	10	0.98	1.7	4.00
* F28T5	1	28	50/10	0.12	07/32	0.03/1.00	10	0.98	1.7	3.13
F28T5/ES (25W)	1	25	50/10	0.11	07/30	0.03/1.00	10	0.98	1.7	3.33

Wiring Diagram



Diag. 55B

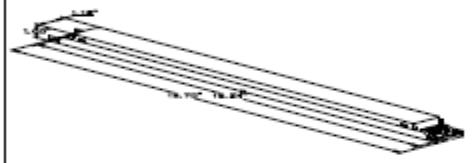
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

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

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

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
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 01/18/2011

Data is based upon tests performed by Philips Lighting Electronics N.A. in a controlled environment and is 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.

PHILIPS LIGHTING ELECTRONICS N.A.
10275 WEST HIGGINS ROAD - ROSEMONT, IL 60018
Tel: 800-322-2086 · Fax: 888-423-1882 · www.philips.com/advance
Customer Support/Technical Service: 800-372-3331 · OEM Support: 866-915-5866

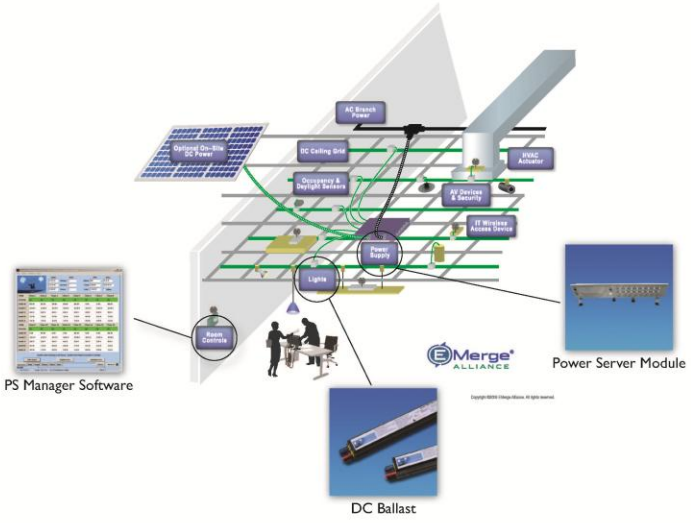
fixture type: J1

Nextek Power Systems

Nextek Power Server Module
Model 1600-C2 DC Power Supply
Model 1600-C2-24V ALT DC Power Supply
16 Channel, Class 2, 24 V DC Output

Power Server Module

- Nextek's **Power Server Module** converts 208 or 240 V AC power to 24 V DC through 16 individual Class 2 outputs. The Power Server Module has a wireless remote control and monitoring system.
- The **system advantage** is that the Power Server Module provides a safe, low-voltage DC distribution system that allows quick plug-and-play, energy efficient and individually controllable Direct Current (DC) lighting and other loads.
- The **patented triangular design** of the Power Server Module makes for a clean fit into a suspended ceiling grid for ease of installation and removal of ceiling tiles.



Why A Power Server Module?

Over the last 50 years, we have moved steadily from an electro-mechanical to an electronic world—a world where most of our electrical devices are driven by DC, and where most of our non-fossil fuel energy sources (such as photovoltaic cells and batteries) deliver their power as a DC supply.

The cost of Alternating Current (AC) - Despite these changes, the vast majority of today's electricity is still generated, transported and delivered as AC. Converting AC to DC and integrating alternative DC sources with the mainstream AC supply are inefficient and expensive activities that add significantly to capital costs and lock us all into archaic and uncompetitive utility pricing structures.

Take advantage of DC efficiency - Nextek's AC/DC integration technology represents a breakthrough in on-site electrical management, combining the availability of AC power with the quality and efficiency of a DC supply.

Why Class 2?

Class 2 circuits are power limited to 100 Volt-Amperes (Watts) and can be installed using more relaxed Class 2 wiring methods. A Class 2, 24 Volt DC circuit provides acceptable protection from electrical shock and fire initiation.

Clean, Efficient and Less Expensive Power

- Easy conversion of AC lighting fixtures to DC-powered systems
- Easy conversion of AC grid power into DC power for commercial building applications
- Highly efficient management of peak loads
- Complete continuity of supply through the seamless integration of available rechargeable batteries
- Complete continuity of alternative energy sources such as PV, micro turbines and fuel cells

In Addition – Unlike conventional PV installations utilizing DC to AC inverters that must be shut down in the event of a grid power failure (anti-islanding), the Nextek system can stay on and continue to support the DC loads by combining all available DC sources.

NEXTEK Power Systems

Nextek Power Systems
461 Burroughs Street
Detroit, Michigan 48202

Tel: 313-887-1321
Toll free: 1 (877) 24-VOLTS
Fax: 313-887-9433

www.nextekpower.com
info@nextekpower.com

Nextek Power Systems

***Nextek* Power Server Module,**
Model 1600-C2 DC Power Supply
Model 1600-C2-24V ALT DC Power Supply
16 Channel, Class 2, 24 V DC Output

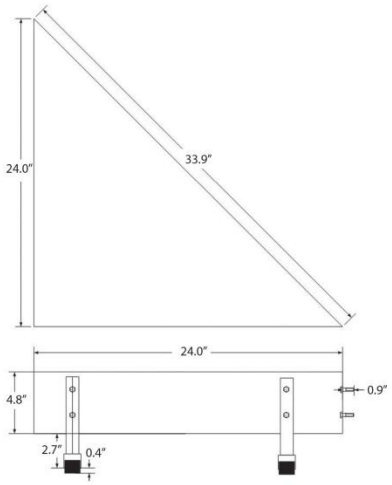
POWER SERVER MODULE SPECIFICATIONS:

STANDARDS / SPECIFICATIONS

- **UL2043** – Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
- **UL1310** – Class 2 Power Units
- **UL1012** – Power Units Other Than Class 2
- **UL2577** – Suspended Ceiling Grid Low Voltage Lighting Systems (Pending)
- **Emerge Alliance® Registered**
- **ZigBee® Alliance** Certification (Pending)
- **RoHS** compliant

MECHANICAL

- **Weight**
  - 21.1 pounds
- **Mounting Orientation**
  - Flat horizontal surface – using rubber feet
  - Ceiling grid – using plastic grid interconnects
- **Audible Noise**
  - Less than 15 dBA
- **Operational Environmental Limits**
  - Temperature Range 0°C – 49°C
  - Humidity: 90% RH non-condensing
  - Vibration: Low-frequency 10 – 55 Hz
- **Storage Environmental Limits**
  - Temperature Range -40°C – 60°C
  - Humidity: 95% RH non-condensing (transport and storage in protective container)
  - Vibration: Low-frequency 10 – 55 Hz
- **Construction**
  - Meets NEMA Type 1 specifications
  - Made of 20 gauge steel
  - Steel manufactured in U.S.A.
- **Installation**
  - When installed in a suspended ceiling, installation requires a minimum of 12" from the top of the ceiling grid to the deck.



ELECTRICAL

- **Input Power**
  - 208 – 240 VAC single phase, 13.5 A max., 50/60 HZ
- **ALT Input Power**
  - 24.0 – 24.5 VDC, 65 A max.
  - Only included in Model 1600-C2-24V ALT
- **Output Per Channel**
  - 24 VDC ± 5%
  - 95 W maximum current limited to 3.96 A continuous
  - Rated impulse current – 80 A for .2 mSec
- **Efficiency**
  - Quiescent power = 7W
  - 90% @ 240 VAC input; 1500 W output
- **Wireless Communication**
  - Provided through a ZigBee® module series (XBee Series2®) and a Nextek Power Systems software interface (PS Manager). See PS Manager manual for functionality and usage.

STATUS INDICATORS

System status shall be indicated by 4 different types of LED indicators on the Power Server Module as follows:

- **Power LED (bottom of Power Server Module)**
- **System Status LED (bottom of Power Server Module)**
- **ZigBee Association LED (bottom of Power Server Module)**
- **Channel Status LEDs (front of Power Server Module)**

In addition to the status indicators, control and monitoring software is available to provide additional functionality.

031511

fixture type: J2

www.sylvania.com

OPTOTRONIC®

Electronic 10.5V DC & 12V DC LED Power Supplies

Key Features & Benefits

- Damp rated designs available for use in outdoor applications
- Wide input voltage range: 100-277V AC (select models)
- Broad ambient temperature range for use in extreme application conditions
- Electronically stabilized output voltage with low line ripple
- Short circuit, overload and overheat protection for sustained performance
- High power factor and efficiency
- Compact enclosures for variety of applications and fixture designs
- UL Class 2 output for safe operation
- Exceptional line and load regulation

OPTOTRONIC power supplies are compact and electronically stabilized. The wide range of input voltage on select models, from 100 to 277V AC, enables worldwide use on single-phase AC power lines. These supplies are available in 10.5Vdc and 12Vdc outputs and are protected against open circuit, short circuit, overload and overheating conditions.

Product Offering

Ordering Abbreviation	Output Wattage	Output Voltage
OT6/100-120/10CE	6	10.5
OT20/120-240/10E	20	10.5
OT25/120/10	25	10.5
OT50/120-277/10E	50	10.5
OT10/120-240/12	10	12
OT25/120-277/12	25	12
OT60/120-277/12	60	12

LED power supplies compatible with: 10.5V or 12V LED modules

Application Information

Applications

- Ambience lighting inside furniture
- Backlighting
- Compact installations
- Effect lighting
- General lighting
- Low & medium power applications
- Panel lighting
- Path and roadway marking
- Signs
- Step and seat marking
- Wall washing

Specifications and Certifications

OPTOTRONIC LED power supplies are UL1310 and UL48 Recognized for the US and Canada Class 2 Unit.

OT6, OT25 and OT50 are CSA approved.

RoHS compliant (except for Item# 51505)

This light source meets restrictions on hazardous substances.

FCC 47CFR Part 15 compliant

SEE THE WORLD IN A NEW LIGHT SYLVANIA

ECS049R9 4/10

fixture type: J3

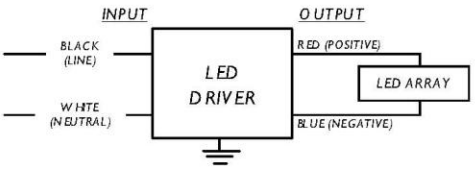
PHILIPS ADVANCE

LED-277A-0700C-28-F-O	
Brand Name	XITANIUM
Driver Type	Electronic
Input Voltage	277
Input Frequency	50/60Hz
RoHS	Yes
Status	Active

Electrical Specifications

Max. Output Power (W)	Output Voltage (V)	Output Current (A)	Operating Temp. Range (°F/°C)	Input Current at 277V (A)	Max. Input Power (W)	Inrush Current ($A_{pk}/\mu s$)	Max. THD (%)	Min. Power Factor	Surge Protection (KV)	Weight (Lbs)	IP Rating
20	2.8~28.0	0.7	-40°~140°F (-40~60°C)	0.09	24	-	20	0.9	2.0	0.3/135	IP66

Wiring Diagram



Input, Output and 0-10V Dimming use lead-wires.
Lead-wires are 18AWG 105C/600V solid copper

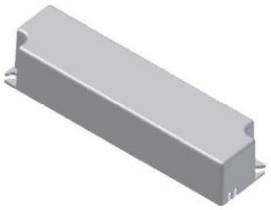
Standard Lead Length

	in.	cm.
Black	6	15
White	6	15
Blue	6	15
Red	6	15
Gray	6	15
Violet	6	15

Maximum Wiring Distance (at full load)

Wire Size (AWG)	Distance (feet)
26	8
24	13
22	21
20	34
18	54
16	85
14	137
12	210
10	357

Enclosure



	in. (mm)
Case Length	5.2 (132)
Case Width	1.3 (34)
Case Height	1.0 (25)
Mounting Length	4.8 (122.4)
Mounting Width	1.0 (24.8)
Overall Length	5.2 (132)

c UL us — UL Class 2 E220165

C SP US — 7310_S-000 3426-32

Revised 12/10/2009

PHILIPS LIGHTING ELECTRONICS N.A.
10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Tel: 800-322-2086 · Fax: 888-423-1882 · www.philips.com/advance
Customer Support/Technical Service: 800-372-3331 · OEM Support: 866-915-5886

fixture type: M1

GE Consumer & Industrial
Lighting

ULTRAMAX eHID
Superior Lumen Maintenance

70, 100 and 150 Watt Slim Line Electronic HID Ballast

GE's line of ultra cool UltraMax® eHID electronic ballasts provide up to 70% energy savings and 2-4 times the life of standard halogen. End users get the cost savings and the advantages offered in meeting strict watts per square foot requirements with these systems. UltraMax® eHID is a high energy efficiency ballast that uses less wattage to provide full light output.

The UltraMax® multi-volt slim line eHID ballast is designed for recessed can down lighting and outdoor landscape lighting requiring high efficiency energy savings, long life, cool ballast operation and maximum performance with ceramic metal halide lamps.

You can count on GE to answer your lamp and ballast questions at 1-888-GEBALLAST.

Performance Features

- 15-22% energy savings when replacing an HID electromagnetic ballast with UltraMax® eHID. Reduce energy costs up to $100 per fixture* over the 5-year warranty period..
- Over 90% energy efficient ballasts.
- Low watts per square foot and long lamp life provide lower cost of ownership compared to halogen.
- Low frequency square wave electronic ballast maximizes ceramic metal halide performance and lamp life.
- Industry standard mini-square can size.
- Ultra cool operation ensures maximum ballast life and maintained warranty.
- 2% output regulation over accepted ANSI lamp voltages reduces visual flicker and maintains consistent lamp color. EM lag ballasts have up to 20% change in output power over the same lamp variation range which results in an increase in power (watts) to the lamp as the voltage increases over the life of the lamp.

Applications

- Replacement of electromagnetic HID ballasts.
- Replacement of 100W halogen or higher.
- High ceiling heights requiring high point source lumens.
- Any recessed down light application where watts per square foot are critical.

Benefits of Electronic Systems

System - Recessed Downlight @ 277 V	Ballast	Performance				% Savings (W)
		Initial Lumens	Watts	LPW	Lamp Life (hrs)	
CMH70PAR38SP	70W HX-HPF Magnetic UltraMax eHID 70W	4800 4800	94 77	51 62	- 10000	-22%
CMH100PAR38SP	100W HX-HPF Magnetic UltraMax eHID 100W	6500 6500	129 107	50 61	- 10000	-21%
MXR150/C/U/MED/O	150W CWA Magnetic UltraMax eHID 150W	12000 12000	189 164	63 73	- 15000	-15%

UltraMax® 100W eHID ballasts provide 22% energy savings and improvement in Lumens Per Watt when replacing a 100W HX-HFP electromagnetic ballast.

imagination at work

* @ $.10 kwh over 5-year warranty period of ballast.
Ballasts and system specs listed on back.

Specifications: 70, 100 and 150 Watt Slim Line Electronic HID Ballast

Product Code 12 Pack	Description	ANSI Designation	Line Voltage	System Watts	Nominal Current (Amps)	Power Factor	THD%	Ballast Efficiency
87546	GEMH70-SLF-MV	M98, M/C143	120	77	.66	> 99%	4.9%	91%
			277	77	.30	>97%	7.7%	91%
87561	GEMH100-SLF-MV	M90, M/C140	120	110	.93	> 99%	4.7%	91%
			277	107	.41	> 99%	7.8%	93.5%
87576	GEMH150-SLF-MV	M102, M/C142	120	167	1.44	> 99%	4.2%	90%
			277	164	.62	> 99%	10.6%	91.5%

Specifications

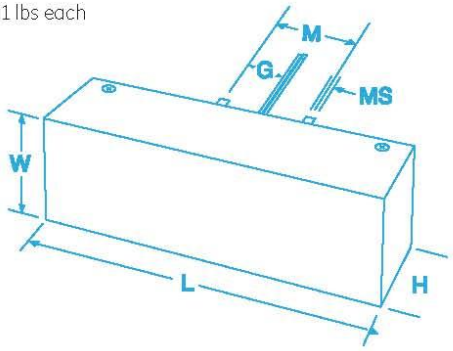
- Line Voltage120VAC, +/- 10%, 50-60Hz
- Short Circuit Protection
- End of Life lamp protection
- Low Frequency Square Wave
- Lamp operating frequency: 130Hz
- OCV - 500 Vrms (Vpk-4.0kV)
- Lamp current crest factor <1.4
- Remote mounting distance = 8ft (18AWG)
- Meets ANSI Standard C62.41-1991
- ANSI approved pulse starting ensures high voltage reliable starting
- Bottom leads with mounting studs
- Meets FCC Part 18 (Class A) for EMI and RFI, Non-Consumer Limits
- UL C-UL 1029 listed, UL listed suitable for recessed use
- RoHS Compliant (Reduction in Hazardous Substances)
- Durable metal housing
- Inherent Thermal Protection
- Minimum Starting Temp: 0F, -18C
- 10 +2"/-0" lead wires 18AWG 200C
- Max Case Temp 70-100W -194F/90C 3yr, 167F/75C 5yr
  150W - 185F/85C 3yr @ 277V
  176F/80C 3yr @ 120V
  158F/70C 5yr

Lamp Operation

M98, M/C143, M90, M/C140, M102, M/C142 Pulse Arc or Ceramic Metal Halide lamps

Packaging

2.01 lbs each



The Power Behind the Power

UltraMax® eHID electronic ballasts are custom-manufactured to our demanding Six Sigma specifications for dependable performance with 100% burn in all ballasts at the factory to ensure every ballast is ready to go on-site.

Case Dimensions						
Length	Width	Height	Mount Offset	Mount Length	Mount Width	Mount Slot
(L)	(W)	(H)	(G)	(M)	(X)	(MS)
7.28 in	2.58 in	2.2 in	1 in	.43 in	-	-
185 mm	65.5 mm	56 mm	25.4 mm	50.8 mm	-	#8-32 x .43

Transforming the POWER of light™

National Customer Service Center
1-888-GEBALLAST (432-2552)

Product Code: 89550
UltraMax® is a registered trademark of General Electric Company.

fixture types: M2

CFL Biax® Ballasts

Product Code 10 Pack	Description	Type	Lamps #	Input Volts	Input Watts	Ballast Factor	System Lumens	System LPW	Nominal Line Amps	Power Factor	Starting Temp
75948	GEC140MAX-A										
		F40/30BX/2G11	1	120	38	0.90	2835	75	0.32	>0.99	0F
				277	38	0.90	2835	75	0.14	>0.95	0F
		F40/28BX/2G11	1	120	34	1.00	2800	82	0.29	>0.99	0F
				277	34	1.00	2800	82	0.13	>0.95	0F
		F40/25BX/2G11	1	120	31	1.00	2600	84	0.25	>0.99	0F
				277	31	1.00	2600	84	0.12	>0.90	0F
		F32T8	1	120	33	0.94	2632	80	0.27	>0.99	0F
				277	33	0.94	2632	80	0.13	>0.95	0F
		F28T5/HE	1	120	36	1.10	3190	89	0.30	>0.99	0F
				277	36	1.10	3190	89	0.14	>0.95	0F
71435	GEC240MAX-A										
		F40/30BX/2G11	2	120	69	0.90	5670	82	0.58	>0.99	0F
				277	68	0.90	5670	83	0.25	>0.95	0F
		F40/28BX/2G11	2	120	63	1.00	5600	89	0.54	>0.99	0F
				277	62	1.00	5600	90	0.23	>0.95	0F
		F40/25BX/2G11	2	120	58	1.00	5200	90	0.50	>0.99	0F
				277	57	1.00	5200	91	0.21	>0.90	0F
		F32T8	2	120	63	0.94	5264	84	0.54	>0.99	0F
				277	62	0.94	5264	85	0.23	>0.95	0F
		F28T5/HE	2	120	69	1.10	6380	92	0.59	>0.99	0F
				277	68	1.10	6380	94	0.25	>0.95	0F
71436	GEC340MAX-A										
		F40/30BX/2G11	3	120	100	0.90	8505	85	0.86	>0.99	0F
				277	99	0.90	8505	86	0.36	>0.99	0F
		F40/28BX/2G11	3	120	93	1.00	8400	90	0.79	>0.99	0F
				277	91	1.00	8400	92	0.33	>0.95	0F
		F40/25BX/2G11	3	120	85	1.00	7800	92	0.73	>0.99	0F
				277	84	1.00	7800	93	0.31	>0.95	0F
		F32T8	3	120	92	0.94	7896	86	0.78	>0.99	0F
				277	90	0.94	7896	88	0.33	>0.95	0F
		F28T5/HE	3	120	102	1.10	9570	94	0.87	>0.99	0F
				277	100	1.10	9570	96	0.37	>0.99	0F
71437	GEC240MVPS-A										
		F40/30BX/2G11	2	120	70	0.90	5670	81	0.59	>0.99	0F
				277	69	0.90	5670	82	0.25	>0.95	0F
		F40/30BX/2G11	1	120	42	1.04	3276	78	0.36	>0.99	0F
				277	42	1.04	3276	78	0.17	>0.95	0F
75950	GEC225MVPS-A										
		F40/28BX/2G11	2	120	62	1.00	5600	90	0.53	>0.99	0F
				277	61	1.00	5600	92	0.23	>0.95	0F
		F40/25BX/2G11	2	120	57	1.00	5200	91	0.48	>0.99	0F
				277	56	1.00	5200	93	0.21	>0.95	0F
		F40/28BX/2G11	1	120	40	1.17	3276	82	0.33	>0.99	0F
				277	40	1.17	3276	82	0.15	>0.95	0F
		F40/25BX/2G11	1	120	36	1.22	3172	88	0.30	>0.99	0F
				277	36	1.22	3172	88	0.14	>0.95	0F

Transforming the POWER of Light™

GE National Customer Service Center
1-888-GEBALLAST (432-2552)

For product specifications and application information, please consult GE's Website:
www.gelighting.com

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11/2009 Printed in USA

GE Consumer & Industrial
Lighting

UltraMax® Instant Start & UltraStart® Programmed Start High Lumen CFL Biax® Ballasts

ULTRAMAX CFL
HIGH LUMEN BIAX® BALLAST
High Efficiency Instant Start

ULTRASTART™ CFL
HIGH LUMEN BIAX® BALLAST
High Efficiency Program Start

RoHS COMPLIANT

Featuring the Extreme Efficiency Solution for Compact 2x2 Fixtures...

GE Ultra Watt-Miser® 25W Biax® System

imagination at work

High Lumen Biax® High Efficiency CFL Ballasts

GE has developed a line of High Lumen **Biax®** CFL ballasts that incorporate all the benefits of **GE's UltraMax®** instant start and **UltraStart®** programmed start T8 and T5 ballasts. These high efficiency (>90%) ballasts along with GE's 25W High Lumen **Biax®** 104 Lumen Per Watt Lamp are GE's highest efficient fluorescent system for compact spaces typical in 2x2 ft fixtures. 25W High Lumen **Biax®** lamps are direct replacements for F40/30 watt CFL lamps on standard instant start ballasts. These lamps can be operated on standard instant start ballasts or GE's **UltraStart®** programmed start ballast designed for the 25W.

The GE UltraStart® Watt-Miser® Biax® Lamp and Ballast System Advantage

- 14 watts, 20% lower system watts than standard 2-lamp, F40/30 watt CFL systems
- Operates lamps in parallel (which means if one lamp fails, the other lamps remain on)
  – Significantly reduces lamp maintenance costs.
- Extends Lamp Life to a 36,000 hours @ 12 Hr Start with an Extended 3 Year GE Express System Warranty

GE UltraStart® Biax® programmed start ballasts use a control circuit to apply very precise cathode heat to ensure lamp cathodes have reached optimum temperature during lamp starting. Precise starting reduces the amount of cathode degradation associated with each start and increases lamp life significantly. After starting the lamps, continuous cathode cutout technology (CCC) is applied - which eliminates wasted power to the lamps, resulting in high efficiencies.

GE's Highest Efficient Fluorescent System for 2x2 ft Fixtures

Standard 2 Lamp T12U	25W Watt-Miser® Lamp	UltraStart® Watt-Miser®
Mean Lumens = 4,791	Mean Lumens = 4,940	Mean Lumens = 4,940
Watts = 90W	Watts = 60W	Watts = 56W
Mean LPW = 53	Mean LPW = 82	Mean LPW = 88
Life = 14,000 hrs	Life = 20,000*	Life = 36,000
	Savings = $18/fixture	Savings = $20.40/fixture

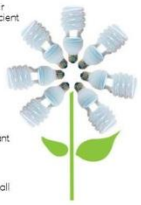
Assumptions: $.10 kwh @ 12 hours starts 6000hrs Annual Operation, *Standard instant start

Environmental Awareness

Eco**magination**SM is GE's commitment to create products that help our customers improve their environmental and operating performance. **GE Biax®** ballasts are high-efficiency, energy-efficient and RoHS compliant.

GE's UltraStart® Biax® programmed start and **GE UltraMax® Biax® Instant Start ballasts** are among the highest energy-efficient ballasts available and contribute to significant reductions in energy consumption and the curbing of greenhouse gas emissions.

RoHS compliant:
(European Directive 2002/95EC on the Restriction of Hazardous Substances) states that (beyond certain limited exemptions) electrical and electronic products shall not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBBs), or polybrominated diphenyl ethers (PBDEs). **GE's Biax®** ballasts use lead-free solder and other environmentally preferable materials that meet the RoHS directive. RoHS-compliant ballasts are GE's commitment to helping our customers meet their disposal needs now, and in the future.



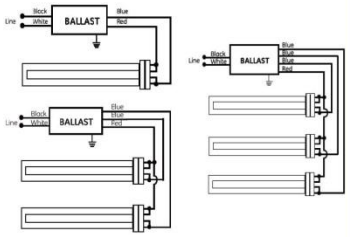
GE encourages customer awareness on the importance of reducing hazardous materials and getting ahead of complying with environmental trends. Look for the RoHS-compliant mark on all **GE Biax®** and other **GE ballasts**.

UltraMax® & UltraStart® Biax® Ballasts Features and Benefits

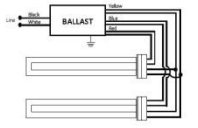
- **GE UltraStart® programmed start ballasts** for use with sensors, short burn cycles or where lamp life is a primary concern
- **GE UltraStart® instant start ballasts** for use in long (> 3 hr) lamp cycles.
- **High-Efficiency, Energy Savings**
  High efficiency components, low losses & **GE UltraStart® ballasts** complete cathode cutout maximizes energy savings.
- **Multi-Voltage Technology** – Simplify installation. Adapts automatically to any voltage from 108V to 305V
- **Anti-Striation Control** – Reduces maintenance issues caused by striating lamps
- **End of Life Lamp Protection**
- **Lower Maintenance Costs with Parallel Lamp Operation**
  If one lamp fails, the other lamps remain lit. This can reduce spot relamping by 50%, or extend group relamping by up to 15%.
- **Fast Starting Time**
  GE UltraStart® ballasts start in less than 700 milliseconds compared with standard programmed start >1.1 seconds. This is an important feature when using sensors. **GE UltraStart® ballasts** fast starting time eliminate the traditional PS ballast delay of waiting for the lights to turn on.
- **Auto-Reset** – Automatically resets after lamp replacement and withstands temporary losses in power typical with backup lighting systems
- **Complies with (RoHS) Restrictions of Hazardous Materials Standards** – Environmentally conscious

Technical Specifications

UltraMax® Instant Start



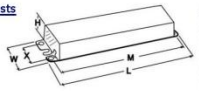
UltraStart® Programmed Start



For 1-Lamp operation insulate unused blue leads for 600 Vrms

*All ballasts include lead wires

GE Biax Ballasts	
Length (L)	9.5"
Mount Length (M)	8.9"
Width (W)	1.7"
Mount Width (X)	1.05"
Height (H)	1.18"



Specifications
- Lamp Frequency > 42KHz
- Lamp CCF: < 1.7
- Lamp End of Life Protection Circuit
- Re-lamp Auto-Reset
- THD: < 10%
- Power Factor: > 98%
- cUL listed, Outdoor Type 1, HL
- FCC 47CFR Part 18 Non-Consumer

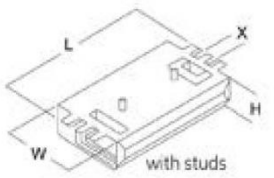
fixture type: N1

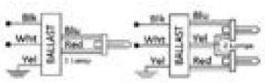
GE Lighting

71428 - GEC213-MVPS-BES

GE CFL Multi-Volt ProLine™ Electronic Program / Rapid Start Ballast

- Multi-Voltage technology means a single ballast handles voltage from 108V to 305V
- Programmed starting for extended lamp life
- End-of-Lamp-Life Protection
- Color Coded Poke-In Connectors simplifies wiring





GENERAL CHARACTERISTICS

Application	2 or 1- CFQ13W/G24q Bottom Exit with Studs 120-277V Proline PS
Category	Compact Fluorescent
Ballast Type	Electronic - Program / Rapid Start
Starting Method	Programmed start
Lamp Wiring	Series
Line Voltage Regulation (+/-)	10 %
Case Temperature	70 °C(158 °F)
Ballast Factor	Normal
Power Factor Correction	Active
Sound Rating	A (20-24 decibels)
Enclosure Type	Metal
Additional Info	Auto-restart/Thermally protected/Universal voltage

PRODUCT INFORMATION

Product Code	71428
Description	GEC213-MVPS-BES
Standard Package	Case
Standard Package GTIN	10043168714287
Standard Package Quantity	10
Sales Unit	Case
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	10
UPC	043168714280

DIMENSIONS

Case dimensions	
Length (L)	5.0 in(127.00 mm)
Width (W)	2.4 in(60.96 mm)
Height (H)	1.0 in(25.40 mm)
Mounting dimensions	
Mount Length (M)	4.6 in(117.60 mm)
Weight	0.57 lb
Exit Type	Poke-in
Remote Mounting Distance	20 ft
Remote Mounting Wire Gauge	18 AWG

ELECTRICAL CHARACTERISTICS

Supply Current Frequency	50 Hz/60 Hz

SAFETY & PERFORMANCE

- CSA
- UL Class P
- UL Listed
- UL Type 1 Outdoor
- UL Type CC
- UL Type HL
- FCC Part 18 Class B at 120 volts

SPECIFICATIONS BY LAMP & WATTAGE

Lamp	# of Lamps	Line Volts	System Watts	Nom. Line Current	System Ballast Factor	Ballast Efficacy Factor	Power Factor% (>=)	Crest Factor (<=)	THD% (<=)	Min. Starting Temp (°F/°C)
CFTR18W/4P	1	120	20	0.17 A	1.00	5.00	99	1 1/2	12	-20.0 / -29
CFTR18W/4P	1	277	20	0.07 A	1.00	5.00	97	1 1/2	12	-20.0 / -29
CFTR13W/4P	1	120	16	0.16 A	1.00	NaN	96	1 1/2	10	-20.0 / -29
CFTR13W/4P	1	277	16	0.06 A	1.00	NaN	96	1 1/2	10	-20.0 / -29
CFTR13W/4P	2	120	29	0.25 A	1.00	3.45	99	1 1/2	10	-20.0 / -29
CFTR13W/4P	2	277	29	0.11 A	1.00	3.45	99	1 1/2	10	-20.0 / -29
CFS16W/4P	1	120	17	0.14 A	1.00	5.88	96	1 1/2	12	-20.0 / -29
CFS16W/4P	1	277	17	0.06 A	1.00	5.88	96	1 1/2	12	-20.0 / -29
CFS10W/4P	1	120	13	0.11 A	1.05	8.08	96	1 1/2	14	-20.0 / -29
CFS10W/4P	1	277	13	0.05 A	1.05	8.08	96	1 1/2	14	-20.0 / -29
CFS10W/4P	2	120	23	0.19 A	0.95	4.13	97	1 1/2	11	-20.0 / -29
CFS10W/4P	2	277	23	0.09 A	0.95	4.13	97	1 1/2	11	-20.0 / -29
CFQ18W/4P	1	120	20	0.17 A	1.00	5.00	99	1 1/2	12	-20.0 / -29
CFQ18W/4P	1	277	20	0.07 A	1.00	5.00	97	1 1/2	12	-20.0 / -29
CFQ13W/4P	1	120	16	0.16 A	1.00	NaN	96	1 1/2	10	-20.0 / -29
CFQ13W/4P	1	277	16	0.06 A	1.00	NaN	96	1 1/2	10	-20.0 / -29
CFQ13W/4P	2	120	29	0.25 A	1.00	3.45	99	1 1/2	10	-20.0 / -29
CFQ13W/4P	2	277	29	0.11 A	1.00	3.45	99	1 1/2	10	-20.0 / -29

WARRANTY INFORMATION

For additional information, visit www.gelighting.com

Page 1

fixture type: N2

UltraStart® Watt-Miser® and High Lumen T5 Systems

T5 Watt-Miser® High Output Lamps

P/C	Description	Watts	Lumens Initial	Lumens Mean	Color Temp	CRI	Rated Life 3hrs/start	Rated Life 12hrs/start	Nominal Length (in.)	Case Qty
71627	F54T5/830/WM/ECO	51	5,000	4,600	3000	85	25,000	30,000	45.2	40
71628	F54T5/835/WM/ECO	51	5,000	4,600	3500	85	25,000	30,000	45.2	40
71629	F54T5/841/WM/ECO	51	5,000	4,600	4100	85	25,000	30,000	45.2	40
71630	F54T5/850/WM/ECO	51	4,790	4,410	5000	85	25,000	30,000	45.2	40
71631	F54T5/865/WM/ECO	51	4,750	4,370	6500	85	25,000	30,000	45.2	40

T5 Watt-Miser® High Efficiency

P/C	Case Description	Watts	Lumens Initial	Lumens Mean	Color Temp	CRI	Rated Life 3hrs/start	Rated Life 12hrs/start	Nominal Length (in.)	Qty
71632	F14T5/830/WM/ECO	13	1,350	1,240	3000	85	25,000	30,000	21.6	40
71633	F14T5/835/WM/ECO	13	1,350	1,240	3500	85	25,000	30,000	21.6	40
71634	F14T5/841/WM/ECO	13	1,350	1,240	4100	85	25,000	30,000	21.6	40
71635	F14T5/850/WM/ECO	13	1,300	1,190	5000	85	25,000	30,000	21.6	40
71636	F14T5/865/WM/ECO	13	1,250	1,150	6500	85	25,000	30,000	21.6	40
71637	F21T5/830/WM/ECO	20	2,100	1,930	3000	85	25,000	30,000	33.4	40
71638	F21T5/835/WM/ECO	20	2,100	1,930	3500	85	25,000	30,000	33.4	40
71639	F21T5/841/WM/ECO	20	2,100	1,930	4100	85	25,000	30,000	33.4	40
71640	F21T5/850/WM/ECO	20	2,000	1,840	5000	85	25,000	30,000	33.4	40
71641	F21T5/865/WM/ECO	20	1,950	1,790	6500	85	25,000	30,000	33.4	40
71642	F28T5/830/WM/ECO	26	2,900	2,660	3000	85	25,000	30,000	45.2	40
71643	F28T5/835/WM/ECO	26	2,900	2,660	3500	85	25,000	30,000	45.2	40
71644	F28T5/841/WM/ECO	26	2,900	2,660	4100	85	25,000	30,000	45.2	40
71645	F28T5/850/WM/ECO	26	2,750	2,530	5000	85	25,000	30,000	45.2	40
71646	F28T5/865/WM/ECO	26	2,700	2,480	6500	85	25,000	30,000	45.2	40
71647	F35T5/830/WM/ECO	33	3,650	3,350	3000	85	25,000	30,000	57.1	40
71648	F35T5/835/WM/ECO	33	3,650	3,350	3500	85	25,000	30,000	57.1	40
71649	F35T5/841/WM/ECO	33	3,650	3,350	4100	85	25,000	30,000	57.1	40
71650	F35T5/850/WM/ECO	33	3,500	3,220	5000	85	25,000	30,000	57.1	40
71651	F35T5/865/WM/ECO	33	3,400	3,120	6500	85	25,000	30,000	57.1	40

T5 High Lumen

P/C	Description	Watts	Lumens Initial	Lumens Mean	Color Temp	CRI	Rated Life 3hrs/start	Rated Life 12hrs/start	Nominal Length (in.)	Case Qty
71652	F28WT5/830HL/ECO	26	3,050	2,810	3000	85	20,000	24,000	45.2	40
71653	F28WT5/835HL/ECO	26	3,050	2,810	3500	85	20,000	24,000	45.2	40
71654	F28WT5/841HL/ECO	26	3,050	2,810	4100	85	20,000	24,000	45.2	40
71655	F28WT5/850HL/ECO	26	2,900	2,670	5000	85	20,000	24,000	45.2	40
71656	F28WT5/865HL/ECO	26	2,850	2,620	6500	85	20,000	24,000	45.2	40

GE UltraStart® Ballast

P/C	Description	# Lamps	Lamp Type	Voltage	Type	Output	Additional Information
99649	GE45MM/PS90-E	4-1	F54T5HO	120 to 277	UltraStart	PRS	High Temp E Can
99650	GE45MM/PS90-E-42	4-1	F54T5HO	120 to 277	UltraStart	PRS	High Temp E Can Pallet Pack
99651	GE25MM/PS90-F	2 or 1	F54T5HO	120 to 277	UltraStart	PRS	High Temp F Can
99652	GE25MM/PS90-F-42	2 or 1	F54T5HO	120 to 277	UltraStart	PRS	High Temp F Can Pallet Pack
99653	GE228M/PSH-A	2 or 1	F14-F35HE	120 to 277	UltraStart	PRS	High Light 1.15 BF A Can
99654	GE228M/PSHA-T42	2 or 1	F14-F35HE	120 to 277	UltraStart	PRS	High Light 1.15 BF A Can Pallet
99655	GE228M/PS-A	2 or 1	F14-F35HE	120 to 277	UltraStart	PRS	Normal Light .95 BF A Can
99656	GE228M/PS-A-T42	2 or 1	F14-F35HE	120 to 277	UltraStart	PRS	Normal Light .95 BF A Can Pallet

For additional product and application information, please consult GE's Website: www.gelighting.com

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GE Consumer & Industrial
Lighting

ULTRASTART T5 WATT-MISER®

UltraStart® Watt-Miser® T5 Systems

imagination at work

High-Bay Solutions

Incredible Energy Savings

The GE UltraStart ® Watt-Miser® T5 system offers the industry's **lowest** overall system wattage for high-bay applications – 216 watts vs. 234 watts. This equates to over **$54.00** in energy savings per fixture. See below.

Huge Maintenance Savings

GE incorporates parallel lamp operation with the UltraStart® Watt-Miser® T5 System. When one lamp fails, the others remain lit. Studies show parallel operation reduces spot re-lamping by up to 50% and can extend group re-lamping by 15%.

"Ultra-Fast" Starting Time

Faster than typical programmed start systems, the GE UltraStart® Watt-Miser® T5 system is virtually "instant on" (.7 seconds start time). You'll experience no delays associated with the use of occupancy sensors and/or lighting controls

UltraStart® T5 54W Multi-Volt Ballast

- Parallel operation
- Adapts automatically to any voltage from 120-277
- Anti-striation control
- Bi-Level switching
- Environmentally conscious – RoHS compliant
- Arc-guard protection UL type CC rating
- Fast starting time: 700ms
- 90C Temperature rating 5 year/55C ambient, making more Hi Bay applications possible

Save up to $54.00 per Fixture High Output Watt-Miser® Lamp + UltraStart® Ballast

High Output Watt-Miser® Lamps

- Save $36.00 energy per 4-lamp fixture vs. standard F54T5 lamp!
- 51W T5 High output lamp
- 5,000 Initial lumens (same as current 54W lamp)
- 98 Initial lumens/watt
- Ideal for spot and group relamping
- 25,000 hr rated life
- Environmentally conscious TCLP-compliant

Don't Leave Money On The Table By Not Choosing GE T5 Systems!

Standard 4 lamp 54W T5	Watt-Miser® lamp	UltraStart® Watt-Miser®
		NEW GE Energy Saving T5 System
Initial Lumens = 20,000	Initial Lumens = 20,000	Initial Lumens = 20,000
Watts = 234W	Watts = 222W	Watts = 216W
LPW = 85	LPW = 90	LPW = 93
	Lamp to Lamp Savings = $36/fixture	Lamp and Ballast Savings = $54/fixture

Assumptions: $.10 kwh 30,000 hour life @ 12 hours start Savings per 4 lamp 54W T5 fixture

Commercial Troffer Solutions

UltraStart® T5 14-35W Multi-Volt Ballast

- Parallel operation
- Adapts automatically to any voltage from 120-277
- One ballast handles a variety of lamp sizes 14W to 35W
- Anti-striation control
- Bi-Level switching
- Environmentally conscious – RoHS compliant Arc-guard protection UL type CC rating
- Fast starting time: 700ms
- 90C Temperature rating 5 year/55C ambient, making more Hi Bay applications possible

High Efficiency Watt-Miser® Lamps

Save 5% energy per lamp vs. standard High Efficiency lamps!

- Save 5% on wattage by lamp type
- Same Light Output
- 25,000 hour rated life
- Environmentally conscious: TCLP compliant
- Compatible with existing T5 ballasts; maximum savings using GE UltraStart T5 ballasts
- All lamps offered in: 3000K/3500K/4100K/5000K/6500K

F28WT5 High Lumen

5% higher lumen output vs. standard F28WT5 lamps

- Reduce maintenance costs: High lumen lamps output allow shift from 3-lamp T12/T8 systems to 2-lamp T5 systems
- Ideal solution for indirect lighting applications
- 3050 initial lumens vs. 2900 lumens for standard T5
- 20,000 hour rated life
- Environmentally conscious: TCLP compliant

Lamp Type	F34T12	F32T8	F28T5HL	F28T5HL	F28T5WM	F28T5WM
Ballast Type	2 EM	Std IS	HE PS	HE PS	HE PS	HE PS
Lamp Life*	20000	24000	24000	24000	30000	30000
Number of Lamps	3	3	2	2	2	2
Initial Lumens	2750	2800	3050	3050	2900	2900
Ballast Factor	0.90	0.88	1.15	0.95	1.15	0.95
Light Source Lumen (Mean)	6,683	7,022	6,664	5,505	6,337	5,235
Optical Efficiency (Parabolic)	73.0%	73.0%	86.0%	86.0%	86.0%	86.0%
Fixture Lumen Output (Mean)	4,878	5,126	5,731	4,735	5,449	4,502
Light Loss/Gain		5%	17%	-8%	6%	-12%
System Wattage	114	84	70	57	67	55
Light Source LPW (Mean)	59	84	95	97	95	95
Fixture LPW (Mean)	43	61	82	83	81	82
% Energy Savings		26%	39%	50%	41%	52%

* @ 12 hours per start

fixture type: N3

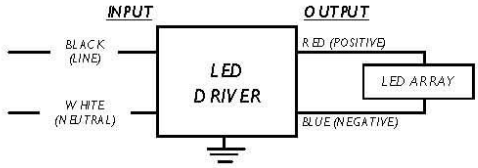
PHILIPS ADVANCE

LED-INTA-0024V-28-F-O	
Brand Name	XITANIUM
Driver Type	Electronic
Input Voltage	120~277
Input Frequency	50/60Hz
RoHS	Yes
Status	Active

Electrical Specifications

Output Power (W)	Output Voltage (V)	Output Current (A)	Operating Temp. Range (°F/°C)	Input Current at 120V (A)	Max. Input Power (W)	Inrush Current (A_{pk}/µs)	Max. THD (%)	Min. Power Factor	Surge Protection (KV)	Weight (Lbs)	IP Rating
67	24	0.10~2.8	-40°~140°F (-40~60°C)	0.65	78	100/200	20	0.99	2.5	1.4/635	IP66

Wiring Diagram



Input and output use lead-wires.
Lead-wires are 18AWG 105C/600V solid copper

Standard Lead Length

	in.	cm.
Black	9	22
White	9	22
Blue	26	66
Red	26	66
Gray		
Violet		

Maximum Wiring Distance (at full load)

Wire Size (AWG)	Distance (feet)
26	2
24	3
22	5
20	9
18	14
16	21
14	34
12	53
10	89

Enclosure

	in. (mm)
Case Length	8.34 (211.8)
Case Width	1.76 (42.5)
Case Height	1.1 (27.9)
Mounting Length	8.99 (228.4)
Mounting Width	1.22 (30.9)
Overall Length	9.45 (240)

c UL us — UL Class 2 E220165

C SA US — 7310_S-000 3426-32

Revised 09/15/2009

PHILIPS LIGHTING ELECTRONICS N.A.
10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Tel: 800-322-2086 · Fax: 888-423-1882 · www.philips.com/advance
Customer Support/Technical Service: 800-372-3331 · OEM Support: 866-915-5886

GE Lighting

DATA SHEET

CMH Electronic Ballasts

Product Information for Original Equipment Manufacturers

A range of GE electronic ballasts have been introduced to complement the 20, 35, 70 and 150W Constant Color™ Ceramic Metal Halide lamps

Features

- Integral version with open terminals for embodiment into luminaire
- Remote version with terminal cover and cable strain relief for location outside the luminaire
- 50,000 hours service life under the specified conditions
- Reduced power consumption compared to electromagnetic circuits
- Reduced component count and simplified wiring compared to electromagnetic circuits
- Rapid and controlled power run-up
- Lamp life maximised by square-wave current and constant lamp power
- Excellent lamp colour stability throughout life
- Automatic lamp failure shut-down
- Timed restart after mains voltage interruption
- Immune to mains voltage variations

Watts	Volts	Description	Mounting	Weight	Pack Qty	Product Code/W
20	220-240	BLS/E/20W/CMH	Integral	190 g	12	13032
20	220-240	BLS/E/20W/CMH/R	Remote	230 g	12	13034
35	220-240	BLS/E/35W/CMH	Integral	215 g	12	13035
35	220-240	BLS/E/35W/CMH/R	Remote	230 g	12	13036
70	220-240	BLS/E/70W/CMH	Integral	300 g	12	13040
70	220-240	BLS/E/70W/CMH/R	Remote	310 g	12	13047
150	220-240	BLS/E/150W/CMH	Integral	430 g	12	13050
150	220-240	BLS/E/150W/CMH/R	Remote	445 g	12	13053

	20W	35W	70W	150W	
System Power	235	43	78	159	W
System Efficacy	72	79	79	88	lm/W
Lumens *	1700	3400	6200	14000	lm
Lamp Power	20	39	72	146	W
Lamp Efficacy	85	87	86	96	lm/W
Lamp Voltage Range	70…125	70…125	70…125	70…125	V

*Typical value for Single Ended Mini 20W/35W/70W CMH and Single Ended 150W/3000K CMH

	20W	35W	70W	150W
Single Ended Mini	•	•	•	
Single Ended		•	•	•
Double Ended			•	•
PAR 20		•		
PAR 30		•	•	
Elliptical Clear			•	
Elliptical Diffuse			•	
Tubular Clear			•	•

Application Areas

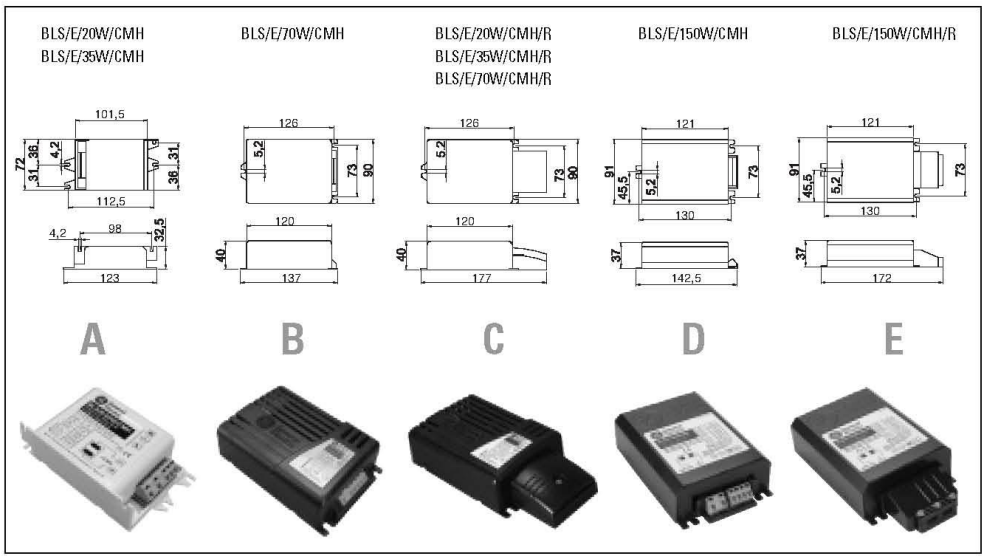
- Retail
- Display Cabinet
- Commercial Interior
- Offices
- Lobbies
- Public Buildings

CMH Electronic Ballasts

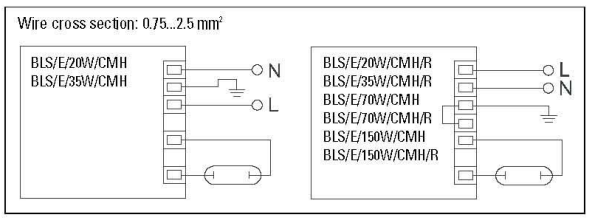
Operating Characteristics	20W	35W	70W	150W	
Mains Voltage	220...240	220...240	220...240	220...240	V
Mains Current	0.10	0.18	0.33	0.69	A
Mains Frequency	50...60	50...60	50...60	50...60	Hz
Power Factor	> 0.95	> 0.95	> 0.95	> 0.95	
Allowed MainsVoltage Range	198...264	198...264	198...264	198...264	V
Ignition Voltage*	< 2.5	< 2.5	< 2.5	< 2.5	kV
Lamp Operating Frequency	150	150	150	150	Hz
Max Cable Capacitance	1000	3000	3000	3000	pF
Max Lamp Distance**	10	25	25	25	m
Ambient Temperature Range	-20...+50	-20...+50	-20...+50	-20...+50	°C
Maximum Case Temperature	75	75	75	80	°C
Thermal Cut-off on PCB	110	110	110	110	°C

* If a hot lamp or no lamp is detected the ballast will attempt to start the lamp after one minute, if not successful further attempts are made up to a maximum of 4 times in 5 minute cycles, then if not successful the ballast will shut-down. The ballast is reset automatically by a supply interruption.
** Typical value if cable capacitance is below the specifi ed limit

Dimensions



Circuitry



The ballasts comply with the relevant parts of the following standards:

– RFI suppression EN 55015
– Harmonics EN 61000-3-2
– Immunity EN 61547
– Safety EN 60926/EN 60928/EN 61347
– Performance EN 60927/EN 60929

GE Lighting

Please visit us on the web at www.GELighting.com

GE Lighting is constantly developing and improving its products. For this reason, all product descriptions in this brochure are intended as a general guide, and we may change specifications time to time in the interest of product development, without prior notification or public announcement. All descriptions in this publication present only general particulars of the goods to which they refer and shall not form part of any contract. Data in this guide has been obtained in controlled experimental conditions. However, GE Lighting cannot accept any liability arising from the reliance on such data to the extent permitted by law.
CMH Electronic Ballasts – Product Information for OEMs – October 2003.

fixture type: P4-16

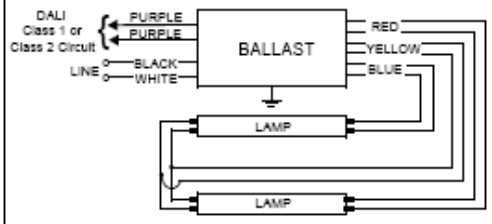
PHILIPS ADVANCE

IDA-2S28-D@277V	
Brand Name	ROVR
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts) (min/max)	Ballast Factor (min/max)	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
F14T5	2	14	50/10	0.12	09/34	0.03/1.00	10	0.98	1.7	2.94
F21T5	2	21	50/10	0.18	10/49	0.03/1.00	10	0.98	1.7	2.04
* F28T5	2	28	50/10	0.22	12/63	0.03/1.00	10	0.98	1.7	1.59
F28T5/ES (25W)	2	25	50/10	0.21	12/59	0.03/1.00	10	0.98	1.7	1.69

Wiring Diagram



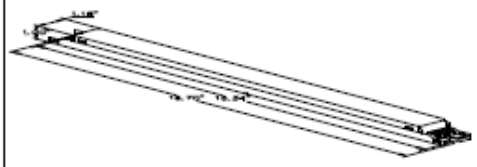
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

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

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

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
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 01/18/2011

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

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fixture type: S1

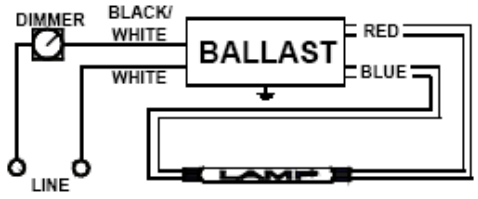
PHILIPS ADVANCE

VEZ-154	
Brand Name	MARK 10 POWERLINE
Ballast Type	Electronic Dimming
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (Watts) (min/max)	Ballast Factor (min/max)	MAX THD %	Power Factor	Lamp Current Crest Factor	B.E.F.
F54T5/HO	1	54	50/10	0.23	13/63	0.03/1.00	10	0.98	1.7	1.59
F54T5/HO/ES (49W)	1	49	50/10	0.21	13/59	0.03/1.00	10	0.98	1.7	1.69
* FC12T5/HO	1	55	50/10	0.22	13/59	0.03/0.90	10	0.98	1.7	1.53
FT55W/2G11	1	55	50/10	0.22	13/59	0.05/0.90	10	0.98	1.7	1.53

Wiring Diagram



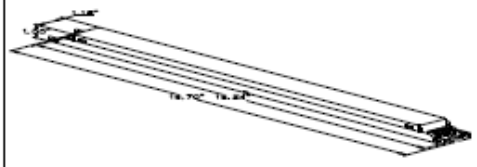
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

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

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

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
16.70 "	1.18 "	1.00 "	16.34 "
16 7/10	1 9/50	1	16 17/50
42.4 cm	3 cm	2.5 cm	41.5 cm

Revised 01/07/2011

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fixture type: Z1

Revised: 3/5/2009

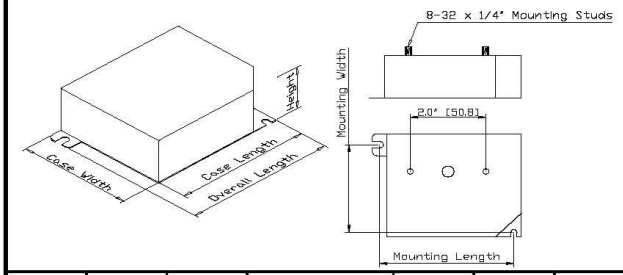
PHILIPS ADVANCE

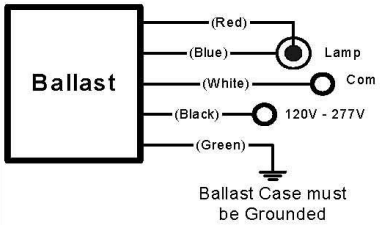
e-Vision® Electronic Ballast for Metal Halide Lamps

Catalog Number: IMH-39-G
For 39W Metal Halide Lamps
ANSI M130
120-277 50/60Hz Electronic
Status: RELEASED

DIMENSIONS AND DATA

Lamp Number	Lamp Watts	Input Volts	Catalong Number*	Line Current (Amps)	Input Power (Watts)	Min Power Factor	Wiring Diag	Fig.	Weight (lb)	Max. Distance to Lamp (ft)
39W Watt Lamp, ANSI Code M130 Minimum Starting Temp -30°C/-20°F										
1	39	120	IMH-39-G-XXX	0.39	46	0.9	3	G	0.9	5
		277		0.18	45					

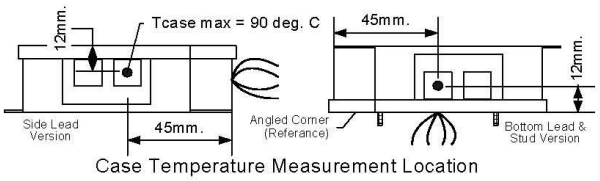




Ballast Case must be Grounded

Wiring Diagram 3

Case Figure	Overall Length	Case Length	Case Width	Height	Mountin Length	Mounting Width
G	97mm [3.8"]	90mm [3.5"]	77mm [3.0"]	30mm [1.2"]	87mm [3.4"]	67mm [2.6"]



Case Temperature Measurement Location

INSTALLATION & APPLICATION NOTES:

1. Maximum allowable case temperature is 90°C. See figure above for measurement location
2. Ignition pulse is 4 kV max
3. All leads are 9 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp
6. Connect the red lead to the center terminals of the lamp when using screw base lamps

***Ordering Information**

Order Suffix	Description
-LF	Ballast with side exit leads and mounting feet
-BLS	Ballast with bottom exit leads and mounting studs

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

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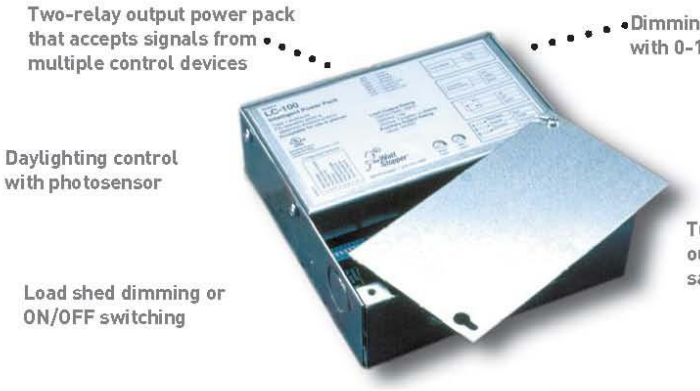
appendix c – full control schedule and cut sheets

Controls Schedule			
Type	Manufacturer	Product	Description
LC-100	Wattstopper	Intelligent Power Pack	Power pack delivers 0-10V dimming control to lighting loads.
LMLS-305	Wattstopper	LightSaver Photocell	Closed loop photosensor provides the daylight data necessary for operation.
LMRC-211	Wattstopper	LightSaver Room Dimming Controller	Provides automatic dimming control for fluorescent fixtures. Closed loop control utilizes a photocell for single-zone dimming.
LMRC-212	Wattstopper	LightSaver Room Dimming Controller	Provides automatic dimming control for fluorescent fixtures. Closed loop control utilizes a single photocell for multi-zone dimming.
LMRC-213	Wattstopper	LightSaver Room Digital Controller	Provides up to 16 scene settings for maximum control of restaurant lighting settings.
LMSW-100	Wattstopper	LightSaver Wall Switches	Allows occupants to temporarily override the daylighting control systems.
LMSW-105	Wattstopper	LightSaver Scene Switch	Allows occupant control of dimming scenes.

control type: LC-100

COMMERCIAL OCCUPANCY SENSORS & CONTROLS

LC-100 Intelligent Power Pack



PROJECT

LOCATION/TYPE

Product Overview

Description

The LC-100 is a power pack with two relay outputs and two dimming channels delivering both switching and 0-10V dimming control to lighting loads. Signal inputs offer integrated operation with a range of control devices.

Operation

A dual voltage device capable of operating at either 120 or 277V, the LC-100 installs as a standard power pack, connecting to junction boxes in a ceiling or a location close to controlled loads. With 24VDC at 150mA available, it provides power to occupancy sensors, photocells, and other devices. Low voltage switch inputs give occupants ON/OFF switching and up/down dimming control of two independent lighting loads. Separate signaling inputs for occupancy sensors, time clocks and photocells allow shutoff and daylighting control while providing convenient scenarios (i.e., blink warning, manual on or auto on, hold on, on only) to meet control needs.

Dimming Control

When used with 0-10V controllable ballasts, the LC-100 provides dimming and ON/OFF control of up to 100 ballasts per dimming channel. Occupants can conveniently dim up/down and turn lighting ON/OFF using momentary low voltage switches. The load shed feature dims lighting to preset levels during peak demand periods to reduce energy consumption. Lighting maximum levels can also be set for greater energy savings.

Applications

The LC-100 integrates control of other devices to meet room-specific lighting control needs. It is ideal for compliance with bi-level switching, daylighting and lighting shutoff energy code provisions. Where load shedding is needed, the LC-100 can switch off non-critical lighting while leaving other lighting on. Or with controllable ballasts, it can dim lighting down to preset load "shed" levels.

Features

- Single package with relay outputs, dimming channels, power supply, and device inputs for simpler installation
- Two switch inputs accept three-wire momentary, two-wire momentary pushbutton, or maintained low voltage switches
- Hold-ON feature keeps lighting on during scheduled time, reverts to occupancy sensor control after hours
- Burn in timer prevents lamps from dimming for initial 100 hours for extended lamp life
- Pilot light output for status annunciation at switches
- Blink warning five minutes prior to shutoff
- Isolated relay contact for each relay output provides status
- Manual ON/Auto ON settings for convenience and energy savings
- After hour override adjustable to 30 minutes, 1 hour, 2 hours or 4 hours
- Works with the LS-301 dimming photosensor to provide closed loop dimming control
- Qualifies for ARRA-funded public works projects

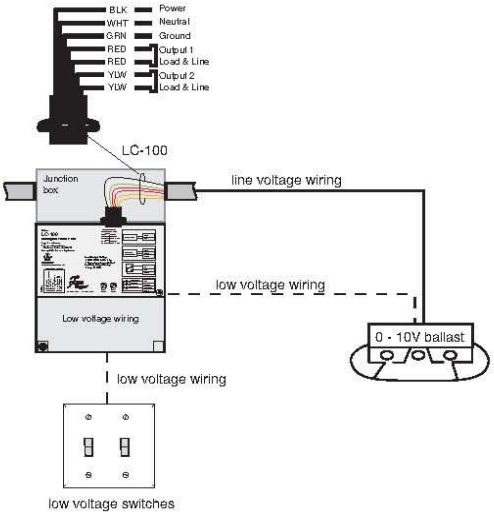
WattStopper®
www.wattstopper.com
800.879.8585

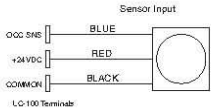
Specifications

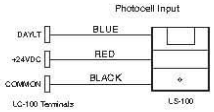
- 120/277 VAC voltage input, 50/60 Hz
- Two relay outputs rated 20 Amp 120V tungsten and ballast, 20 Amp 277V ballast
- Two isolated NO/NC relays rated 1 Amp @ 24VDC
- NEMA 1 enclosure; acceptable for use in plenum spaces
- Output power 150mA @ 24VDC with automatic overload protection
- Dual voltage input 120 or 277VAC @ 14 Watts maximum
- Switch wiring distances up to 1000 feet with 18 gauge wire
- Dimensions: 6.63" x 6.13" x 2.13" (168.4mm x 155.7mm x 54.1mm) with a 1/2 inch snap-in nipple
- UL and cUL listed
- Five year warranty

Wiring & Installation

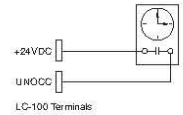
LC-100 Wiring Connections, Inputs, and to Dimming Ballasts





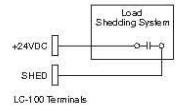


Time Scheduled Occupancy



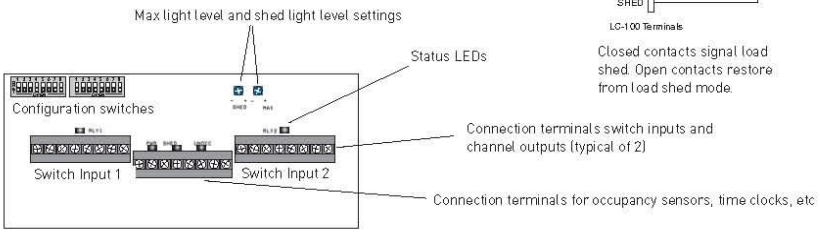
Closed contacts signal non-occupancy. Open contacts signal occupancy.

Load Shed



Closed contacts signal load shed. Open contacts restore from load shed mode.

LC-100 Wiring Connections



Ordering Information

Catalog No.	Input Voltage	Load Ratings: Ballast (A)	Incan (A)	Motor (HP)	Output
☐ LC-100	120/277 VAC; 50/60 Hz	20	20	1*	24 VDC; 150 mA**

* 1 Hp rated at 120/250 VAC. ** Output is 150 mA with relays connected.

Installation Notes

1. All WattStopper power packs should be installed in accordance with state, local, and national electrical codes and requirements.
2. Power packs are designed to attach to existing or new electrical enclosures with 1/2 inch knockouts. (Check electrical codes in your area.)
3. Low-voltage wiring should use stranded, 18-22 AWG, properly rated cable. Do not run low voltage Class 2 wiring with high voltage wiring. For plenum return ceilings use UL listed plenum-approved cables.

Pub. No. 14703 rev.10/2009

www.wattstopper.com | 800.879.8585

control type: LMLS-305

Daylighting Sensors | DIGITAL LIGHTING MANAGEMENT

LMLS-305 0-10 Volt Dimming Photosensor

Single zone, closed loop automatic dimming daylighting sensor

Component of Digital Lighting Managment integrated control systems

Controls standard 0-10 VDC electronic dimming ballasts

All setup performed remotely with LightSaver handheld or DLM wireless configuration tool

Optional occupant adjustment via handheld remote

LOCATION/TYPE

Product Overview

Description

The LMLS-305 0-10 Volt Dimming Photosensor is a single zone ceiling-mounted device that works with standard 0-10 VDC electronic dimming ballasts to dim lighting as the ambient light level increases. It is an optional part of a WattStopper Digital Lighting Management (DLM) system and is designed for closed loop daylighting applications.

Operation

The LMLS-305 operates on Class 2 power supplied to a DLM local network by one or more DLM room controllers. It is a closed loop photosensor that measures the total light level from daylight and electric light in the controlled area in order to adjust electric lighting levels. As the daylight contribution increases, the controlled lights dim down. The LMLS-305 features a sliding setpoint control algorithm to compensate for the different spatial distribution ratios of electric light and daylight. It calculates the required light level based on two setpoints. The night setpoint is the target level when no daylight is present. The day setpoint is the target level when significant daylight is present. In Plug n' Go mode, the LMLS-305 defaults to controlling the first load in the DLM system.

Adjustment via Handheld Remote Control

All LMLS-305 adjustments can be made either with the LightSaver LSR-301-S or the DLM LMCT-100 handheld remotes. The LSR-301-S provides five buttons for initial setup, which is easily completed by first raising or lowering electric lighting to desired levels, then programming this target level into the photosensor. The LMCT-100 uses simple, menu-driven screens for users to adjust daylighting parameters. In addition, an occupant remote control (LSR-301-P) provides an easy tool for use by occupants in adjusting light levels. With this optional tool, users can increase target light levels by up to 25% or reduce them to the lamp/ballast minimum level. Pressing the "Auto" button returns the control to programmed levels.

Applications

The LMLS-305 is designed to blend into its surroundings when installed in any environment. It provides one zone of daylighting control for applications such as private offices or classrooms. The LMLS-305 can be combined with a DLM occupancy sensor and a DLM wall switch.

Features

- Provides precise control of lighting to maintain desired light level
- Extremely linear photocell response with greater than 1% accuracy
- Designed to measure light as the human eye perceives it and eliminate overreporting of illumination levels provided by daylight
- Separate handheld remote controls for setup and occupant adjustment to prevent tampering
- Boosts energy savings by reducing maximum lamp output, often resulting in savings of 20%, or more, compared with lights at full output
- Achieves lumen maintenance by holding target light level as lamp output decreases over time
- Qualifies for ARRA-funded public projects

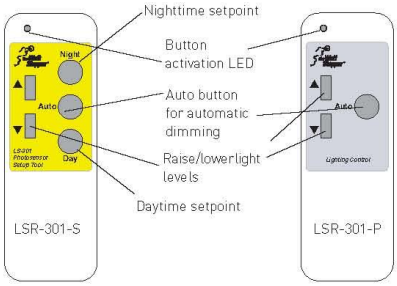
WattStopper
www.wattstopper.com
800.879.8585

Specifications

- Input voltage: 24VDC from DLM network
- Current consumption: 30 mA
- DLM local network connection: 1 RJ45 port via RJ45 plug and coupler (included)
- Full range dimming: .2 VDC (minimum) to 10 VDC (100% lighting) output voltage
- 0-10VDC signal: grey and violet to ballast
- Controls up to 50 standard dimming ballasts
- Setpoints are adjustable from 20-60 footcandles (210-640 lux)
- Operating conditions: for indoor use only; 32-120°F (0-49°C); less than 90% RH
- UL and cUL listed
- FCC part 15 compliant
- Five year warranty

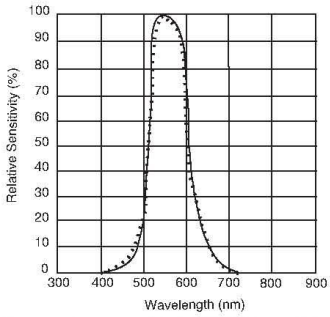
Controls & Response

Remote Controls



Remote handheld (above left) enables easy setup while optional occupant remote (above right) provides adjustability for individual lighting preferences.

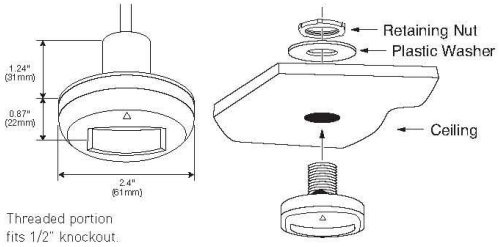
Spectral Response Curve



The spectral response of the LMLS-305 photocell closely matches the sensitivity of the human eye.

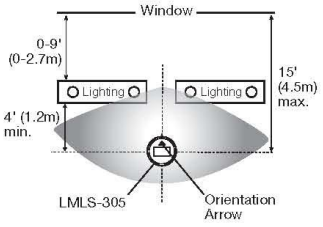
Installation & Placement

Mounting and Installation



Threaded portion fits 1/2" knockout.

Placement

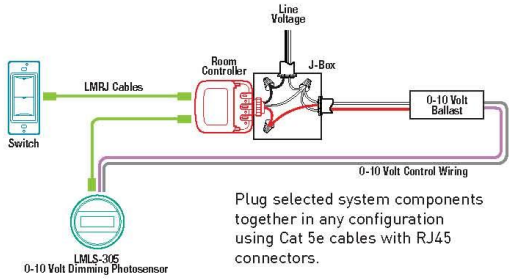


Placement Guidelines

- Mount photocell between 6 and 12 feet (1.8m - 3.7m) from window.
- Do not mount directly above direct/indirect pendant fixtures. Mount at least 4 feet (1.2m) from pendant fixtures.

Connecting

Sample Connection Diagram



Plug selected system components together in any configuration using Cat 5e cables with RJ45 connectors.

Ordering Information

Catalog No.	Description
☐ LMLS-305 ☐ LMLS-305-U	0-10 Volt Dimming Photosensor 0-10 Volt Dimming Photosensor, ARRA-compliant
☐ LSR-301-S ☐ LSR-301-S-U	Setup Remote Control (2 AAA batteries included) Setup Remote Control, ARRA-compliant (2 AAA batteries included)
☐ LSR-301-P ☐ LSR-301-P-U	Occupant Remote Control (2 AAA batteries included) Occupant Remote Control, ARRA-compliant (2 AAA batteries included)
☐ LMCT-100 ☐ LMCT-100-U	Wireless Remote Configuration Tool Wireless Remote Configuration Tool, ARRA-compliant

Pub. No. 31101 rev. 09/2009

A Group brand
www.wattstopper.com | 800.879.8585

control type: LMRC-211, 212, 213

Room Controllers | DIGITAL LIGHTING MANAGEMENT

LMRC-210 Series Digital On/Off/0-10 Volt Dimming Room Controllers

Plenum-rated controllers with line voltage relay(s) and 0-10 volt dimming output(s)

Components of Digital Lighting Management integrated control systems

Plug to other components using Cat 5e cables with RJ45 connectors eliminating wiring errors

Plug n' Go automatic configuration for maximum energy efficiency

Store 16 preset lighting levels for each load

Support energy saving manual-on, bi-level, tri-level and dimming control strategies

PROJECT

LOCATION/TYPE

Product Overview

Description

LMRC-210 Series Digital Room Controllers include one, two or three relay(s) to switch a total of 20 amps, a high-efficiency switching power supply and one 0-10 volt output per relay for control of dimmable loads including electronic ballasts (Advance Mark 7, or equivalent). They are the foundation of a WattStopper Digital Lighting Management (DLM) system, and allow integration of occupancy sensors, daylighting controls and switches for energy-efficient lighting control.

Operation

LMRC-210 Series Room Controllers operate on one 120 or 277 volt, 20 amp, feed and provide Class 2 power to sensors and switches via the DLM local network. Once powered up, Plug n' Go automatically configures system components for the most energy-efficient operation. The room controllers then dim or switch lighting or motor loads in response to input from the communicating devices. When a dimming input is received, the relay switches on when the dimmed level rises above zero, and off when it reaches zero, to coordinate control of power and the 0-10 volt signal to the load. They also monitor the current draw of the total connected load. Each room controller stores up to 16 preset levels for each dimmed output.

Plug n' Go Automatic Configuration

DLM room controllers manage Plug n' Go automatic system configuration, which establishes functionality based on the installed components. When room controllers are connected only to occupancy sensors, the system defaults to automatic on/off operation. If a wall switch is added to a system with one load, the load defaults to manual-on/automatic-off operation. If there is a wall switch and multiple loads, load one turns on automatically, while additional loads default to manual-on control; all loads turn off automatically. At system startup, default dimming parameters are established including: levels for presets 1-4; fade times; and fade and ramp rates. Dimming and system parameters may be customized using Push n' Learn.

Applications

LMRC-210 Series Room Controllers are ideal for single or multiple zone on/off or dimming lighting control applications. They are appropriate for applications in private offices, open offices, conference rooms and classrooms in any commercial building. LMRC-210 Series Room Controllers also help facility managers who want to track building power usage by monitoring current for lighting or other loads. A network bridge (LMBC-300 or LMRC-3xx) is required to expose DLM local network power data readings to a Segment Manager or BAS.

Features

- Plug n' Go™ automatic configuration for quick installation and maximum energy savings
- Push n' Learn™ functionality for personalization without the need for tools or a PC
- Digital Lighting Management components plug together on a free-topology Cat 5e DLM local network
- On/Off/Dim button for each load
- LED indicates status of each connected load
- Integral current monitoring of total connected load
- Optional lamp burn in, from 1-100 hours
- 4 RJ45 ports with integral strain relief
- Zero-crossing circuitry for each relay for reliability and increased product life
- UL 2043 plenum rated
- RoHS compliant
- Qualifies for ARRA-funded public works projects

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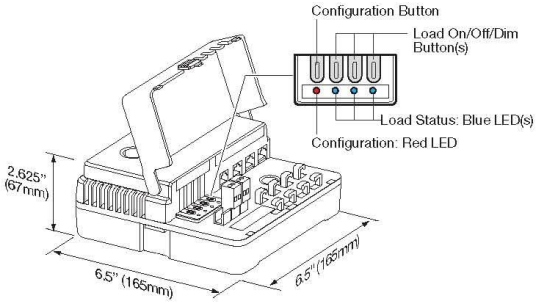
Specifications

- Input/ouput voltage: 120/277VAC, 50/60Hz
- Maximum 20A combined load per Room Controller; each relay rated for:
  Ballast or incandescent: 20A
  Motor load: 1Hp
- Class 2 dimming control signal: 0-10VDC, sinks up to 100mA per channel for control of compatible ballasts (50 if each sources 2mA)
- Class 2 output to DLM local network: 24VDC, up to 250mA across 4 RJ45 ports
- DLM local network parameters:
  - Maximum current: 800mA
  - Category 5e cable, up to 1,000'
  - Up to 64 loads
  - Up to 48 communicating devices
  - Maximum 4 LMRC-100 Series Room Controllers
- Operating conditions: for indoor use only; 32-158°F (0-70°C); 5-95% RH, non-condensing
- UL and cUL listed
- FCC part 15 compliant
- Five year warranty

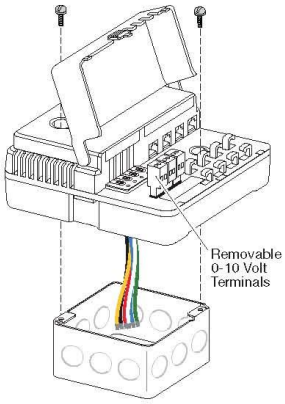
Controls & Mounting

Controls and Dimensions



Load Parameter (for each dimmed output)	Default Setting	Available Options
High trim	100%	1-100%
Low trim	0%	0-100%
Preset level: Scenes 1-16	1: 100%, 2: 75%, 3: 50%, 4: 25%, 5-16: 100%	all: 0-100%
Preset fade time	2 seconds	0 seconds -18 hours
Lamp burn in time	0	0-100 hours

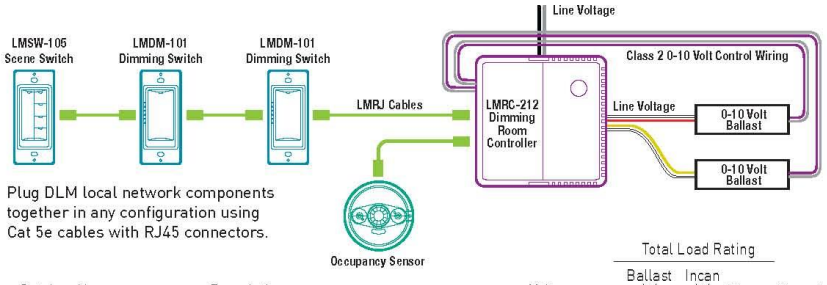
Mounting and Wiring



Mount to 4" x 4" x 2 1/8" deep electrical box. Depending on outputs used, a 4-square extension box may be needed. Connect to single 20A circuit.

Connecting

Sample Connection Diagram with Dimming Switches and Scene Control



Plug DLM local network components together in any configuration using Cat 5e cables with RJ45 connectors.

Ordering Information

Catalog. No.	Description	Voltage	Total Load Rating Ballast (A)	Incan (A)	Motor	Class 2 Outputs
☐ LMRC-211 ☐ LMRC-211-U	1 Relay Room Controller, 0-10V dimming 1 Relay Room Controller, 0-10V dimming, ARRA compliant	120/277VAC, 50/60Hz	20	20	1 Hp	24VDC, 250mA and 0-10VDC
☐ LMRC-212 ☐ LMRC-212-U	2 Relay Room Controller, 0-10V dimming 2 Relay Room Controller, 0-10V dimming, ARRA compliant					
☐ LMRC-213 ☐ LMRC-213-U	3 Relay Room Controller, 0-10V dimming 3 Relay Room Controller, 0-10V dimming, ARRA compliant					
☐ LMRC-CA	Conduit Adapter for Low Voltage Connections					

Pub. No. 30104 rev. 11/2010

www.wattstopper.com | 800.879.8585

control type: LMSW-102, 105

LMSW-100 Series Digital Wall Switches

Low voltage pushbutton switches for control of multiple loads

Components of Digital Lighting Management integrated control system

Plug to other components using Cat 5e cables with RJ45 connectors eliminating wiring errors

Customizable buttons with LED status indicators

IR transceiver for wireless configuration and remote control

Plug n' Go automatic configuration and Push n' Learn for personalization

PROJECT

LOCATION/TYPE

Product Overview

Description

LMSW-100 Series Digital Wall Switches are low voltage devices for energy-saving manual on/off control of one or more loads from one or more locations. They are part of a Digital Lighting Management (DLM) system and can control any load(s) connected to DLM room controllers.

Operation

LMSW-100 Series Switches operate on Class 2 power supplied to a DLM local network by one or more room controllers. The switches send a digital signal for on or off whenever a pushbutton is pressed by a user. Plug n' Go automatic configuration assigns each load to a switch button upon system startup. If the number of buttons equals the number of loads, each button operates one load. If there are more loads than buttons, the last button controls multiple loads. Any extra buttons are unassigned. When multiple switches are installed, default operation is for multi-way control; each switch controls all of the loads on the system. Button assignments may be quickly reconfigured using Push n' Learn. Button configuration may be changed from load control to scene control using DLM configuration tools.

Button Features and IR Communications

An LED shows the status of the load(s) or scene assigned to each button on a switch. Switches are available with one, two, three, four or eight buttons. When an unassigned button is pressed, the LED will blink. Each switch may be personalized in the field with custom-engraved buttons. The IR transceiver in each LMSW-100 Series Digital Wall Switch allows two-way communication for both wireless system configuration and operation.

Applications

LMSW-100 Series Digital Wall Switches are recommended for virtually all applications, including offices, conference rooms and classrooms. They are ideal for any area where manual on/off control is desired. They are also perfect for applications requiring multi-way control. LMSW-100 Series Switches increase energy savings and improve the return on investment of any Digital Lighting Management system.

Features

- Hidden configuration button for easy access to Push n' Learn
- Digital Lighting Managment components plug together on a free-topology Category 5e DLM local network
- Infrared (IR) transceiver for wireless configuration and control
- Sleek single gang devices fit decorator wall plates; 1-, 2-, 3-, 4-, and 8-button models
- Each button can control individual or multiple loads, or one scene; LED indicates status
- Switches may be used for multi-way control
- Five color options and custom engraving options; standard buttons may be replaced in the field
- RoHS compliant
- Qualifies for ARRA-funded public works projects

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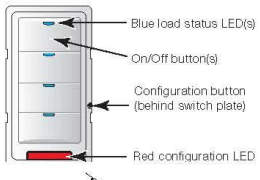
www.wattstopper.com
800.879.8585

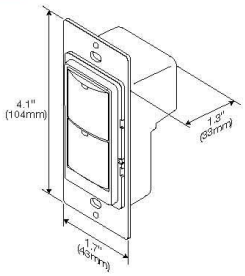
Specifications

- Input voltage: 24VDC from DLM local network
- Current consumption: 5mA
- DLM local network connection: 2 RJ45 ports
- 1, 2, 3, 4 or 8 control buttons, each with LED status indicator
- Hidden configuration button to access Push n' Learn
- Infrared (IR) transceiver
- Operating conditions: for indoor use only; 32-131°F (0-55°C); 5-95% RH, non-condensing
- UL and cUL listed
- FCC part 15 compliant
- Five year warranty

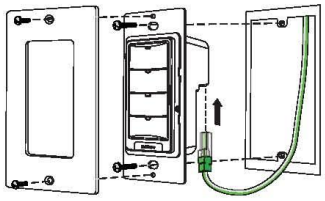
Controls & Mounting

Product Controls, Dimensions and Models





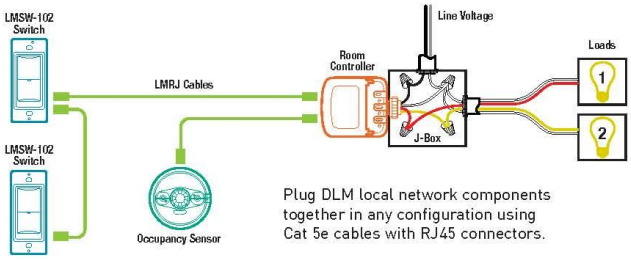
Mounting



LMSW-100 Series Switches fit in standard single gang boxes.

Connecting

Sample Connection Diagram with Multi-way Bi-level Control



Plug DLM local network components together in any configuration using Cat 5e cables with RJ45 connectors.

Ordering Information

Catalog No.	Color	Product Description
☐ LMSW-101-W ☐ LMSW-101-LA ☐ LMSW-101-I ☐ LMSW-101-G ☐ LMSW-101-B	White Light Almond Ivory Grey Black	1-Button Digital Wall Switch
☐ LMSW-101-W-U ☐ LMSW-101-I-U	White Light Almond	1-Button Digital Wall Switch, ARRA-compliant
☐ LMSW-102-W ☐ LMSW-102-LA ☐ LMSW-102-I ☐ LMSW-102-G ☐ LMSW-102-B	White Light Almond Ivory Grey Black	2-Button Digital Wall Switch
☐ LMSW-102-W-U ☐ LMSW-102-I-U	White Light Almond	2-Button Digital Wall Switch, ARRA compliant
☐ LMSW-103-W ☐ LMSW-103-LA ☐ LMSW-103-I ☐ LMSW-103-G ☐ LMSW-103-B	White Light Almond Ivory Grey Black	3-Button Digital Wall Switch
☐ LMSW-103-W-U ☐ LMSW-103-I-U	White Light Almond	3-Button Digital Wall Switch, ARRA-compliant

Catalog No.	Color	Product Description
☐ LMSW-104-W ☐ LMSW-104-LA ☐ LMSW-104-I ☐ LMSW-104-G ☐ LMSW-104-B	White Light Almond Ivory Grey Black	4-Button Digital Wall Switch
☐ LMSW-104-W-U ☐ LMSW-104-I-U	White Light Almond	4-Button Digital Wall Switch, ARRA-compliant
☐ LMSW-108-W ☐ LMSW-108-LA ☐ LMSW-108-I ☐ LMSW-108-G ☐ LMSW-108-B	White Light Almond Ivory Grey Black	8-Button Digital Wall Switch
☐ LMSW-108-W-U ☐ LMSW-108-I-U	White Light Almond	8-Button Digital Wall Switch, ARRA-compliant

Note: Switches do not include face plates. Order decorator style plate separately.

Pub. No. 30802 rev. 03/2010

appendix d – lighting plans

EXISTING TREE TO BE PROTECTED TYP.

LAWN

Quercus palustris | 1
Pin Oak

1 | Nyssa sylvatica
Black Tupelo

LAWN

LAWN

LP-1-1

LP-1-1

Fitness Center Third Floor Lighting Plan 1/16" = 1"

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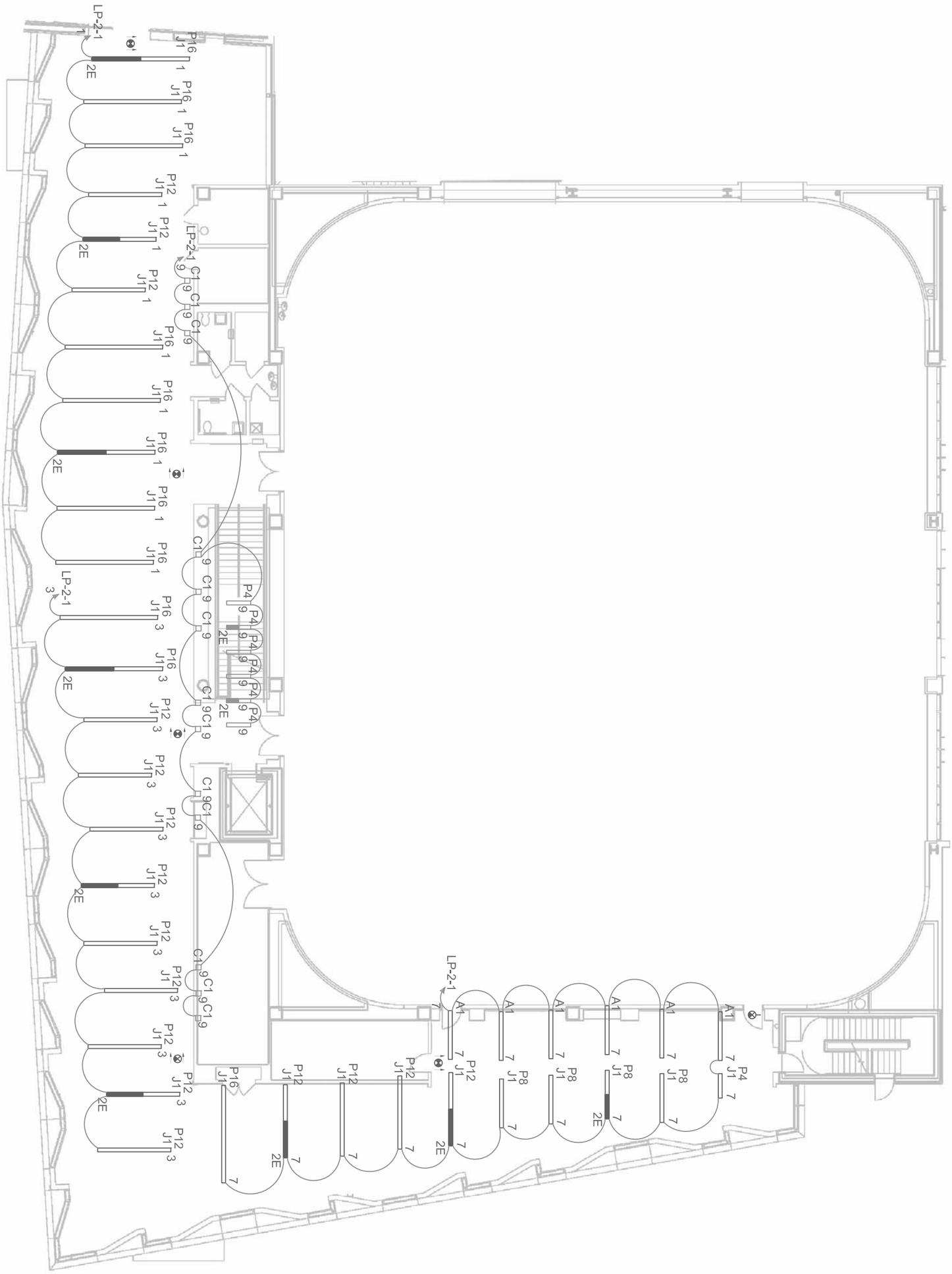

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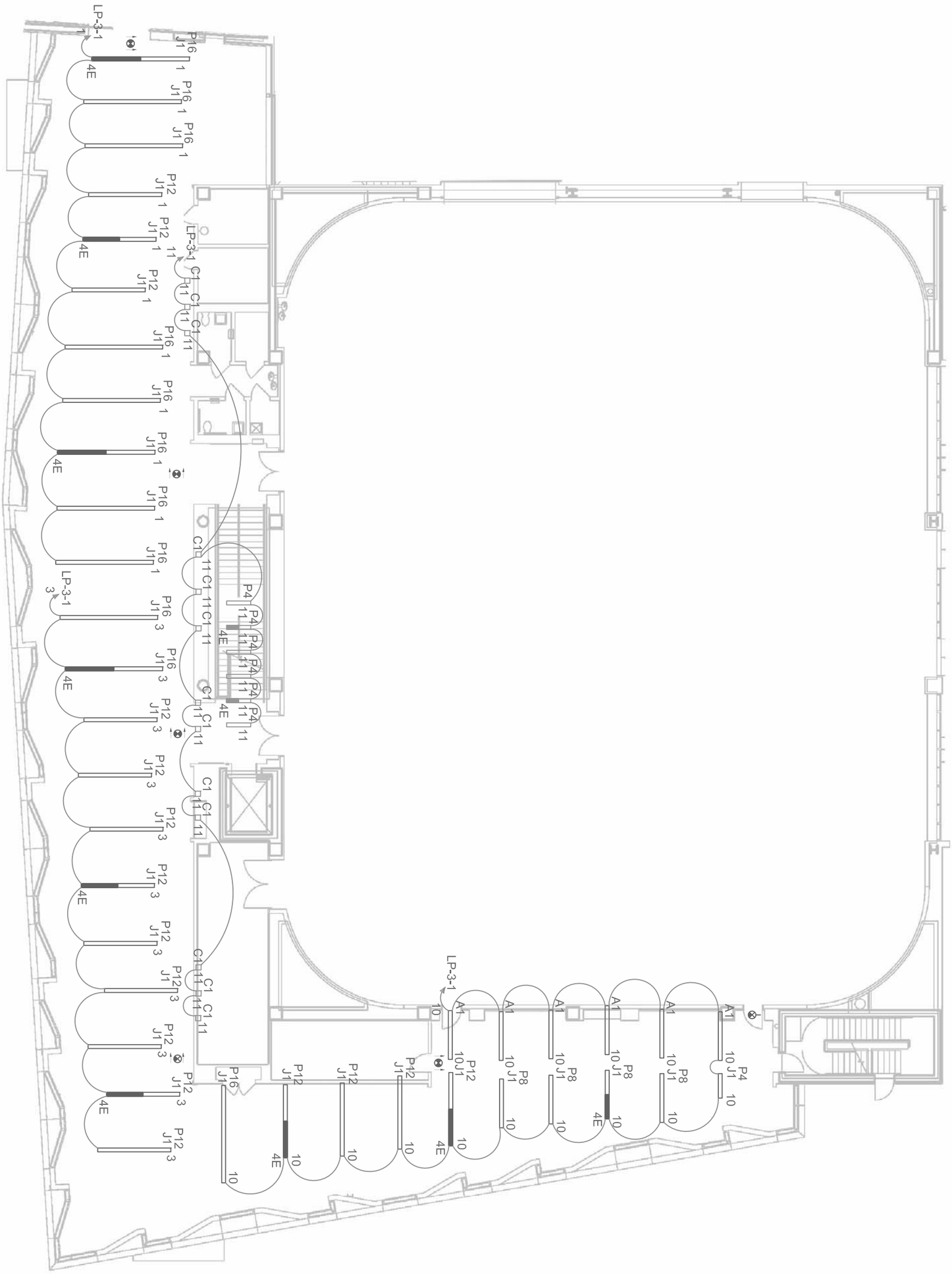
Fitness Center Second Floor
Lighting Plan 1/16" = 1"



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Fitness Center Third Floor
Lighting Plan 1/16" = 1"

Lobby
Lighting Plan 1/16" = 1"

Drawing notes:

1. All emergency luminaires of type C2 are connected to emergency lighting panel ESLP-1-1.
2. All luminaires of type J2 are on lighting panel LP-1-1, circuit 4.
3. Luminaire type C2, typical of 147.

C2 3

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Restaurant
Lighting Plan 1/16" = 1"

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