final report

angelica santana | lighting/electrical

princeton neuroscience and psychology complex, princeton, new jersey

Architectural Engineering Senior Thesis Final Report

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. Executive Summary .

The Princeton Neuroscience & Psychology Complex will be a state-of-the art lab and educational facility and the newest addition to the science community at Princeton University housing both the Neuroscience Institute and the Psychology Department.

Concepts inspired by the occupants and the architecture are used to design the lighting in four spaces. The core of the report covers the design and analysis of these four spaces (North Entry, Lobby, Lecture Hall, and Cafeteria) and the electrical changes that accompany it. Main concepts include themes that relate to the brain and psychology like “connection, mirroring opposites, static motion, and building as brain activity”. The lighting not only satisfies the themes but also meets human needs and is energy compliant. The report first analyses the existent systems and then proposes a different solution to the problem. It includes the entire lighting design process from concepts to criteria to design development and finally documentation.

Because lighting cannot be achieved without electrical, another mayor portion of this report includes electrical design. The four spaces where the lighting changed consequently caused changes in the circuits where the original lighting was. The panelboards affected are redesigned, and voltage drop calculations are performed as well as a short circuit analysis through one path of the system. Also, a motor control center design is included as well as a bus duct study that compares aluminum to copper.

For the breadth topics, the ceiling in the Lecture Hall is re-designed using the lighting concepts to fully integrate architecture and lighting. Because of the functions of the space, acoustics is an important part. Therefore, an acoustical analysis is shown calculating reverberation time for speaker-type settings.

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www.engr.psu.edu/ae/thesis/portfolios/2011/azs168

project team

design architect	Rafael Moneo Valles Arquitecto
architect	Davis Brody Bond, LLP
structural/mep	Ove Arup & Partners
contractor	Barr & Barr, Inc.
lighting	Fisher Marantz Stone

statistics

occupancy	academic
size	248,000 sf
levels	6 one side, 5 other
construction	summer 2010-spring 2013
delivery	design-bid-build

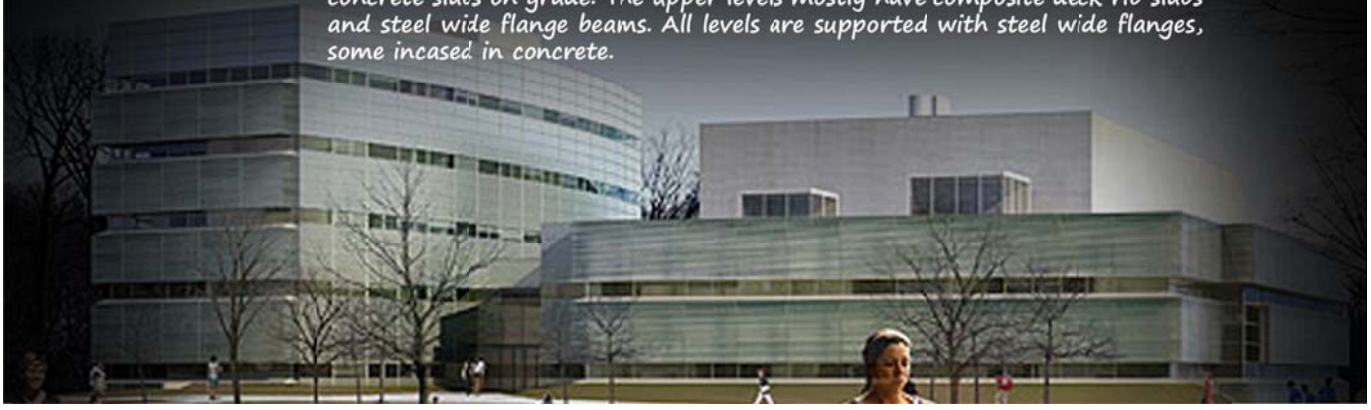
architecture The Neuroscience & Psychology Complex at Princeton University is comprised of two modern structures joined by a common space. The buildings' design not only connects with the complex landscape but also binds the two separate disciplines. Bridging the two sciences is essential for collaboration and community The complex facade carries the theme of connection by having rain screens in between floors hiding where the slab separation would be.

lighting Lighting in the non-laboratory spaces includes recessed linear fluorescent wall grazers, troffers, and channels accompanied by recessed compact flourescent and halogen downlights and accent lights. Metal halide floodlights highlight the light monitors. Through the circulation spaces, Cirkul fixtures by Louis Poulsen provide diffuse illumination. Lab space lighting is provided by flourescent sources including surgical troffers, high-bay, sealed, and downlights. Controls include daylight and occupancy sensors.

electrical The utility company, PSE&G, supplies electricity at 4160V to campus main location which feeds each building. Two service entrances feed two double-ended substations; one with 480Y/277V 3P 4W and the other with 208Y/120V 3P 4W secondary service. The 4160V generator provides emergency power. Both voltage systems are carried up the building in busways.

mechanical Nine air handling units (AHU) provide a total flow rate capacity of 137,000 cfm. Seven units are in Level 3 Penthouse and serve the north and south variable air volume (VAV) system, laboratories, and the Neuroscience chilled beams. The remaining two are in Level C/B and serve the Psychology chilled beams and the lecture hall.

structural The structural system includes column, wall, and braced frame concrete pad footings with reinforcing in both directions. Nine braced frames run along the height of the buildings. Level C/B has from 6"-12" one-way and two-way concrete slabs on grade. The upper levels mostly have composite deck rib slabs and steel wide flange beams. All levels are supported with steel wide flanges, some incased in concrete.



. General Building Statistics .

Building General Data

Name | Neuroscience & Psychology Building Complex

Location | Princeton, NJ
Campus location: south of Icahn Laboratory on the current site of Lot 20, next to Roberts Stadium

Occupants | Neuroscience Institute and the Psychology Department

Function | Educational: state-of-the-art labs, faculty offices, and classrooms

Size | 248,000 sq.ft.

Stories | Psychology building is six stories high, while the neuroscience building is five stories

Design architect | Rafael Moneo Valles Arquitecto

Executive architect | Davis Brody Bond, LLP | http://www.davisbrody.com/

Laboratory planning | GPR / Jacobs Consultancy | http://www.jacobsconsultancy.com/

Structural/MEP | Ove Arup & Partners Consulting Engineers, P.C. | http://www.arup.com/

Landscape architects | Michael Van Valkenburgh Associates, Inc. | http://www.mvvainc.com/

Civil/site engineers | Van Note–Harvey Associates, P.C. | http://www.vannoteharvey.com/

Construction manager | Barr & Barr, Inc Builders | http://www.barrandbarr.com/

Princeton project manager | Ahmed Sultan

Princeton program manager | Mark Wilson

Date of construction | Summer 2010 to Spring 2013

Cost | Approximately 180 million dollars, exact cost not available at this time

Project delivery method | Design-Bid-Build

Architecture

The Neuroscience & Psychology Complex at Princeton University is comprised of two modern structures joined by a common space. Designed by Jose Rafael Moneo Valles who is known for "integrating contemporary architecture into rich physical contexts", the buildings' design not only connects with the intricate landscape but also binds the two separate disciplines housed within with a literal bridge-like shared area. Linking the two sciences is essential for collaboration and community which is enhanced by the location of the site adjacent to the physics, chemistry, and genomics buildings. The buildings' facades carry the theme of connection by having rain screens in between floors hiding where the slab separation would be. The lighting, another key feature of the design, will join the exterior to the interior. Where the light does not penetrate through the glass skins of the façade, there will be light monitors spanning the entire height of the building allowing the light to cascade down connecting all the different levels.

SITE UNDER CONSTRUCTION, ICAHN LAB TO THE LEFT

Codes

IBC 2006, NSPC 2006, IMC 2006, NEC 2008, N.J.A.C. 5-70 and 5:23-7, ASHRAE 90.1 2004 | New Jersey Building Codes

Building Enclosure

"The outer walls, composed of two "skins" of glass with a three-foot-wide airspace sandwiched between them, will have a luminous quality and will be energy-efficient". The façade curtain wall's main feature is the rain screen modules made of cast glass with an air gap and insulating spandrel translucent glass

units behind. In between these bays, there is vision glass that allow light to reach each floor. (Princeton University News). The roofing consists of 4lb lead flashing set in asphalt mastic, “tremco” burmastic-200, 4 ply roofing system, ½” densdeck, and polyisocyanurate insulation.
Zoning | Township of Princeton Municipality

Sustainability

Princeton is very concerned with the environment and all new construction is expected to meet LEED Silver standards. To do so, the complex will include:

- Natural lighting, automatic lighting controls
- Storm water reclamation system for non-potable use
- High performance exterior façade featuring outer ribbed glass sunscreen and inner high-performance
- Energy efficient HVAC system including heat-recovery system
- Low flow plumbing fixtures

Construction

Construction for the Neuroscience & Psychology Complex began in May 2010 and is expected to be completed in spring of 2013. The estimated cost for the buildings is 180 million dollars. Actual costs have been withheld by the Princeton. The construction manager is Barr & Barr Builders, Inc. and the project delivery method is design-bid-build. Within the campus, the building was strategically located adjacent to other science buildings to enhance and promote collaboration between them. The complex is located south of Icahn Laboratory on the current site of Lot 20, next to Roberts Stadium.

Lighting

There are two separate lighting systems in the building. Lighting for public spaces was designed by Fisher Marantz Stone. The general lighting is mostly fluorescent. Classrooms and corridors have fully recessed linear fluorescent wall grazers to highlight perimeter walls and provide lighting for circulation. Classrooms and seminar rooms include fully recessed linear fluorescent troffer for high ambient illuminance levels necessary for reading and writing. The circulation spaces (corridors, nodes, stairs, cafeteria, and vestibules) are lit with Cirkul fixtures by Louis Poulsen in several sizes and mountings depending on the location. There are fully recessed compact fluorescent downlight with 7” aperture throughout the offices. Linear fluorescent channels provide the necessary levels in the restrooms and are used as perimeter lighting for the cafeteria. The main lecture hall light source changes to low voltage tungsten halogen donwlights and steplights to highlight the wooden panels and dim correctly for the projector mode. Ceramic metal halide floodlights were used on all light monitors (stairways).
The rest of the complex, including the laboratory spaces, was done by Ove Arup. Lab lighting systems are completely fluorescent with some LED tasklights. Fluorescent systems include troffers, recessed downlights, high-bay fixtures, suspended utility fixtures (electrical rooms), sealed single and double lamp fixtures, and surgical troffers.
Complex controls are located throughout the building. They include daylight photocell sensors (off or dimming), occupancy sensors, manual dimming, and building timelocks.

Electrical

The Neuroscience & Psychology complex has an intricate electrical system design due to its large area and complicated laboratory spaces. The electricity supplied by the utility is bought by Princeton University at 4160 primary voltage. There are two service entrances that feed two double ended substations; one distributes electricity to the building at 408Y/277V and the other at 208Y/120V. The 480/277V system includes the following general loads: lighting, AHUs, and mechanical. The 208/120V system feeds the following general loads: receptacles, server racks, and VAV boxes (single-fed). The most common over current devices are draw-out circuit breakers. Emergency power comes from the exterior generator that feeds the emergency transformer, switchboard, and fire pump. The grounding system is very complex. Special equipment includes uninterrupted power supply systems and transient voltage surge suppressors.

Mechanical

There are a total of nine air handling units that provide air conditioning to the entire complex with a total flow rate capacity of 137,000 cubic feet per minute (cfm). Seven are located in Level 3 (penthouse MER) and serve the following areas: south variable air volume (VAV) system, laboratories, Neuroscience building chilled beams, and north VAV system. The remaining two are located in level C/B (MER) serve the following areas: Psychology Building chilled beams, and Lecture Hall. The air handling units include a supply fan, preheat coil, cooling coil, heating coil, return fan, glycol hr. (heat recovery) coil, humidifier, pre-filter, and a final filter.

Labs are required to have 100% outside air. The rest of the spaces have return air or heat recovery wheels. There are 25 fan coil units from International Environmental (IEC). Variable air volume boxes capacities range from 0-4500 cfm. Their sizes range from 5”-16” diameters and up to 24x16 rectangular areas. There are a total of four chilled beam types, three hot water cabinet/unit heaters, and 13 chillers. The mechanical system also includes three radiators with a total capacity of 1400 BTUH/LF.

Chilled water supply and return is rated at 300 psi and comes through the CHW main service valve provided by Princeton University. Steam supply is also rated at 300psi and enters through the service valve also provided by Princeton University.

Structural

The main structural systems for the Princeton Neuroscience and Psychology systems are described below. Level C/B has a slab on grade that includes 6” and 12” two way concrete slabs, 6”/11”/12” one way concrete slabs, and composite deck rib (D1). There are also some grade beams, typically GB1 and GB2. Steel wide flange and HSS columns encased in concrete support the floors above. The upper levels mostly have composite deck rib (D2 and D3) and are supported with steel wide flange beams.

For moment support, there are a total of nine braced frame systems with braced frame footings. Column footings have both long and short direction reinforcing and exist in two options throughout the building ranging in 20 different sizes. Wall footings have dowels to match wall reinforcing and exist in four different sizes.

For vibration attenuation in important laboratory spaces, the floor structures are suspended. They are composed of suspended steel framing with composite slab and are limited to displacements of 2000 and 4000 micro-inches per second.

Fire Protection

For Fire Protection compliance, the New Jersey Uniform Construction Code, IBC 2006, U.C.C listed editions of National Fire Protection Standards were used. The objective of the fire alarm system is to provide safety for the occupants during an emergency.

Because of the building size and complexity of the spaces, the fire sprinkler system is extensive. There are several sprinkler head types including concealed pendant, upright, sidewall, extended sidewall, and window sprinkler heads. To supply water to the sprinkler heads, several piping systems were used. Wet, Pre-action, and Dry piping comprise the intricate fire protection piping system. Flow switches and tamper switches control the flow throughout the building as well as the different types of valves (gate, air release, casing relief, control with tamper switch, shut-off, check, OS and Y with TS, angle hose, dry, pre-action, and sprinkler alarm check). There is both a fire pump and a jockey pump with respective automatic fire pump controller with automatic transfer switch and jockey pump controller.

Transportation

To connect all the floors, six elevators, two doubles and two singles, and eight main stairways run up through of the complex. Several other stairways (18) connect single levels, especially in the C/B Level of the building and the exterior. The main transportation nodes are located in the following places; three in the Psychology building, one is the main Lobby, and four in the Neuroscience building. Some of the main stairways are also light monitors.

Three of the elevators are passenger, and three are service elevators. Only one is a Passenger Borehole Hydraulic elevator with an oil machine type with a 3000lbs capacity. The rest are Geared Traction elevators. The Service ones have a 5000lbs capacity while the Passenger ones have a 3000lbs one.

Telecommunications

There is a main server room located on level c/b which bonds with 8 Intermediate Distribution Frame (IDF) Rooms and one Building Distribution Frame (BDF)/IDF Room to form the backbone of the telecommunication system. These rooms cover every zone of the complex. There are several outlet types throughout the building including wall-phone, weather proof, standard IT, high density IT, and security camera outlets.

The server room has 40 racks in 6 rows with alternating cool and hot aisles and the necessary spacing for their accessibility and maintenance. A 12”x4” cable tray runs through the building’s corridors carrying all the necessary communication cables to most rooms.

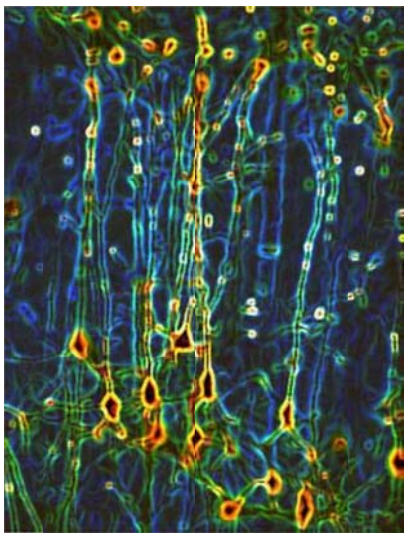
Audiovisuals

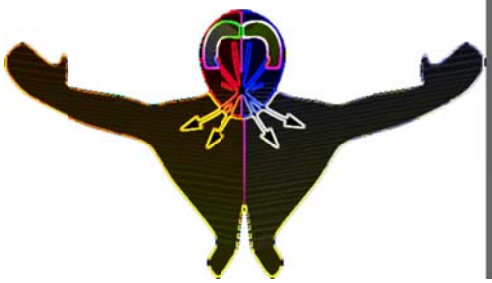
Audiovisual systems are located in all conference rooms in the building. They include a ceiling mounted data/visual projector with a projection screen with an electronic lower/raise switch, and ceiling speaker assemblies varying with room size. Several classrooms also have a similar arrangement.

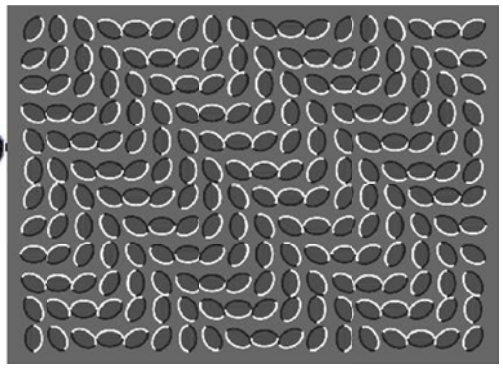
The main lecture hall has a projection booth at the rear of the room with ceiling mounted three projectors and screens that raise/lower in front of the chalkboards. There are speakers dispersed through the ceiling and in-wall stereo speaker assembly on both sides of the projection screens. There are also in-wall subwoofer assemblies below the projection screens.

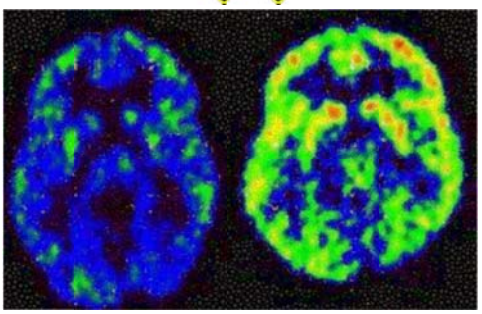
. Overall Concepts .

Lighting concepts were generated to catapult the schematic design of the Princeton Neuroscience & Psychology Complex in a way that represents its occupants and the architecture. Since the building is occupied by two sciences that deal with the brain, the main inspiration for the concepts was drawn from this. The first concept is ***connection***. There are 50-100 billion neurons in the brain linked with up to 10,000 synaptic connections each. Furthermore, the objective of placing both sciences in a complex together was to promote interaction between them while still maintaining their individual identities. That is why the building has two "towers" with a core lobby connecting them and with shared underground floors. The location of the building adjacent to other science buildings was to promote a sense of community between all sciences. Rafael Moneo Valles, the architect, is also known for integrating modern structures with intricate landscapes. The second concept is ***mirroring opposites***. The right side of the brain controls the left side of the body and vice-versa. There are two hemispheres in the brain just like in this building. The architecture has two sides, the "towers", which are not exactly alike but resemble each other which give the building"almost" symmetry. Also, the Neuroscience Institute and the Psychology Department are to interact and mirror each other while still being different. The third concept is ***static motion***. Synaptic connections in the brain appear as light moving through different paths. There is no movement, but the appearance of it through light. Appearance and perception is a major part of psychology as well as lighting. The last concept is ***building as brain activity***. Like a brain scan, where parts of the brain where there is activity are lit up, the building will represent the users and show the exterior what is happening in the interior. Control of the users and interaction of the lighting with the users will support this concept.









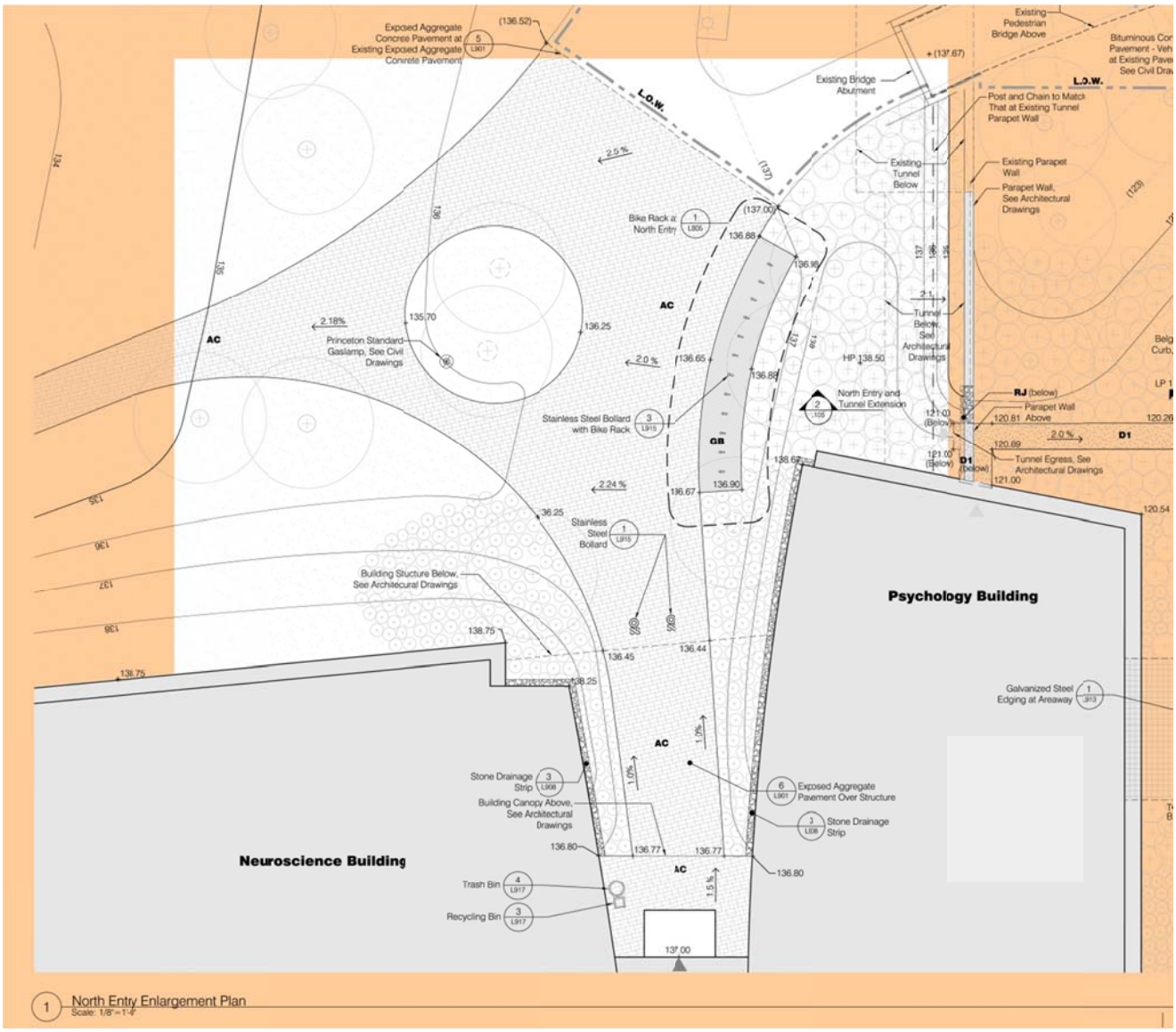
. Lighting Depth .

Exterior Space | North Entry

Existing Conditions

Description of Space

The north (main) entrance to the building is accessible by several pathways that connect in one node and lead you in. The walkways are surrounded by landscaping with many trees and smaller shrubs. The north vestibule leads into the lobby and is sandwiched by the Neuroscience and Psychology buildings. “The outer walls, composed of two "skins" of glass with a three-foot-wide airspace sandwiched between them, will have a luminous quality and will be energy-efficient” (Princeton University News). The façade curtain wall’s main feature is the rain screen modules.

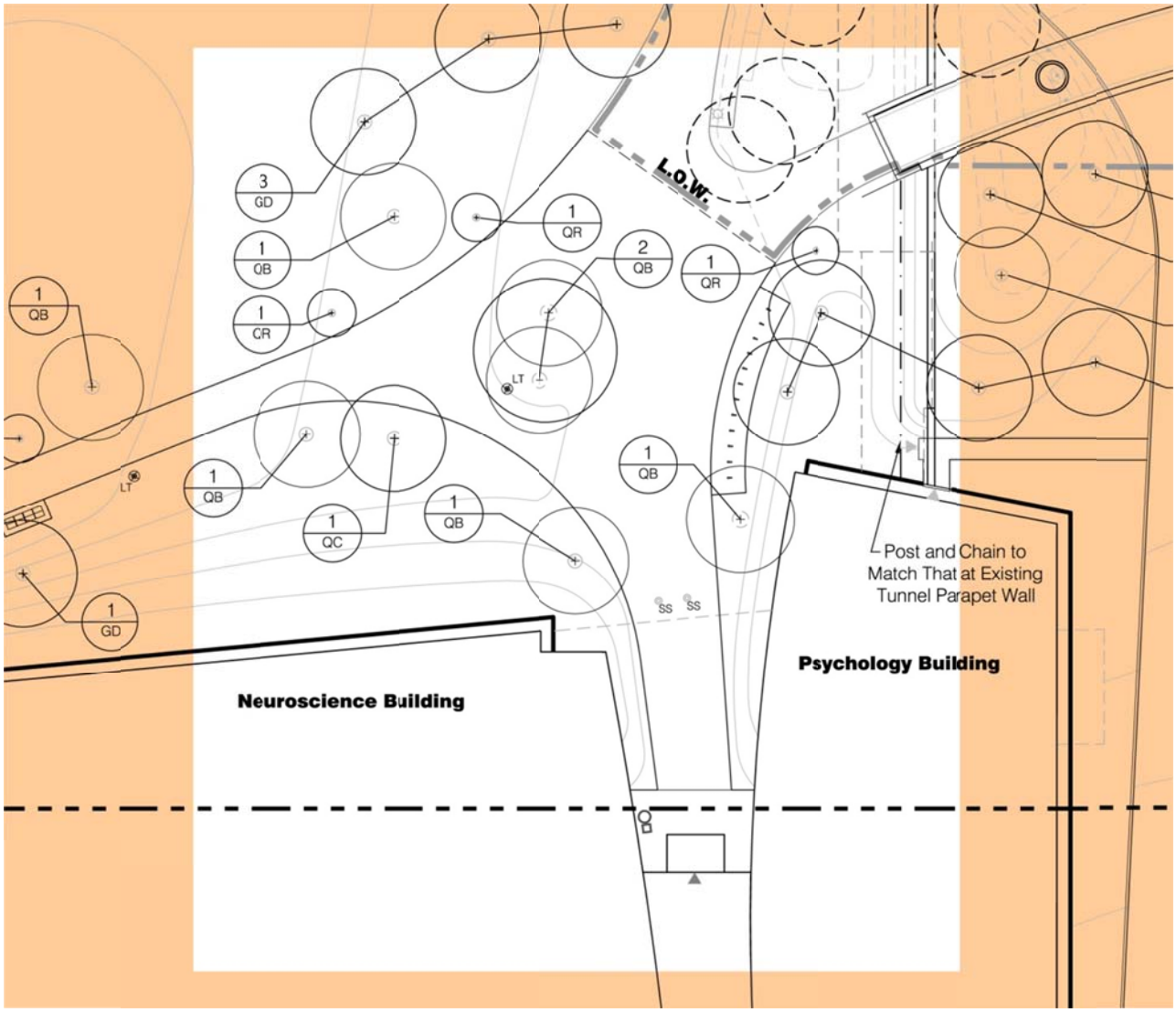


NORTH ENTRANCE, LANDSCPAE PLAN, NTS

Furniture and Surface Materials

Material	Reflectance *	Specifications #	Location
Exposed aggregate concrete pavement	0.35		Walkways
Granular pavement	0.30		Landscape
River jacks	0.26		Neuroscience and Psychology Buildings
Granite block	0.26		Bike racks
Stainless steel	0.60		Bollards, bike rack
Aluminum louver	0.65	08900	Curtain wall, façade
Vision glass	0.10	08800	Curtain wall, façade
Cast glass	0.20	08800	Curtain wall, façade
Translucent glass	0.25	08800	Curtain wall, façade
Spandrel glass	0.70	08800	Curtain wall, façade

*Assumed, some from Figure 1-36 from IESNA Handbook Page 1-22 and some from 3ds Max.



NORTH ENTRANCE, TREE PLANTING PLAN

Design Considerations

The façade has a very interesting curtain wall that acts as a rain screen. It includes several different types of glass (listed is the finish schedule above). The north vestibule exits at a pedestrian pathway that guides the way to the building. Night outdoors environments present several design challenges. The eye works differently at low light levels, people experience different emotions, and control of the light is expected. The façade must be illuminated in a way that attracts attention and enhances the architecture but at the same time complying with light pollution criteria and energy efficiency. The pathways must be illuminated to promote safety and security.

Visual Tasks

Guided circulation is the main visual task. The walkways need to be illuminated, and the entrance should have even higher levels to attract pedestrians. Safety and security needs to be addressed as well.

Qualitative System Performance Considerations

The following lists in order of importance the design issues that are of consideration for an exterior façade of a prominent building. The ninth edition of The IESNA Lighting Handbook was referenced ("Exterior Lighting", Chapter 21 and "Emergency, Safety, and Security Lighting", Chapter 29).

Very Important | Appearance of space and luminaires | Lighting should enhance the building's appearance at night and should attract attention to the entrance and make a favorable impression on the viewer. The lighting should render the structure otherwise lost without the sun, enhance the architecture, and guide pedestrians towards the main entrance. The architecture of the complex is very interesting and the curtain wall/rain screen is the main component and should be subtlety highlighted. The paths around the building intertwine and come together on nodes that resemble brain connections and the lighting should mimic this.

Very Important | Color appearance and color contrast | The natural colors of foliage and flowers is beautiful and the lighting should not omit it. Therefore, the CRI of lamps in the landscape should be good enough for pedestrians to see the full colors of their surrounding correctly.

Very Important | Direct and Reflected glare | Glare can be discomforting and impair visibility reducing safety and security.

Very Important | Light pollution/trespass | To control light pollution, the flux above the horizontal must be limited, non-target illumination minimized, and some of outdoor lighting turned off during hours of low use. To control light trespass, areas adjacent to the lighting design must be inspected, full-cut off reflectors and refractors and well shielded luminaires must be used, and floodlight angles must be kept low. All construction in Princeton University is expected to attain LEED Silver Accreditation. The point that deals with Light Pollution Reduction is not required to add up to the Silver rating therefore it is not required. However, light trespass and community affect the community so it must still be taken into account.

Very Important | Modeling of faces or objects | It is important to model faces of pedestrians walking around the entrance at night to increase security in the area.

Very Important | Peripheral detection | The lighting of the entrance should attract attention from people passing by on foot or car and should leave a positive impression. To better attract attention, the building entrance should be able to be detected from the peripheral view. With regards to security, being able to see peripheral movement for pedestrians is important.

Very Important | Points of interest | The main point of interest of a building exterior is usually the entrance. Therefore, the lighting design should guide the visitors to the entrance, either the north or south vestibules. The second point of interest will be the architecture and landscape, especially the nodes of the pedestrian walkways. Effective exterior lighting includes minimal ambient levels with highlights on points of interest such as destinations, architectural features, and hazards.

Very Important | Shadows | Patterns of light will highlight certain parts of the building leaving others in shadows. Without shadow, there is no light, and the use of both makes for an interesting exterior lighting design. See the description of Light distribution on surfaces above for more information.

Very Important | Source/task/eye geometry | When lighting the exterior, bollards should not be the only light source because they do not address higher vertical surfaces, like faces, and source/task/eye geometry would be hindered.

Very Important | Surface characteristics | Surface luminance is important for an exterior environment. It adds interest and depth to the scene while providing good visibility and security. Some of the surfaces in the exterior to be lit include landscape surfaces. Special attention must be paid to plant shape, size, foliage characteristic, branching pattern, trunk conditions, rood depth, growth rate, and seasonal changes.

Very Important | Illuminance (horizontal) | Horizontal illuminance is important for safety and security on pedestrian walkways and entrances around the building, especially the north and south vestibules. It is not of concern for the façade itself. The illuminance value required is listed below.

Very Important | Illuminance (Vertical) | Vertical illuminance is important for security and safety because it provides facial recognition and aids in peripheral vision. The sense of security provides a lighting that will allow enough response time to escape from a potential threat.

Important | Light distribution on surfaces | Patterns of light and shadow affect task visibility on interior spaces but they increase contrast on exterior spaces making them interesting. Therefore, uniformity is not a criterion in this case.

Important | Sparkle/desirable reflected highlights | Reflected highlight and sparkle can be discomforting in interior situations but can add character to an exterior environment by highlighting certain surfaces. Here, the building will have more a uniform and subdued glowing feel and contrast, with few reflections and sparkle.

Quantitative System Performance Considerations

Illuminance (horizontal) | 5fc (50lux) for Building Entrances

Illuminance (vertical) | 3fc (30lux) for Building Entrances

Illuminance (Building and Grounds Security) | 0.5-2fc

Luminance ratios | High luminance differences in exterior night settings can cause annoyance, impair task visibility, create safety hazards, and disrupt the surrounding community. Therefore luminance levels should be lowered and the ratio should be set in accordance to the setting and the community. It should not exceed 20:1.

Energy

ASHRAE 90.1 2004

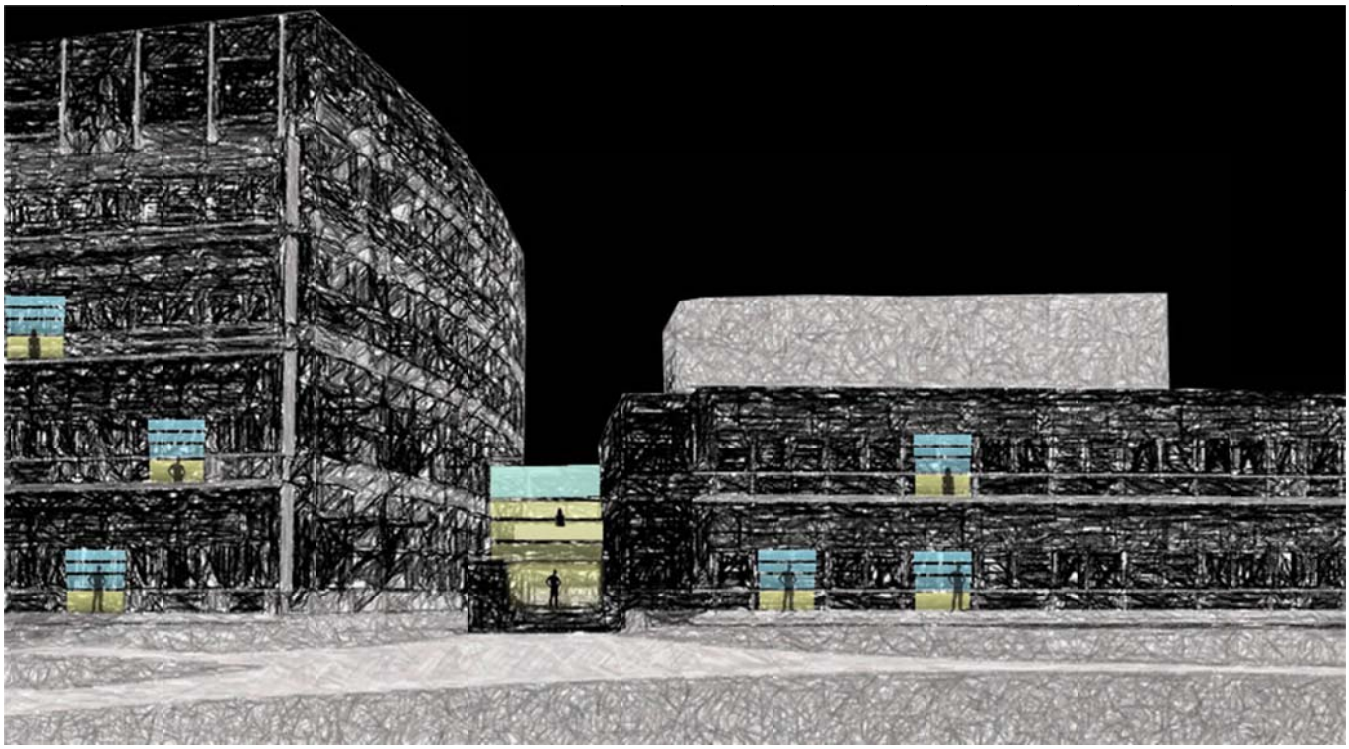
Building Exterior Lighting Power Densities | Walkways less than 10 feet wide: 1.0 W/lf
Walkways 10 feet wide or greater,
Special feature areas: 0.2 W/sq.ft.
Main entries: 30 W/lf of door width
Canopies: 1.25 W/sq.ft.
Building facades: 0.2 W/sq.ft. or 5.0 W/lf

Lighting Redesign

Lighting Solutions

The objective of the lighting in the North Entry pathway is to safely guide pedestrians to the building and to the nodes where they can take different routes. To do this, LED in-ground luminaires were places along the walkways with their spacing decreasing as they approach the nodes and the building. This spacing difference creates a ***static motion*** effect. For safe circulation, pedestrian light poles whose shape resemble brain ***connection***, the walkways, and the Streicker bridge, were distributed evenly along the opposite side of the pathway were the small LED circles are. To add more attention to the nodes, up-lights graze the tree trunks. The façade will remain unlit so that the lighting from the spaces within cause the translucent panels to glow and the clear vision glass will provide the transparency showing the ***activity*** within.

CONCEPTUAL SKETCH PLAN OF LIGHTING



CONCEPTUAL SKETCH OF FAÇADE LIGHTING

Controls

The exterior luminaires will be controlled using time-clock capabilities to save energy when the system is not being used but keeping it simple without the need for daylight sensors.

Summary Performance Evaluation

Overall the new lighting design works adequately to meet criteria for safety and security. Pedestrian lamp-posts provide vertical illumination for face recognition and more than the required levels on the ground for circulation. Higher levels at the entrance attract people this way as well as towards the nodes by up lighting the trees. The LEED points regarding light trespass and night sky are not required for their certification so up-lights can be used for landscape lighting but they will still be kept to a minimum. The LED decorative fixtures placed at different intervals enhance the static motion effect.

Documentation

Lighting Schedule / Ballast Schedule

Type	Description	Lamp	Watt	Volt	Mfr	Catalog #
AB	Recessed compact fluorescent downlight with 6" nominal diameter aperture with aluminum, bright anodized reflector with plastic, translucent diffuser and integral electronic ballast, 3000k	PHILIPS PL-T 18W/830/4 P/ALTO 82CRI	18.4	277/120	Edison Price	TRPV 18/6
AM	Pole top metal halide exterior indirect adjustable luminaire with die-cast aluminum optical housing and 31.5" diameter and .25" thick aluminum plate secured by two die-cast aluminum "saddle" with maximum 30 degrees tilt and IP65 classification.	PHILIPS CDM Elite 70/T6/ 930 90CRI	88	277	Bega	8200MH
AP	Recessed exterior round drive-over in-ground halogen up light for foliage with stainless steel housing, convex tempered glass diffuser, anodized matte reflector, and natural bronze casting finish, rated IP67, with integral electronic transformer.	35W T4 GY6.35 12V	46	120/11.6	Bega	8702
AR	Fully Recessed LED indicator in-ground luminaire for both outdoor and indoor applications, with remote constant 6V driver, stainless steel housing, rated IP67, and visible nominal diameter of 7/8" with the base being nominal 5".	LED	0.08	277	MP Lighting	L06-WS27S-X-X-S6

Type	Location	PF	Input Current	Input Wattage	Lamp Wattage	Other	BF
AB	page 17-5 GE catalog	0.97	0.08	20	18	ProLine CFL Electronic Ballasts	1.05
AM	page 18-11 GE	0.9	0.4	88		86847	1
AP		1		46	46		1
AR		1		0.08	0.08		1

Lighting Plan

REFER TO APPENDIX L FOR FULL SIZE DRAWING WITH SCALE

Visual Performance | Visual Quality

Zone	Average Illuminance	Maximum	Minimum	Max/Min	Coeff. Variation
Pathways	1.72	3.90	0.60	6.50	0.42
Entrance	10.00	21.80	4.50	4.84	0.61

Light Loss Factor Calculations

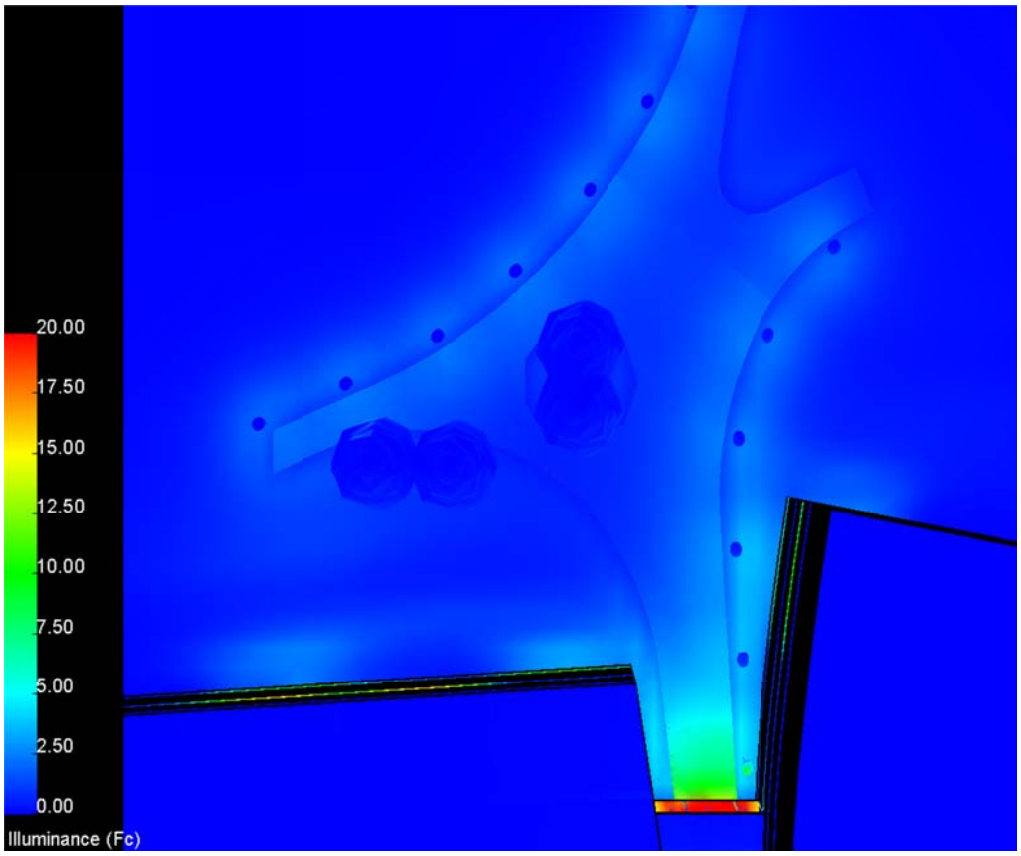
Luminaire Type	Lamp Lumen Depreciation	Ballast Factor	Lamp Dirt Depreciation	Total Light Loss Factors
AB	0.86	1.05	0.95	0.86
AM	0.89	1.00	0.75	0.67
AP	1.00	1.00	0.75	0.75
AR	0.70	1.00	0.75	0.53

Energy Calculations

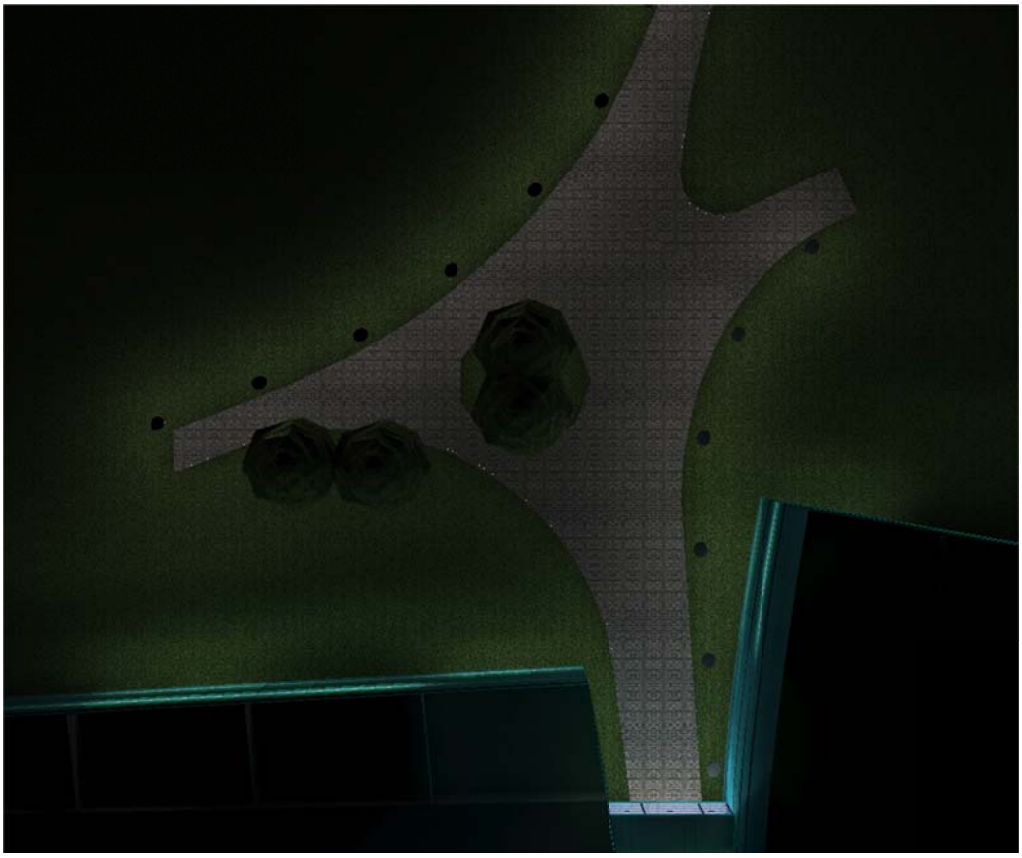
	Walkways (>10ft wide) W/sq.ft.	Main Entry W/lf	Canopies W/sq.ft.	Building Façade W/sq.ft.
Allowable LPD	0.14	30	1.25	0.2
		Total Allowable Watts		1414.54
		Actual Watts		1239.84
		Percentage		12.350

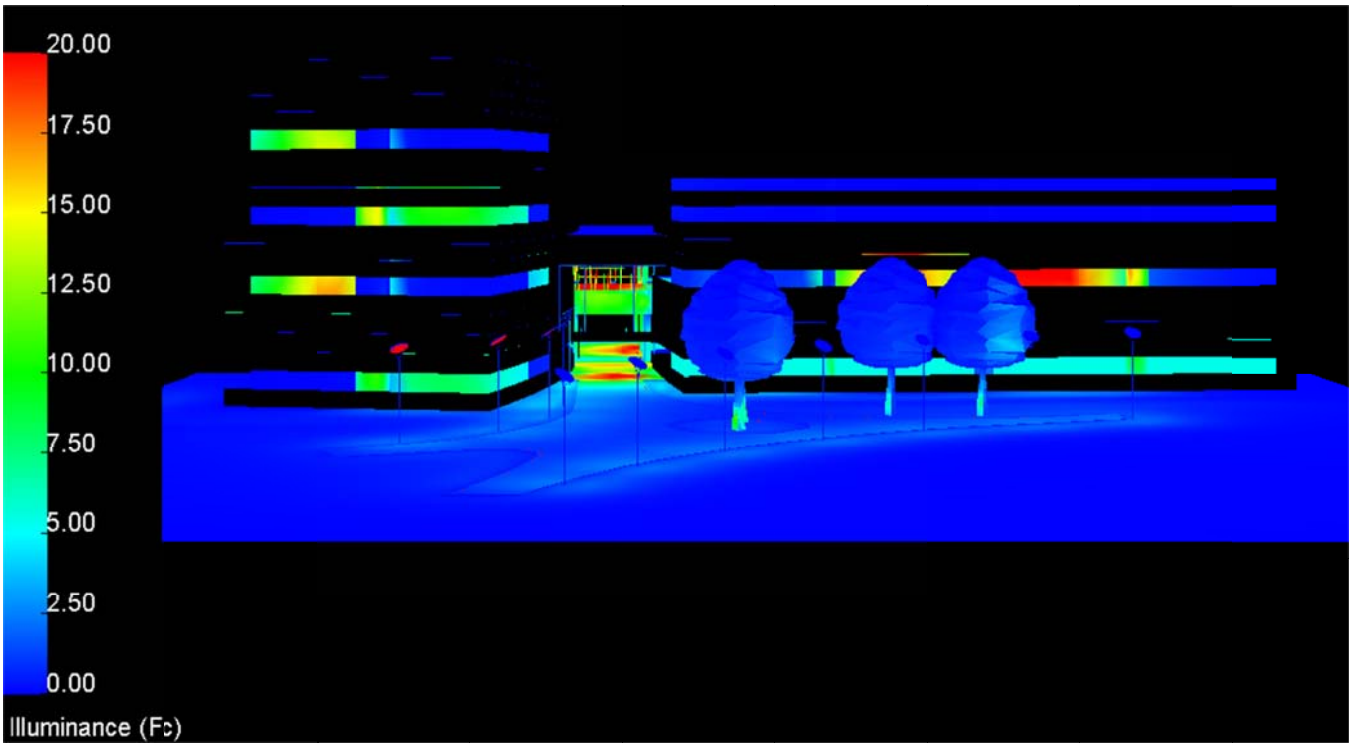
Area Pathways	Main Entry Length	Canopy Area	Façade Area
5461	7	352	0

Luminaire Type	Watts/ Luminaire	Amount	Total Wattage
AB	18.4	4	73.6
AM	88	9	792
AP	46	8	368
AR	0.08	78	6.24
	TOTAL WATTAGE =		1239.84



PLAN VIEW IN PSEUDOCOLOR AND MATERIAL MODE FROM AGI32

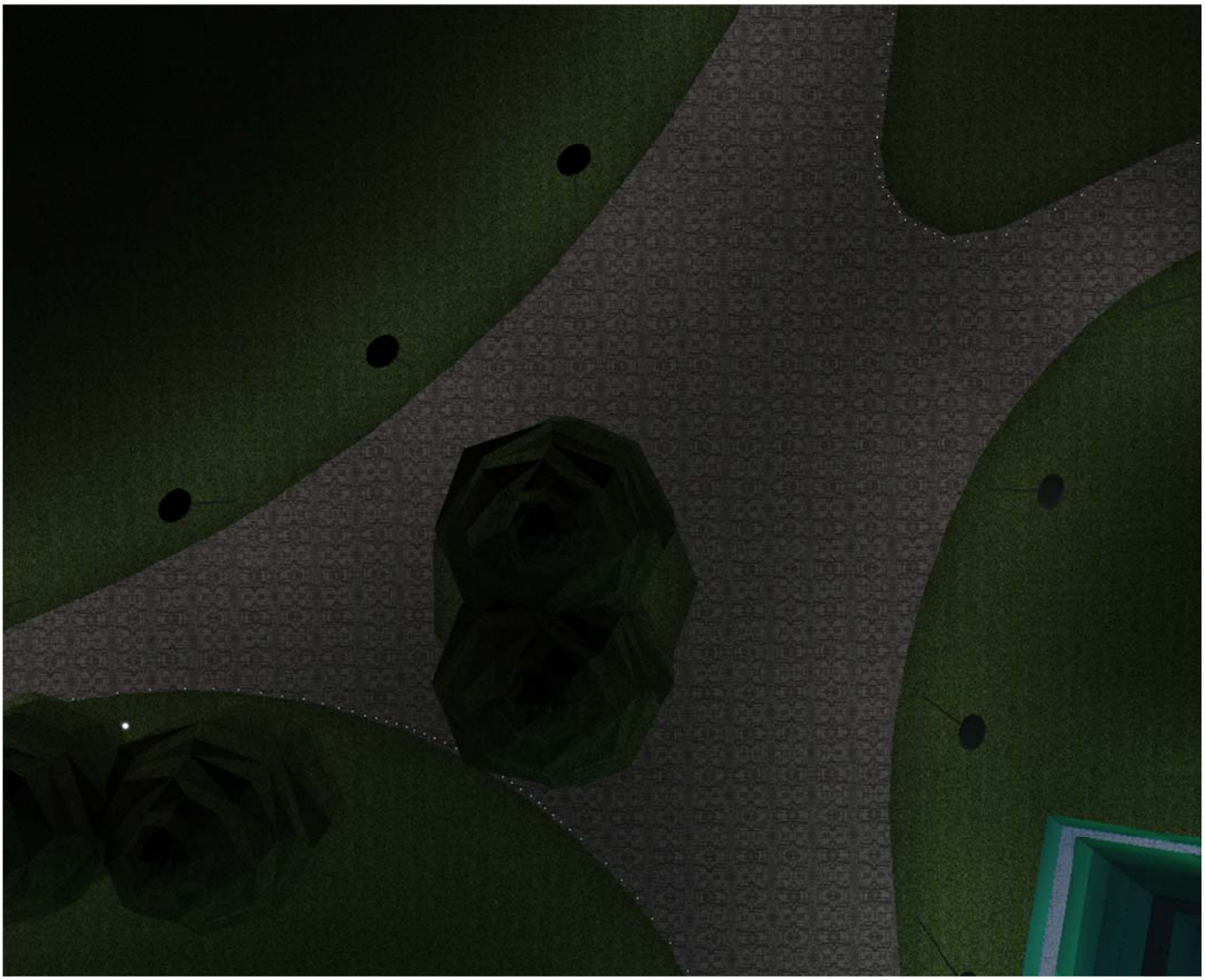




VIEW FROM ICAHN LAB IN PSEUDOCOLOR AND MATERIAL MODE FROM AGI32

VIEW FROM PEDESTRIAN LEVEL TOWARDS NORTH ENTRY

VIEW FROM PEDESTRIAN LEVEL TOWARDS NORTH ENTRY



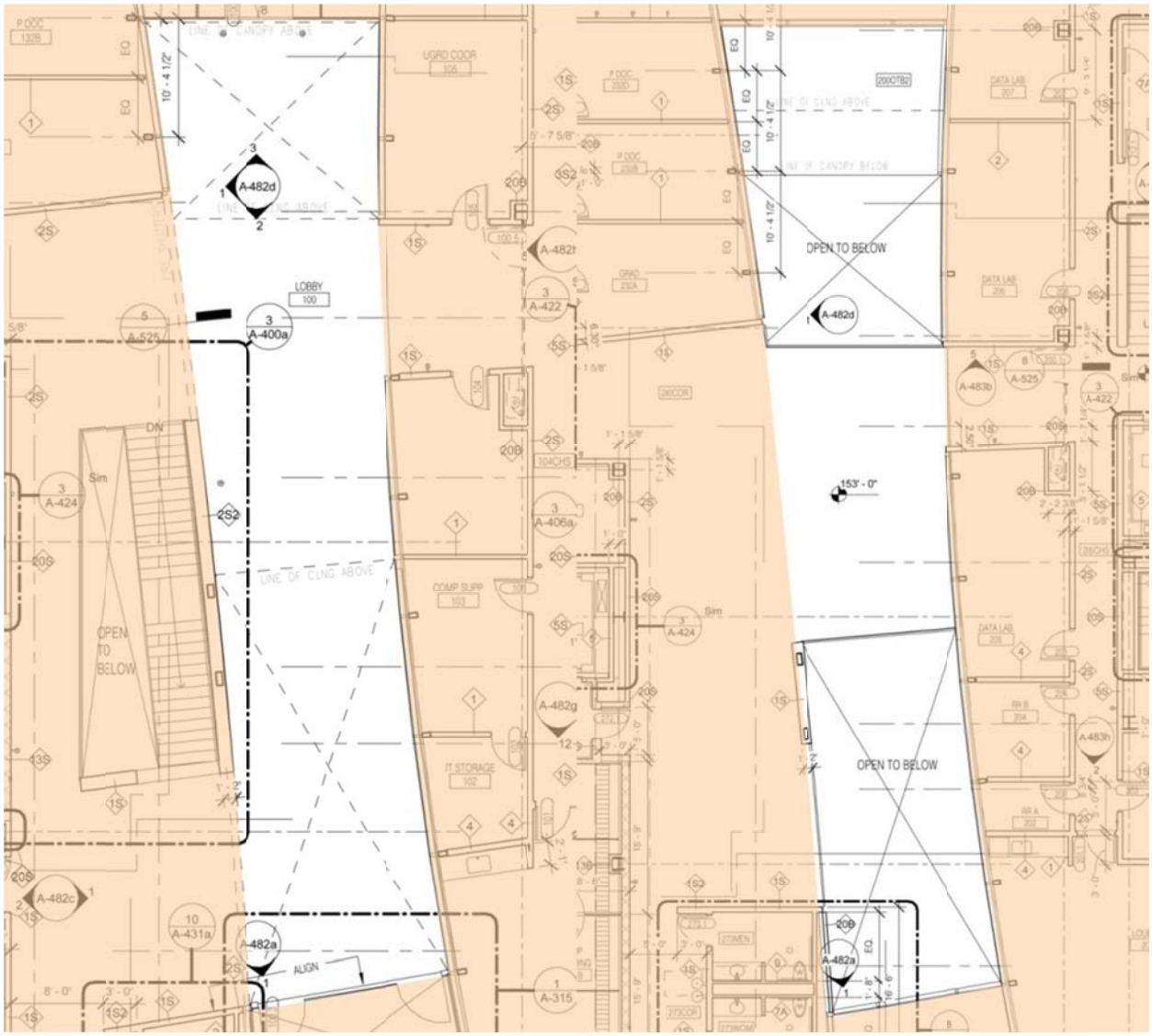
VIEW FROM ABOVE TO SHOW SPACING OF FIXTURE TYPE AR

Circulation Space **| Lobby |** Three Schematic Design Concepts

Existing Conditions

Description of Space

This space brings both the Neuroscience and Psychology buildings together. It fills the gap and ties the architecture of both buildings connecting physically the science departments and bridging the exterior to the interior. Geometrically, it resembles the Streicker Bridge shown below which also provides a pedestrian connection between science facilities and is adjacent to the complex. It has curved walls on both sides and is capped by two vestibules on the north and south entrances. The lobby is two stories high and the first floor is more of a reception and circulation area while the second is a lounging space. The brain has millions of connections. Because this building deals with the science of the brain, this space of connection will be a key element in the entire lighting design and will carry the theme of the connection of the entire building.



LOBBY FIRST FLOOR PLAN LOBBY SECOND FLOOR PLAN

Furniture and Surface Materials

Stone covers several walls and the floor making contrast with the glass from the interior curtain wall of both buildings. A key feature is the wooden panel wall. Below is a complete list of the materials and their reflectances:

Material	Reflectance *	Specifications #	Location
Glazing	0.10	08900	Interior and exterior curtain wall
Aluminum framing	0.65	08900	Interior and exterior curtain wall
Painted gypsum wall board	0.70	09250	Part of Walls
Vision glass	0.10	08800	Interior and exterior curtain wall
Opaque glass	0.25	08800	Interior and exterior curtain wall
Glacier Blue Devonian Sandstone, honed finish on all exposed surfaces	0.30	04401	Part of Walls
Stone	0.30	09600	Floor
Wood panels	0.25	06400	Special Wall

*Assumed, some from Figure 1-36 from IESNA Handbook Page 1-22 and some from 3ds Max.

Design Considerations

The lobby is the first impressions visitors get of the building so it must be aesthetically pleasing and the lighting should enhance the architecture. Since it is a transition space from the exterior to the interior, illuminance levels need to make the change comfortable. Walls are the most important part of the lobby and they should be highlighted. Here, some walls are made of stone which will look good grazed while the rest of the walls are glass. The ones that have translucent glass will be able to glow while the clear ones will allow light from adjacent rooms to trespass. Since there was no criteria for lobbies in educational facilities, the criteria for office lobby was used.

Three Schematic Designs

Since the lobby space is the most important space for the theme of connection in the complex, there will be three schematic lighting designs done to represent the idea. All designs will carry the theme of connection and circulation in different ways. The designs will explore guided and random circulation, neuroscience and the millions of brains connections as a theme, psychology and the effects lighting has on humans, and architecture.

Visual Tasks

The main task will be guided circulation. When a visitor walks into this space, he has several options of where he could go. The lighting will help guide visitors in and through the space. Another task is to show the theme of connection with the lighting. This is also a space that will be used for egress in case of emergencies. Therefore, the lighting must comply with safety requirements. As the main entrance to the building, security requirements must also be met.

Qualitative System Performance Considerations

The following lists in order of importance the design issues that are of consideration for a lobby. The ninth edition of The IESNA Lighting Handbook was referenced (Offices; Lobbies, lounges, and reception areas).

Very Important | Appearance of space and luminaires | Coordination between the space, the luminaires, and the architecture can produce visually appealing spaces leaving a positive impression on visitors. Since the architecture is modern and interesting, the fixtures should either appear invisible or complement the architectural design while guiding pedestrians through the building.

Important | Color appearance and color contrast | Usually the lobby has the most expensive finishes and surfaces. To render their color appearance properly, lamps must have a good CRI. This will enhance the first impression of the building.

Important | Direct glare | Direct glare is uncomfortable. The lighting should provide a safe transition from the outside to the inside by not blinding the pedestrians as they enter the building. Overhead glare is also annoying but since people will be circulating through the space, the effects of it will not be too

bothersome. To minimize glare, luminaires luminances should not more than 100 times of those of the surrounding surfaces.

Important | Light distribution on surfaces | Patterns of light and shadows cause discomfort and affect visibility. Therefore, uniform light distribution is desirable and luminances levels should be within 3:1 ratio for different surfaces within the room.

Important | Luminances of room surfaces | Most wall surfaces on the lobby have low reflectances; therefore, more light will be needed for them to have higher luminances.

Important | Modeling of faces or objects | As a circulation space, the lobby will be full of people. Without good modeling of faces, they will look flat and unattractive. The lighting should make people feel and look better. Modeling of objects helps reveal the shape, depth, and texture. One of the main walls in the lobby is made of stone and the lighting should add depth by enhancing its texture. Modeling of faces is also important for security reasons.

Important | Surface characteristics | Surfaces have a profound effect on the interaction between the light and the space. Therefore, the lighting designers should coordinate with the architect to select building material and lighting systems that complement each other and achieve a good impression on the visitors.

Important | Illuminance (vertical) | In a lobby, even though the circulation plane is horizontal, people look at vertical surfaces to see where they are headed. Vertical illuminance highlights these surfaces. Also, the walls are the most important feature of the lobby and their plane of illuminance is vertical.

Quantitative System Performance Considerations

Illuminance (horizontal) | 10fc (100lux)

Illuminance (vertical) | 3fc (30lux)

Reflectances | The IESNA Handbook lists no specific criteria dealing with reflectances of surfaces in a lobby.

Luminance ratios | Since the lobby is next to the exterior, the luminance ratio from the interior to exterior varies with the time of day. During the daytime, the interior walls need to be brighter to be perceived from the outside, while at night the luminance levels should greatly decrease. There are no specific luminance ratios for a lobby listed in the IESNA handbook to use as criteria.

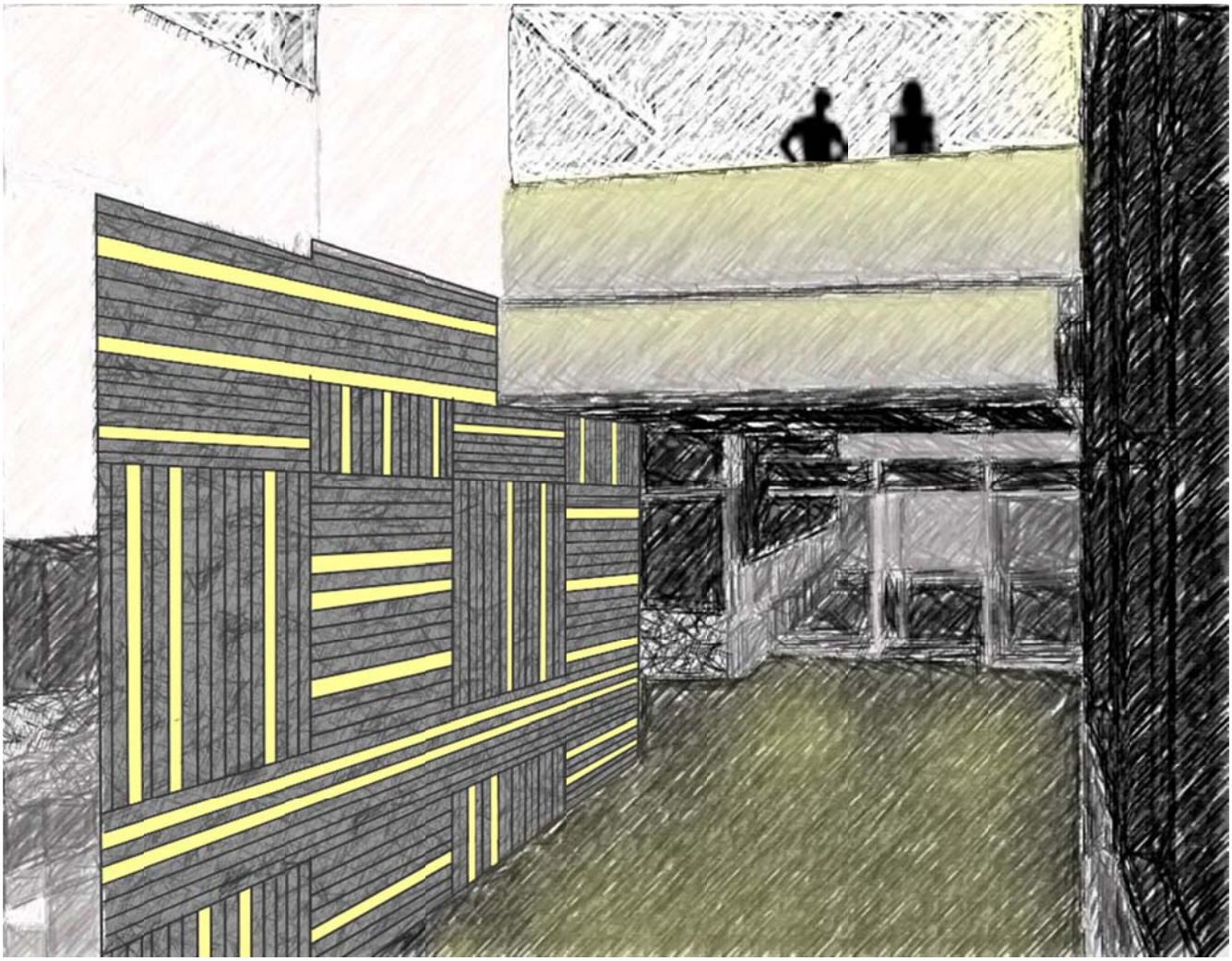
Energy

ASHRAE 90.1 2004
Building Area Method Lighting Power Densities, School/University | 1.2 W/sq.ft.
Space-by-Space Method Lighting Power Densities, Lobby | 1.3 W/sq.ft.

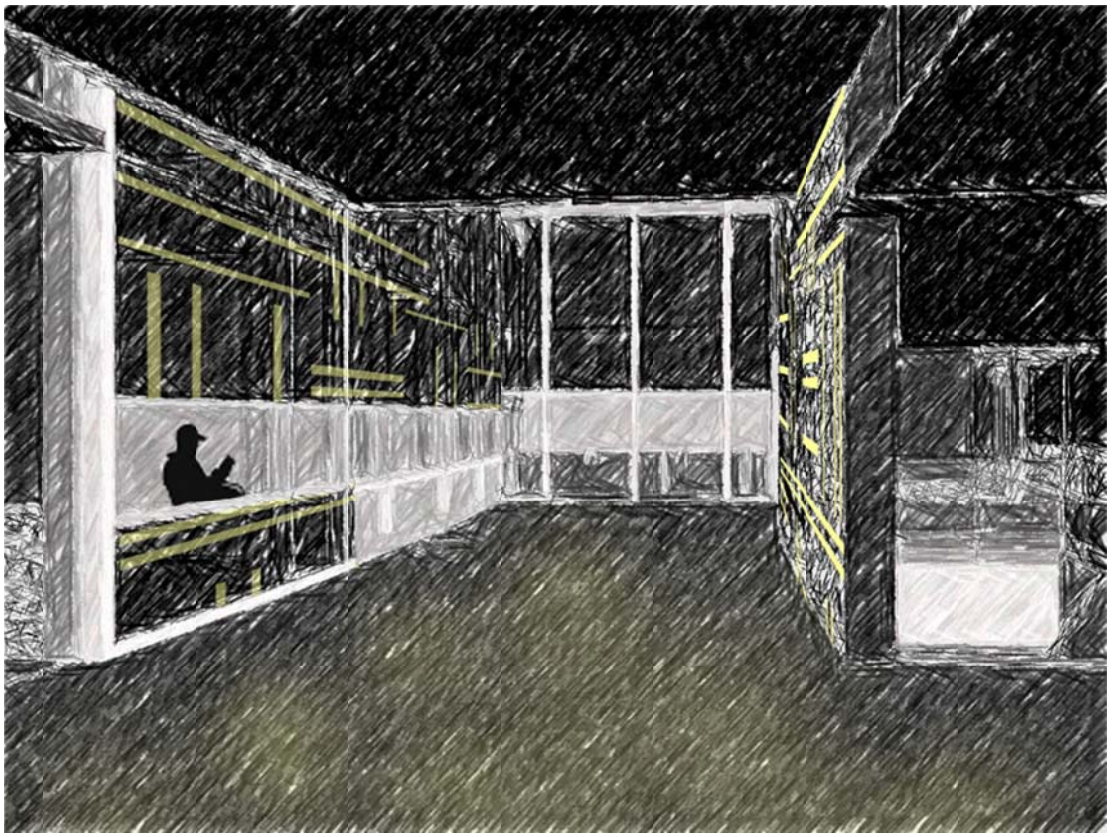
Lighting Redesign

Lighting Solutions

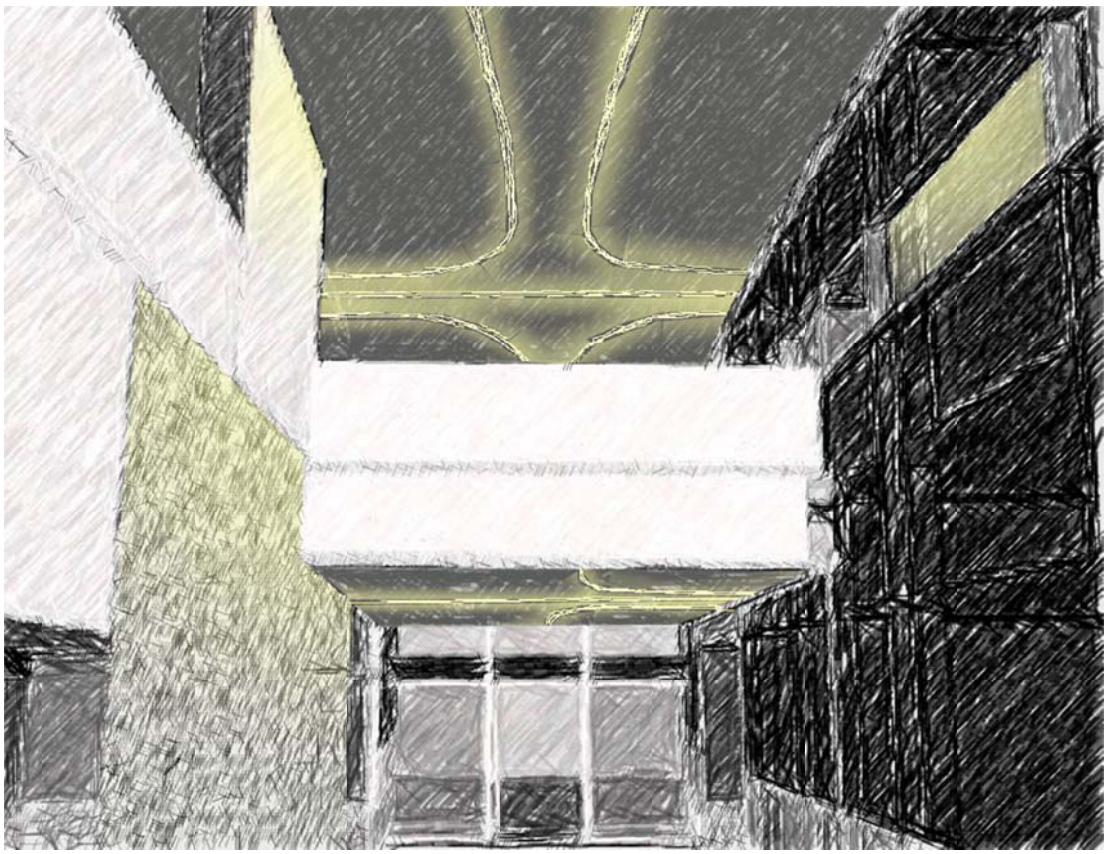
To add interest, exalt the architecture, and promote circulation, three schematic designs were created for the Lobby space. The first was based on architecture and it highlights architectural masses like the crossing bridge on the second level and the ceiling. The main focus is on the stone wall where lights are integrated into the woodwork at random places and they interact with people passing by. This creates an effect of ***static motion*** while encouraging interactive circulation. The material opposite to the wood is glass, both translucent and clear, so it will reflect the effects happening on the wood wall creating ***mirroring opposites***. The second schematic design was based on Neuroscience. Still highlighting vertical elements and providing enough light for circulation, the main focus is now the ceiling. With curving strips of light that randomly light up in a continuous motion mimicking synaptic ***connections*** and encouraging guided circulation. The third schematic design was based on psychology and the Flynn impressions of Openness and Enclosure. Higher light levels and peripheral emphasize attract the occupants while darker space repel them indirectly promoting circulation.



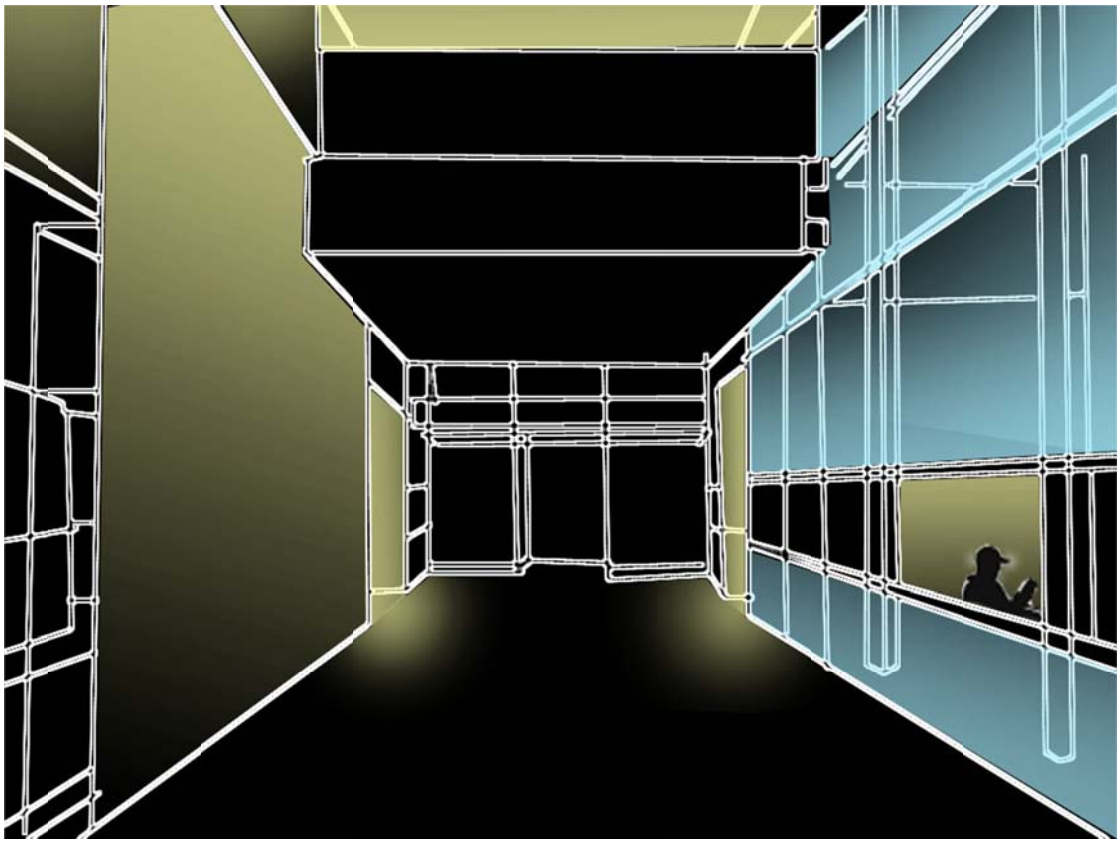
CONCEPTUAL SKETCH, FIRST SCHEMATIC DESIGN: ARCHITECTURE



CONCEPTUAL SKETCH, FIRST SCHEMATIC DESIGN: ARCHITECTURE



CONCEPTUAL SKETCH, SECOND SCHEMATIC DESIGN: NEUROSCIENCE



CONCEPTUAL SKETCH, THIRD SCHEMATIC DESIGN: PSYCHOLOGY

For the final design, a combination of all three schematic designs was selected. From the first schematic design, the ceiling was illuminated as well as some walls while keeping the main attention on the wooden wall. From the second, a line a of light was placed on the first floor ceiling for guided circulation on this floor while providing required levels on the floor. From the third, high levels on the ceiling influence you to look above and indirectly guide you throughout the space. The entrances to the corridors that leave from this central space also have higher levels to attract attention and serve as guidance.

Controls

The general lobby lighting will be ON probably all the time, therefore no time-clock setting is necessary. However, for the decorative elements, such as the in-ground specialty wall grazer and the recessed second floor wall grazers, do not need to be on during the daytime. When sunlight is coming in, the levels of these grazer elements will most likely not be enough to be noticeable. Therefore, these zones will be on time-clock capabilities like the north entrance and will turn ON/OFF simultaneously.

Summary Performance Evaluation

Overall the new lighting design works adequately to meet the most important criterion which is safe circulation with an average of 10fc. Also, it enhances the space by bringing attention to important architectural features, such as key walls and the ceiling. It provided guided circulation because the wooden wall encourages movement and the first level ceiling lighting points you in possible direction. The lit ceiling draws the attention up to tell the users that there are multiple floors in the building.

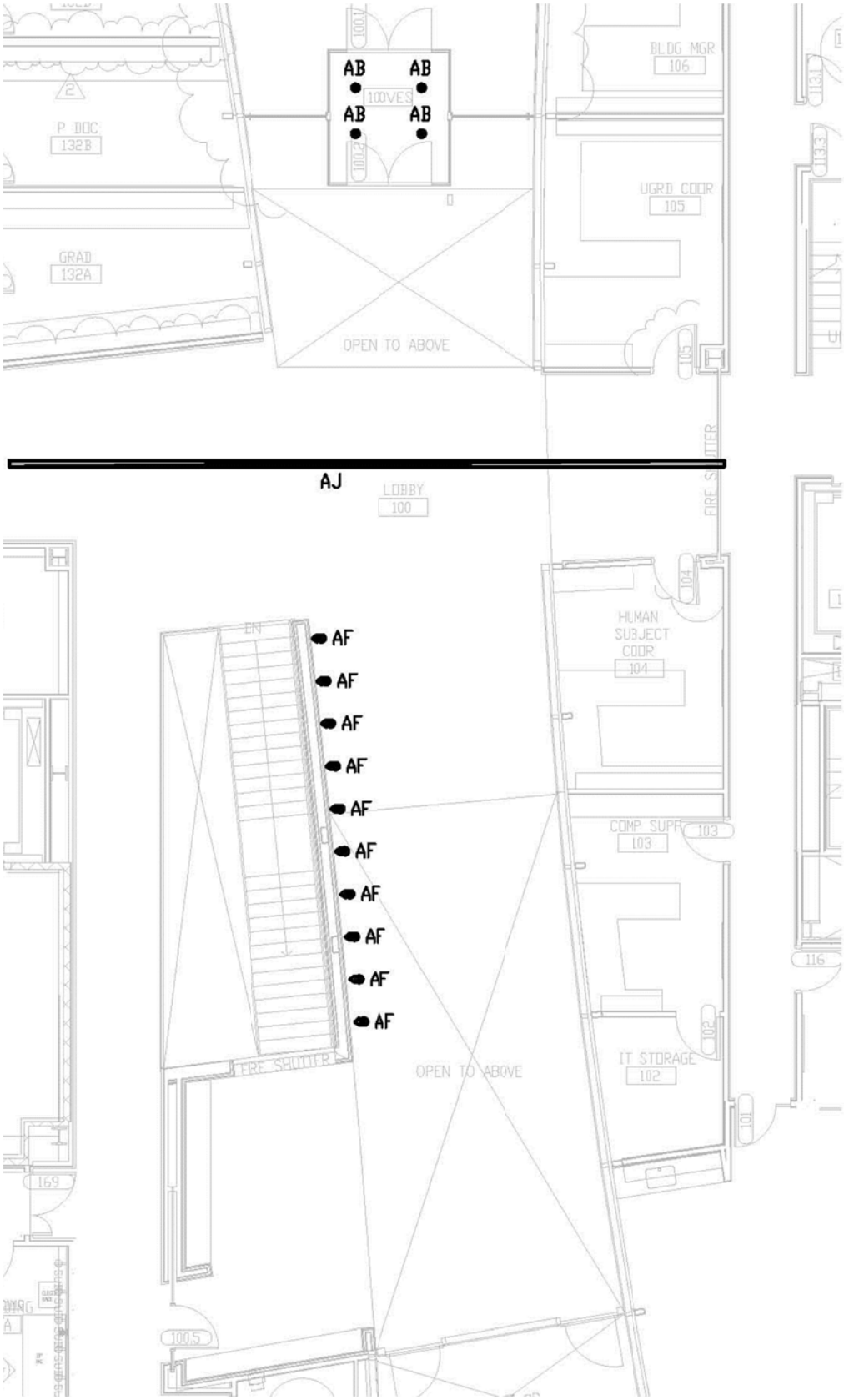
Documentation

Lighting Schedule / Ballast Schedule

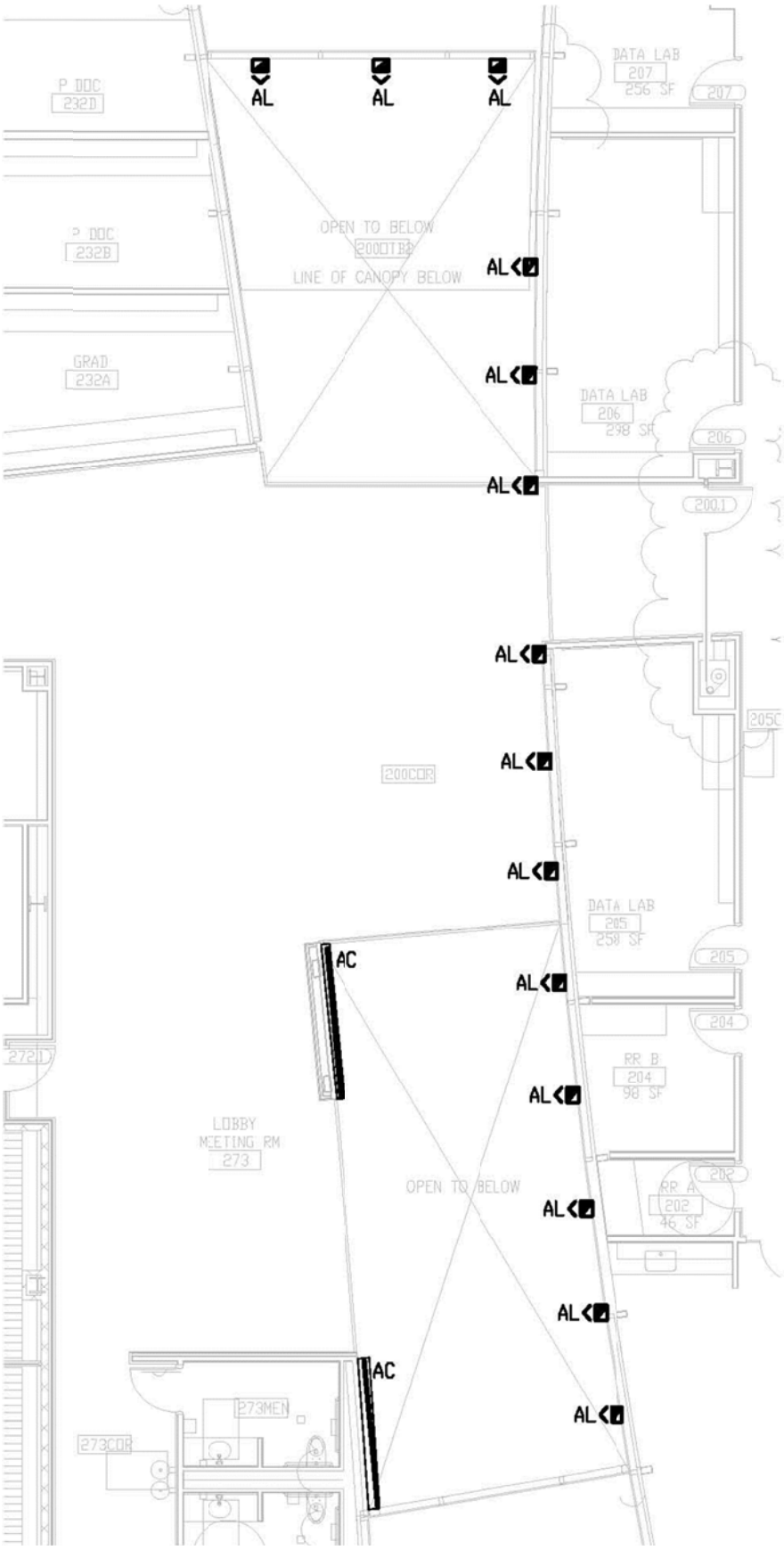
Type	Description	Lamp	Watt	Volt	Mfr	Catalog #
AC	Surface mounted LED strip approximately 0.75"x0.75" in cross section and incremental nominal lengths ranging from 6" to 96" with extruded aluminum housing and acrylic optics, 96W driver supplied, 3000k. Consult factory for high CRI option availability.	High CRI option LED	2.92 W/lf	277	Cooper IO	0.03.1.3k.45.101.1.XX.2.277V
AD	Surface mounted high-performance LED grazing fixture , 1.5" diameter by 2.1" high and 1ft increments with die-cast aluminum white powder coated finish housing and polycarbonate lens	LED 83CRI	13.5	277	Color Kinetics	eW Fuse Powercore 3000K, 10 by 60 degree beam angle
AF	Recessed in-ground low-voltage halogen wall-washer with cast aluminum body and outer casing and double tempered glass and nominal 5" diameter with integral electronic transformer.	PHILIPS 10W/T 3/12V	10	12-277	iGuzzini	I.B001-277-13
AJ	Fully recessed and flangeless linear fluorescent slotlight nominal 6" wide with extruded aluminum housing, powder coated high-reflectance which finish, and joiner system allowing uniform appearance with frosted acrylic lens. Lengths as required by architecture.	PHILIPS F28T5/ 835/AL TO 85CRI	30	277	Zumtobel	SLR6NX-XX-1285-XX-OLP-DX
AL	Surface wall mounted elliptipar metal halide ceiling uplight mounted to the mullions of the exterior façade inside the lobby with bright clear anodized aluminum reflector with mill finish aluminum door and end plates and black yoke/mounting plate and remote electronic ballast.	PHILIPS CDM150/T6/942 96CRI	150	277	The Lighting Quotient	1403-150G-W-00-2-00-0

Type	Location	PF	Input Current	Input Wattage	Lamp Wattage	Other	BF
AC		1.00		2.92 W/lf	2.92 W/lf		1
AD		1.00		13.5	13.5		1
AF		1		10	10		1
AJ	page 13-3 GE	0.92	0.17	43		T5 High Efficiency - Programmed Start	1.22
AL	page 18-14 GE	0.9	0.7	186		86718 - GEM150MLTLC3D-5	1

Lighting Plans

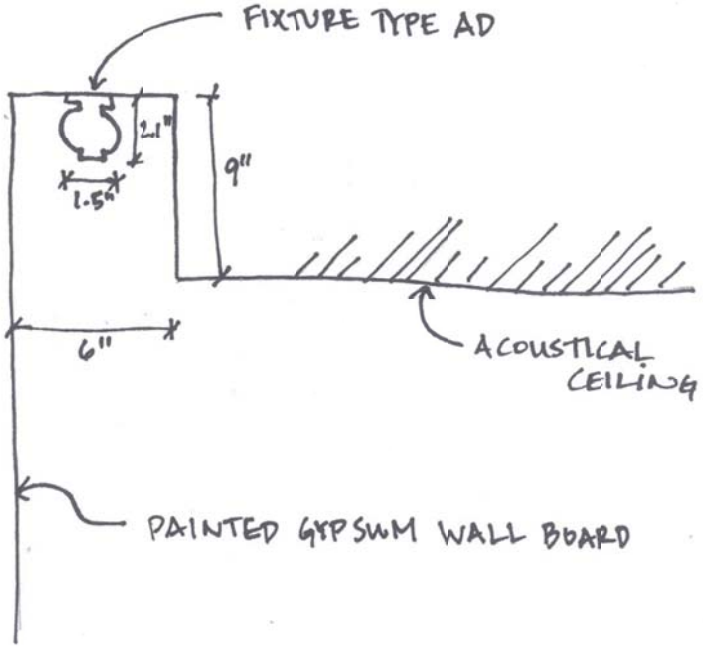


REFER TO APPENDIX L FOR FULL-SIZE DRAWING AND SCALE



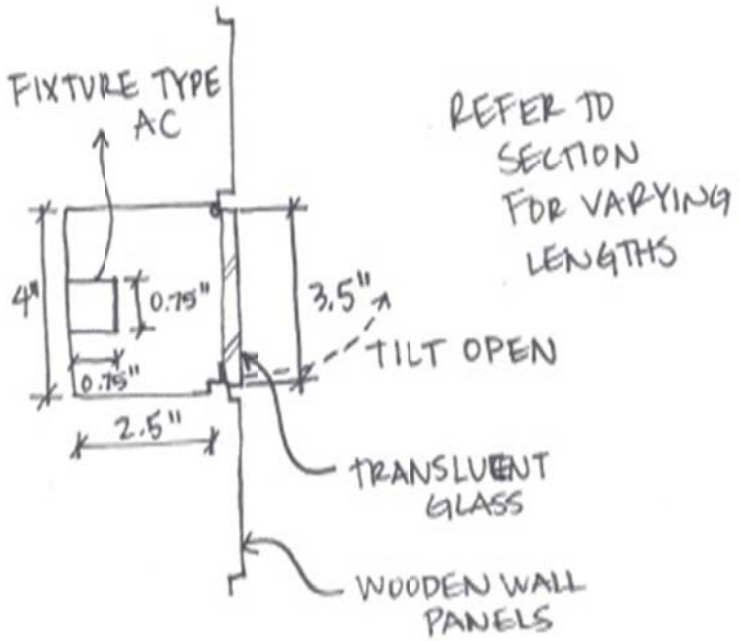
REFER TO APPENDIX L FOR FULL-SIZE DRAWING AND SCALE

Mounting Details



LOBBY COVE DETAIL

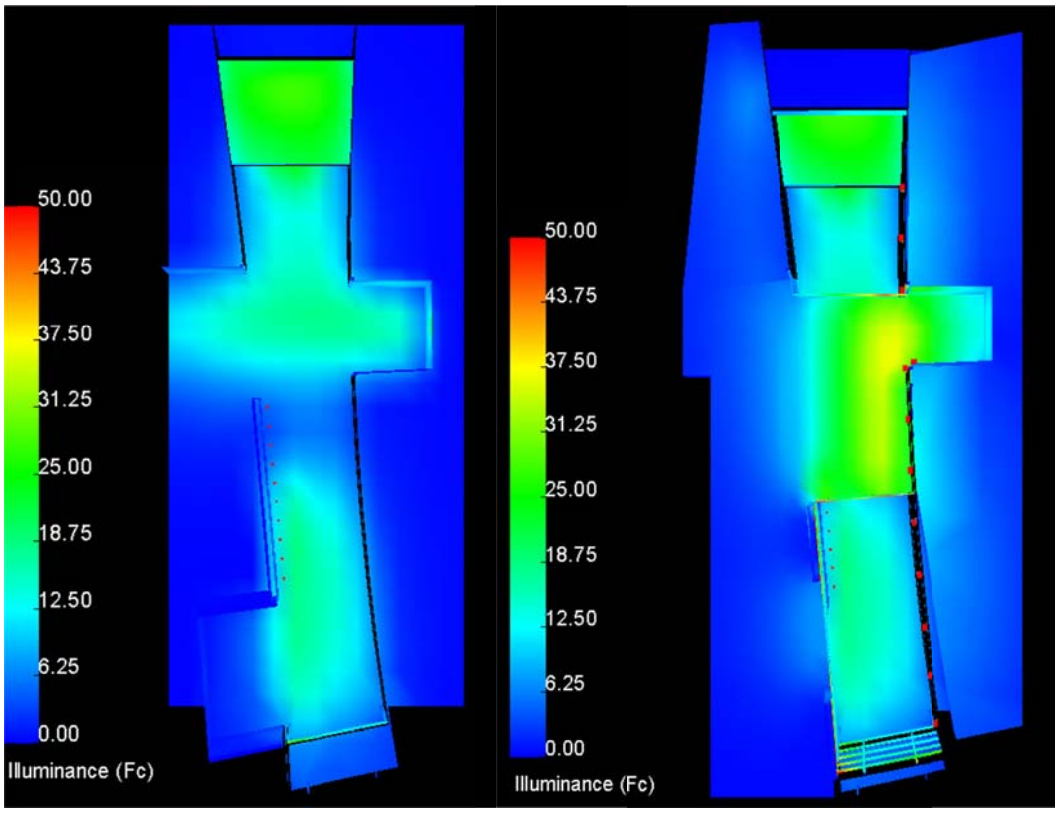
SCALE: NTS



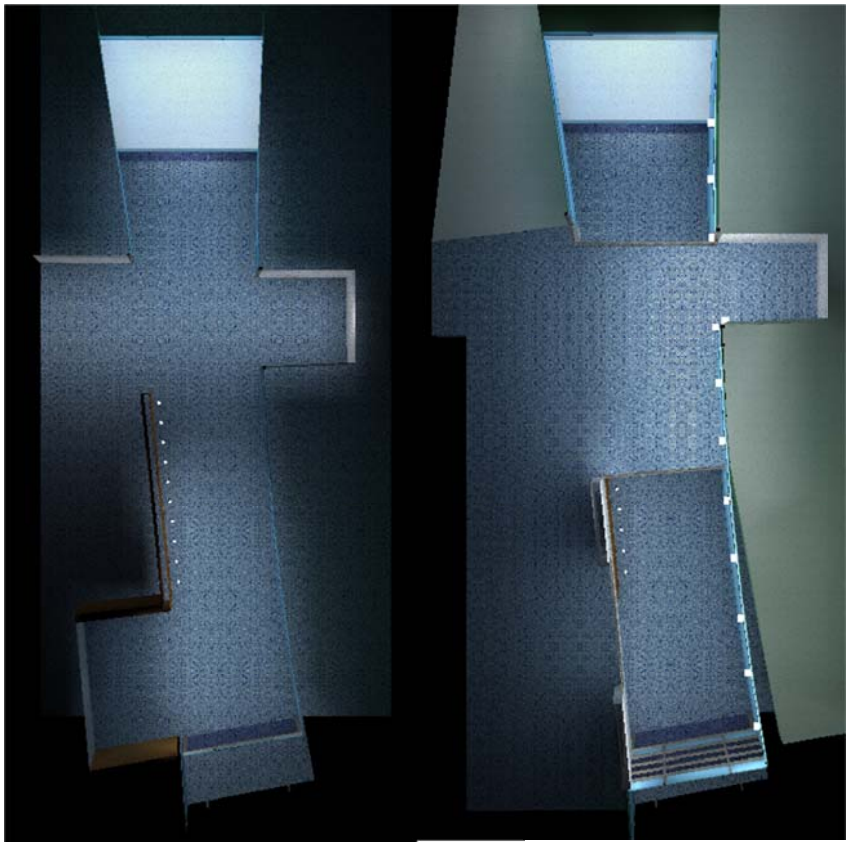
LOBBY WOODEN WALL DETAIL

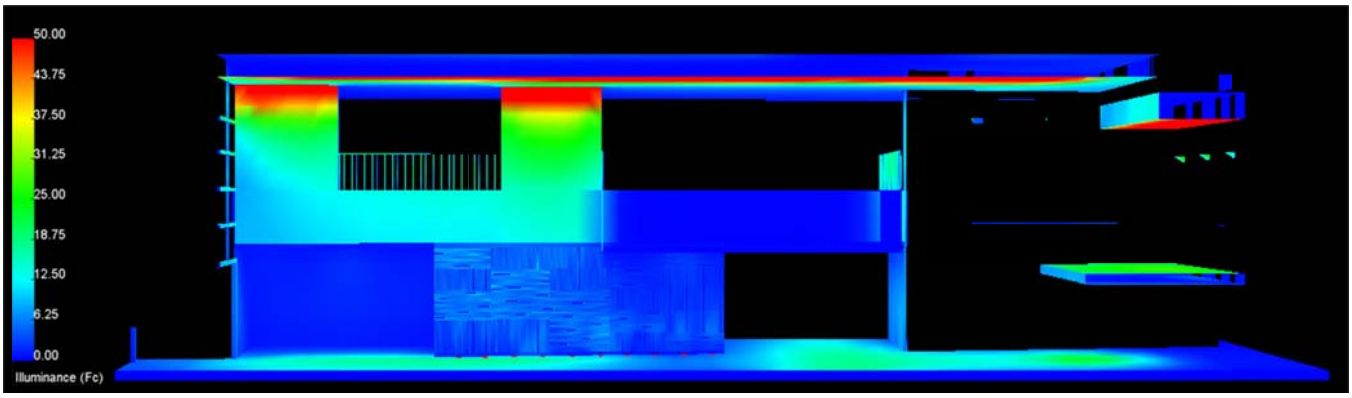
SCALE: NTS

Visual Performance | Visual Quality



PLAN VIEW IN PSEUDOCOLOR AND MATERIAL MODE FROM AGI32





ELEVATION VIEW LOOKING TOWARDS WOODEN WALL IN PSEUDOCOLOR AND MATERIAL MODE FROM AGI32

Results:

Zone	Average Illuminance	Maximum	Minimum	Max/Min	Coeff. Variation
First Floor	12.69	22.70	4.70	4.83	
Second Floor	26.50	37.10	10.60	3.50	
Ceiling	47.03	176.00	4.20		0.87
Vestibule	20.93	26.00	16.60	1.57	0.14

Light Loss Factor Calculations

Luminaire Type	Lamp Lumen Depreciation	Ballast Factor	Lamp Dirt Depreciation	Total Light Loss Factors
AC	0.70	1.00	0.95	0.67
AD	0.70	1.00	0.95	0.67
AF	1.00	1.00	0.95	0.95
AJ	0.95	1.22	0.95	1.10
AL	0.70	1.00	0.95	0.67

Energy Calculations

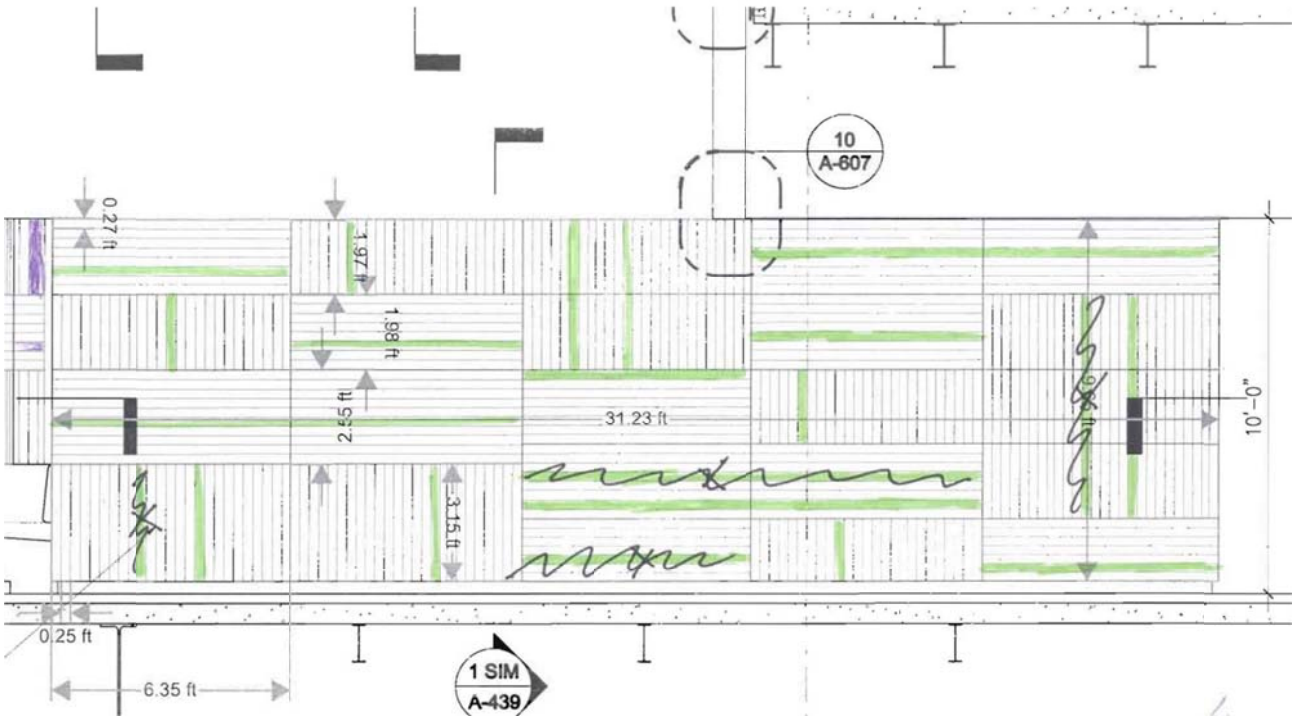
	Building Area	Space-by-Space
Allowable LPD (W/sq.ft.)	1.2	1.3
Actual LPD (W/sq.ft.)	0.816	0.816
Percentage	32.028	37.256

Area (sq.ft.)
3447

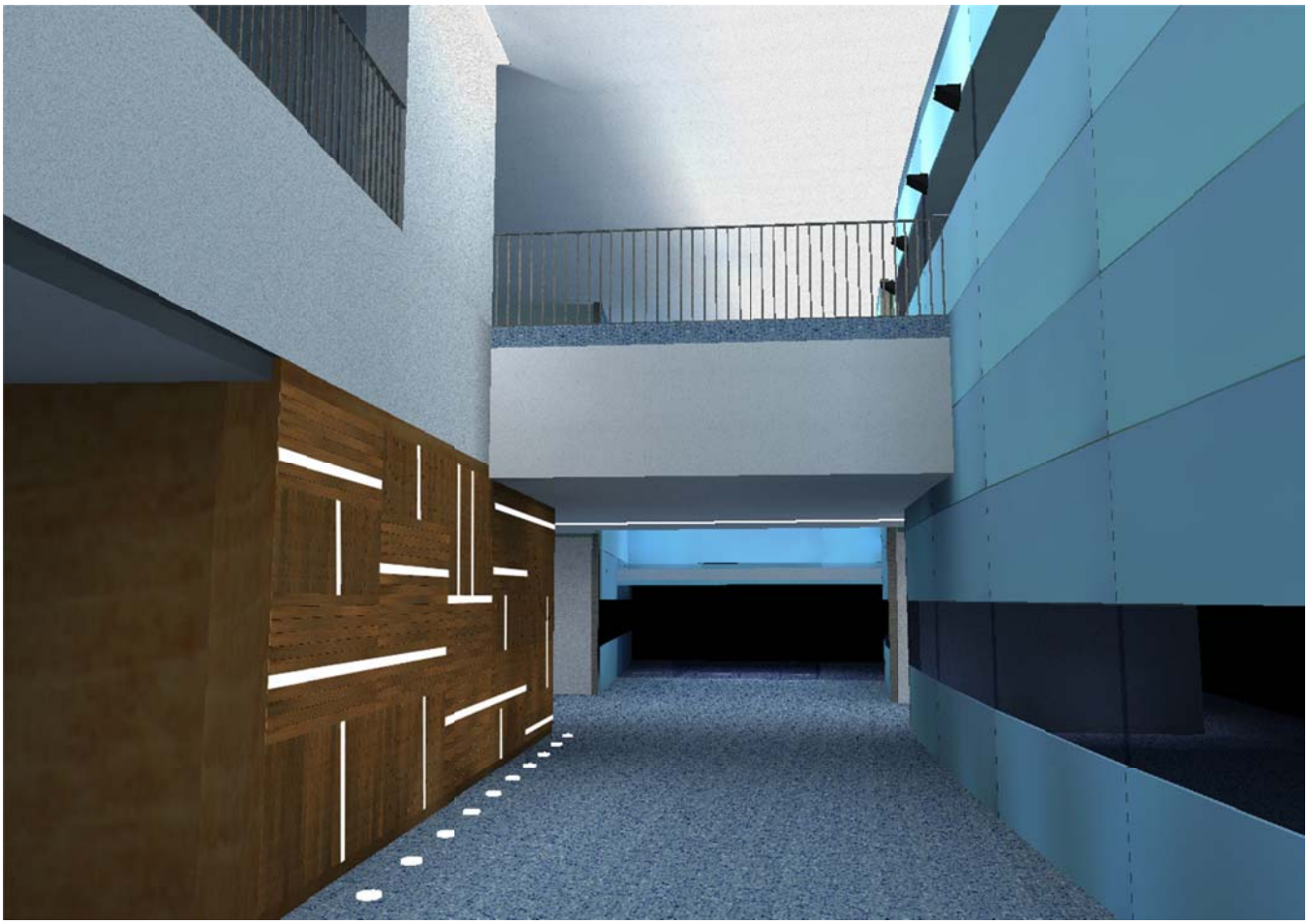
Luminaire Type	Watts/ Luminaire	Amount	Total Wattage
AB	18.4	4	73.6
AD	11.9	20	238
AF	10	10	100
AJ	30	5	150
AL	150	15	2250
AC	19.6	25	490
	TOTAL WATTAGE =		2811.6

*Decorative Allowance
1.0
0.142
85.785

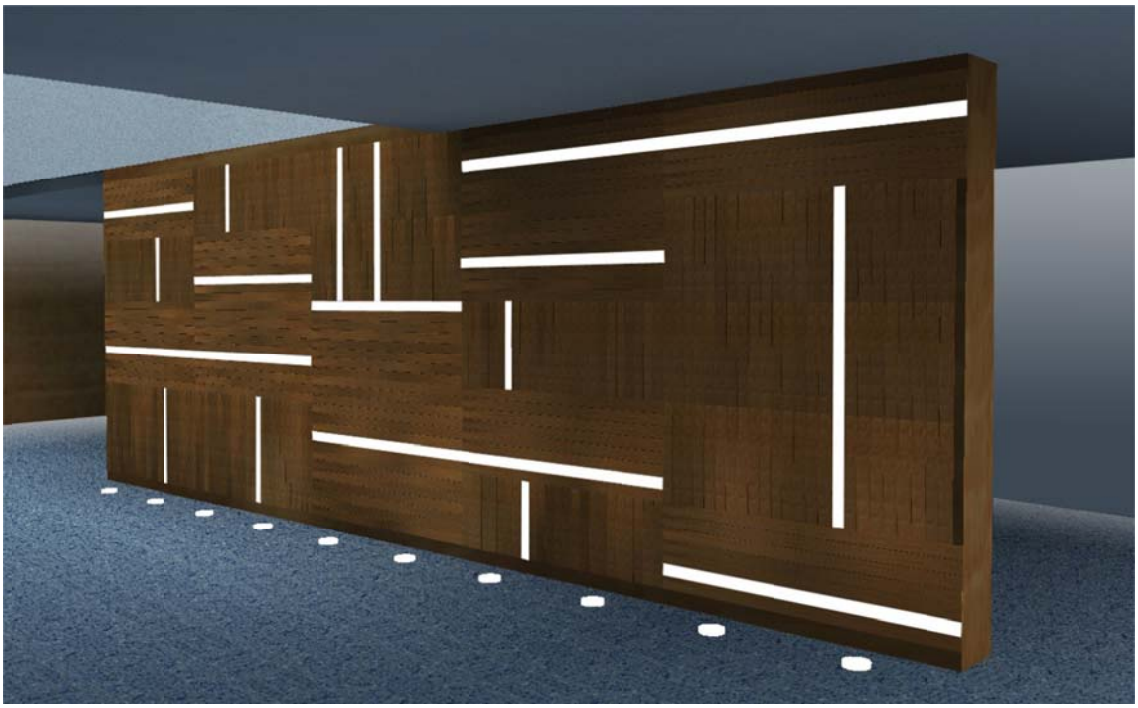
TOTAL WATTAGE 3301.6



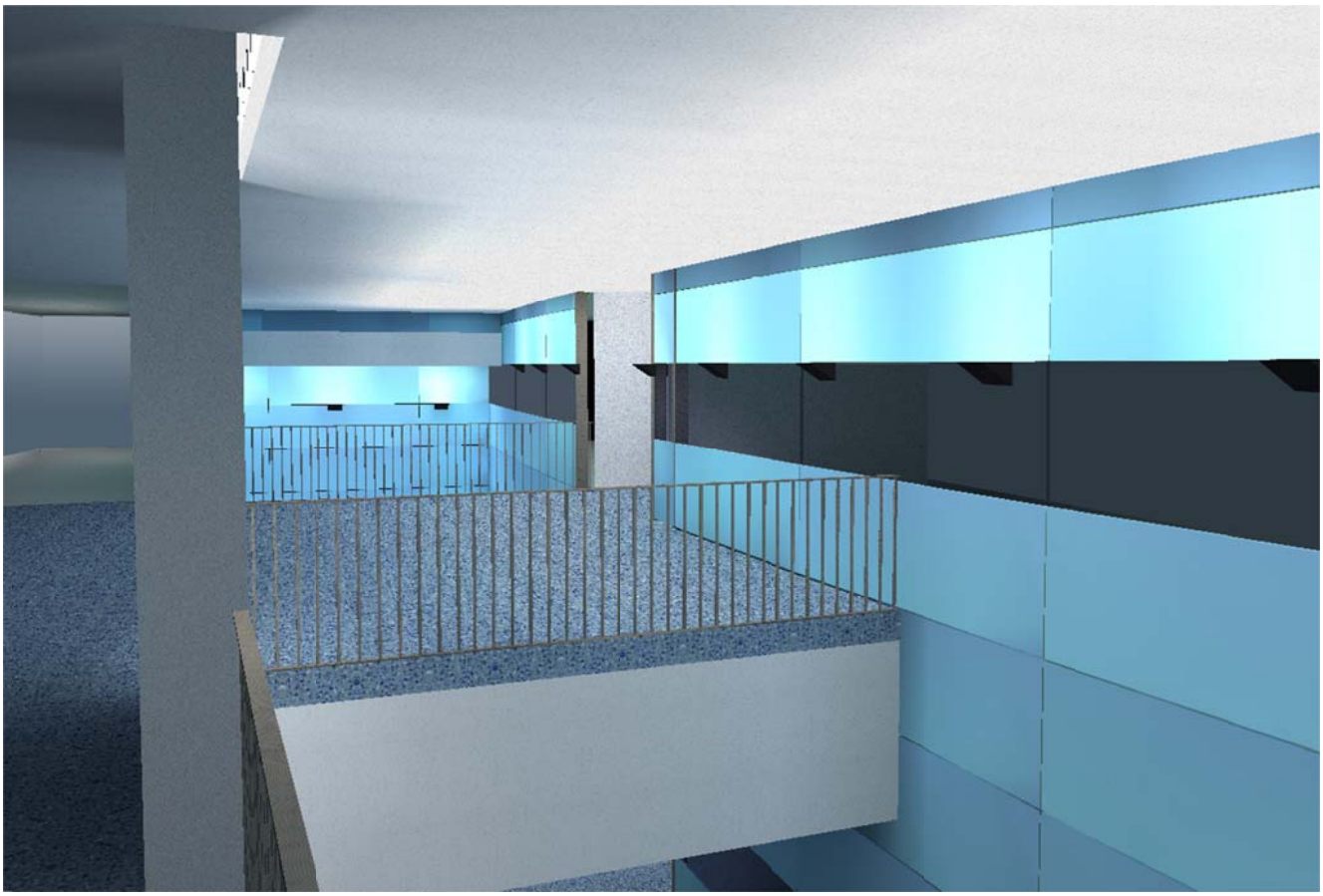
SKETCH OF WOODEN WALL LIGHTING



VIEW LOOKING TOWARDS SOUTH ENTRY FROM FIRST LEVEL



WOODEN WALL LIGHTING



VIEW LOOKING TOWARDS SOUTH ENTRY FROM SECOND LEVEL

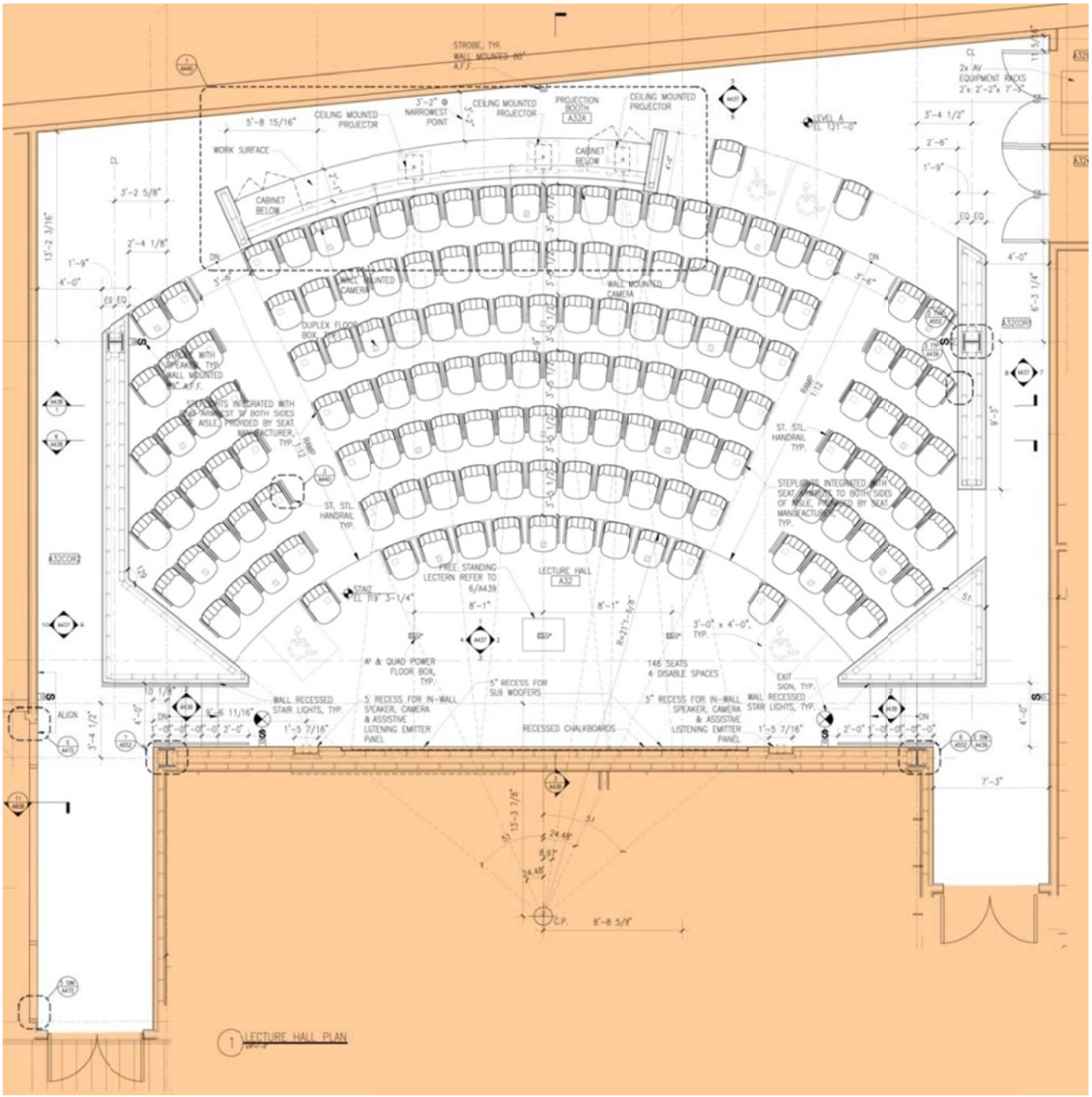
VIEW LOOKING TOWARDS NORTH ENTRY FROM FIRST LEVEL

Large Work Space | Lecture Hall A32

Existing Conditions

Description of Space

Half radially symmetric, the lecture hall has 145 seats with an inclination of 1:12. There is a projector booth on the rear of the room (north) with three ceiling mounted projectors. There are two entrances and the seating area is enclosed by corridors on three sides with the teaching space at the front (south). The main surface of the ceiling and walls is wood. The lecture hall is located in the northeast part of Level A in the Neuroscience portion of the complex.



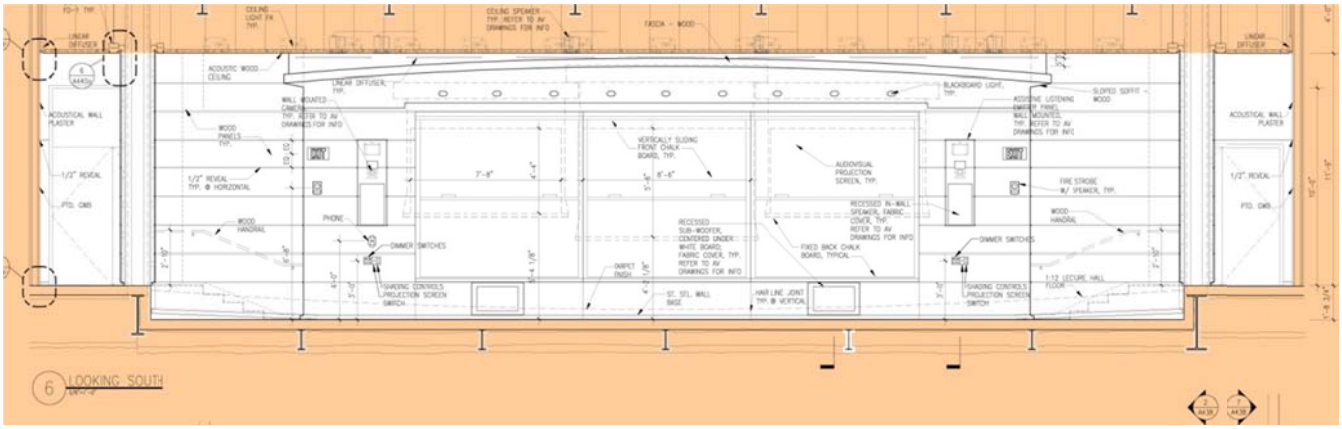
LECTURE HALL, PLAN, NTS

Furniture and Surface Materials

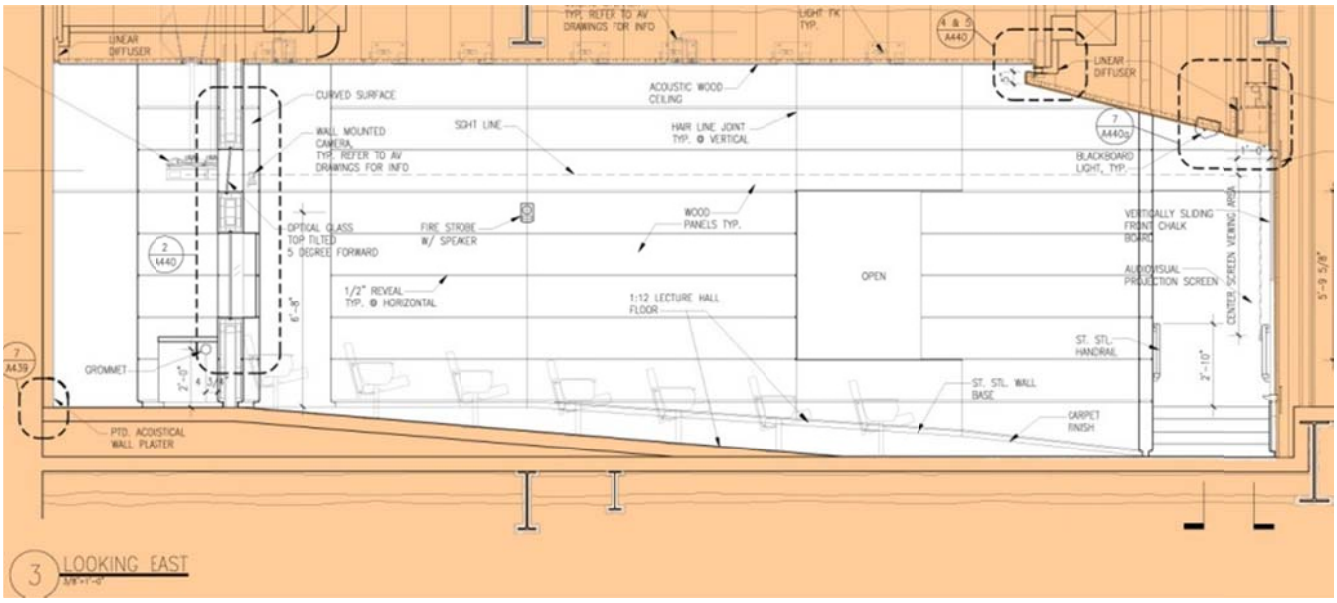
Auditorium chairs are the main furnishing of the lecture hall accompanied by a free standing lectern, chalkboards, and projection booth cabinets. Materials in the room include the following:

Material	Reflectance *	Specifications #	Location
Glazing	0.1	08910	A32COR west elevation
Painted acoustic wall plaster	0.8	09900	A32COR west elevation
Painted gypsum wall board	0.7	09250	A32COR
Wood panels	0.25	06400	Throughout
Acoustic wood ceiling	0.3	06400	Throughout
Carpet, Grama 44025 by Monterey Carpets, Color to be chosen by Architect	0.3	09681	Throughout
Chalk board	0.1		South elevation
Projection screen	0.8		South elevation
Curved glass	0.1	08800	Projection area
Auditorium seats, Irwin Seating Company Allegro Model No. 27.17.80.150, Color chosen by Architect	0.3	12710	Throughout

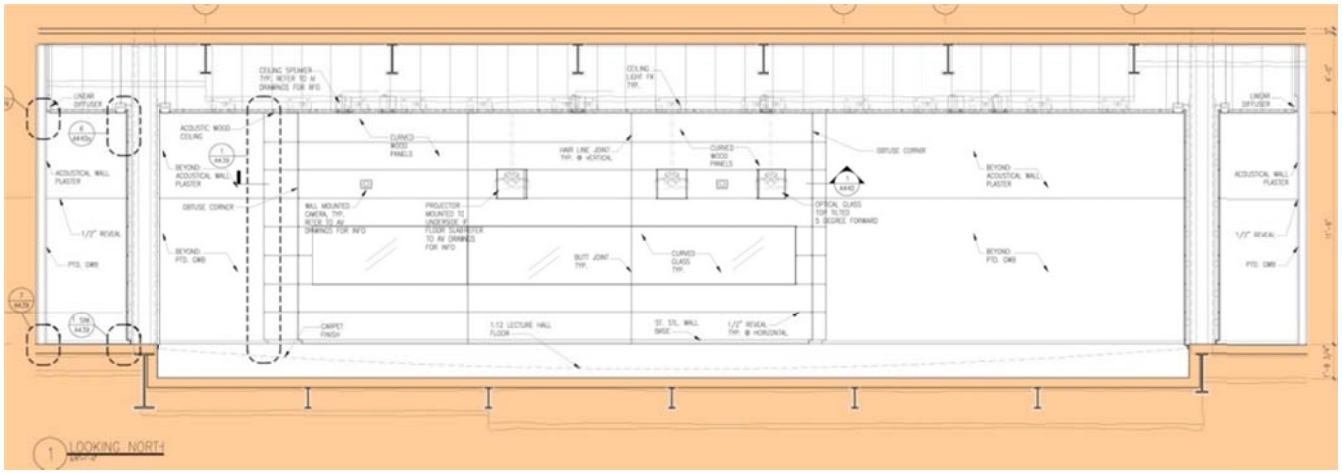
*Assumed, some from Figure 1-36 from IESNA Handbook Page 1-22, others from AGI32



LECTURE HALL, SECTION LOOKING SOUTH, NTS



LECTURE HALL, SECTION LOOKING EAST, NTS



LECTURE HALL, SECTION LOOKING NORTH, NTS

Design Considerations

The objective of the lighting design in an educational environment is to promote the learning processes. Education can be promoted by designing a lighting system that evokes the emotional and psychological responses of the learners making them feel pleasant and comfortable while accurately viewing the visual tasks necessary for learning. In a lecture hall, special attention must be paid to the horizontal illuminance, the vertical illuminance, and the uniformity of the light distribution on the work plane. Specifically in a lecture hall, there must be at least flexibility for two scenarios: one for note-taking/reading and the other for demonstrations. Since many of the surfaces are wood, the lighting should bring out the material with good CRI and warm CCT.

Visual Tasks

Reading and writing are the most important tasks and students are required to adjust rapidly from near to faraway visual tasks. Enough general lighting shall be provided and the recommendations are listed under the quantitative considerations below. Projection onto screen will also occur and the entire audience must be able to see it clearly. To successfully light the speaker/demonstration, directional downlights should be located 40-60 degree angle from the horizontal to the speaker. This minimizes glare and models well the facial expressions.

Qualitative System Performance Considerations

The following lists in order of importance the design issues that are of consideration for a Lecture Hall both for reading and demonstration. The ninth edition of The IESNA Lighting Handbook was referenced (Educational Facility Lighting, Lecture Hall both Reading and Demonstration).

Very Important | Light distribution on a task plane (uniformity) | It is important that the task area have an illuminance 1.5 to 3 times higher than the surroundings but not too much to cause visual fatigue. Uniform light distribution on the task plane increases visibility, comfort, and perception for demonstration settings in the Lecture Hall.

Very Important | Illuminance (horizontal) | Horizontal illuminance is crucial for note-taking and reading, both of which are horizontal tasks. High values of illuminance are necessary for these tasks to be performed diligently and effectively. Below are the values necessaries to achieve this.

Very Important | Illuminance (vertical) | When something is projected on the screen in the front of the lecture room, low illuminance is desirable. On the other hand, when the lecturer is utilizing the board, the audience, even from far away, must be able to see it. The values necessary for this will be listed below.

Important | Direct glare | Glare causes discomfort and distraction. This is something not desirable in a space where the objective is to promote learning and concentration. To minimize glare, luminaires luminances should not more than 100 times of those of the surrounding surfaces.

Important | Light distribution on surfaces | Patterns of light and shadows cause discomfort and affect visibility. Therefore, uniform light distribution is preferred and luminances levels should be within 3:1 ratio for different surfaces within the room.

Important | Points of interest | The main point of interest is the lectern space and the chalkboard and these will be highlighted with illumination when required. If the audience is required to take notes, the lecture hall will be more uniformly lit but there should still be emphasis on the front of the room. When the projector is in use, the light from the projector will be enough to attract attention while maintaining the rest of the space at low illuminance levels.

Important | Reflected glare | Reflected glare reduces task visibility. To reduce it, light sources can be placed on the sides of the task and the ratio of illuminance on the task from the mirror angle relative to the total illuminance on the task should be less than 0.3.

Important | Shadows | Shadows also reduce task visibility. To diminish them, linear or area sources can be used instead of point sources.

Important | Source/task/eye geometry | This relationship is critical for reading and writing. Coordination between the light source and the location of the task must be made.

Important | Appearance of space and luminaires | The lighting should give clues as to where areas of special attention are. Here, special attention should be paid to the front where the lectern is. Light should also enhance the architecture and this space has interestingly textured wooden walls that can be highlighted with illumination. The aesthetics are important for the entire building, designed by a world renowned architect; therefore, the lecture hall should maintain a lighting that carries the aesthetic themes of the building's design.

Very Important | System control and flexibility | Since several different tasks will occur on the Lecture Hall, different light settings are required. There is a necessity for flexibility in the space, as the lighting for a speaker is not the same for projections onto a screen. Flexibility can be achieved with the use of controls and dimmers.

Quantitative System Performance Considerations

The following quantitative levels are recommended by The IESNA Handbook for successful design of a Lecture Hall.

Illuminance (horizontal) | 100fc (1000lux) for demonstration
30fc (300lux) for reading
5fc (50fc) for simple orientation for short visits

Illuminance (vertical) | 50fc (500lux) for demonstration

Reflectances | Walls: Non-specular surfaces with 40-60% reflectance
Wall above luminaires: 80%
Ceiling: >80%, Non-specular
Floor: 25%, Non-specular

Luminance ratios | These ratios are critical for the lecture hall because the eye is constantly shifting from one task with one luminance to a different one. The background also takes an important role as it creates contrast against the task luminance. The luminance of a surface looked directly should not be greater than five times the luminance of the task for good visual performance. Any large area should not exceed three times the luminance of the task. Surfaces immediately adjacent to the task should have a lower luminance than the task but at least 1/3 of it; the closer the better. For good luminance ratios, the reflectances of the surfaces should be increased as well as the light on them.

Between surface looked directly and task:	max 5:1
Between large area and task:	max 3:1
Between adjacent surfaces and task:	lower but at least 1/3

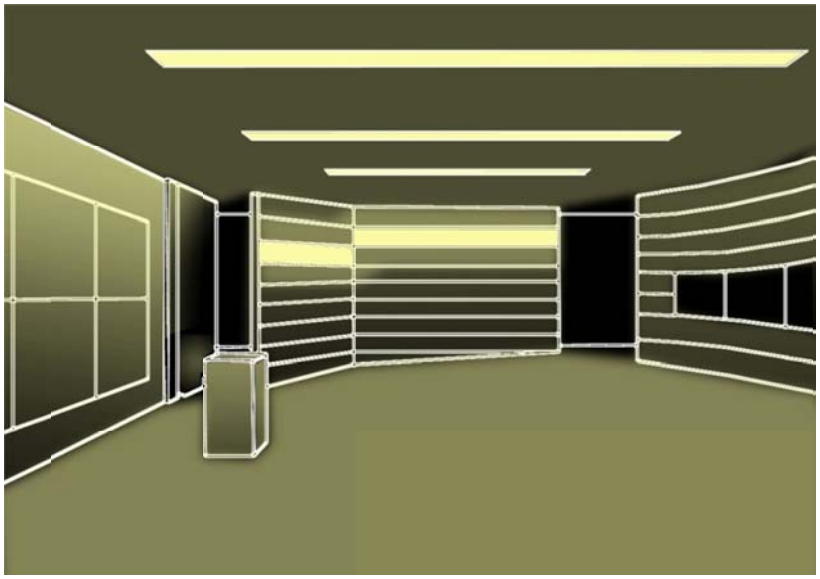
Energy

ASHRAE 90.1 2004
Building Area Method Lighting Power Densities, School/University | 1.2 W/sq.ft.
Space-by-Space Method Lighting Power Densities, Classroom/Lecture | 1.4 W/sq.ft.

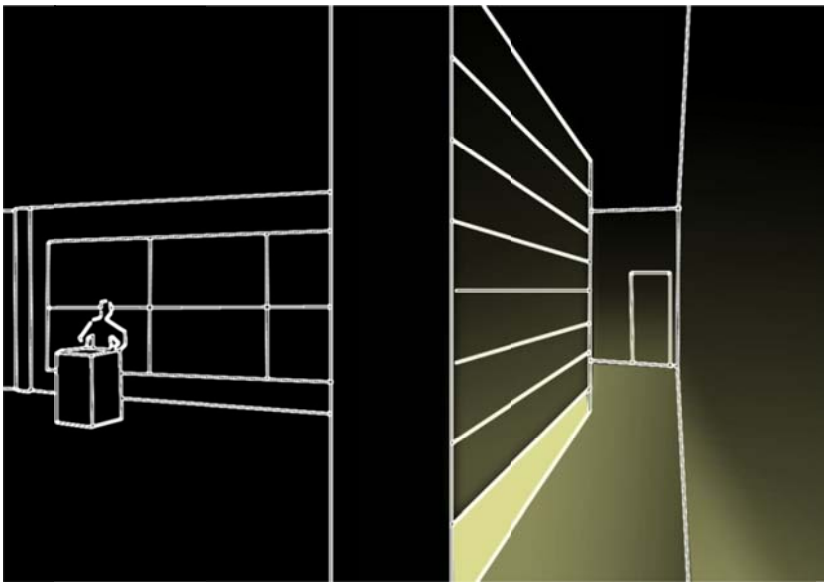
Lighting Redesign

Lighting Solutions

To achieve a more interesting space in the Lecture Hall, the idea was to add lines of light to the side wooden walls as well as to the ceiling. In the end, since the ceiling was re-designed for the architectural breadth, the lines in the ceiling shifter to a radial pattern (refer to architectural breadth for more information). These provide high general levels of illumination for the reading/writing tasks while following of ***static motion*** and ***mirroring opposites*** concepts. The diffuse nature of the acrylic frosted lens will remove problems of veiling reflections, glare, and shadows. The front wall with the chalkboards was washed to reach higher levels than the rest of the space and act as a point of attention. When the projector screen is used, controls will allow for dimming and turning off of the front wall-washer. The corridor will also have a linear light element to account for circulation without interfering with the seating area of the space. Step lighting will provide the adequate levels for safety.



CONCEPTUAL SKETCH, SEATING AREA



CONCEPTUAL SKETCH, CORRIDOR

Controls

Lutron Grafik Eye control system was specified for the Lecture Hall. Since the space must satisfy the needs for several scenarios, this seemed like a good solution. There will be six control zones and three scenes. The control zones are grouped in the following fashion: step light, corridors, projection booth, new ceiling coves, lectern area, and chalkboard area. The scenes are reading/writing/demonstration, projection, and enter/exit mode. All fixtures will be dimmable and they are all fluorescent 0-10V with the exception of the step lights (Fixture Type AG) which are incandescent. The control station will be by the chalkboard near the lecturer so that he can control the scenes. There will also be switches located at both entrances which will control the corridor, step lights, and the cove lights throughout to provide safe travel to the lecture hall. The system will also be connected to a time-clock device to turn on/off the lights at the appropriate times. Refer to Appendix C for One Line Diagram, Bill of Materials, Button Engraving Form, Load Schedule, Preset Dimming Control, and Full-size Image.

GRAFIK Eye. QS Load Schedule

Model Number: QSGRJ-6P

Phase Control Zones

Zone	Name	Load Type	No. Fixtures	Wattage/Fixture	Total Wattage
1	chalkboard	Fluorescent 0-10V	11	17	187
2	lectern	Fluorescent 0-10V	6	17	102
3	lines coves +	Fluorescent 0-10V	28	57	1596
4	proj booth +	Fluorescent 0-10V	6	18	108
5	corridor	Fluorescent 0-10V	3	57	171
6	steplights	Inc / Hal	33	10	330

Summary Performance Evaluation

Overall the new lighting design works adequately to meet the most important criteria. The reading and writing criteria of 30fc was met with an average of 29fc. Focus was drawn to the front stage part of the lecture hall not only with the new ceiling design but also with higher levels of illumination as seen below. The desired 100fc horizontal level for demonstration was not met but it could be done by hiding a theatrical source four fixture in one of the coves if the owner finds that this is a pertinent criterion. Circulation criteria were exceeded as well as higher vertical levels at the chalkboard area.

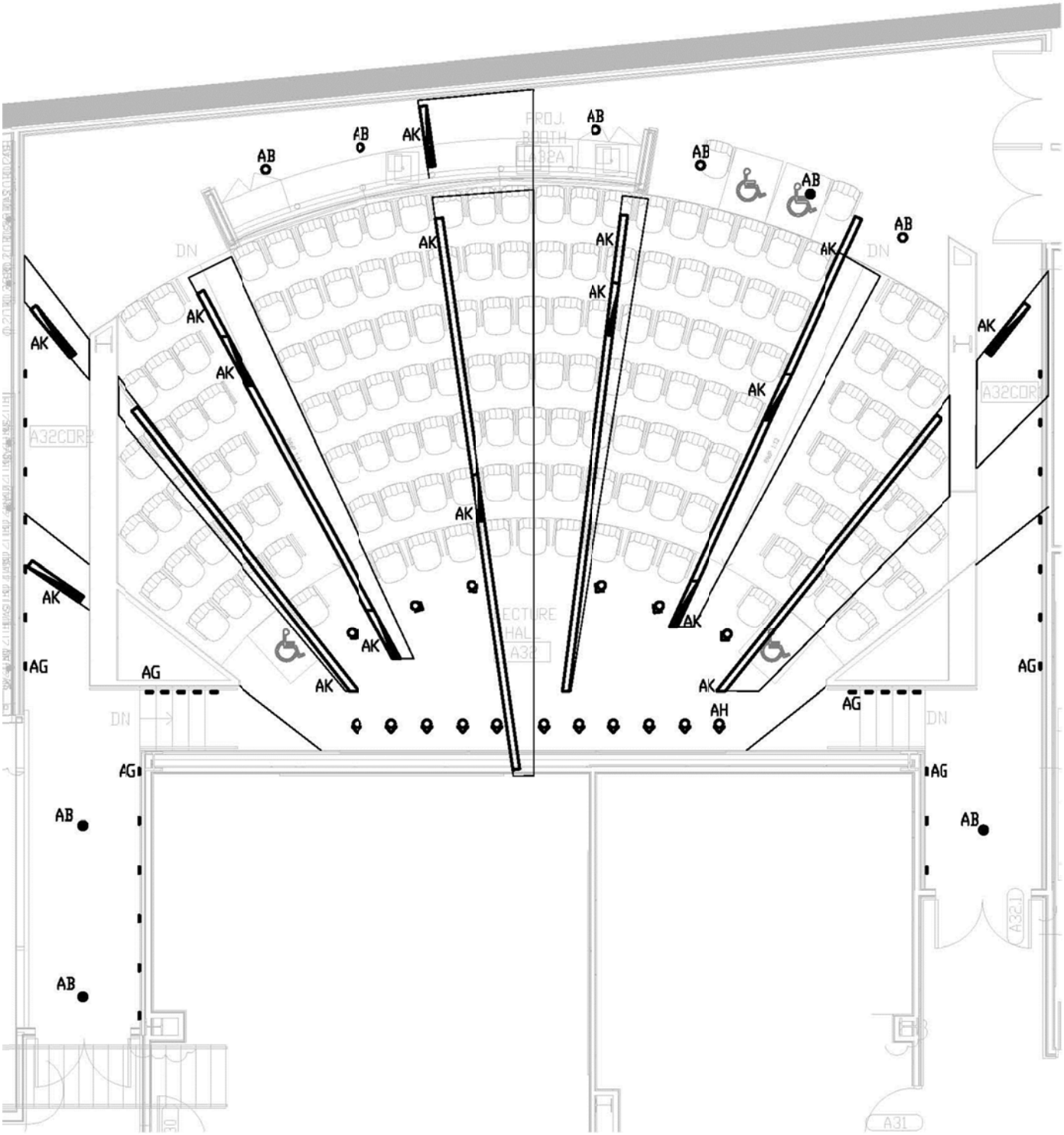
Documentation

Lighting Schedule / Ballast Schedule

Type	Description	Lamp	Watt	Volt	Mfr	Catalog #
AB	Recessed compact fluorescent downlight with 6" nominal diameter aperture with aluminum, bright anodized reflector with plastic, translucent diffuser and integral electronic ballast, 3000k	PHILIPS PL-T 18W/830/4P/AL TO 82CRI	18.4	277/ 120	Edison Price	TRPV 18/6
AG	Recessed low voltage halogen wall luminaire with die-cast aluminum housing with integral wiring compartment, impact resistant satin matte crystal glass, requires a remote Class 2, 12V transformer, nominal 3 in square.	PHILIPS 10W/T3/12V	10	120/ 12	Bega	2303
AH	Recessed compact fluorescent wall-washer with 6" nominal diameter aperture with aluminum, bright anodized reflector with plastic, translucent diffuser and integral electronic ballast, 3000k	(2) PHILIPS PL-T 26W/830/4P/AL TO 82CRI	46	120	Edison Price	WLX 226/6
AK	Fully recessed and flangeless linear fluorescent slotlight nominal 6" wide with extruded aluminum housing, powder coated high-reflectance which finish, and joiner system allowing uniform appearance with frosted acrylic lens. Lengths as required by architecture.	PHILIPS F54T5/ 835/HO/ALTO 85CRI	57	120	Zumtobel	SLR6NX-XX-1545-XX-OLP-DX

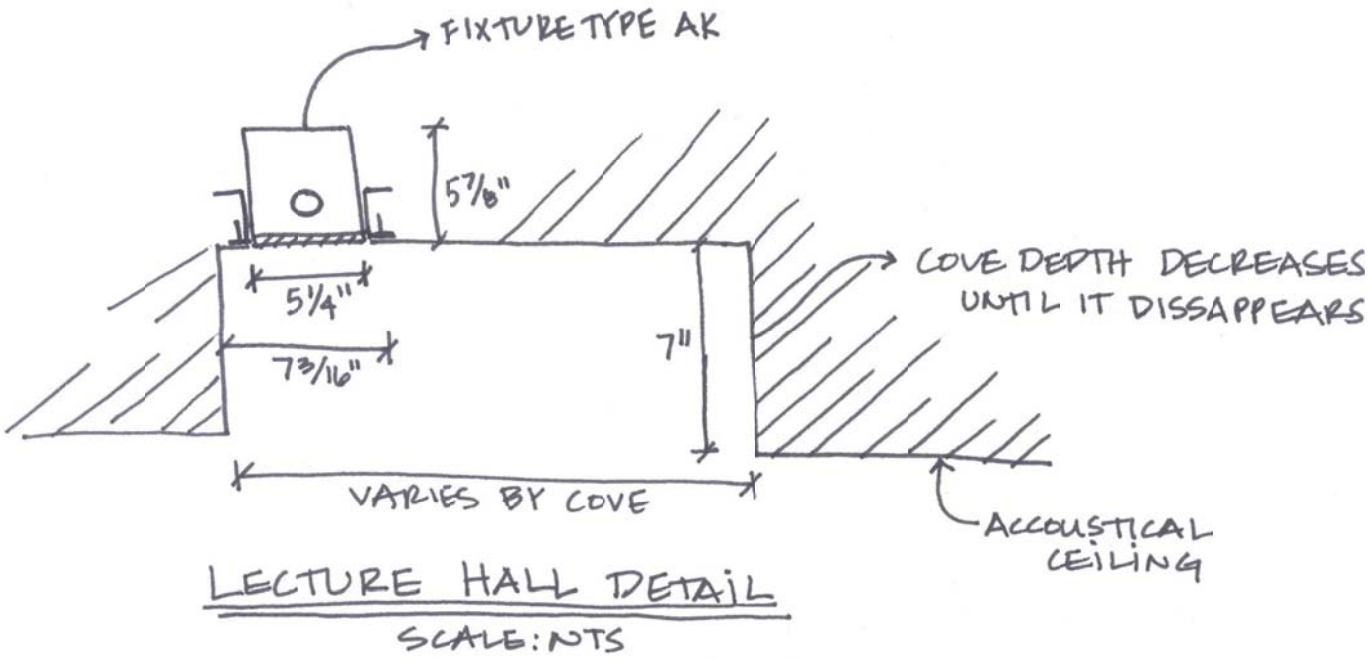
Type	Location	PF	Input Current	Input Wattage	Lamp Wattage	Other	BF
AB	page 17-5 GE catalog	0.97	0.08	20	18	ProLine CFL Electronic Ballasts	1.05
AG		1		10	10		1
AH	page 17-6 GE catalog	0.99	0.2	54	46	ProLine CFL Electronic Ballasts	1
AK	page 13-6 GE	0.97	0.26	71			1.11

Lighting Plans

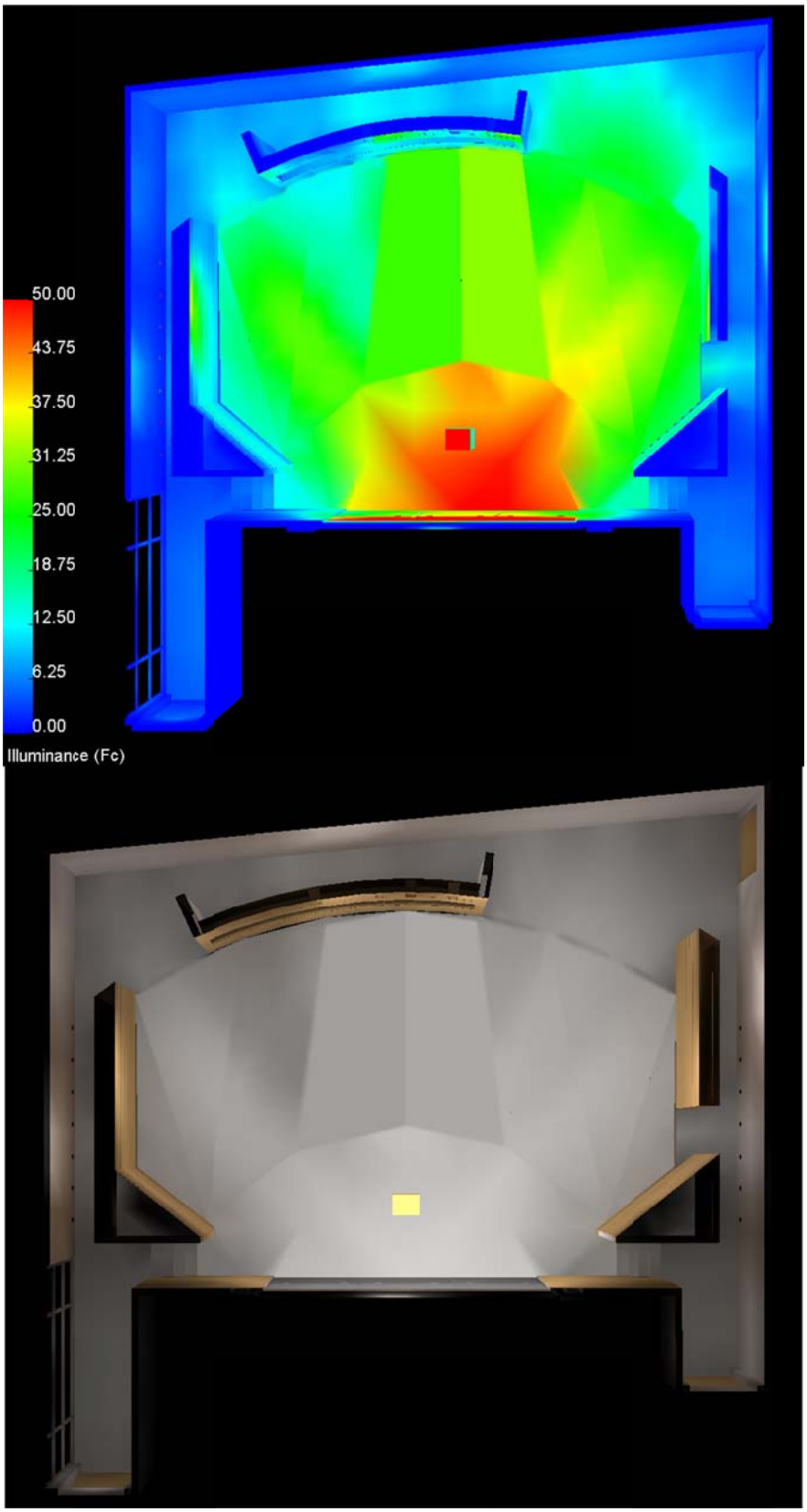


REFER TO APPENDIX L FOR FULL-SIZE DRAWING AND SCALE

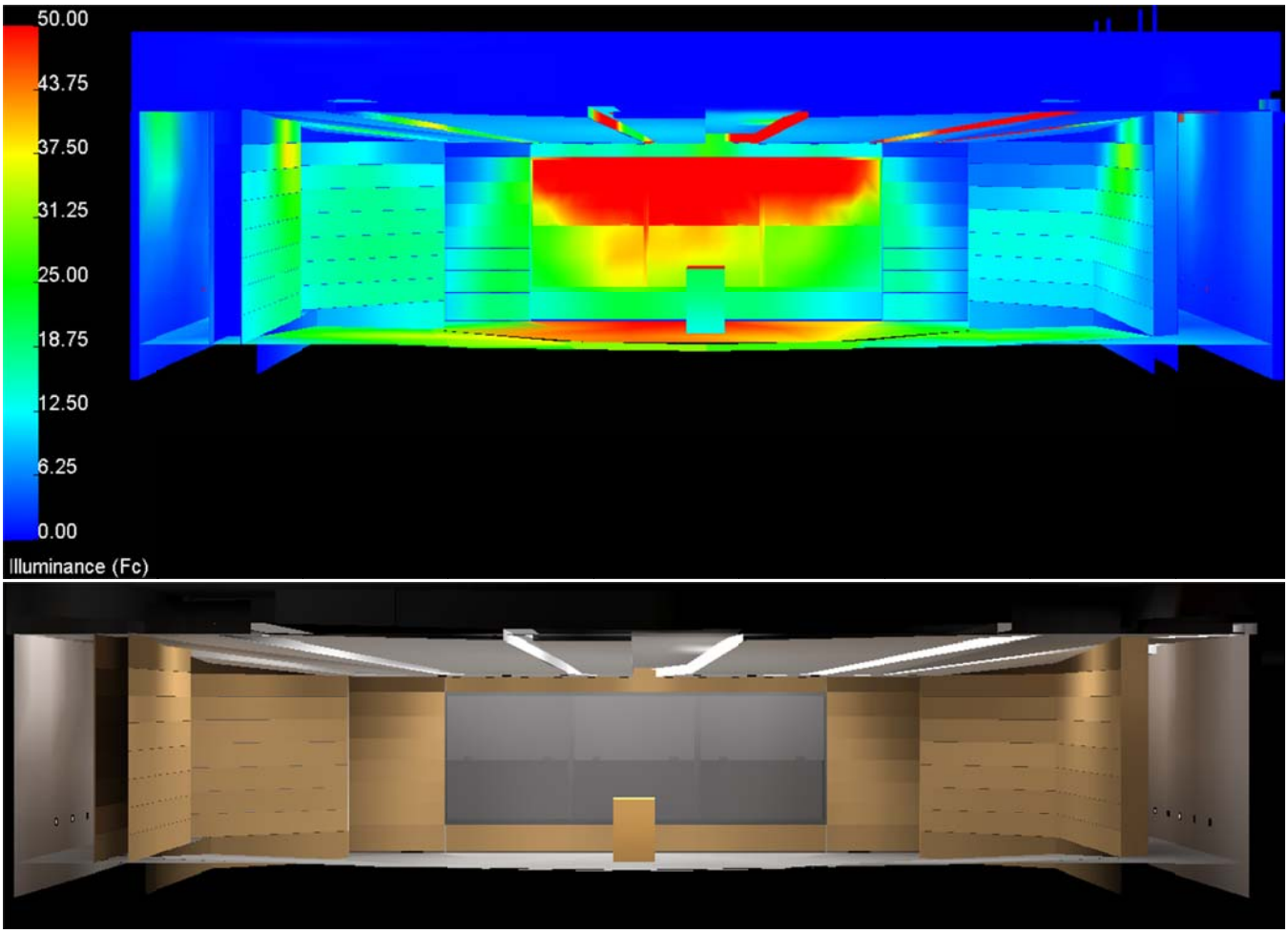
Mounting Details



Visual Performance | Visual Quality



PSEUDOCOLOR AND MATERIAL MODE IN AGI32 FOR FLOOR PLAN WITH ALL LUMINAIRES ON



ELEVATION LOOKING TOWARDS BLACKBOARD WITH ALL LUMINAIRES ON IN PSEUDOCOLO AND MATERIAL MODE IN AGI32

Results:

Zone	Average Illuminance	Maximum	Minimum	Max/Min	Coeff. Variation
Reading	28.48	59	9.1	6.48	
Lectern	67.82	83.2	47.9	1.74	
Lectern Vertical	30.81	36.1	19.7	1.83	
Stairs	6.72	10.4	4.6	2.26	
Corridors	6.57	15	2.7	5.56	
Chalkboard	45.88	83.7	19.6	4.27	0.36

Light Loss Factor Calculations

Luminaire Type	Lamp Lumen Depreciation	Ballast Factor	Lamp Dirt Depreciation	Total Light Loss Factors
AB	0.86	1.05	0.95	0.86
AG	1.00	1.00	0.95	0.95
AH	0.86	1.00	0.95	0.82
AK	0.95	1.11	0.95	1.00

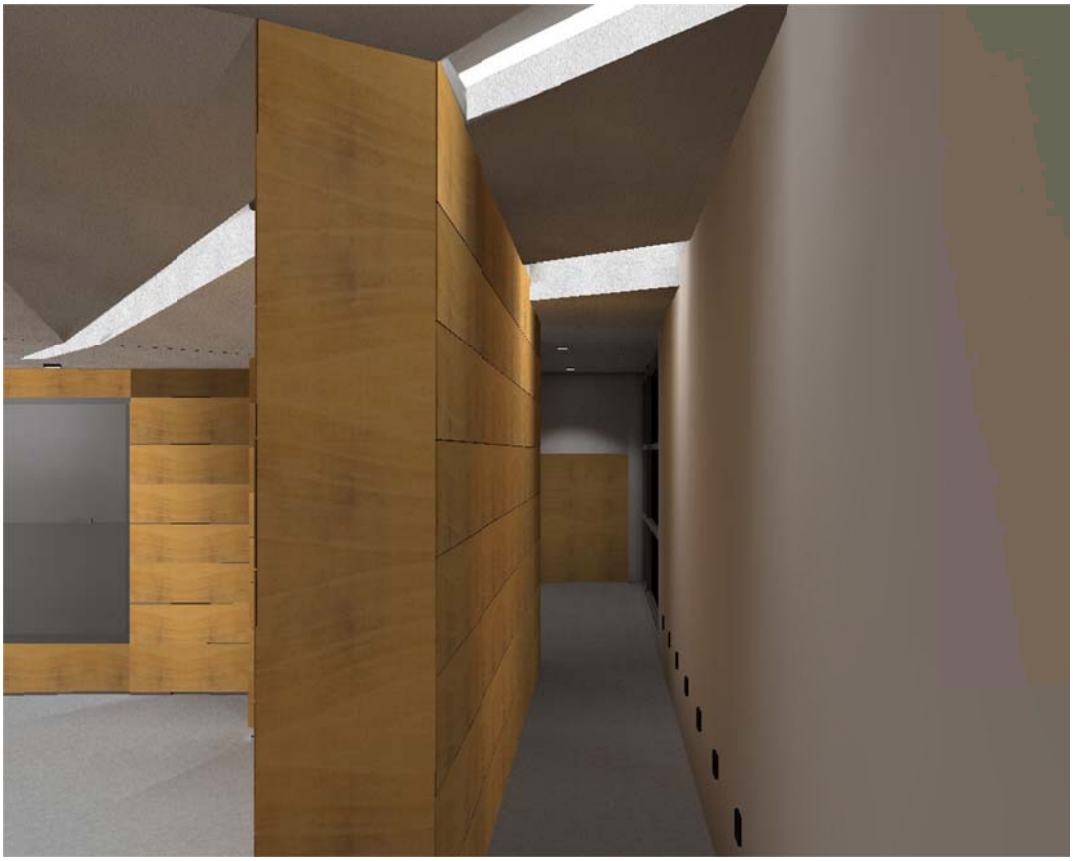
Energy Calculations

	Building Area	Space-by-Space
Allowable LPD (W/sq.ft.)	1.2	1.4
Actual LPD (W/sq.ft.)	1.156	1.156
Percentage	3.669	17.431

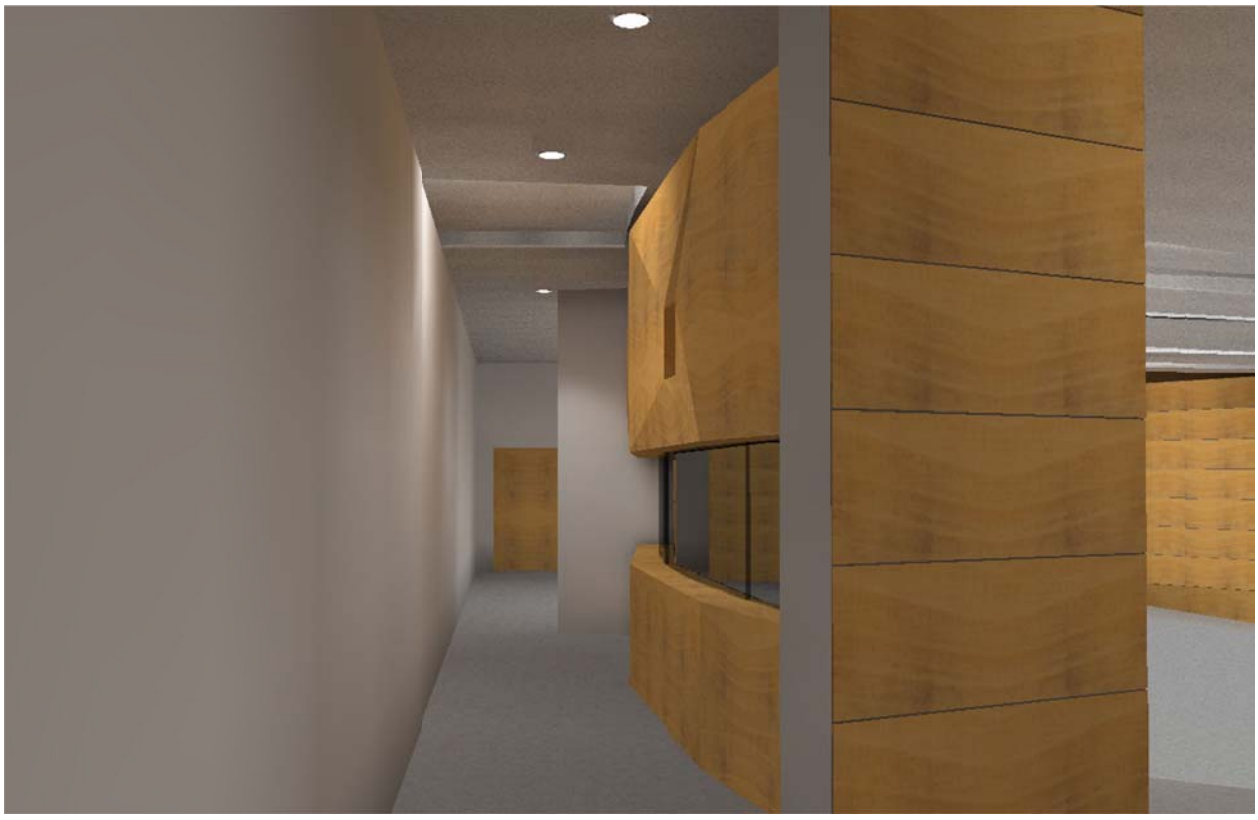
Area (sq.ft.)
3075

Luminaire Type	Watts/ Luminaire	Amount	Total Wattage
AB	18.4	9	165.6
AG	10	33	330
AH	46	17	782
AJ	30	17	510
AK	57	31	1767
	TOTAL WATTAGE =		3554.6

VIEW FROM SEATING AREA LOOKING TOWARDS BLACKBOARD



VIEW OF CORRIDOR



VIEW OF PROJECTION BOOTH AREA

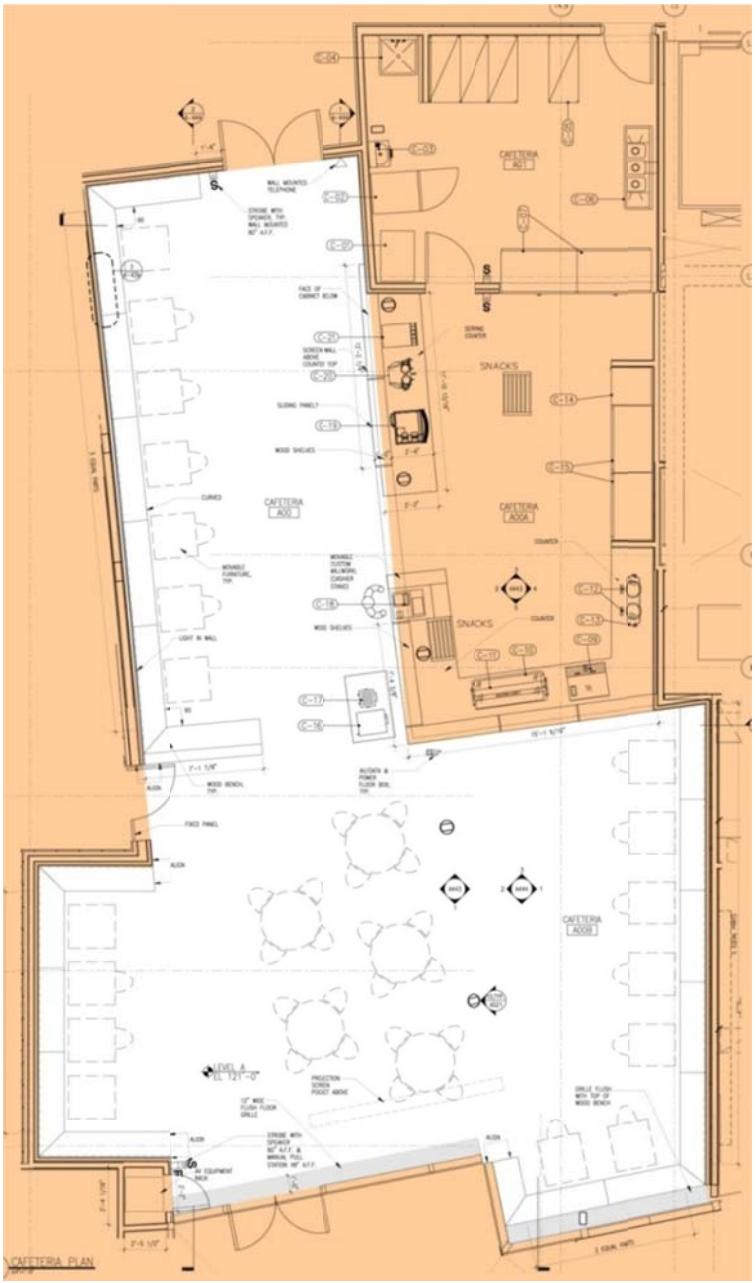
VIEW OF STEPS INTO LECTERN AREA

Special Purpose Space **| Cafeteria A00 |** Psychological Reinforcement

Existing Conditions

Description of Space

The cafeteria is full of odd angles and corners. There is a separate area for serving with several counters and the cashier surrounded by wood shelving and the seating area of the space. There are 18 smaller tables around the perimeter wooden bench. There are also several center tables and that can be moved when the projection screen needs to be used. The southern wall is part of the exterior curtain wall. Since this café is within a university scene, studying and lounging will occur and the space can be accommodated to hold special seminars or other gatherings.



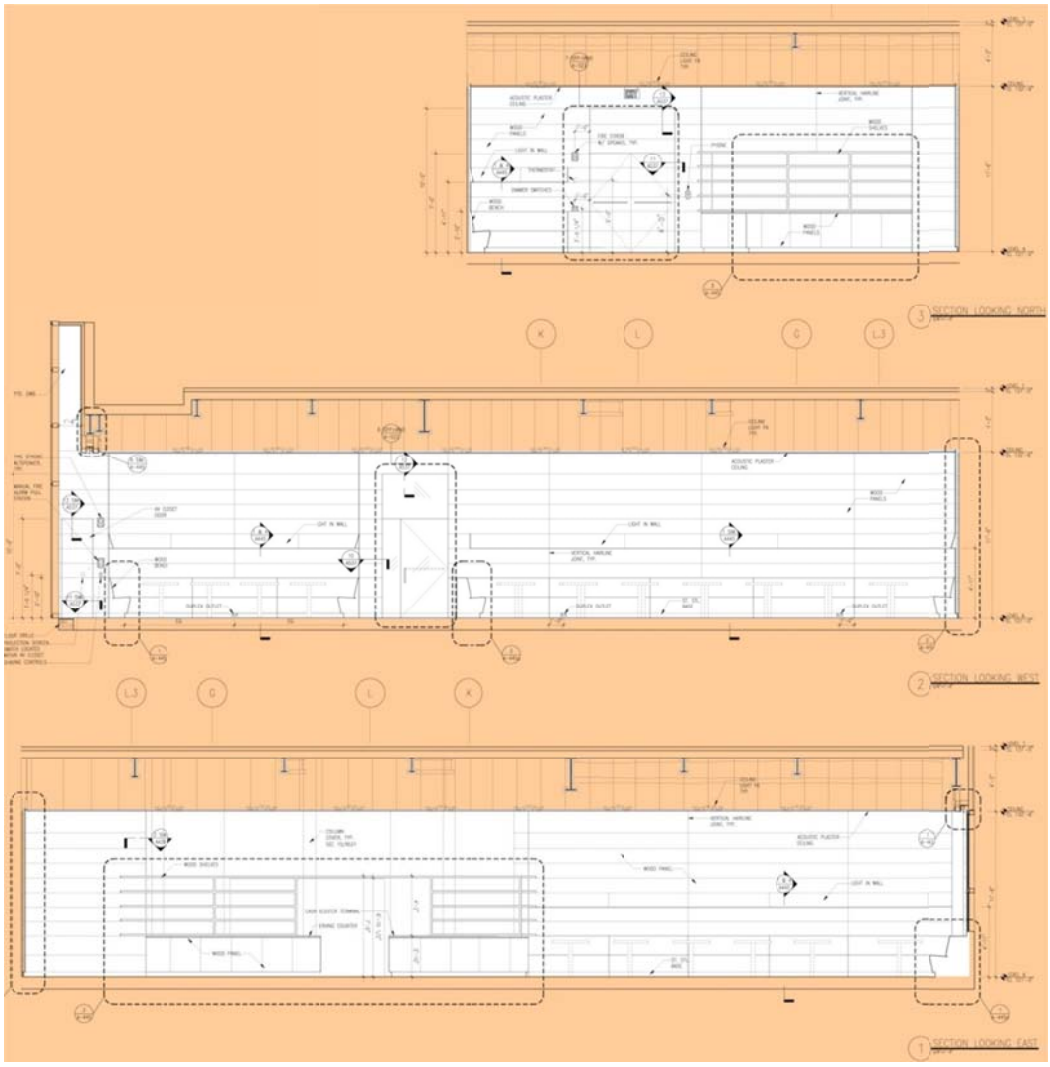
CAFETERIA PLAN, NTS

Furniture and Surface Materials

The space is full of seating areas which include wooden benches, tables, and chairs. There are also wooden bookshelves around the food preparation area and there is a projector screen that drops from the ceiling when needed.

Material	Reflectance *	Specifications #	Location
Exterior curtain wall	0.10	08910	South wall
Acoustic plaster	0.78	09900	Throughout
Painted gypsum wall board	0.70	09250	Food preparation area
Wood	0.25	06400	Wall panels, benches, shelves
Painted glass fiber reinforced plaster	0.76		
Stone	0.30	09600	Floor
Projection screen	0.80		

*Assumed, some from Figure 1-36 from IESNA Handbook Page 1-22, some from 3ds Max



CAFETERIA SECTIONS, NTS

Design Considerations

The cafeteria will be designed as a leisure type of dining area and the Flynn Mode of Privacy will be enforced. Lounging will be encouraged. For those students who might want to read as well, some areas will have slightly higher illuminance values to accommodate for this task but it will not be the main focus of the space. Because of the projector screen, the room must have the flexibility to switch from a dining space to a demonstration one.

Psychological Reinforcement

Dr. John Flynn developed criteria for evaluating the lighting in spaces by determining users' subjective response. For a space to feel "relaxed" according to his studies, the lighting would include non-uniform distribution, wall lighting, and lower light levels. The idea here is to enforce the criteria of a leisure dining type spaces using Flynn's Mode of Relaxation.

Visual Tasks

The most important visual tasks will be eating. Secondary visual tasks will include lounging and studying. In cafeterias, color is important for food appearance. Projector viewing will not be a regular task but since the space is equipped for it, the lighting must be able to accommodate for it.

Qualitative System Performance Considerations

The following lists in order of importance the design issues that are of consideration for a cafeteria, specifically the dining area, not the food preparation area. The ninth edition of The IESNA Lighting Handbook was referenced (Both Dining area and Reading area). For the dining task, the leisure type was chosen for the criteria selection. For the Reading task, it was assumed that most of the writing would be from #2 pencil and 8-10 point type. If one of the design issues appears under both reading and dining, then the dining criteria will be followed because it is the primary objective of the space.

Very Important (Dining) | Color appearance and color contrast | Color contributes to the enjoyment of food and it affects visibility and aesthetics. Several factors contribute to color appearance like the spectral power distribution (SPD) of light sources, perception ability of viewers, and the surfaces' transmission and reflection properties. Lighting designers can control the SDP by choosing a source that has a high Color Rendering Index (CRI). Lamps with a CRI higher than 80 must be used to ensure a pleasant appearance of food.

Important (Dining) | Appearance of space and luminaires | In dining areas, it is important to have an aesthetic appeal. The style of luminaires when coordinated with the architecture can enhance the design of the space. Lighting can evoke emotions and create an image. In a leisure type dining area, the lighting can promote relaxation.

Important (Dining) | Direct glare | Direct glare includes "discomfort glare" and "overhead glare". Both of these are undesirable in a place of relaxation. To minimize glare, luminaires luminances should not more than 100 times of those of the surrounding surfaces.

Important (Dining) | Points of interest | Even though the food is the most important part of a dining area, the focus should be kept away from the people to increase a sense of relaxation in accordance with the Flynn mode of relaxation.

Important (Dining) | System of control and flexibility | Control and flexibility are very important in dining environments were the illuminance levels are lower during the dining time and then need to increase for cleaning. Because this is a multi-function room, controls are necessary. There needs to be flexibility to change from a demonstration environment to a reading one as well as a leisure dining area.

Important (Dining) | Sparkle/desirable reflected highlights | Small points of bright light can add interest to a space. For example, in dining areas, light creates sparkle on silverware adding a sense of elegance.

Somewhat Important (Dining) | Illuminance (vertical) | Vertical illuminance helps for face modeling and can be desirable for dining situations.

Quantitative System Performance Considerations

Illuminance (horizontal) | 5-10fc (50-100lux) for leisure types of dining spaces

Illuminance (vertical) | 3fc (30lux) for dining

Energy

ASHRAE 90.1 2004
Building Area Method Lighting Power Densities, School/University | 1.2 W/sq.ft.
Space-by-Space Method Lighting Power Densities, Dining Area, Leisure Dining | 1.4 W/sq.ft.

Lighting Redesign

Lighting Solutions

To promote the Flynn mode of relaxation in the Cafeteria, a non-uniform lighting scheme was created that focused away from the users. Higher levels at the food preparation station will attract attention to this area as well as the under-lit cabinets surrounding it. Perimeter lighting includes grazing the surrounding wooden panel walls. Suspended luminaires will be hung and controlled by the users promoting the concept of ***building as brain activity***. These suspended elements will have lamps with a higher CRI because they will be lighting the food purchased by the occupants.

CONCEPTUAL SKETCH

Controls

This space will give a lot of control to the individual users to support the concept of building as brain activity. Each suspended luminaire will have its own ON/OFF switch, no dimming required, as well as be connected to the main 3 way switching. The downlights throughout must be dimmable for projector screen presentation mode but the wood grazing luminaires do not need to dim. The three switches will be located close to the two entrances and by the food preparation area.

Summary Performance Evaluation

The levels required for leisure type of dining spaces were obtained without the pendant luminaires ON which is shown below. The pendant luminaires bring the levels much higher, enough for reading/writing, for those who need it. The lamp used, halogen, has a very high CRI which will enhance the appearance of food and as point sources will add sparkle. The food preparation area levels of 30fc were also achieved with the addition of downlights. The rest of the space has enough illumination to provide safe circulation. The wood panels were highlighted with the use of linear LED luminaires and this brings the attention away from the user as desired. All the criteria stated were met for this space.

Documentation

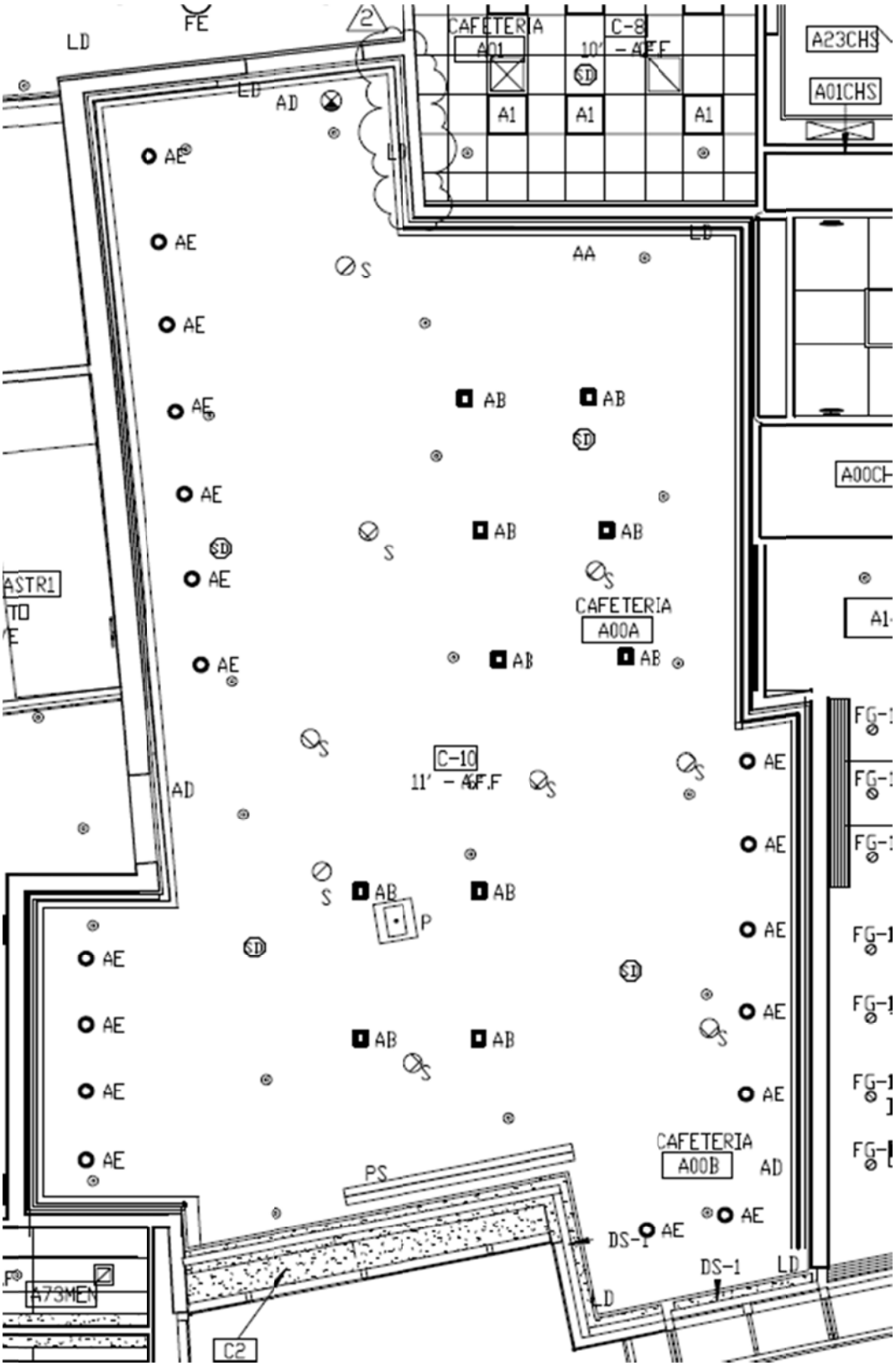
Luminaire Schedule

Type	Description	Lamp	Watt	Volt	Mfr	Catalog #
AA	Surface mounted linear fluorescent lamp and extruded aluminum housing with nominal 2.5" height by 2" wide, integral electronic ballast and T6 lamps for end-to-end smooth continuous illumination mounted within architectural cove, 3000k. Lengths as required by architecture.	NIPPO T6 FL 88CRI	9-10 W/lf	277	Nippo	SAL-UW-XXXX/FRT-XXXX-EL30
AB	Recessed compact fluorescent downlight with 6" nominal diameter aperture with aluminum, bright anodized reflector with plastic, translucent diffuser and integral electronic ballast, 3000k	PHILIPS PL-T 18W/830/4P /ALTO 82CRI	18.4	277/ 120	Edison Price	TRPV 18/6
AC	Surface mounted LED strip approximately 0.75"x0.75" in cross section and incremental nominal lengths ranging from 6" to 96" with extruded aluminum housing and acrylic optics, 96W driver supplied, 3000k. Consult factory for high CRI option availability.	High CRI option LED	2.92 W/lf	277	Cooper IO	0.03.1.3k.45.101.1 .XX.2.277V
AD	Surface mounted high-performance LED grazing fixture , 1.5" diameter by 2.1" high and 1ft increments with die-cast aluminum white powder coated finish housing and polycarbonate lens	LED 83CRI	13.5	277	Color Kinetics	eW Fuse Powercore 3000K, 10 by 60 degree beam angle
AE	Suspended halogen pendant with extruded and die-cast aluminum housing, grey finish, suspension cable included, designed by Roberto Pamio.	GE Q75G9	75	277	iGuzzini	Cup SM19

Ballast Schedule

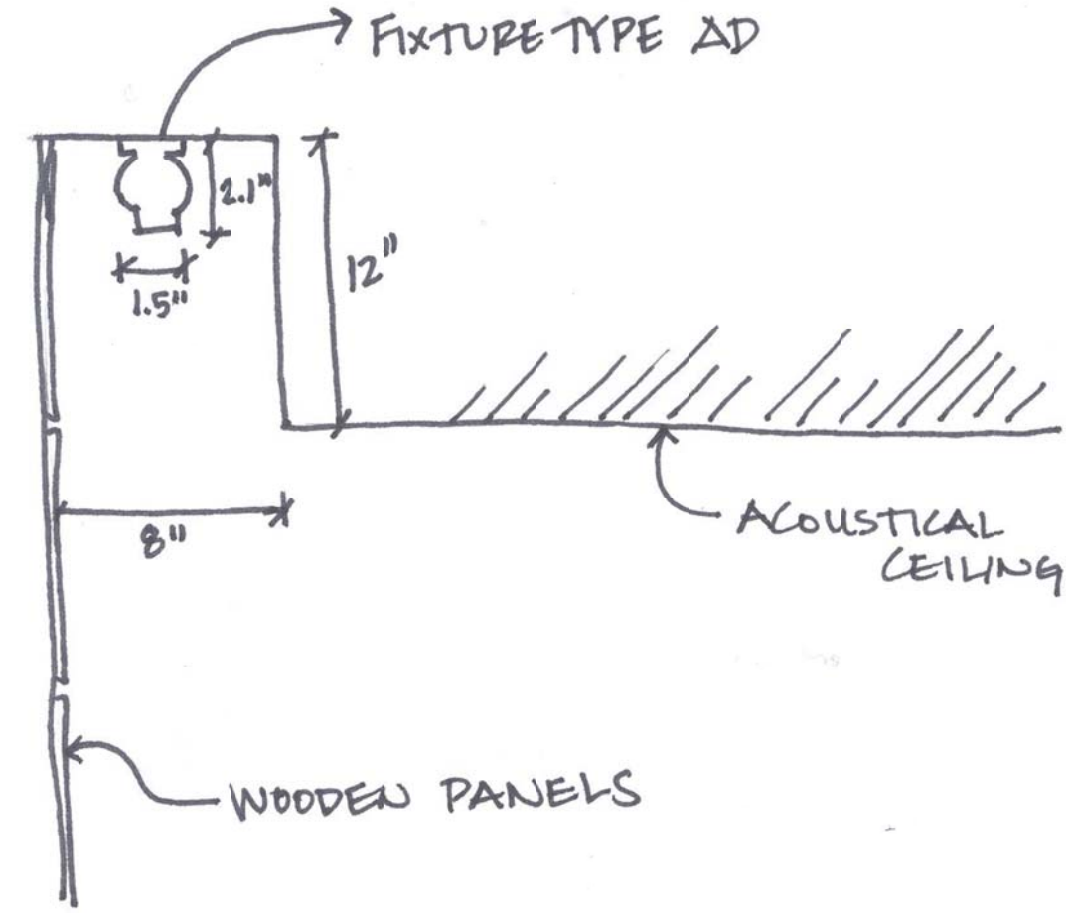
Type	Location	PF	Input Current	Input Wattage	Lamp Wattage	Other	BF
AA	Nippo Specs	0.98	0.17 for 4ft section (1250cm)	47	39	Advance Xfmr, non-dimming	
AB	page 17-5 GE catalog	0.97	0.08	20	18	ProLine CFL Electronic Ballasts	1.05
AC		1.00		2.92 W/lf	2.92 W/lf		1
AD		1.00		13.5	13.5		1
AE	page 17-5 GE catalog	0.97	0.08	20	18	ProLine CFL Electronic Ballasts	1.05

Lighting Plans



REFER TO APPENDIX L FOR FULL-SIZE DRAWING AND SCALE

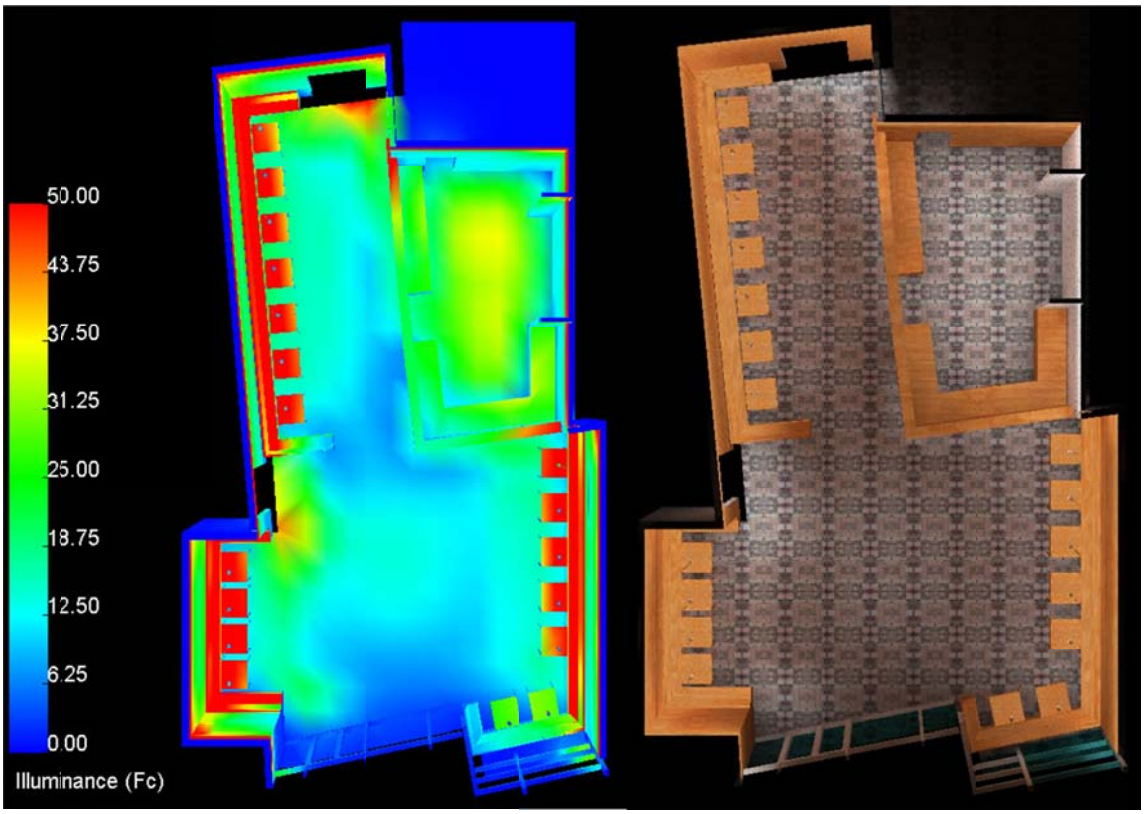
Mounting Details



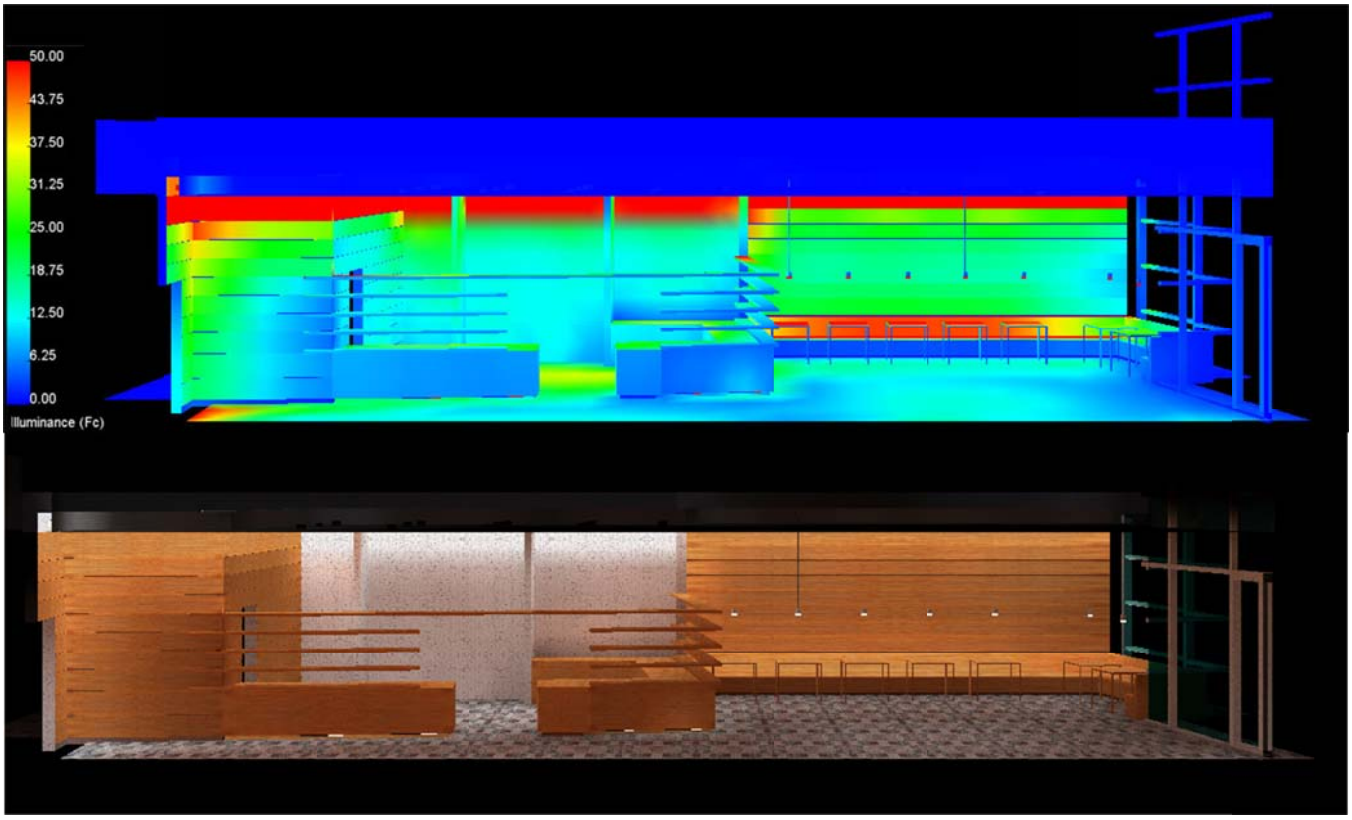
CAFETERIA COVE DETAIL

SCALE: NTS

Visual Performance | Visual Quality



PLAN VIEW IN PSEUDOCOLOR AND MATERIAL MODE FROM AGI32



ELEVATION VIEW IN PSEUDOCOLOR AND MATERIAL MODE FROM AGI32

Zone	Average Illuminance	Maximum	Minimum	Max/Min	Coeff. Variation
Tables	9.05	27.20	2.00	13.60	0.61
Lounge	11.79	15.20	5.80	2.62	
Food Prep	30.55	41.10	15.50	2.65	

Pendant luminaires OFF

Zone	Average Illuminance	Maximum	Minimum	Max/Min	Coeff. Variation
Tables	39.74	62.00	25.90	2.39	0.20
Lounge	12.95	16.30	6.90	2.36	
Food Prep	31.11	41.40	16.30	2.54	

Pendant luminaires ON

Light Loss Factor Calculations

Luminaire Type	Lamp Lumen Depreciation	Ballast Factor	Lamp Dirt Depreciation	Total Light Loss Factors
AA	0.92	0.88	0.95	0.77
AB	0.86	1.05	0.95	0.86
AC	0.70	1.00	0.95	0.67
AD	0.70	1.00	0.95	0.67
AE	1.00	1.05	0.95	1.00

Energy Calculations

	Building Area	Space-by-Space
Allowable LPD (W/sq.ft.)	1.2	1.4
Actual LPD (W/sq.ft.)	1.001	1.001
Percentage	16.586	28.503

Area (sq.ft.)
2283

Luminaire Type	Watts/ Luminaire	Amount	Total Wattage
AA	37	13	481
AB	18.4	19	349.6
AC	19.6	5	98
AD	11.9	114	1356.6
AE*	75	18	1350
	TOTAL WATTAGE* =		2285.2

*Decorative Allowance
1.0
0.591
40.867

TOTAL WATTAGE

3635.2

VIEW LOOKING NORTH

VIEW LOOKING EAST

VIEW LOOKING SOUTH INTO FOOD PREPARATION AREA

VIEW LOOKING TO CAFERTERIA SEATING FROM FOOD PREPARATION AREA

Four Lighting Spaces

Introduction

The four spaces in the Princeton Neuroscience & Psychology Complex where the lighting will be designed are the North Entrance, Lobby, Lecture Hall, and Cafeteria. Since the lighting will change, the electrical loads of the spaces will also be altered and therefore a redesign of the branch circuit distribution is necessary. The North Entrance has some pathways that lead to the lobby. There is only one Princeton standard gas lamp in the walkway areas in addition to the canopy LED downlights and fluorescent vestibule downlights. The lighting in the Lobby, Lecture Hall, and Cafeteria is composed of fluorescent downlights. The redesign of the North Entrance includes the addition of pedestrian light poles for safety and security. The Lobby scheme will completely change and will include a decorative installation in the main wooden wall. The Lecture Hall ceiling was redesigned for the architectural breadth therefore the downlights will be substituted with linear elements. The Cafeteria downlights were substituted with linear elements that bring emphasis to the perimeter creating a more comfortable and relax environment. The objective of the electrical design is to incorporate all these lighting design changes and make it work with the existing panelboards while reducing the energy consumption as a whole.

Panelboards						
Panel Tag	Voltage	System	North Entry	Lobby	Lecture Hall	Cafeteria
LP-AA	480Y/277V, 3P, 4W	N				X
ELP-AA	480Y/277V, 3P, 4W	N/E				X
LPD-AAL	208Y/120V, 3P, 4W	N			X	
ELPD-AAL	208Y/120V, 3P, 4W	N/E			X	
ELP-2B	480Y/277V, 3P, 4W	N/E	X	X		

Luminaire Schedule

Type	Description	Lamp	Watt	Volt	Mfr	Catalog #
AA	Surface mounted linear fluorescent lamp and extruded aluminum housing with nominal 2.5" height by 2" wide, integral electronic ballast and T6 lamps for end-to-end smooth continuous illumination mounted within architectural cove, 3000k. Lengths as required by architecture.	NIPPO T6 FL 88CRI	9-10 W/lf	277	Nippo	SAL-UW-XXXX/FRT-XXXX-EL30
AB	Recessed compact fluorescent downlight with 6" nominal diameter aperture with aluminum, bright anodized reflector with plastic, translucent diffuser and integral electronic ballast, 3000k	PHILIPS PL-T 18W/830/4P/ALTO 82CRI	18.4	277/120	Edison Price	TRPV 18/6
AC	Surface mounted LED strip approximately 0.75"x0.75" in cross section and incremental nominal lengths ranging from 6" to 96" with extruded aluminum housing and acrylic optics, 96W driver supplied, 3000k. Consult factory for high CRI option availability.	High CRI option LED	2.92 W/lf	277	Cooper IO	0.03.1.3k.45.101.1.XX.2.277V
AD	Surface mounted high-performance LED grazing fixture , 1.5" diameter by 2.1" high and 1ft increments with die-cast aluminum white powder coated finish housing and polycarbonate lens	LED 83CRI	13.5	277	Color Kinetics	eW Fuse Powercore 3000K, 10 by 60 degree beam angle
AE	Suspended halogen pendant with extruded and die-cast aluminum housing, grey finish, suspension cable included, designed by Roberto Pamio.	GE Q75G9	75	277	iGuzzini	Cup SM19
AF	Recessed in-ground low-voltage halogen wall-washer with cast aluminum body and outer casing and double tempered glass and nominal 5" diameter with integral electronic transformer.	PHILIPS 10W/T3/12V	10	12-277	iGuzzini	I.B001-277-13

Type	Description	Lamp	Watt	Volt	Mfr	Catalog #
AG	Recessed low voltage halogen wall luminaire with die-cast aluminum housing with integral wiring compartment, impact resistant satin matte crystal glass, requires a remote Class 2, 12V transformer, nominal 3 in square.	PHILIPS 10W/T3/12V	10	120/12	Bega	2303
AH	Recessed compact fluorescent wall-washer with 6" nominal diameter aperture with aluminum, bright anodized reflector with plastic, translucent diffuser and integral electronic ballast, 3000k	(2) PHILIPS PL-T 26W/830/4P/ALT O 82CRI	46	120	Edison Price	WLX 226/6
AJ	Fully recessed and flangeless linear fluorescent slotlight nominal 6" wide with extruded aluminum housing, powder coated high-reflectance which finish, and joiner system allowing uniform appearance with frosted acrylic lens. Lengths as required by architecture.	PHILIPS F28T5/ 835/ALTO 85CRI	30	277	Zumtobel	SLR6NX-XX-1285-XX-OLP-DX
AK	Fully recessed and flangeless linear fluorescent slotlight nominal 6" wide with extruded aluminum housing, powder coated high-reflectance which finish, and joiner system allowing uniform appearance with frosted acrylic lens. Lengths as required by architecture.	PHILIPS F54T5/ 835/HO/ALTO 85CRI	57	120	Zumtobel	SLR6NX-XX-1545-XX-OLP-DX
AL	Surface wall mounted elliptipar metal halide ceiling uplight mounted to the mullions of the exterior façade inside the lobby with bright clear anodized aluminum reflector with mill finish aluminum door and end plates and black yoke/mounting plate and remote electronic ballast.	PHILIPS CDM150/T6/942 96CRI	150	277	The Lighting Quotient	1403-150G-W-00-2-00-0

Type	Description	Lamp	Watt	Volt	Mfr	Catalog #
AM	Pole top metal halide exterior indirect adjustable luminaire with die-cast aluminum optical housing and 31.5" diameter and .25" thick aluminum plate secured by two die-cast aluminum "saddle" with maximum 30 degrees tilt and IP65 classification.	PHILIPS CDM Elite 70/T6/ 930 90CRI	88	277	Bega	8200MH
AP	Recessed exterior round drive-over in-ground halogen up light for foliage with stainless steel housing, convex tempered glass diffuser, anodized matte reflector, and natural bronze casting finish, rated IP67, with integral electronic transformer.	35W T4 GY6.35 12V	46	120/11.6	Bega	8702
AR	Fully Recessed LED indicator in-ground luminaire for both outdoor and indoor applications, with remote constant 6V driver, stainless steel housing, rated IP67, and visible nominal diameter of 7/8" with the base being nominal 5".	LED	0.08	277	MP Lighting	L06-WS27S-X-X-S6

Ballast Information for each luminaire:

Type	Location	PF	Input Current	Input Wattage	Lamp Wattage	Other	BF
AA	Nippo Specs	0.98	0.17 for 4ft section (1250cm)	47	39	Advance Xfmr, non-dimming	
AB	page 17-5 GE catalog	0.97	0.08	20	18	ProLine CFL Electronic Ballasts	1.05
AC		1.00		2.92 W/lf	2.92 W/lf		1
AD		1.00		13.5	13.5		1
AE	page 17-5 GE catalog	0.97	0.08	20	18	ProLine CFL Electronic Ballasts	1.05
AF		1		10	10		1
AG		1		10	10		1
AH	page 17-6 GE catalog	0.99	0.2	54	46	ProLine CFL Electronic Ballasts	1
AJ	page 13-3 GE	0.92	0.17	43		T5 High Efficiency - Programmed Start	1.22
AK	page 13-6 GE	0.97	0.26	71			1.11
AL	page 18-14 GE	0.9	0.7	186		86718 - GEM150MLTLC3D-5	1
AM	page 18-11 GE	0.9	0.4	88		86847	1
AP		1		46	46		1
AR		1		0.08	0.08		1

Controls

The North Entry luminaires will be controlled with line-voltage switching as well as the Cafeteria. The Lecture Hall requires several pre-set scenes therefore low-voltage dimming will be used to control it with the use of Lutron Grafik Eye Control System. The Lobby will be mostly ON always; therefore it will also be controlled using line-voltage switching and time-clock capabilities.

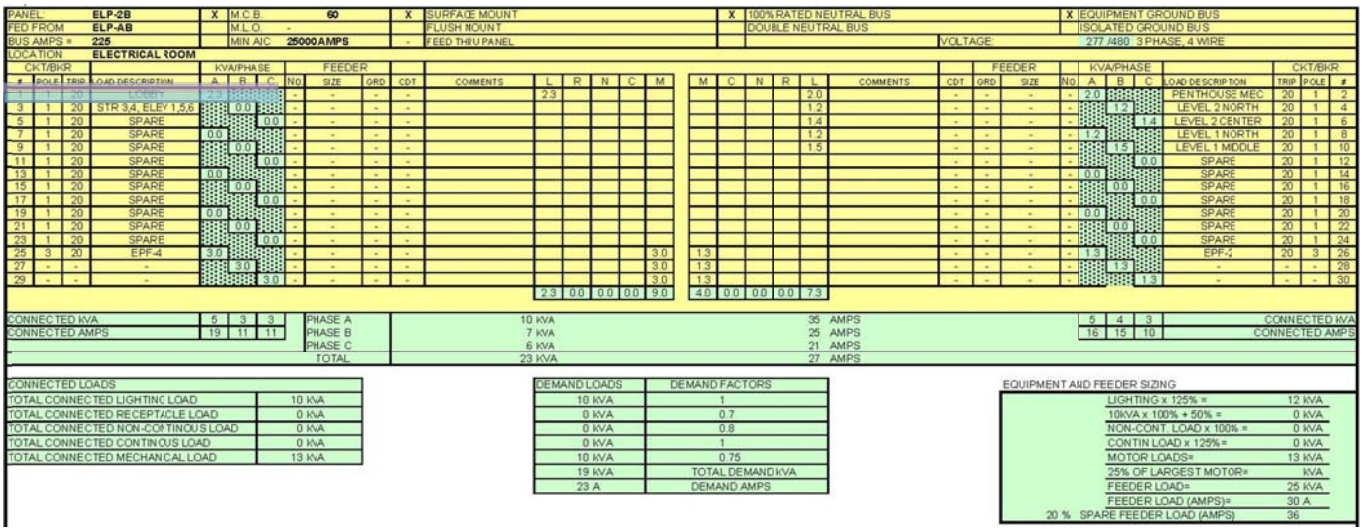
Electrical Plans

Refer to Appendix E for full size Electrical Plans with scale.

Existing Panelboard Schedules

The branch circuit to be redesigned is highlighted according to the colors in the chart at the beginning.

ELP-2B



PANEL:	ELP-2B	X	M.C.B.	60	X	SURFACE MOUNT	X	100% RATED NEUTRAL BUS	X	EQUIPMENT GROUND BUS
FED FROM	ELP-AB		M.L.O.	-		FLUSH MOUNT		DOUBLE NEUTRAL BUS		ISOLATED GROUND BUS
BUS AMPS =	225		MIN AIC	25000 AMPS	-	FEED THRU PANEL		VOLTAGE		277 /480 3 PHASE, 4 WIRE
LOCATION	ELECTRICAL ROOM									

CKT/BKR #	POLE	TRIP	LOAD DESCRIPTION	KVA/PHASE A	B	C	FEEDER No.	SIZE	GRD	CDT	COMMENTS	L	R	N	C	M
1	1	20	LOBBY	2.3			-	-	-	-		2.3				
3	1	20	STR 3,4, ELEV 1,5,6		0.0		-	-	-	-						
5	1	20	SPARE			0.0	-	-	-	-						
7	1	20	SPARE	0.0			-	-	-	-						
9	1	20	SPARE		0.0		-	-	-	-						
11	1	20	SPARE			0.0	-	-	-	-						
13	1	20	SPARE	0.0			-	-	-	-						
15	1	20	SPARE		0.0		-	-	-	-						
17	1	20	SPARE			0.0	-	-	-	-						
19	1	20	SPARE	0.0			-	-	-	-						
21	1	20	SPARE		0.0		-	-	-	-						
23	1	20	SPARE			0.0	-	-	-	-						
25	3	20	EPF-4	3.0			-	-	-	-						3.0
27	-	-	-		3.0		-	-	-	-						3.0
29	-	-	-			3.0	-	-	-	-						3.0
												2.3	0.0	0.0	0.0	9.0

CKT/BKR #	POLE	TRIP	LOAD DESCRIPTION	L	R	N	C	M	COMMENTS	CDT	GRD	SIZE	No.	KVA/PHASE A	B	C	LOAD DESCRIPTION	TRIP	POLE	#
																	PENTHOUSE MEC	20	1	2
																	LEVEL 2 NORTH	20	1	4
																	LEVEL 2 CENTER	20	1	6
																	LEVEL 1 NORTH	20	1	8
																	LEVEL 1 MIDDLE	20	1	10
																	SPARE	20	1	12
																	SPARE	20	1	14
																	SPARE	20	1	16
																	SPARE	20	1	18
																	SPARE	20	1	20
																	SPARE	20	1	22
																	SPARE	20	1	24
																	EPF-2	20	3	25
																	-	-	-	28
																	-	-	-	30
2.3	0.0	0.0	0.0	9.0																
4.0	0.0	0.0	0.0	7.3																

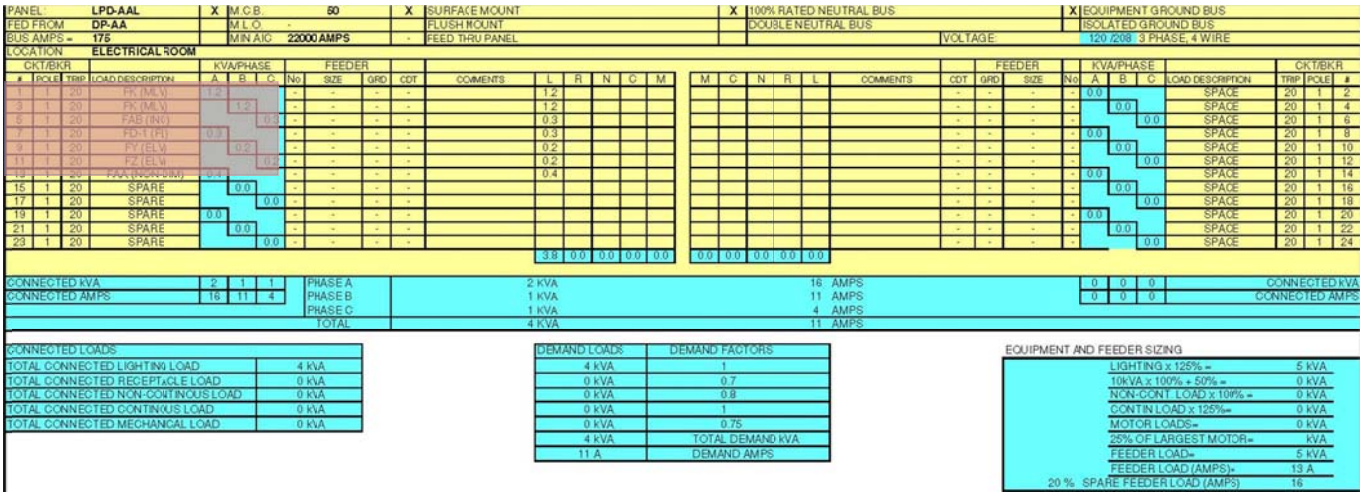
CONNECTED KVA	5	3	3	PHASE A	10 KVA	35 AMPS	5	4	3	CONNECTED KVA
CONNECTED AMPS	19	11	11	PHASE B	7 KVA	25 AMPS	16	15	10	CONNECTED AMPS
				PHASE C	6 KVA	21 AMPS				
				TOTAL	23 KVA	27 AMPS				

CONNECTED LOADS	
TOTAL CONNECTED LIGHTING LOAD	10 KVA
TOTAL CONNECTED RECEPTACLE LOAD	0 KVA
TOTAL CONNECTED NON-CONTINOUS LOAD	0 KVA
TOTAL CONNECTED CONTINOUS LOAD	0 KVA
TOTAL CONNECTED MECHANICAL LOAD	13 KVA

DEMAND LOADS	DEMAND FACTORS
10 KVA	1
0 KVA	0.7
0 KVA	0.8
0 KVA	1
10 KVA	0.75
19 KVA	TOTAL DEMAND KVA
23 A	DEMAND AMPS

EQUIPMENT AND FEEDER SIZING	
LIGHTING x 125% =	12 KVA
10KVA x 100% + 50% =	0 KVA
NON-CONT. LOAD x 100% =	0 KVA
CONTIN LOAD x 125%=	0 KVA
MOTOR LOADS=	13 KVA
25% OF LARGEST MOTOR=	KVA
FEEDER LOAD=	25 KVA
FEEDER LOAD (AMPS)=	30 A
20 % SPARE FEEDER LOAD (AMPS)	36

LPD-AAL



PANEL:	LPD-AAL	X	M.C.B.	50	X	SURFACE MOUNT	X	100% RATED NEUTRAL BUS	X	EQUIPMENT GROUND BUS
FED FROM	DP-AA		M.L.O.	-		FLUSH MOUNT		DOUBLE NEUTRAL BUS		ISOLATED GROUND BUS
BUS AMPS =	175		MIN AIC	22000 AMPS	-	FEED THRU PANEL		VOLTAGE		120 /208 : 3 PHASE, 4 WIRE
LOCATION	ELECTRICAL ROOM									

CKT/BKR #	POLE	TRIP	LOAD DESCRIPTION	KVA/PHASE A	B	C	FEEDER No	SIZE	GRD	CDT	COMMENTS	L	R	N	C	M	M	C	N	R	L	COMMENTS	FEEDER CDT	GRD	SIZE	No	KVA/PHASE A	B	C	LOAD DESCRIPTION	CKT/BKR TRIP	POLE	#
1	1	20	FK (MLV)	1.2			-	-	-	-		1.2											-	-	-	-	0.0			SPACE	20	1	2
3	1	20	FK (MLV)		1.2		-	-	-	-		1.2											-	-	-	-		0.0		SPACE	20	1	4
5	1	20	FAB (INC)			0.3	-	-	-	-		0.3											-	-	-	-			0.0	SPACE	20	1	6
7	1	20	FD-1 (FL)	0.3			-	-	-	-		0.3											-	-	-	-	0.0			SPACE	20	1	8
9	1	20	FY (ELV)		0.2		-	-	-	-		0.2											-	-	-	-		0.0		SPACE	20	1	10
11	1	20	FZ (ELV)			0.2	-	-	-	-		0.2											-	-	-	-			0.0	SPACE	20	1	12
13	1	20	FAA (NON-DIM)	0.4			-	-	-	-		0.4											-	-	-	-	0.0			SPACE	20	1	14
15	1	20	SPARE		0.0		-	-	-	-													-	-	-	-		0.0		SPACE	20	1	16
17	1	20	SPARE			0.0	-	-	-	-													-	-	-	-			0.0	SPACE	20	1	18
19	1	20	SPARE	0.0			-	-	-	-													-	-	-	-	0.0			SPACE	20	1	20
21	1	20	SPARE		0.0		-	-	-	-													-	-	-	-		0.0		SPACE	20	1	22
23	1	20	SPARE			0.0	-	-	-	-													-	-	-	-			0.0	SPACE	20	1	24
												3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0											

CONNECTED kVA	2	1	1	PHASE A	2 kVA	16 AMPS	0	0	0	CONNECTED kVA
CONNECTED AMPS	16	11	4	PHASE B	1 kVA	11 AMPS	0	0	0	CONNECTED AMPS
				PHASE C	1 kVA	4 AMPS				
				TOTAL	4 kVA	11 AMPS				

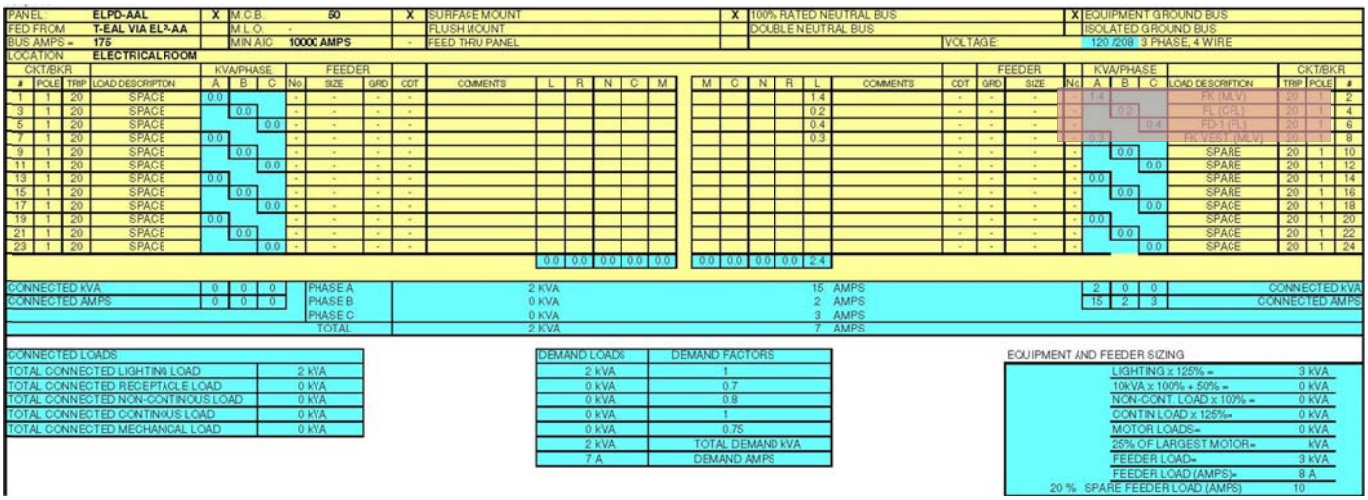
CONNECTED LOADS	
TOTAL CONNECTED LIGHTING LOAD	4 kVA
TOTAL CONNECTED RECEPTACLE LOAD	0 kVA
TOTAL CONNECTED NON-CONTINOUS LOAD	0 kVA
TOTAL CONNECTED CONTINOUS LOAD	0 kVA
TOTAL CONNECTED MECHANICAL LOAD	0 kVA

DEMAND LOADS	DEMAND FACTORS
4 kVA	1
0 kVA	0.7
0 kVA	0.8
0 kVA	1
0 kVA	0.75
4 kVA	TOTAL DEMAND kVA
11 A	DEMAND AMPS

EQUIPMENT AND FEEDER SIZING

LIGHTING x 125% =	5 kVA
10kVA x 100% + 50% =	0 kVA
NON-CONT. LOAD x 100% =	0 kVA
CONTIN LOAD x 125%=	0 kVA
MOTOR LOADS=	0 kVA
25% OF LARGEST MOTOR=	kVA
FEEDER LOAD=	5 kVA
FEEDER LOAD (AMPS)=	13 A
20 % SPARE FEEDER LOAD (AMPS)	16

ELPD-AAL



PANEL:	ELPD-AAL	X	M.C.B.	50	X	SURFACE MOUNT	X	100% RATED NEUTRAL BUS	X	EQUIPMENT GROUND BUS
FED FROM	T-EAL VIA EL³-AA		M.L.O.	-		FLUSH MOUNT		DOUBLE NEUTRAL BUS		ISOLATED GROUND BUS
BUS AMPS =	175		MIN AIC	10000 AMPS	-	FEED THRU PANEL		VOLTAGE:		120 /208 3 PHASE, 4 WIRE
LOCATION:	ELECTRICAL ROOM									

CKT/BKR #	POLE	TRIP	LOAD DESCRIPTION	KVA/PHASE A	B	C	FEEDER No.	SIZE	GRD	CDT	COMMENTS	L	R	N	C	M
1	1	20	SPACE	0.0			-	-	-	-						
3	1	20	SPACE		0.0		-	-	-	-						
5	1	20	SPACE			0.0	-	-	-	-						
7	1	20	SPACE	0.0			-	-	-	-						
9	1	20	SPACE		0.0		-	-	-	-						
11	1	20	SPACE			0.0	-	-	-	-						
13	1	20	SPACE	0.0			-	-	-	-						
15	1	20	SPACE		0.0		-	-	-	-						
17	1	20	SPACE			0.0	-	-	-	-						
19	1	20	SPACE	0.0			-	-	-	-						
21	1	20	SPACE		0.0		-	-	-	-						
23	1	20	SPACE			0.0	-	-	-	-						
												0.0	0.0	0.0	0.0	0.0

M	C	N	R	L	COMMENTS	CDT	FEEDER GRD	FEEDER SIZE	KVA/PHASE No.	A	B	C	LOAD DESCRIPTION	CKT/BKR TRIP	POLE	#
				1.4		-	-	-	-	1.4			FK (MLV)	20	1	2
				0.2		-	-	-	-		0.2		FL (CFL)	20	1	4
				0.4		-	-	-	-			0.4	FD-1 (FL)	20	1	6
				0.3		-	-	-	-	0.3			FK VEST. (MLV)	20	1	8
						-	-	-	-		0.0		SPARE	20	1	10
						-	-	-	-			0.0	SPARE	20	1	12
						-	-	-	-	0.0			SPARE	20	1	14
						-	-	-	-		0.0		SPARE	20	1	16
						-	-	-	-			0.0	SPACE	20	1	18
						-	-	-	-	0.0			SPACE	20	1	20
						-	-	-	-		0.0		SPACE	20	1	22
						-	-	-	-			0.0	SPACE	20	1	24
0.0	0.0	0.0	0.0	2.4												

CONNECTED KVA	0	0	0	PHASE A	2 KVA
CONNECTED AMPS	0	0	0	PHASE B	0 KVA
				PHASE C	0 KVA
				TOTAL	2 KVA

					15 AMPS
					2 AMPS
					3 AMPS
					7 AMPS

2	0	0	CONNECTED KVA		
15	2	3	CONNECTED AMPS		

CONNECTED LOADS	
TOTAL CONNECTED LIGHTING LOAD	2 KVA
TOTAL CONNECTED RECEPTACLE LOAD	0 KVA
TOTAL CONNECTED NON-CONTINOUS LOAD	0 KVA
TOTAL CONNECTED CONTINUOUS LOAD	0 KVA
TOTAL CONNECTED MECHANICAL LOAD	0 KVA

DEMAND LOADS	DEMAND FACTORS
2 KVA	1
0 KVA	0.7
0 KVA	0.8
0 KVA	1
0 KVA	0.75
2 KVA	TOTAL DEMAND KVA
7 A	DEMAND AMPS

EQUIPMENT AND FEEDER SIZING	
LIGHTING x 125% =	3 KVA
10kVA x 100% + 50% =	0 KVA
NON-CONT. LOAD x 100% =	0 KVA
CONTIN LOAD x 125%=	0 KVA
MOTOR LOADS=	0 KVA
25% OF LARGEST MOTOR=	KVA
FEEDER LOAD=	3 KVA
FEEDER LOAD (AMPS)=	8 A
20 % SPARE FEEDER LOAD (AMPS)	10

LP-AA

PANEL: LP-AA	-	M.C.B. -	X	SURFACE MOUNT	X	100% RATED NEUTRAL BUS	X	EQUIPMENT GROUND BUS
FED FROM BUSWAY	X	M.L.O. -		FLUSH MOUNT		DOUBLE NEUTRAL BUS		ISOLATED GROUND BUS
BUS AMPS = 225		MIN AIC 25000 AMPS	-	FEED THRU PANEL		VOLTAGE:		277 /480 3 PHASE, 4 WIRE
LOCATION ELECTRICAL ROOM								

#	POLE	TRIP	LOAD DESCRIPTION	A	B	C	No.	SIZE	GRD	CDT	COMMENTS	L	R	N	C	M	M	C	N	R	L	COMMENTS	CDT	GRD	SIZE	No.	A	B	C	LOAD DESCRIPTION	TRIP	POLE	#
1	1	20	ROOMS	2.6			-	-	-	-		2.6									2.6		-	-	-	-	2.6			CAFETERIA	20	1	2
3	1	20	ROOMS		1.3		-	-	-	-		1.3									0.6		-	-	-	-		0.6		OFFICE	20	1	4
5	1	20	ROOMS			1.5	-	-	-	-		1.5									1.0		-	-	-	-			1.0	CORRIDOR	20	1	6
7	1	20	LVL BC MER	3.5			-	-	-	-		3.5									1.2		-	-	-	-	1.2			TUNNEL	20	1	8
9	1	20	LVL BC BOH		2.6		-	-	-	-		2.6											-	-	-	-		0.0		SPARE	20	1	10
11	1	20	SPARE			0.0	-	-	-	-													-	-	-	-			0.0	SPARE	20	1	12
13	1	20	SPARE	0.0			-	-	-	-													-	-	-	-	0.0			SPARE	20	1	14
15	1	20	SPARE		0.0		-	-	-	-													-	-	-	-		0.0		SPARE	20	1	16
17	1	20	SPARE			0.0	-	-	-	-													-	-	-	-			0.0	SPARE	20	1	18
19	1	20	SPARE	0.0			-	-	-	-													-	-	-	-	0.0			SPARE	20	1	20
21	1	20	SPARE		0.0		-	-	-	-													-	-	-	-		0.0		SPARE	20	1	22
23	1	20	SPARE			0.0	-	-	-	-													-	-	-	-			0.0	SPARE	20	1	24
25	1	20	SPARE	0.0			-	-	-	-													-	-	-	-	0.0			SPARE	20	1	26
27	1	20	SPARE		0.0		-	-	-	-													-	-	-	-		0.0		SPARE	20	1	28
29	1	20	SPARE			0.0	-	-	-	-													-	-	-	-			0.0	SPARE	20	1	30
												11.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3												

	A	B	C				A	B	C	
CONNECTED kVA	6	4	2	PHASE A	10 KVA	35 AMPS	4	1	1	CONNECTED kVA
CONNECTED AMPS	22	14	5	PHASE B	5 KVA	16 AMPS	14	2	4	CONNECTED AMPS
				PHASE C	3 KVA	9 AMPS				
				TOTAL	17 KVA	20 AMPS				

CONNECTED LOADS	
TOTAL CONNECTED LIGHTING LOAD	17 kVA
TOTAL CONNECTED RECEPTACLE LOAD	0 kVA
TOTAL CONNECTED NON-CONTINOUS LOAD	0 kVA
TOTAL CONNECTED CONTINOUS LOAD	0 kVA
TOTAL CONNECTED MECHANCAL LOAD	0 kVA

DEMAND LOADS	DEMAND FACTORS
17 kVA	1
0 kVA	0.7
0 kVA	0.8
0 kVA	1
0 kVA	0.75
17 kVA	TOTAL DEMAND kVA
20 A	DEMAND AMPS

EQUIPMENT AND FEEDER SIZING

LIGHTING x 125% =	21 kVA
10kVA x 100% + 50% =	0 kVA
NON-CONT. LOAD x 100% =	0 kVA
CONTIN LOAD x 125%=	0 kVA
MOTOR LOADS=	0 kVA
25% OF LARGEST MOTOR=	kVA
FEEDER LOAD=	21 kVA
FEEDER LOAD (AMPS)=	25 A
20 % SPARE FEEDER LOAD (AMPS)	30

X	100% RATED NEUTRAL BUS	X	EQUIPMENT GROUND BUS
	DOUBLE NEUTRAL BUS		ISOLATED GROUND BUS
	VOLTAGE:		277 /480 3 PHASE, 4 WIRE

M	C	N	R	L	COMMENTS	CDT	GRD	SIZE	No.	A	B	C	LOAD DESCRIPTION	TRIP	POLE	#
				2.6		-	-	-	-	2.6			CAFETERIA	20	1	2
				0.6		-	-	-	-		0.6		OFFICE	20	1	4
				1.0		-	-	-	-			1.0	CORRIDOR	20	1	6
				1.2		-	-	-	-	1.2			TUNNEL	20	1	8
						-	-	-	-		0.0		SPARE	20	1	10
						-	-	-	-			0.0	SPARE	20	1	12
						-	-	-	-	0.0			SPARE	20	1	14
						-	-	-	-		0.0		SPARE	20	1	16
						-	-	-	-			0.0	SPARE	20	1	18
						-	-	-	-	0.0			SPARE	20	1	20
						-	-	-	-		0.0		SPARE	20	1	22
						-	-	-	-			0.0	SPARE	20	1	24
						-	-	-	-	0.0			SPARE	20	1	26
						-	-	-	-		0.0		SPARE	20	1	28
						-	-	-	-			0.0	SPARE	20	1	30
0.0	0.0	0.0	0.0	5.3												

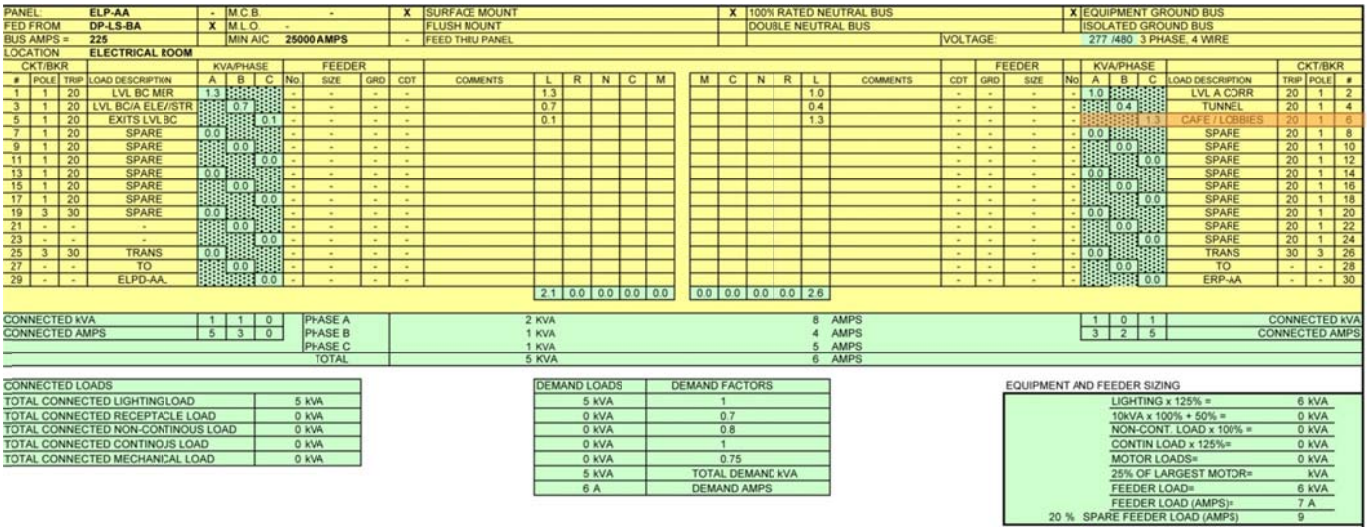
	A	B	C	
35 AMPS	4	1	1	CONNECTED kVA
16 AMPS	14	2	4	CONNECTED AMPS
9 AMPS				
20 AMPS				

EMAND FACTORS
1
0.7
0.8
1
0.75
TOTAL DEMAND kVA
DEMAND AMPS

EQUIPMENT AND FEEDER SIZING

LIGHTING x 125% =	21 kVA
10kVA x 100% + 50% =	0 kVA
NON-CONT. LOAD x 100% =	0 kVA
CONTIN LOAD x 125%=	0 kVA
MOTOR LOADS=	0 kVA
25% OF LARGEST MOTOR=	kVA
FEEDER LOAD=	21 kVA
FEEDER LOAD (AMPS)=	25 A
20 % SPARE FEEDER LOAD (AMPS)	30

ELP-AA



PANEL: ELP-AA | - M.C.B. - | X SURFACE MOUNT | X 100% RATED NEUTRAL BUS | X EQUIPMENT GROUND BUS
FED FROM: DP-LS-BA | X M.L.O. - | FLUSH MOUNT | DOUBLE NEUTRAL BUS | ISOLATED GROUND BUS
BUS AMPS = 225 | MIN AIC 25000 AMPS | - FEED THRU PANEL | VOLTAGE: 277 /480 3 PHASE, 4 WIRE
LOCATION: ELECTRICAL ROOM

CKT/BKR #	POLE	TRIP	LOAD DESCRIPTION	KVA/PHASE A	B	C	FEEDER No.	SIZE	GRD	CDT	COMMENTS	L	R	N	C	M
1	1	20	LVL BC MER	1.3			-	-	-	-		1.3				
3	1	20	LVL BC/A ELE//STR		0.7		-	-	-	-		0.7				
5	1	20	EXITS LVL BC			0.1	-	-	-	-		0.1				
7	1	20	SPARE	0.0			-	-	-	-						
9	1	20	SPARE		0.0		-	-	-	-						
11	1	20	SPARE			0.0	-	-	-	-						
13	1	20	SPARE	0.0			-	-	-	-						
15	1	20	SPARE		0.0		-	-	-	-						
17	1	20	SPARE			0.0	-	-	-	-						
19	3	30	SPARE	0.0			-	-	-	-						
21	-	-	-		0.0		-	-	-	-						
23	-	-	-			0.0	-	-	-	-						
25	3	30	TRANS	0.0			-	-	-	-						
27	-	-	TO		0.0		-	-	-	-						
29	-	-	ELPD-AA.			0.0	-	-	-	-						
												2.1	0.0	0.0	0.0	0.0

M	C	N	R	L	COMMENTS	CDT	FEEDER GRD	FEEDER SIZE	No.	KVA/PHASE A	B	C	LOAD DESCRIPTION	CKT/BKR TRIP	POLE	#
				1.0		-	-	-	-	1.0			LVL A CORR	20	1	2
				0.4		-	-	-	-		0.4		TUNNEL	20	1	4
				1.3		-	-	-	-			1.3	CAFE / LOBBIES	20	1	6
						-	-	-	-	0.0			SPARE	20	1	8
						-	-	-	-		0.0		SPARE	20	1	10
						-	-	-	-			0.0	SPARE	20	1	12
						-	-	-	-	0.0			SPARE	20	1	14
						-	-	-	-		0.0		SPARE	20	1	16
						-	-	-	-			0.0	SPARE	20	1	18
						-	-	-	-	0.0			SPARE	20	1	20
						-	-	-	-		0.0		SPARE	20	1	22
						-	-	-	-			0.0	SPARE	20	1	24
						-	-	-	-	0.0			TRANS	30	3	26
						-	-	-	-		0.0		TO	-	-	28
						-	-	-	-			0.0	ERP-AA	-	-	30
0.0	0.0	0.0	0.0	2.6												

CONNECTED kVA	1	1	0	CONNECTED kVA
CONNECTED AMPS	5	3	0	CONNECTED AMPS
PHASE A			2 kVA	8 AMPS
PHASE B			1 kVA	4 AMPS
PHASE C			1 kVA	5 AMPS
TOTAL			5 kVA	6 AMPS

CONNECTED LOADS	
TOTAL CONNECTED LIGHTINGLOAD	5 kVA
TOTAL CONNECTED RECEPTACLE LOAD	0 kVA
TOTAL CONNECTED NON-CONTINOUS LOAD	0 kVA
TOTAL CONNECTED CONTINOJS LOAD	0 kVA
TOTAL CONNECTED MECHANICAL LOAD	0 kVA

DEMAND LOADS	DEMAND FACTORS
5 kVA	1
0 kVA	0.7
0 kVA	0.8
0 kVA	1
0 kVA	0.75
5 kVA	TOTAL DEMAND kVA
6 A	DEMAND AMPS

EQUIPMENT AND FEEDER SIZING

LIGHTING x 125% =	6 kVA
10kVA x 100% + 50% =	0 kVA
NON-CONT. LOAD x 100% =	0 kVA
CONTIN LOAD x 125%=	0 kVA
MOTOR LOADS=	0 kVA
25% OF LARGEST MOTOR=	kVA
FEEDER LOAD=	6 kVA
FEEDER LOAD (AMPS)=	7 A
20 % SPARE FEEDER LOAD (AMPS)	9

Revised Panelboard Schedules

Since 20 amp circuits will be used, the branch circuits must be sized accordingly. Here is the calculation made to obtain the maximum load allowable in each 20 amp circuit:

20 amps x 80% (NEC) = 16 amps x 80% (good engineering practice) = 12.8 amps per circuit max allowable
VA = 12.8amps x 277V x 3 = 10,637 VA = 10.6 kVA load in each circuit allowable

In the following table are the revised lighting loads for each of the four lighting spaces:

Luminaire Type	Watts/ Luminaire	Amount	Total Wattage
AB	18.4	4	73.6
AM	88	9	792
AP	46	8	368
AR	0.08	78	6.24
	TOTAL WATTAGE =		1239.84

Luminaire Type	Watts/ Luminaire	Amount	Total Wattage
AB	18.4	4	73.6
AD	11.9	20	238
AF	10	10	100
AJ	30	5	150
AL	150	15	2250
AC	19.6	25	490
	TOTAL WATTAGE =		2811.6

*Decorative Allowance
1.0
0.142
85.785

TOTAL WATTAGE	LOBBY+CAFÉ
3301.6	6936.8

Luminaire Type	Watts/ Luminaire	Amount	Total Wattage
AB	18.4	9	165.6
AG	10	33	330
AH	46	17	782
AJ	30	17	510
AK	57	31	1767
		TOTAL WATTAGE =	3554.6

Lecture Hall - Emergency

Luminaire Type	Watts/ Luminaire	Amount	Total Wattage
AB	18.4	4	73.6
AG	10	10	100
AH	46	0	0
AJ	30	0	0
AK	57	10	570
		TOTAL WATTAGE =	743.6

Luminaire Type	Watts/ Luminaire	Amount	Total Wattage
AA	37	13	481
AB	18.4	19	349.6
AC	19.6	5	98
AD	11.9	114	1356.6
AE*	75	18	1350
		TOTAL WATTAGE* =	2285.2

*Decorative Allowance
1.0
0.591
40.867

TOTAL WATTAGE

3635.2

Lighting Loads	
Space	VA = W/PF
Cafeteria	3747.6
Lecture Hall	3664.5
Lobby	3403.7
North Entrance	1278.2
* SINCE ALL ARE LESS THAN 10.6 KVA, EACH SPACE ONLY REQUIRES ONE CIRCUIT	

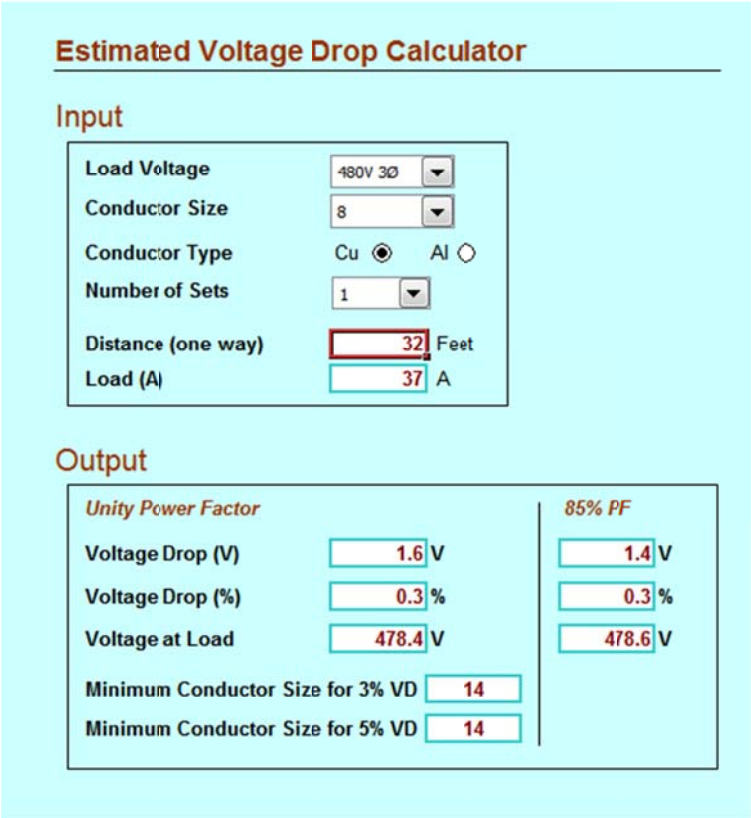
PANELBOARD SCHEDULE

VOLTAGE:	480Y/277V,3PH,4W	PANEL TAG:	ELP-2B	MIN. C/B AIC:	10K
SIZE/TYPE BUS:	60A	PANEL LOCATION:	ELECTRICAL ROOM	OPTIONS:	MCB
SIZE/TYPE MAIN:	60A/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
SPARE		0	20A/1P	1	*			2	20A/1P	1800		PENTHOUSE MEC
STR 3,4 ELEV 1,5,6		36	20A/1P	3		*		4	20A/1P	1104		LVL 2 NORTH
SPARE		0	20A/1P	5			*	6	20A/1P	1288		LVL 2 CENTER
SPARE		0	20A/1P	7	*			8	20A/1P	1104		LVL 1 NORTH
SPARE		0	20A/1P	9		*		10	20A/1P	1380		LVL 1 MIDDLE
SPARE		0	20A/1P	11			*	12	20A/1P	0		SPARE
SPARE		0	20A/1P	13	*			14	20A/1P	0		SPARE
SPARE		0	20A/1P	15		*		16	20A/1P	1240		NORTH ENTRY LGT
LOBBY LIGHTING		3302	20A/1P	17			*	18	20A/1P	0		SPARE
SPARE		0	20A/1P	19	*			20	20A/1P	0		SPARE
SPARE		0	20A/1P	21		*		22	20A/1P	0		SPARE
SPARE		0	20A/1P	23			*	24	20A/1P	0		SPARE
EPF-4		2700	20A/1P	25	*			26	20A/1P	1170		EPF-2
EPF-4		2700	20A/1P	27		*		28	20A/1P	1170		EPF-2
EPF-4		2700	20A/1P	29			*	30	20A/1P	1170		EPF-2
		0	20A/1P	31	*			32	20A/1P	0		
		0	20A/1P	33		*		34	20A/1P	0		
		0	20A/1P	35			*	36	20A/1P	0		
		0	20A/1P	37	*			38	20A/1P	0		
		0	20A/1P	39		*		40	20A/1P	0		
		0	20A/1P	41			*	42	20A/1P	0		

CONNECTED LOAD (KW) - A Ph.	6.77	TOTAL DESIGN LOAD (KW)	27.44
CONNECTED LOAD (KW) - B Ph.	7.63	POWER FACTOR	0.88
CONNECTED LOAD (KW) - C Ph.	8.46	TOTAL DESIGN LOAD (AMPS)	37

ELP-2B is fed from ELP-AB.



PANELBOARD SCHEDULE

VOLTAGE:	208Y/120V,3PH,4W	PANEL TAG:	LPD-AAL	MIN. C/B AIC:	10K
SIZE/TYPE BUS:	60A	PANEL LOCATION:	ELECTRICAL ROOM	OPTIONS:	M.C.B.
SIZE/TYPE MAIN:	60A/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
LECTURE HALL		3555	20A/1P	1	*			2	20A/1P	0		SPARE
SPARE		0	20A/1P	3		*		4	20A/1P	0		SPARE
SPARE		0	20A/1P	5			*	6	20A/1P	0		SPARE
SPARE		0	20A/1P	7	*			8	20A/1P	0		SPARE
SPARE		0	20A/1P	9		*		10	20A/1P	0		SPARE
SPARE		0	20A/1P	11			*	12	20A/1P	0		SPARE
SPARE		0	20A/1P	13	*			14	20A/1P	0		SPARE
SPARE		0	20A/1P	15		*		16	20A/1P	0		SPARE
SPARE		0	20A/1P	17			*	18	20A/1P	0		SPARE
SPARE		0	20A/1P	19	*			20	20A/1P	0		SPARE
SPARE		0	20A/1P	21		*		22	20A/1P	0		SPARE
SPARE		0	20A/1P	23			*	24	20A/1P	0		SPARE
SPARE		0	20A/1P	25	*			26	20A/1P	0		SPARE
SPARE		0	20A/1P	27		*		28	20A/1P	0		SPARE
SPARE		0	20A/1P	29			*	30	20A/1P	0		SPARE
		0	20A/1P	31	*			32	20A/1P	0		
		0	20A/1P	33		*		34	20A/1P	0		
		0	20A/1P	35			*	36	20A/1P	0		
		0	20A/1P	37	*			38	20A/1P	0		
		0	20A/1P	39		*		40	20A/1P	0		
		0	20A/1P	41			*	42	20A/1P	0		

CONNECTED LOAD (KW) - A Ph.	3.56	TOTAL DESIGN LOAD (KW)	4.27
CONNECTED LOAD (KW) - B Ph.	0.00	POWER FACTOR	0.97
CONNECTED LOAD (KW) - C Ph.	0.00	TOTAL DESIGN LOAD (AMPS)	12

LPD-AAL is fed from DP-AA.

Estimated Voltage Drop Calculator

Input

Load Voltage	208V 3Ø
Conductor Size	12
Conductor Type	Cu ◉ Al ○
Number of Sets	1
Distance (one way)	20 Feet
Load (A)	12 A

Output

	Unity Power Factor	*85% PF*
Voltage Drop (V)	0.8 V	0.7 V
Voltage Drop (%)	0.4 %	0.3 %
Voltage at Load	207.2 V	207.3 V
Minimum Conductor Size for 3% VD	14	
Minimum Conductor Size for 5% VD	14	

PANELBOARD SCHEDULE

VOLTAGE:	208Y/120V,3PH,4W	PANEL TAG:	ELPD-AAL	MIN. C/B AIC:	10K
SIZE/TYPE BUS:	60A	PANEL LOCATION:	ELECTRICAL ROOM	OPTIONS:	M.C.B.
SIZE/TYPE MAIN:	60A/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
SPARE		0	20A/1P	1	*			2	20A/1P	744		LECTURE HALL
SPARE		0	20A/1P	3		*		4	20A/1P	0		SPARE
SPARE		0	20A/1P	5			*	6	20A/1P	0		SPARE
SPARE		0	20A/1P	7	*			8	20A/1P	0		SPARE
SPARE		0	20A/1P	9		*		10	20A/1P	0		SPARE
SPARE		0	20A/1P	11			*	12	20A/1P	0		SPARE
SPARE		0	20A/1P	13	*			14	20A/1P	0		SPARE
SPARE		0	20A/1P	15		*		16	20A/1P	0		SPARE
SPARE		0	20A/1P	17			*	18	20A/1P	0		SPARE
SPARE		0	20A/1P	19	*			20	20A/1P	0		SPARE
SPARE		0	20A/1P	21		*		22	20A/1P	0		SPARE
SPARE		0	20A/1P	23			*	24	20A/1P	0		SPARE
SPARE		0	20A/1P	25	*			26	20A/1P	0		SPARE
SPARE		0	20A/1P	27		*		28	20A/1P	0		SPARE
SPARE		0	20A/1P	29			*	30	20A/1P	0		SPARE
		0	20A/1P	31	*			32	20A/1P	0		
		0	20A/1P	33		*		34	20A/1P	0		
		0	20A/1P	35			*	36	20A/1P	0		
		0	20A/1P	37	*			38	20A/1P	0		
		0	20A/1P	39		*		40	20A/1P	0		
		0	20A/1P	41			*	42	20A/1P	0		

CONNECTED LOAD (KW) - A Ph.	0.74	TOTAL DESIGN LOAD (KW)	0.89
CONNECTED LOAD (KW) - B Ph.	0.00	POWER FACTOR	0.97
CONNECTED LOAD (KW) - C Ph.	0.00	TOTAL DESIGN LOAD (AMPS)	3

ELPD-AAL is fed from T-EAL via ELP-AA.

Estimated Voltage Drop Calculator

Input

Load Voltage	208V 3Ø
Conductor Size	12
Conductor Type	Cu ◉ Al ○
Number of Sets	1
Distance (one way)	12 Feet
Load (A)	3 A

Output

	Unity Power Factor	*85% PF*
Voltage Drop (V)	0.1 V	0.1 V
Voltage Drop (%)	0.1 %	0.1 %
Voltage at Load	207.9 V	207.9 V
Minimum Conductor Size for 3% VD	14	
Minimum Conductor Size for 5% VD	14	

PANELBOARD SCHEDULE

VOLTAGE:	480Y/277V,3PH,4W	PANEL TAG:	LP-AA	MIN. C/B AIC:	10K
SIZE/TYPE BUS:	60A	PANEL LOCATION:	ELECTRICAL ROOM	OPTIONS:	M.C.B.
SIZE/TYPE MAIN:	60A/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
ROOMS		2392	20A/1P	1	*			2	20A/1P	0		SPARE
ROOMS		1196	20A/1P	3		*		4	20A/1P	552		OFFICE
ROOMS		1380	20A/1P	5			*	6	20A/1P	920		CORRIDOR
LVL BC MER		3150	20A/1P	7	*			8	20A/1P	0		SPARE
LEVEL BC BOH		2340	20A/1P	9		*		10	20A/1P	1104		TUNEL
SPARE		0	20A/1P	11			*	12	20A/1P	3635		CAFETERIA LGT
SPARE		0	20A/1P	13	*			14	20A/1P	0		SPARE
SPARE		0	20A/1P	15		*		16	20A/1P	0		SPARE
SPARE		0	20A/1P	17			*	18	20A/1P	0		SPARE
SPARE		0	20A/1P	19	*			20	20A/1P	0		SPARE
SPARE		0	20A/1P	21		*		22	20A/1P	0		SPARE
SPARE		0	20A/1P	23			*	24	20A/1P	0		SPARE
SPARE		0	20A/1P	25	*			26	20A/1P	0		SPARE
SPARE		0	20A/1P	27		*		28	20A/1P	0		SPARE
SPARE		0	20A/1P	29			*	30	20A/1P	0		SPARE
		0	20A/1P	31	*			32	20A/1P	0		
		0	20A/1P	33		*		34	20A/1P	0		
		0	20A/1P	35			*	36	20A/1P	0		
		0	20A/1P	37	*			38	20A/1P	0		
		0	20A/1P	39		*		40	20A/1P	0		
		0	20A/1P	41			*	42	20A/1P	0		

CONNECTED LOAD (KW) - A Ph.	5.54	TOTAL DESIGN LOAD (KW)	20.00
CONNECTED LOAD (KW) - B Ph.	5.19	POWER FACTOR	0.92
CONNECTED LOAD (KW) - C Ph.	5.94	TOTAL DESIGN LOAD (AMPS)	26

LP-AA is fed from BUSWAY.

Estimated Voltage Drop Calculator

Input

Load Voltage	480V 3Ø
Conductor Size	10
Conductor Type	Cu ◉ Al ○
Number of Sets	1
Distance (one way)	24 Feet
Load (A)	26 A

Output

	Unity Power Factor	*85% PF*
Voltage Drop (V)	1.3 V	1.2 V
Voltage Drop (%)	0.3 %	0.2 %
Voltage at Load	478.7 V	478.8 V
Minimum Conductor Size for 3% VD	14	
Minimum Conductor Size for 5% VD	14	

PANELBOARD SCHEDULE

VOLTAGE:	480Y/277V,3PH,4W	PANEL TAG:	ELP-AA	MIN. C/B AIC:	10K
SIZE/TYPE BUS:	60A	PANEL LOCATION:	ELECTRICAL ROOM	OPTIONS:	M.C.B.
SIZE/TYPE MAIN:	60A/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
LVL BC MER		1170	20A/1P	1	*			2	20A/1P	0		SPARE
EXITS LVL BC		90	20A/1P	3		*		4	20A/1P	360		TUNNEL
SPARE		0	20A/1P	5			*	6	20A/1P	3635		CAFÉ
LVL BC/A ELEV		630	20A/1P	7	*			8	20A/1P	0		SPARE
LVL A CORR		900	20A/1P	9		*		10	20A/1P	0		SPARE
SPARE		0	20A/1P	11			*	12	20A/1P	0		SPARE
SPARE		0	20A/1P	13	*			14	20A/1P	0		SPARE
SPARE		0	20A/1P	15		*		16	20A/1P	0		SPARE
SPARE		0	20A/1P	17			*	18	20A/1P	0		SPARE
SPARE		0	20A/1P	19	*			20	20A/1P	0		SPARE
SPARE		0	20A/1P	21		*		22	20A/1P	0		SPARE
SPARE		0	20A/1P	23			*	24	20A/1P	0		SPARE
SPARE		0	20A/1P	25	*			26	20A/1P	0		SPARE
SPARE		0	20A/1P	27		*		28	20A/1P	0		SPARE
SPARE		0	20A/1P	29			*	30	20A/1P	0		SPARE
		0	20A/1P	31	*			32	20A/1P	0		
		0	20A/1P	33		*		34	20A/1P	0		
		0	20A/1P	35			*	36	20A/1P	0		
		0	20A/1P	37	*			38	20A/1P	0		
		0	20A/1P	39		*		40	20A/1P	0		
		0	20A/1P	41			*	42	20A/1P	0		

CONNECTED LOAD (KW) - A Ph.	1.80	TOTAL DESIGN LOAD (KW)	8.14
CONNECTED LOAD (KW) - B Ph.	1.35	POWER FACTOR	0.94
CONNECTED LOAD (KW) - C Ph.	3.64	TOTAL DESIGN LOAD (AMPS)	10

ELP-AA is fed from DP-LS-BA.

Estimated Voltage Drop Calculator

Input

Load Voltage	480V 3Ø
Conductor Size	10
Conductor Type	Cu ◉ Al ○
Number of Sets	1
Distance (one way)	8 Feet
Load (A)	10 A

Output

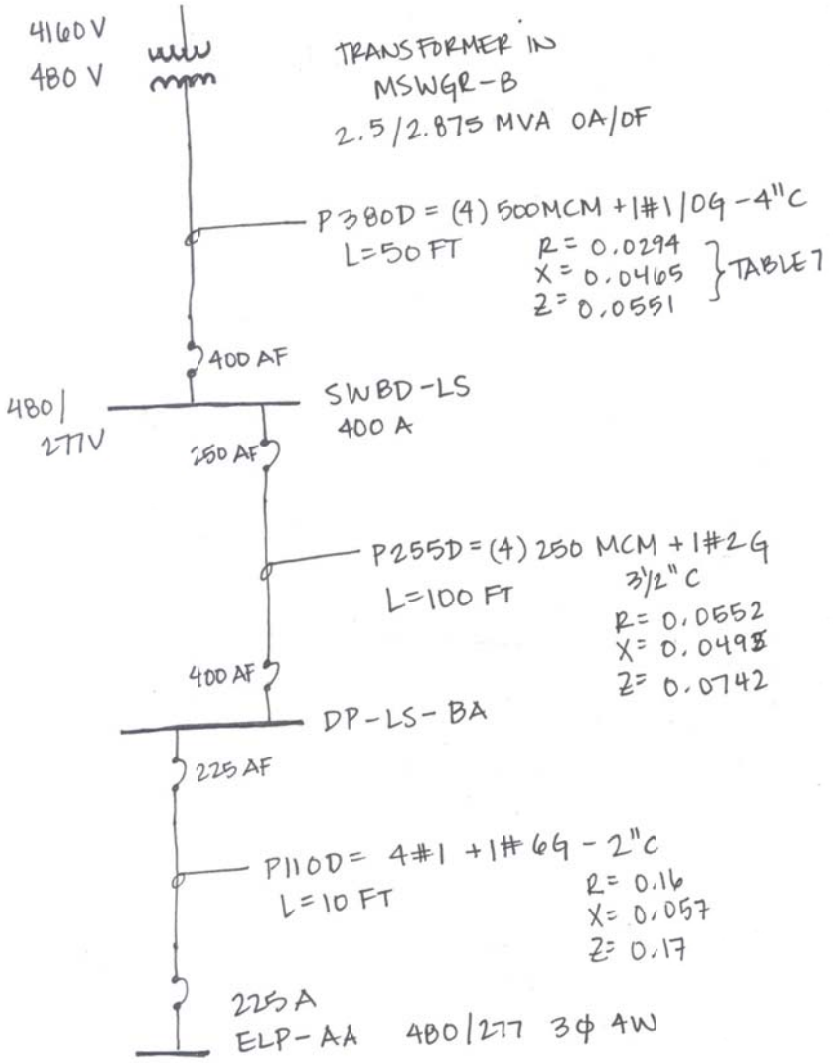
	Unity Power Factor	*85% PF*
Voltage Drop (V)	0.2 V	0.2 V
Voltage Drop (%)	0.0 %	0.0 %
Voltage at Load	479.8 V	479.8 V
Minimum Conductor Size for 3% VD	14	
Minimum Conductor Size for 5% VD	14	

Wire and Conduit Sizing			
Panel Tag	Phase Wire Size	Ground Wire Size	Conduit Size
LP-AA	10	10	0.75" EMT
ELP-AA	12	12	0.75" EMT
LPD-AAL	12	12	0.75" EMT
ELPD-AAL	12	12	0.75" EMT
ELP-2B	8	10	0.75" EMT

Manufacturer's panel board information is located in Appendix P.

Short Circuit

The short circuit calculation follows one path starting at the secondary end of the transformer in one of the substations MSWGR-B to a single panelboard ELP-AA. The sketch below illustrates the path and all its components: MSWGR-B, SWBD-LS, DP-LS-BA, and ELP-AA. The results of the analysis on the following page show that the existing short circuit protection does not cover the short circuit current for the distribution panel DP-LS-BA so this needs to be revised.



SINGLE-LINE AREA CHOSEN AS PATH FOR SHORT CIRCUIT CALCULATION

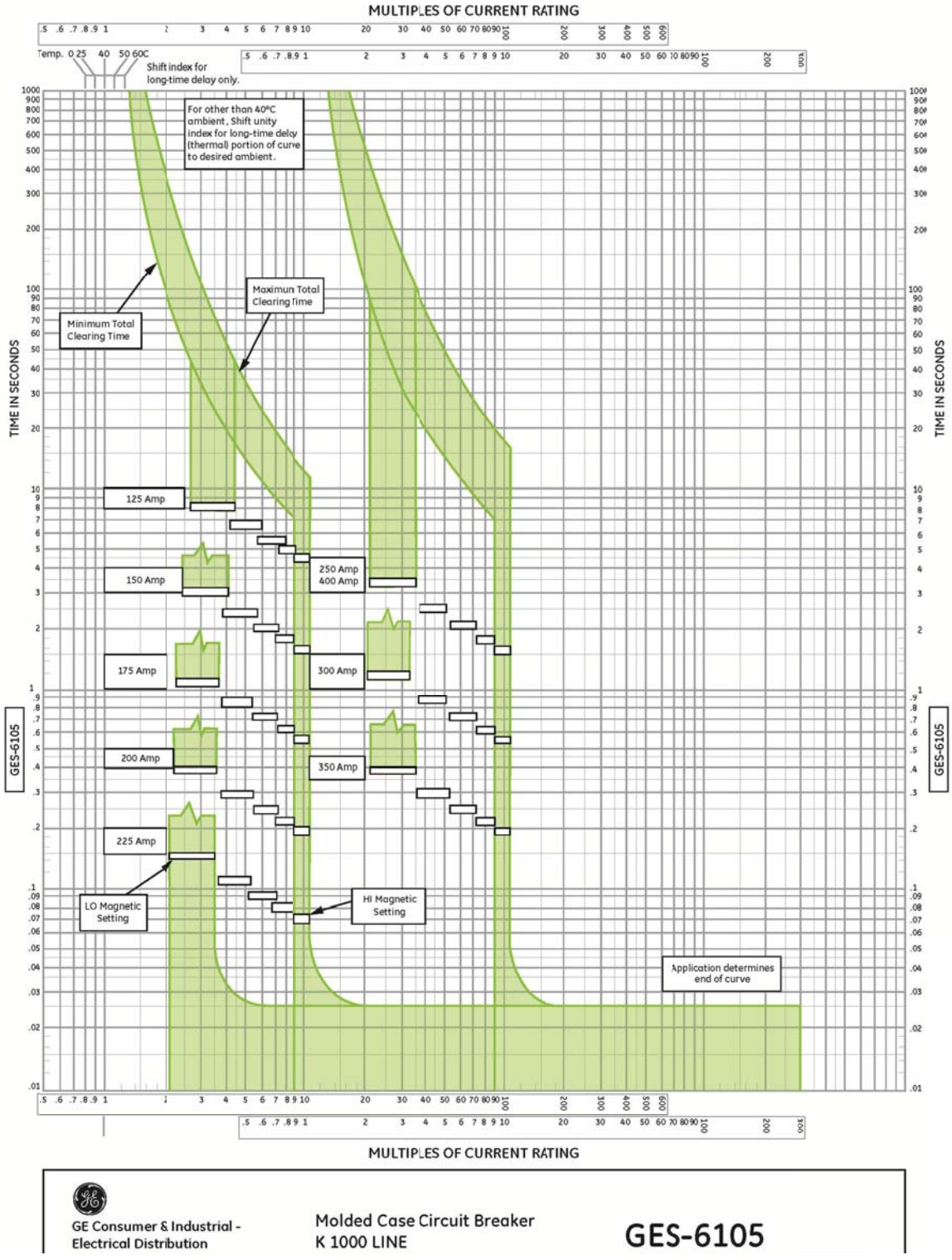
Summary Results of Fault Current				
Point	Location	Available Fault (A)	Standard Breaker Rating (A)	Standard Breaker Rating (A) Existing
A	MSWGR-B	52318	65000	65000
B	SWBD-LS	35029	65000	65000
C	DP-LS-BA	24604	35000	18000
D	ELP-AA	15063	22000	

Fault Current Analysis (Per Unit Method)

Utility Transformer Primary Side MSWGR-B								
System Voltage =	0.48							
Base KVA =	1000							
Utility S.C. KVA =	1E+08							
Utility Primary								
		X(P.U.)=baseKVA/utilityS.C.KVA=		0.00001				
		R(P.U.)=		0				
Transformer Secondary								
					ΣX	ΣR	ΣZ	Isc(A)
%Z =	5.75	X(P.U.)=(%X*baseKVA)/(100*KVAxfmr)=		0.02264	0.02264	0.004	0.02299	52318
X/R =	2.38?	R(P.U.)=(%R*baseKVA)/(100*KVAxfmr)=		0.004				
%X =	5.66							
%R =	1							
KVA =	2500							
KV =	0.48							
Switchboard SWBD-LS								
					ΣX	ΣR	ΣZ	Isc(A)
Wire =	500	X=(L/1000)*XL*(1/SETS)	=	0.00233	0.03273	0.01038	0.03434	35029
Length =	50	R=(L/1000)*R*(1/SETS)	=	0.00147				
Sets =	1							
XL =	0.0465	X(P.U.)=(X*baseKVA)/(1000*KV^2)=		0.01009				
R =	0.0294	R(P.U.)=(R*baseKVA)/(1000*KV^2)=		0.00638				
KV =	0.48							
Distribution Panelboard DP-LS-BA								
					ΣX	ΣR	ΣZ	Isc(A)
Wire =	250	X=(L/1000)*XL*(1/SETS)	=	0.00248	0.04347	0.02236	0.04889	24604
Length =	100	R=(L/1000)*R*(1/SETS)	=	0.00276				
Sets =	1							
XL =	0.0495	X(P.U.)=(X*baseKVA)/(1000*KV^2)=		0.01074				
R =	0.0552	R(P.U.)=(R*baseKVA)/(1000*KV^2)=		0.01198				
KV =	0.48							
Panelboard ELP-AA								
					ΣX	ΣR	ΣZ	Isc(A)
Wire =	1	X=(L/1000)*XL*(1/SETS)	=	0.00285	0.05584	0.05708	0.07985	15063
Length =	10	R=(L/1000)*R*(1/SETS)	=	0.008				
Sets =	1							
XL =	0.057	X(P.U.)=(X*baseKVA)/(1000*KV^2)=		0.01237				
R =	0.16	R(P.U.)=(R*baseKVA)/(1000*KV^2)=		0.03472				
KV =	0.48							

Coordination Study

The chart below shows the overcurrent time delay curves for all the circuit breaker ratings available through the path followed for the short circuit study. This shows the 225A and 250/400A time curves do not overlap but the 250A and 400A are the same curve. This means that the 225A breaker will trip before the 250/400A ones.



Depth 1 | **Motor Control Center Design**

To consolidate all the separate motors in the Penthouse Mechanical and Electrical Room (MER), a motor control center was designed. It ended up having 25 vertical units, some 36" wide and some 24" wide because of the amount of motors in this one room. Below are the loads for each separate unit and the design for each.

LEVEL 3 PENTHOUSE MER MOTOR CONTROL CENTER LOADS

Load Tag	Description	Magnitude	Units	NEC Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW	Qty.	Total Load in KW	VFD	CB Type HMCP	Starter Type	NEMA Starter Size	Standard Unit Space (in)
AHU-1	air handling unit	5	HP	7.6	480	3	0.75	6.311	4.733	2	9.4666	X	15	AFD	1	24
AHU-2	air handling unit	7.5	HP	11	480	3	0.95	9.134	8.678	9	78.099	X	30	AFD	1	24
AHU-3	air handling unit	7.5	HP	11	480	3	0.95	9.134	8.678	9	78.099	X	30	AFD	1	24
AHU-4	air handling unit	7.5	HP	11	480	3	0.95	9.134	8.678	9	78.099	X	30	AFD	1	24
AHU-5	air handling unit	7.5	HP	11	480	3	0.95	9.134	8.678	9	78.099	X	30	AFD	1	24
AHU-6	air handling unit	7.5	HP	11	480	3	0.95	9.134	8.678	6	52.066	X	30	AFD	1	24
AHU-7	air handling unit	5	HP	7.6	480	3	0.75	6.311	4.733	8	37.866	X	15	AFD	1	24
RF-1	return fan	10	HP	14	480	3	0.95	11.63	11.04	1	11.044	X	35	AFD	1	24
LEX-1	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3	X	50	AFD	2	36
LEX-2	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3	X	50	AFD	2	36
LEX-3	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3	X	50	AFD	2	36
LEX-9	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3	X	50	AFD	2	36
LEX-8	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3	X	50	AFD	2	36
LEX-7	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3	X	50	AFD	2	36
LEX-6	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3	X	50	AFD	2	36
LEX-5	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3	X	50	AFD	2	36
LEX-4	exhaust	20	HP	27	480	3	0.95	22.42	21.3	1	21.3	X	50	AFD	2	36
HDX-1	heat exchanger pump	25	HP	34	480	3	0.95	28.23	26.82	1	26.822	X	50	AFD	2	36
HDX-2	heat exchanger pump	25	HP	34	480	3	0.95	28.23	26.82	1	26.822	X	50	AFD	2	36
HDX-3	heat exchanger pump	25	HP	34	480	3	0.95	28.23	26.82	1	26.822	X	50	AFD	2	36
HDX-4	heat exchanger pump	25	HP	34	480	3	0.95	28.23	26.82	1	26.822	X	50	AFD	2	36
HRM-1	AHU-6	30	HP	40	480	3	0.95	33.25	31.59	1	31.592	X	100	AFD	3	36

Notes:
1. EATON 2100 Series Motor Control Centers, 30.1
2. SVX9000 1 - 30hp at 480 V Plug-in Adjustable Frequency Drive Units

Quantity of 24" Units	Quantity of 36" Units
53	14

# of Vertical Sections	
18	7

Motor Control Center: MCC						Location: PENTHOUSE 3RD FLOOR MECHANICAL ROOM			
Amps: 1600		Volts: 480Y/277 3PH 4W, 60HZ				NEMA: 2		AIC: 160,000	
Unit #	Circuit	HP	FLA	Starter		Circuit Protection		Feeder	Notes
				Type	Size	Type	Trip		
A1	AHU-1	5	10	AFD	1	HMCP	15	3#14 + 1#14G AND 3/4"C	-
A2	AHU-1	5	10	AFD	1	HMCP	15	3#14 + 1#14G AND 3/4"C	-
A3	AHU-2	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
B1	AHU-2	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
B2	AHU-2	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
B3	AHU-2	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
C1	AHU-2	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
C2	AHU-2	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
C3	AHU-2	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
D1	AHU-2	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
D2	AHU-2	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
D3	AHU-3	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
E1	AHU-3	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
E2	AHU-3	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
E3	AHU-3	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
F1	AHU-3	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
F2	AHU-3	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
F3	AHU-3	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
G1	AHU-3	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
G2	AHU-3	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
G3	AHU-4	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
H1	AHU-4	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
H2	AHU-4	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
H3	AHU-4	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
I1	AHU-4	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
I2	AHU-4	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
I3	AHU-4	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
J1	AHU-4	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
J2	AHU-4	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
J3	AHU-5	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
K1	AHU-5	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
K2	AHU-5	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
K3	AHU-5	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
L1	AHU-5	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
L2	AHU-5	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
L3	AHU-5	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
M1	AHU-5	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
M2	AHU-5	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
M3	AHU-6	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
N1	AHU-6	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
N2	AHU-6	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
N3	AHU-6	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
O1	AHU-6	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
O2	AHU-6	7.5	14	AFD	1	HMCP	30	3#10 + 1#10G AND 3/4"C	-
O3	AHU-7	5	10	AFD	1	HMCP	15	3#14 + 1#14G AND 3/4"C	-
P1	AHU-7	5	10	AFD	1	HMCP	15	3#14 + 1#14G AND 3/4"C	-
P2	AHU-7	5	10	AFD	1	HMCP	15	3#14 + 1#14G AND 3/4"C	-
P3	AHU-7	5	10	AFD	1	HMCP	15	3#14 + 1#14G AND 3/4"C	-

Q1	AHU-7	5	10	AFD	1	HMCP	15	3#14 + 1#14G AND 3/4"C	-
Q2	AHU-7	5	10	AFD	1	HMCP	15	3#14 + 1#14G AND 3/4"C	-
Q3	AHU-7	5	10	AFD	1	HMCP	15	3#14 + 1#14G AND 3/4"C	-
R1	AHU-7	5	10	AFD	1	HMCP	15	3#14 + 1#14G AND 3/4"C	-
R2	RF-1	10	20	AFD	2	HMCP	35	3#10 + 1#10G AND 3/4"C	-
AA1	LEX-1	20	36	AFD	2	HMCP	50	3#8 +1#10G AND 3/4"C	-
AA2	LEX-2	20	36	AFD	2	HMCP	50	3#8 +1#10G AND 3/4"C	-
BB1	LEX-3	20	36	AFD	2	HMCP	50	3#8 +1#10G AND 3/4"C	-
BB2	LEX-9	20	36	AFD	2	HMCP	50	3#8 +1#10G AND 3/4"C	-
CC1	LEX-8	20	36	AFD	2	HMCP	50	3#8 +1#10G AND 3/4"C	-
CC2	LEX-7	20	36	AFD	2	HMCP	50	3#8 +1#10G AND 3/4"C	-
DD1	LEX-6	20	36	AFD	2	HMCP	50	3#8 +1#10G AND 3/4"C	-
DD2	LEX-5	20	36	AFD	2	HMCP	50	3#8 +1#10G AND 3/4"C	-
EE1	LEX-4	20	36	AFD	2	HMCP	50	3#8 +1#10G AND 3/4"C	-
EE2	HDX-1	25	45	AFD	2	HMCP	50	3#8 +1#10G AND 3/4"C	-
FF1	HDX-2	25	45	AFD	2	HMCP	50	3#8 +1#10G AND 3/4"C	-
FF2	HDX-3	25	45	AFD	2	HMCP	50	3#8 +1#10G AND 3/4"C	-
GG1	HDX-4	25	45	AFD	2	HMCP	50	3#8 +1#10G AND 3/4"C	-
GG2	HRM-1	30	53	AFD	3	HMCP	100	3#3 + 1#8G AND 1-1/4"C	-

TOTAL AMPS 1279

Drawings of Motor Control Center in Appendix P include elevation, 3D view, and details.

Depth 2 | **Bus Duct Analysis**

There are six existing copper bus ducts that run the length of the building. A study was made comparing copper vs. aluminum materials for their construction. There are benefits to both materials but from a first cost perspective, aluminum is the better option. The trends show that the price for copper have been steadily increasing in the past years whereas the aluminum prices have been increasing slower which might make aluminum even a better option for future construction. However, copper is stronger and a better conductor.

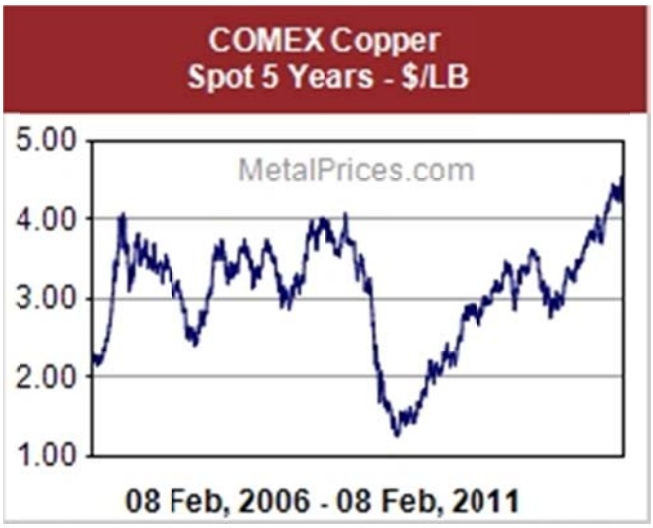
Existing Bus Ducts - Copper						
Tag	Amps	Voltage	Rating (kAIC)	Starting Level	Ending Level	Length (ft.)
A1	400	208Y/120V, 3P, 4W, 1G	22	A	5	74
A2	1000	480Y/277V, 3P, 4W, 1G	50	A	5	74
B9	400	480Y/277V, 3P, 4W, 1G	42	A	2	32
B11	1600	208Y/120V, 3P, 4W, 1G	50	A	2	32
C1	400	480Y/277V, 3P, 4W, 1G	42	A	3	46
C4	1600	208Y/120V, 3P, 4W, 1G	50	A	3	46

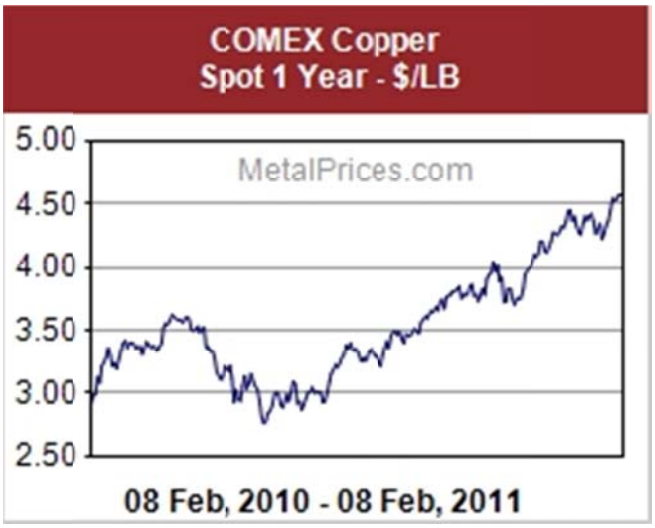
RSMeans Data 2009 (page 227-241)			
Aluminum Straight		Copper Straight	
Total Cost / 10LF	Total Cost	Total Cost / 10LF	Total Cost
$213	$1,576	$239	$1,769
$286	$2,116	$330	$2,442
$213	$682	$239	$765
$480	$1,536	$530	$1,696
$213	$980	$239	$1,099
$480	$2,208	$530	$2,438
	$9,098		$10,209

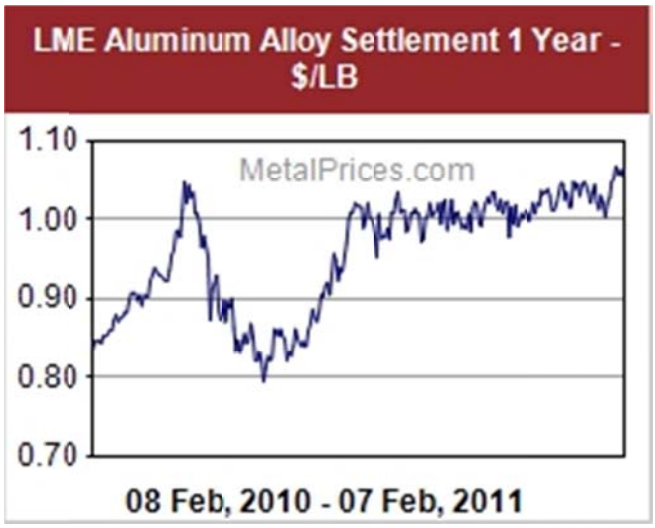
Percent Difference : 10.9%

RSMeans Data 2011 (page 230-244)			
Aluminum Straight		Copper Straight	
Total Cost / 10LF	Total Cost	Total Cost / 10LF	Total Cost
$220	$1,628	$247	$1,827.80
$295	$2,183	$340	$2,516.00
$220	$704	$247	$790.40
$495	$1,584	$545	$1,744.00
$220	$1,012	$247	$1,136.20
$495	$2,277	$545	$2,507.00
	$9,388		$10,521

Percent Difference : 10.8%





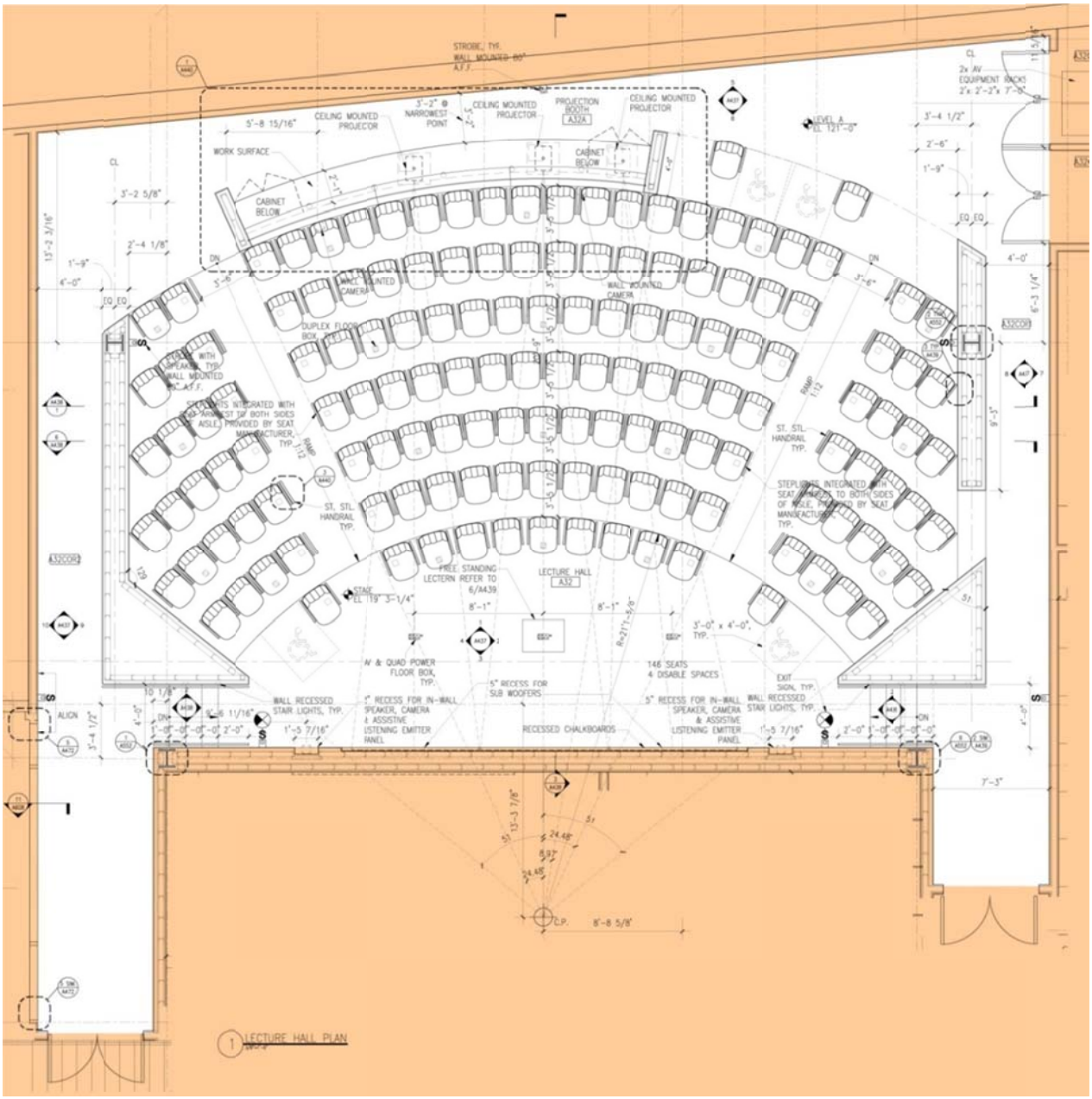


COPPER VS ALUMINUM PRICES IN THE LAST FIVE YEARS

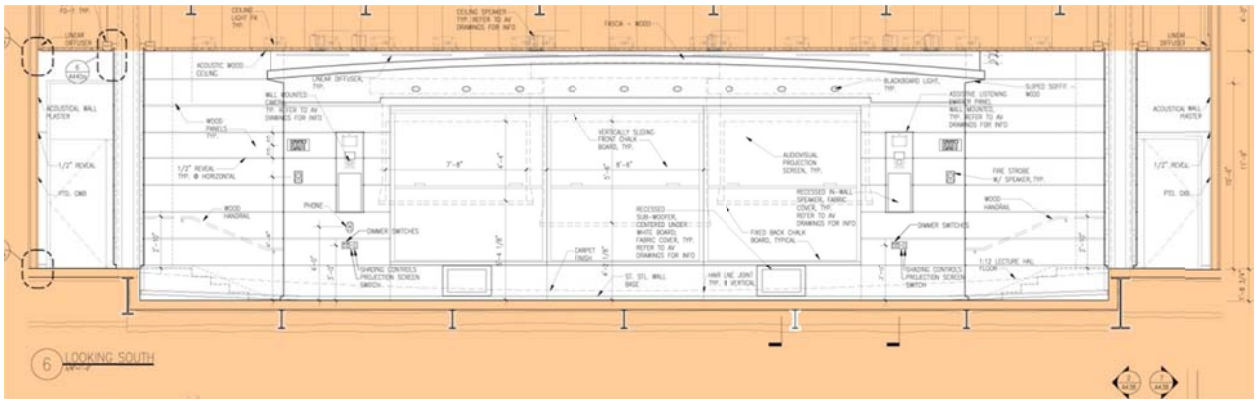
. Breadth Studies .

Introduction

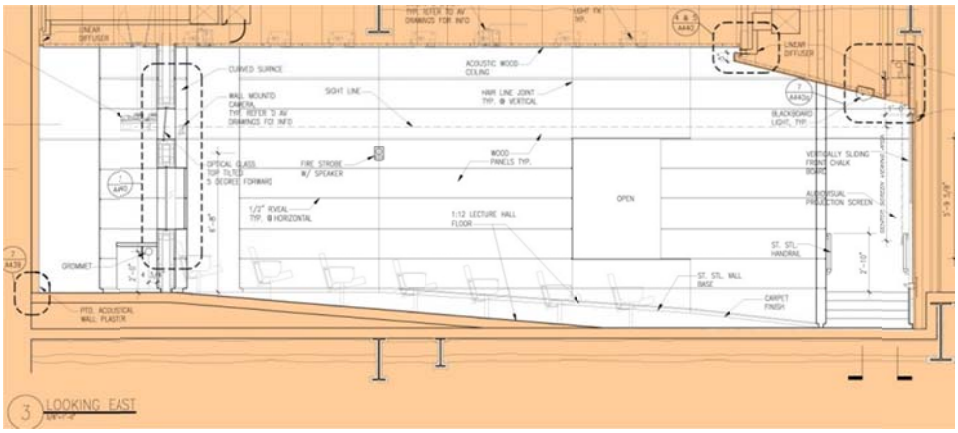
Half radially symmetric, the lecture hall has 145 seats with an inclination of 1:12. There is a projector booth on the rear of the room (north) with three ceiling mounted projectors. There are two entrances and the seating area is enclosed by corridors on three sides with the teaching space at the front (south). The main surface of the ceiling and walls is wood. The lecture hall is located in the northeast part of Level A in the Neuroscience portion of the complex.



LECTURE HALL PLAN, NTS



LECTURE HALL SECTION LOOKING SOUTH, NTS



LECTURE HALL SECTION LOOKING EAST, NTS

This space, as shown before in the report, was chosen as one of the lighting redesign rooms. To integrate the breadth with the lighting depth, an architectural redesign of the ceiling was done accompanied by an acoustical study.

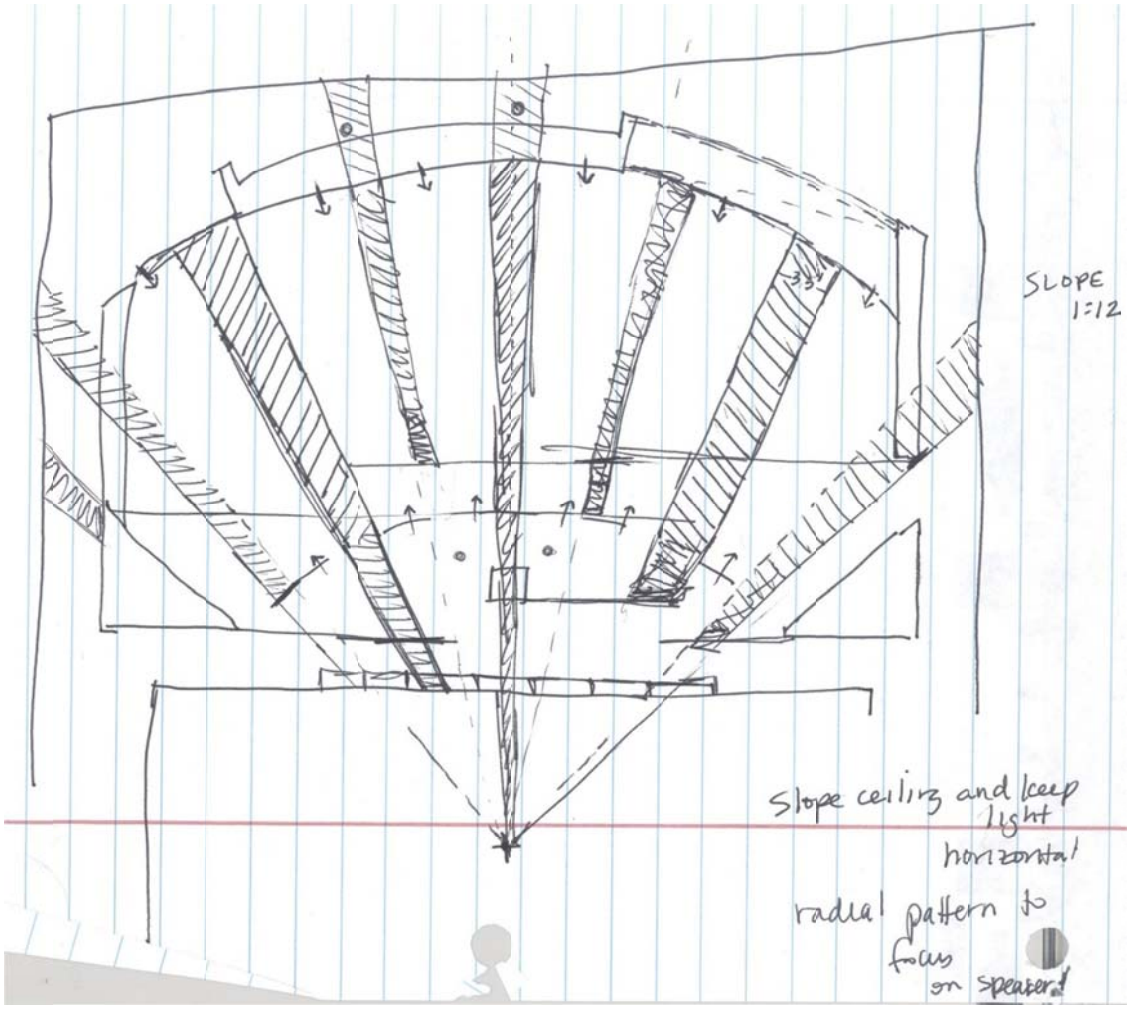
Architectural | **Lecture Hall Ceiling Redesign**

Problem

The lighting in the lecture hall will be changing from circular spot elements to linear ones that provide diffuse lighting to remove multiple shadows caused by many downlights. The ceiling in this space has a curved element towards the front of the room. The idea was to re-design the ceiling to create different levels and linear elements that match the linearity of the wooden panels that surround the entire seating area. The changes in elevation in the ceiling re-design will allow for the lighting to be fully integrated while still concealing mechanical and structural elements. This would unite architecture and light into one and will add visual interest to the space as well as functionality.

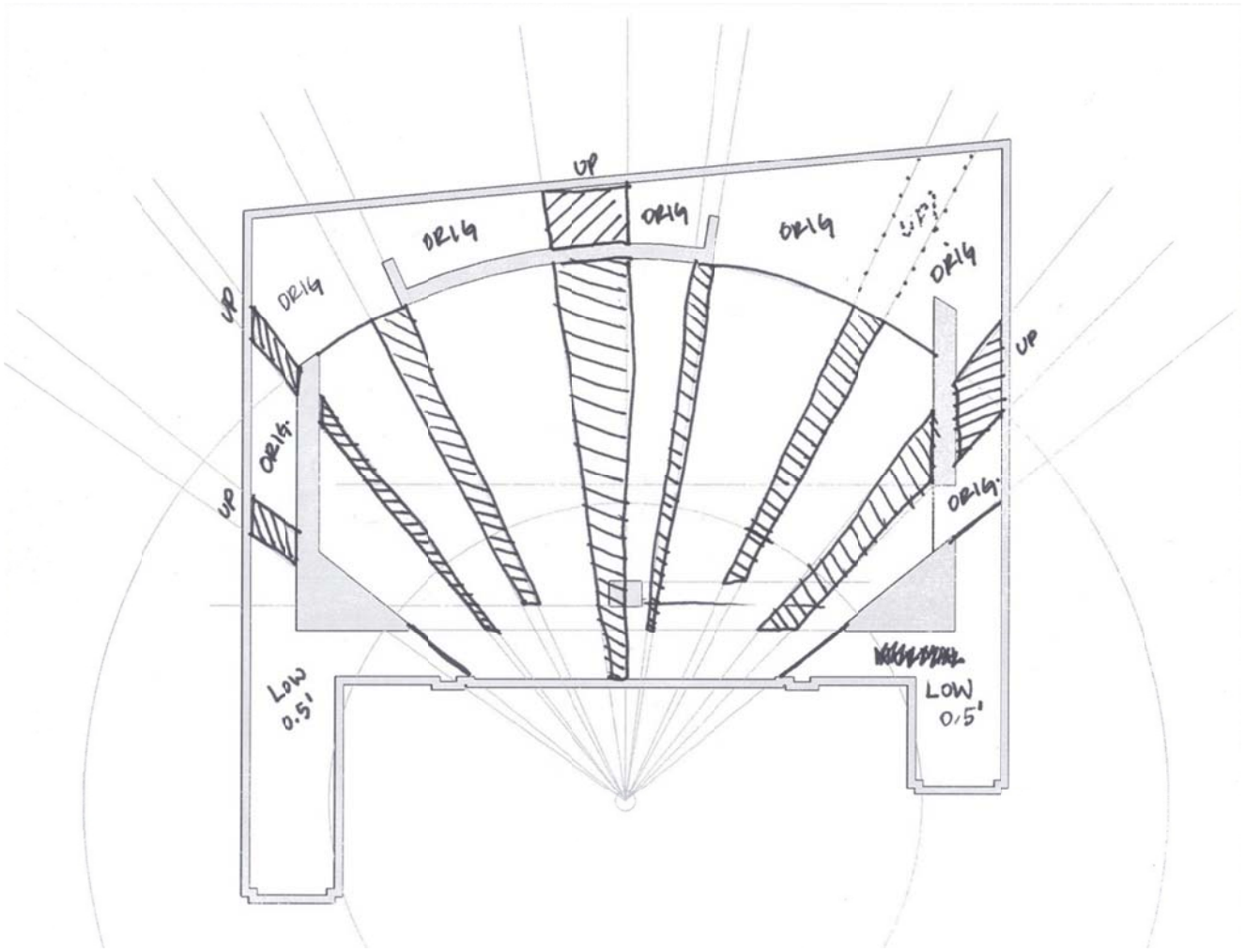
Solution

The ceiling designs concepts match the lighting ones of ***connection*** and ***static motion.*** By using the same circle used to design the rest of the architecture, there is an immediate connection formed between the ceiling and the rest of the space because they flow into one. The center of the circle was kept the same and rays were drawn to create voids in the ceiling.



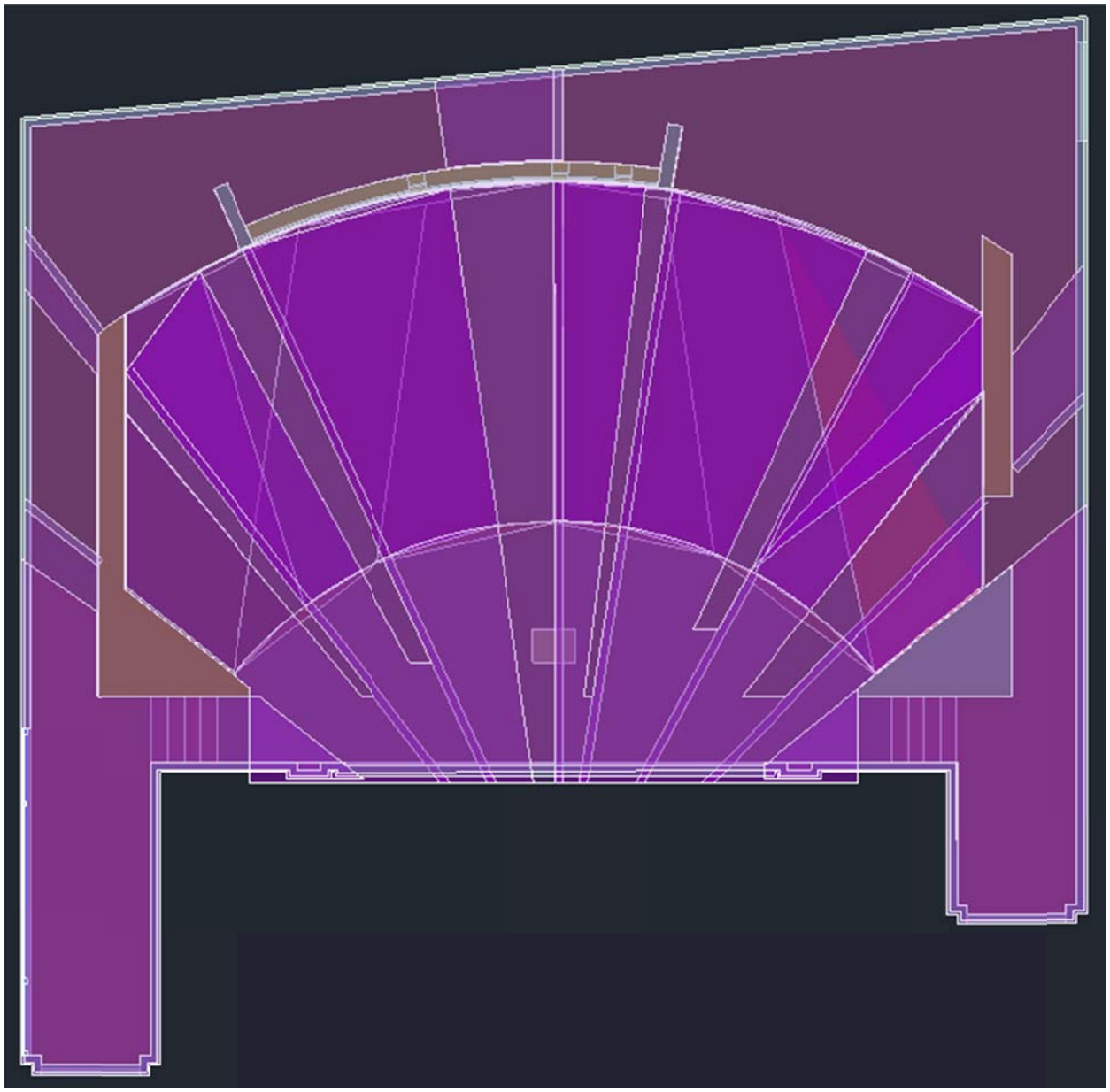
PRELIMINARY SKETCH OF NEW CEILING COVES

The original ceiling had a cavity of about four feet which is more than enough to maneuver the rest of the systems around. However, to ensure that the coves did not create a problem with other systems, the ceiling was sloped and in some parts lowered, never raised, creating more area in the cavity. At its highest point, the original ceiling was almost fourteen feet high. With the new sloped ceiling, the ceiling height is constant throughout the seating area with 11'-9". The ceiling was lowered six inches more at the entrances to encourage people to move towards the higher ceiling. The concept of static motion is not only supported by the latter statement, but also the lines created by the coves in the seating area all moving towards one common central point, when filled with the light, create a wormhole effect that draws the users attention to the front of the room.

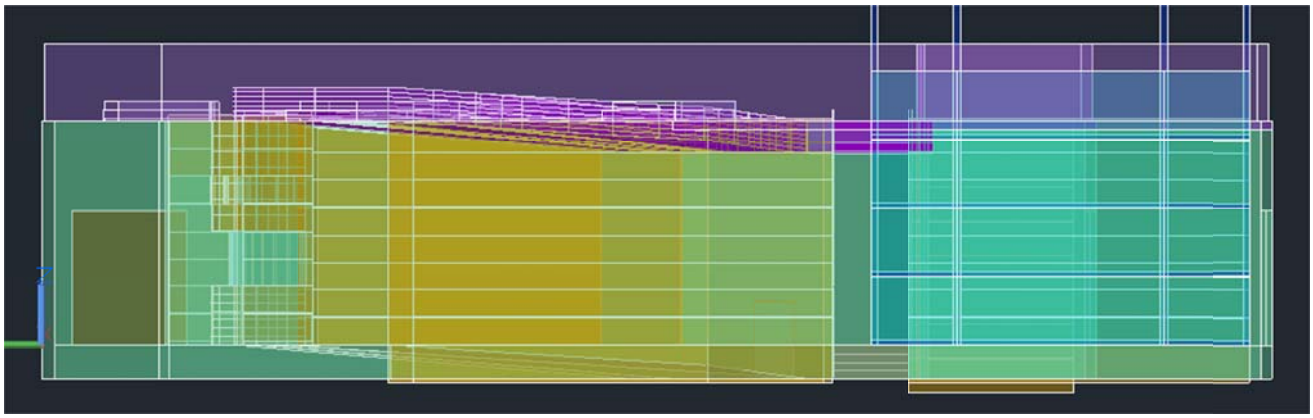


FINAL SKETCH OF NEW CEILING COVES AND REST OF THE CEILING HEIGHTS

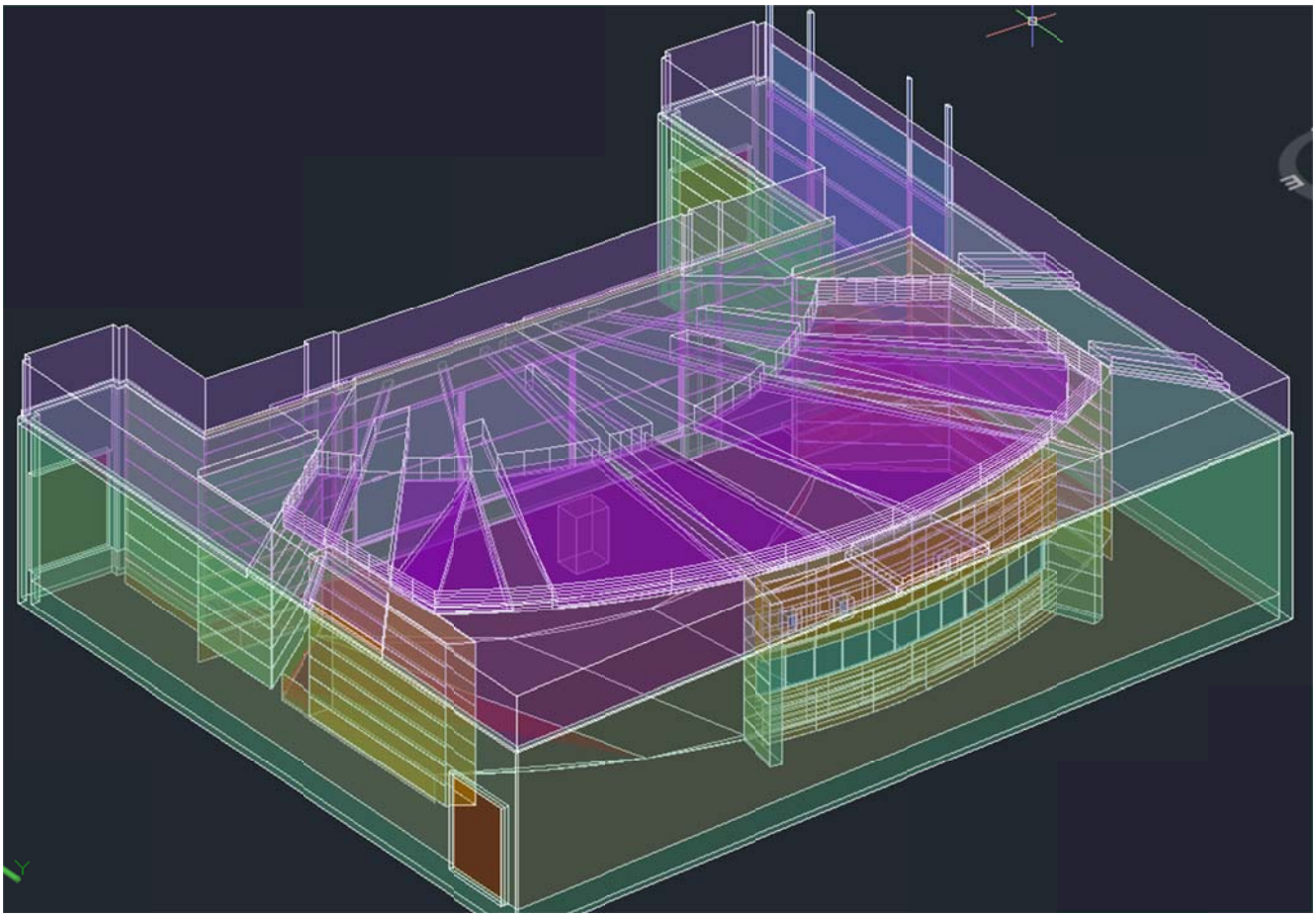
A Model was created in AutoCAD to achieve the design. The slope of the ceiling is 1:12 like that of the floor. The coves are not symmetrical but form a balance that makes the non-uniformity interesting and in its own way is balanced. The linearity of the coves with their radial alignment joins both circular and rectilinear elements that were already present in the room into one. The lines of light on each cove provide enough illumination for reading/writing with enough uniformity and add more interest to the space because they are fully integrated into the architecture.



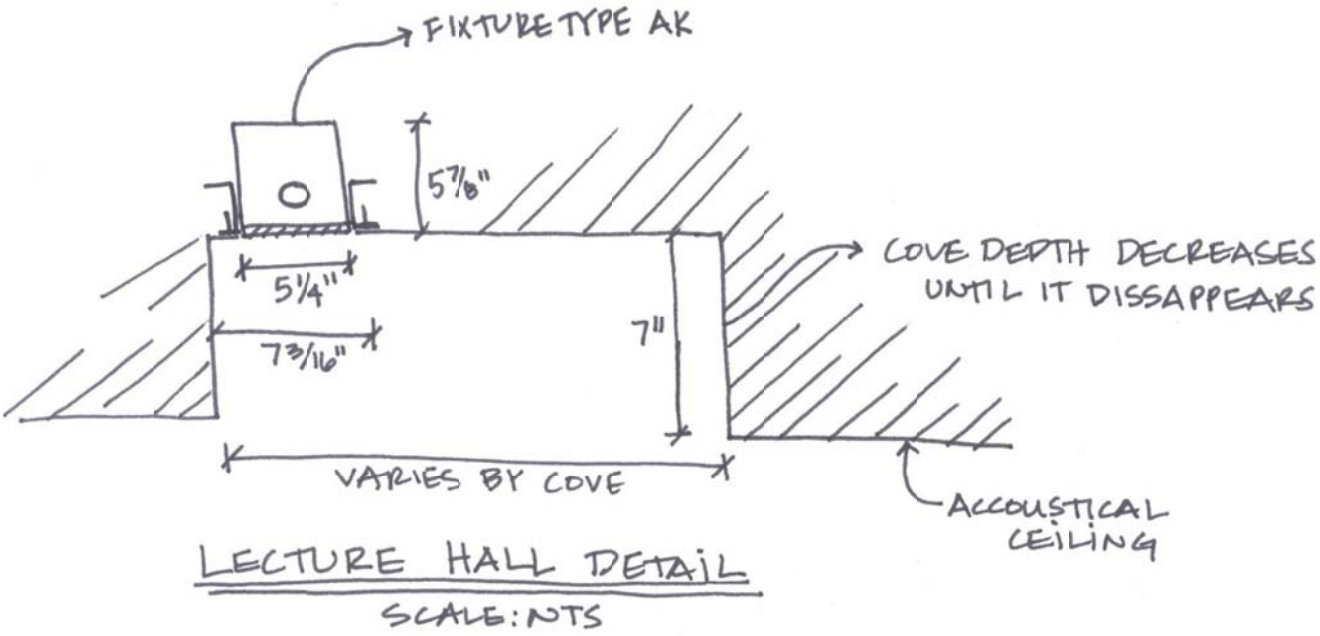
PLAN VIEW OF NEW COVES IN AUTOCAD



SECTION VIEW OF NEW COVES IN AUTOCAD



3D VIEW OF NEW COVES IN AUTOCAD LOOKING TOWARDS BLACKBOARD AND ENTRANCES



LIGHTING MOUNTING DETAIL

Acoustical | **Lecture Hall Analysis and Redesign**

Problem

The architectural alteration in the ceiling accompanied with the new lighting design created changes in the acoustical properties of the space. The idea was to ensure that the space could still provide good acoustics, assuming it already had adequate acoustics, for speech setting in a lecture and conference room. The range of the reverberation time that will ensure this is in between 0.7 and 1.1 seconds.

Solution

An acoustical study was conducted to calculate reverberation time in the space. First, the calculation was done with the original architecture and materials. All material data was taken from “Sound Absorption Data for Lecture Hall Finishes” (Architectural Acoustics by M. David Egan, page 52) because specific finish information was not provided by the architect/owner as well as formulas and desired ranges (Architectural Acoustics by M. David Egan, page 64).

Existing Conditions:

α
Absorption Coefficient of Materials

Material	Frequency (Hz)						
	125	250	500	1000	2000	4000	NRC #
acoustic gypsum wall board	0.55	0.14	0.08	0.04	0.12	0.11	0.1
wood panels	0.42	0.21	0.10	0.08	0.06	0.06	0.1
acoustic wood ceiling	0.10	0.60	0.80	0.82	0.78	0.60	0.75
carpet	0.02	0.06	0.14	0.37	0.60	0.65	0.3
curved glass	0.35	0.25	0.18	0.12	0.07	0.04	0.15
opening	0.50	0.50	0.50	0.50	0.50	0.50	
auditorium seats with students	0.30	0.41	0.49	0.84	0.87	0.84	

S Surface Area (sq.ft.)
279
1194
1608
441
89
517
1167

a = S*α
Room Absorption (sabins)

Frequency (Hz)						
125	250	500	1000	2000	4000	
153.5	39.1	22.3	11.2	33.5	30.7	
501.5	250.7	119.4	95.5	71.6	71.6	
160.8	964.8	1286.4	1318.6	1254.2	964.8	
8.8	26.5	61.7	163.2	264.6	286.7	
31.2	22.3	16.0	10.7	6.2	3.6	
258.5	258.5	258.5	258.5	258.5	258.5	
350.1	478.5	571.8	980.3	1015.3	980.3	
1464.3	**2040.3**	**2336.2**	**2837.9**	**2904.0**	**2596.1**	**Σa**

V Room Volume (ft^3)
19296

T = 0.05*(V/a)
Reverberation Time

Frequency (Hz)					
125	250	500	1000	2000	4000
0.7	**0.5**	**0.4**	**0.3**	**0.3**	**0.4**

Then, the new ceiling was added. Because of the coves, the surface area of the ceiling increased but the volume decreased because the new ceiling is lower. Materials were kept the same, the only exception was that acoustic gypsum wall board was added as the finish of the new ceiling.

Scenario 1:

α
Absorption Coefficient of Materials

Material	Frequency (Hz)						
	125	250	500	1000	2000	4000	NRC #
acoustic gypsum wall board	0.55	0.14	0.08	0.04	0.12	0.11	0.1
wood panels	0.42	0.21	0.10	0.08	0.06	0.06	0.1
acoustic wood ceiling	0.10	0.60	0.80	0.82	0.78	0.60	0.75
carpet	0.02	0.06	0.14	0.37	0.60	0.65	0.3
curved glass	0.35	0.25	0.18	0.12	0.07	0.04	0.15
opening	0.50	0.50	0.50	0.50	0.50	0.50	
auditorium seats with students	0.30	0.41	0.49	0.84	0.87	0.84	

S Surface Area (sq.ft.)
279
1194
1608
441
89
517
1167

a = S*α
Room Absorption (sabins)

Frequency (Hz)						
125	250	500	1000	2000	4000	
153.5	39.1	22.3	11.2	33.5	30.7	
501.5	250.7	119.4	95.5	71.6	71.6	
160.8	964.8	1286.4	1318.6	1254.2	964.8	
8.8	26.5	61.7	163.2	264.6	286.7	
31.2	22.3	16.0	10.7	6.2	3.6	
258.5	258.5	258.5	258.5	258.5	258.5	
350.1	478.5	571.8	980.3	1015.3	980.3	
1464.3	**2040.3**	**2336.2**	**2837.9**	**2904.0**	**2596.1**	**Σa**

V Room Volume (ft^3)
19296

T = 0.05*(V/a)
Reverberation Time

Frequency (Hz)					
125	250	500	1000	2000	4000
0.7	**0.5**	**0.4**	**0.3**	**0.3**	**0.4**

As shown, the ceiling redesign did not affect the room acoustics. However, the reverberation time does not fall in the range desired for good acoustics for speech. Therefore, new materials were chosen that could substitute the older ones to improve this. Highlighted in yellow are the changes made.

Scenario 2:

α
Absorption Coefficient of Materials

Material	Frequency (Hz)						
	125	250	500	1000	2000	4000	NRC #
gypsum wall board (0.5 in thick)	0.29	0.10	0.05	0.04	0.07	0.09	0.05
wood panels	0.42	0.21	0.10	0.08	0.06	0.06	0.1
plaster ceiling	0.14	0.10	0.06	0.05	0.04	0.03	0.05
carpet	0.02	0.06	0.14	0.37	0.60	0.65	0.3
curved glass	0.18	0.06	0.04	0.03	0.02	0.02	0.15
opening	0.50	0.50	0.50	0.50	0.50	0.50	
auditorium seats with students	0.30	0.41	0.49	0.84	0.87	0.84	

S Surface Area (sq.ft.)
279
1194
1608
441
89
517
1167

a = S*α
Room Absorption (sabins)

Frequency (Hz)						
125	250	500	1000	2000	4000	
80.9	27.9	14.0	11.2	19.5	25.1	
501.5	250.7	119.4	95.5	71.6	71.6	
225.1	160.8	96.5	80.4	64.3	48.2	
8.8	26.5	61.7	163.2	264.6	286.7	
16.0	5.3	3.6	2.7	1.8	1.8	
258.5	258.5	258.5	258.5	258.5	258.5	
350.1	478.5	571.8	980.3	1015.3	980.3	
1441.0	**1208.2**	**1125.5**	**1591.7**	**1695.7**	**1672.2**	**Σa**

V Room Volume (ft^3)
19296

T = 0.05*(V/a)
Reverberation Time

Frequency (Hz)					
125	250	500	1000	2000	4000
0.7	**0.8**	**0.9**	**0.6**	**0.6**	**0.6**

These changes did make a significant impact on the reverberation time calculation, making the room acoustics better. However, even more improvements could be made to ensure that all frequencies fall in the desired range of 0.7-1.1 seconds. Below, another type of wood installation was chosen to see if it made a difference in the reverberation time; the change is highlighted in green. The new wood did make things a little better, especially in the 125 Hz frequency but there is still some improvement that could be done and this could either be by achieved by either installing even less absorptive materials or altering the architecture further.

Scenario 3:

α
Absorption Coefficient of Materials

Material	Frequency (Hz)						
	125	250	500	1000	2000	4000	NRC #
gypsum wall board (0.5 in thick)	0.29	0.10	0.05	0.04	0.07	0.09	0.05
wood panels, 1 in paneling	0.19	0.14	0.09	0.06	0.06	0.05	0.1
plaster ceiling	0.14	0.10	0.06	0.05	0.04	0.03	0.05
carpet	0.02	0.06	0.14	0.37	0.60	0.65	0.3
curved glass	0.18	0.06	0.04	0.03	0.02	0.02	0.15
opening	0.50	0.50	0.50	0.50	0.50	0.50	
auditorium seats with students	0.30	0.41	0.49	0.84	0.87	0.84	

S Surface Area (sq.ft.)
279
1194
1608
441
89
517
1167

a = S*α
Room Absorption (sabins)

Frequency (Hz)						
125	250	500	1000	2000	4000	
80.9	27.9	14.0	11.2	19.5	25.1	
226.9	167.2	107.5	71.6	71.6	59.7	
225.1	160.8	96.5	80.4	64.3	48.2	
8.8	26.5	61.7	163.2	264.6	286.7	
16.0	5.3	3.6	2.7	1.8	1.8	
258.5	258.5	258.5	258.5	258.5	258.5	
350.1	478.5	571.8	980.3	1015.3	980.3	
1166.3	**1124.6**	**1113.5**	**1567.8**	**1695.7**	**1660.3**	**Σa**

V Room Volume (ft^3)
19296

T = 0.05*(V/a)
Reverberation Time

Frequency (Hz)					
125	250	500	1000	2000	4000
0.8	**0.9**	**0.9**	**0.6**	**0.6**	**0.6**

In conclusion, the new reverberation times are better suited for the activity happening in the space and the changes had a positive impact in the lecture hall. Below is shown the summary of the calculations for the existing conditions vs. the new ones:

Existing Condition:

T = 0.05*(V/a) Reverberation Time					
Frequency (Hz)					
125	250	500	1000	2000	4000
0.7	**0.5**	**0.4**	**0.3**	**0.3**	**0.4**

Scenario 3:

T = 0.05*(V/a) Reverberation Time					
Frequency (Hz)					
125	250	500	1000	2000	4000
0.8	**0.9**	**0.9**	**0.6**	**0.6**	**0.6**

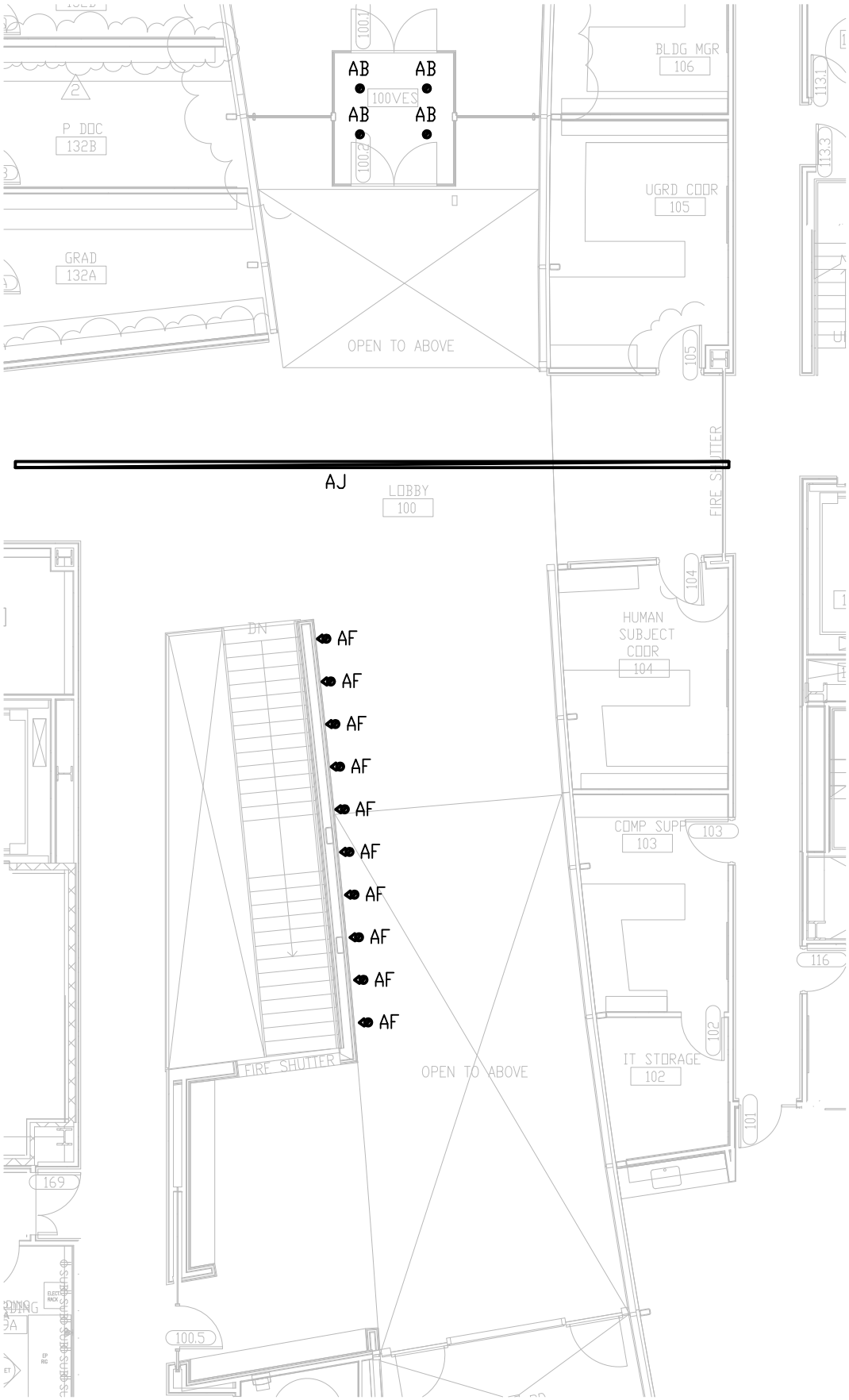
. Appendices .

Appendix L

APPENDIX L

LIGHTING PLAN

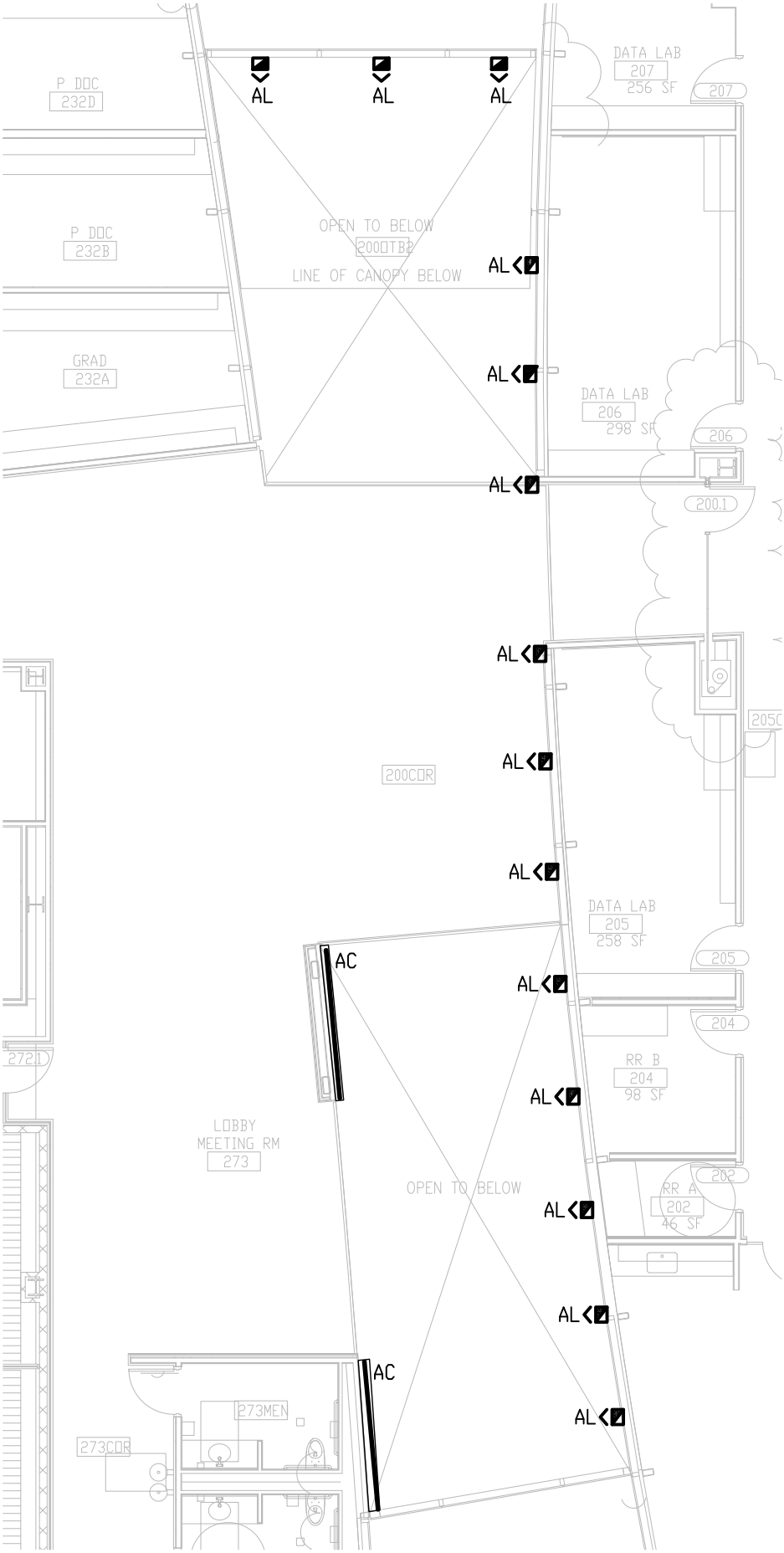
SCALE: 3/32"= 1'-0"



LIGHTING PLAN

SCALE: 3/32"= 1'-0"

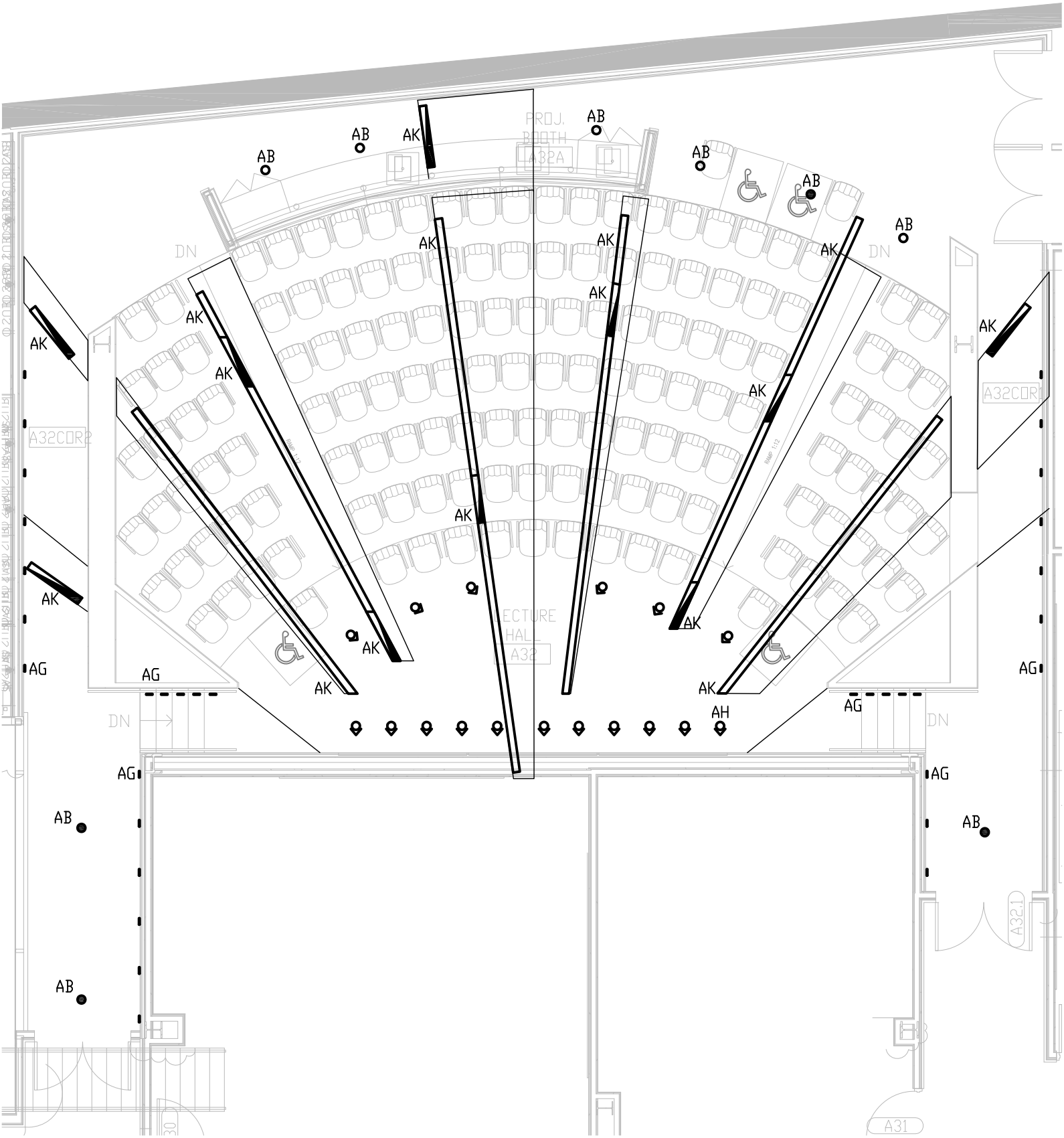
APPENDIX L



LIGHTING PLAN

SCALE: 3/32"= 1'-0"

APPENDIX L



LIGHTING PLAN

SCALE: 1/8" = 1'-0"

APPENDIX L

LIGHTING PLAN

SCALE: 1/8"= 1'-0"

APPENDIX L

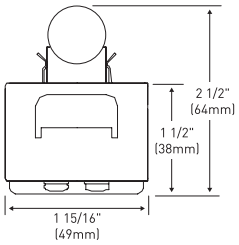
Appendix S

NIPPO seamlessline®

1 Fixture

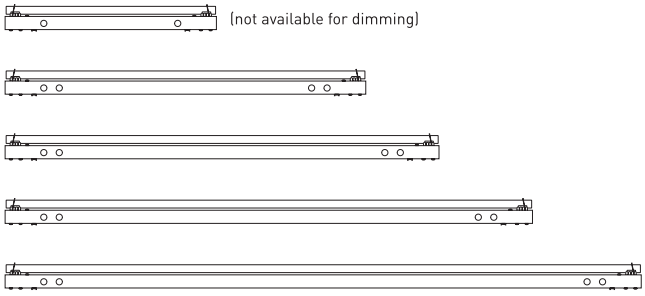
■ LENGTH

500 = 503mm (19 13/16")
850 = 853mm (33 9/16")
1000 = 1003mm (39 1/2")
1250 = 1253mm (49 5/16")
1500 = 1503mm (59 3/16")



nominal length

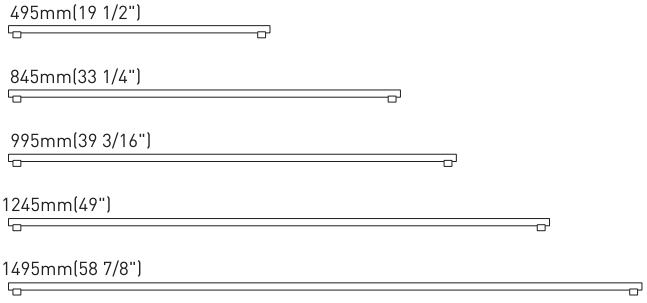
20" (not available for dimming)



2 Lamp

■ LENGTH

500 = 495mm(19 1/2")
850 = 845mm(33 1/4")
1000 = 995mm(39 3/16")
1250 = 1245mm(49")
1500 = 1495mm(58 7/8")



Description

NIPPO Seamlessline

T6 fluorescent series consist of a lamp & linear housing 2 1/2" in height x less than 2" wide designed to fit in tight spaces. The unique side lamp socket design allows for lamps to be mounted end to end for smooth and continuous illumination. In continuous run applications lamps are as close as 1/16" and never more than 1/2" apart end to end with illumination at lamp ends. Individual fixture lengths include nominal 20", 34", 40", 50" and 60". All fixture lengths can be coupled together to form a UL listed continuous thru wire system. Lumen output is maintained regardless of lamp length allowing for mixing of lengths in continuous runs. A variety of lamp color temperatures ranging from 2500K to 6700K all maintain 88CRI. The average rated life for **Seamlessline** lamps is 20,000 hours.

Performance

Seamlessline offers a total luminaire efficiency of 94% along with superior light output and color consistency within each lamp color. Dimming versions allow for continuous smooth dimming down to 10%. Lumen output exceeds 800 lms/ft. 85 lumens / watt average.

Construction

Extruded aluminum fixture housing includes a snap-fit cover, spring clip lamp sockets, and lamp retaining wires for maximum protection.

Mounting Options

Seamlessline is surface mountable with pre-punched back mounting holes for easy installation.

Electrical

All fixtures are pre-wired with factory installed quick-connectors for power feed connection, thru wiring, and low voltage connection (for dimming signal). Electronic ballasts are thermally protected and have a Class "P" rating. Fixtures can be power fed either thru back knock-outs, side knock-outs, or end fed with the Seamlessline SF power feed box. All fixtures can be continuous row mounted and thru wired utilizing the Seamlessline SCI "I" couplings. **Seamlessline** is UL Listed for indoor use.

Power Consumption

All fixture and lamp combinations consume from 9 -10 w/ft.

Finish

The standard fixture housing is an anodized aluminum finish.

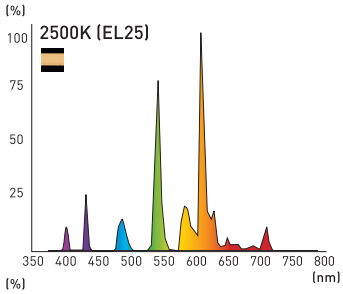
APPENDIX S

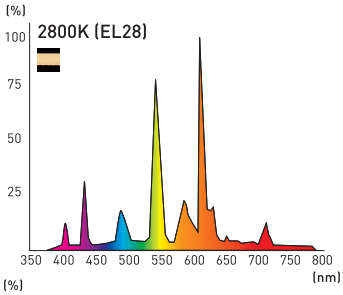
NIPPO seamlessline phone 732-357-2041 fax 732-357-2096 www.NIPPO-web.com/us
Mitsubishi International PolymerTrade Corporation. 2 PENN PLAZA EAST, 11TH FL., NEWARK, NJ 07105

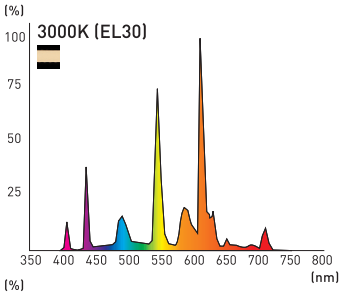
NIPPO seamlessline®

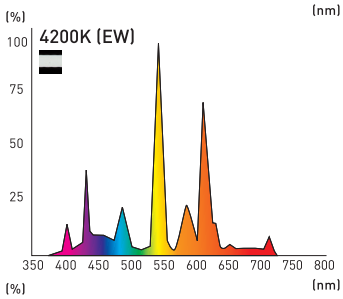
Lamp Color

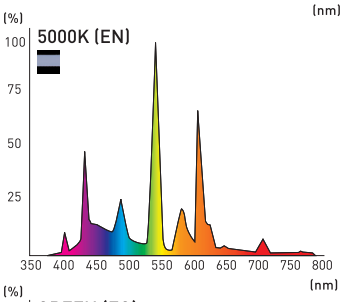
EL25 = 2500K
EL28 = 2800K
EL30 = 3000K
EWW = 3500K
EW = 4200K
EN = 5000K
ED = 6700K
ER = red
EG = green
EB = blue

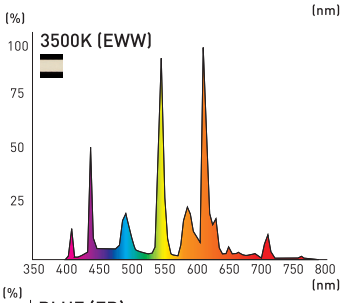


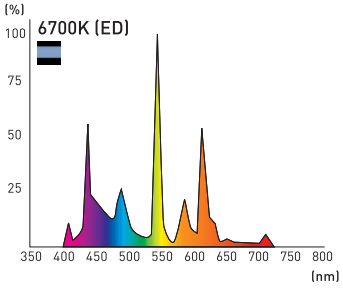


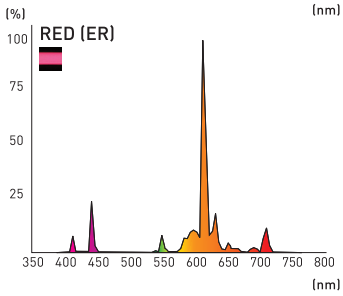


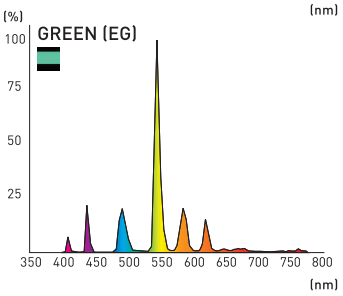


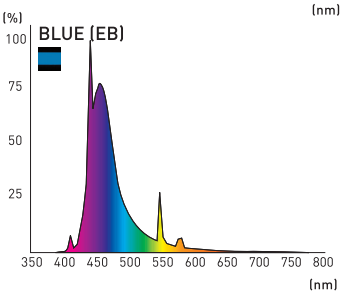






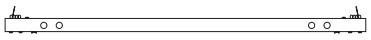






ORDERING FORMAT

1 Fixture



SAL - UW - ____ - ____ - ____

Seamlessline Architectural Lighting
U.S. Wire

LENGTH

★500 = 503mm (19 13/16")
850 = 853mm (33 9/16")
1000 = 1003mm (39 1/2")
1250 = 1253mm (49 5/16")
1500 = 1503mm (59 3/16")

VOLTAGE

A = 120 V
C = 277 V

DIMMING

M = dimming
blank = non dimming
★ Note : 500 not dimmable

2 Lamp

FRT - ____ - ____

Fluorescent Lamp
Rapid start
T - tube

LENGTH

500 = 495mm (19 1/2")
850 = 845mm (33 1/4")
1000 = 995mm (39 3/16")
1250 = 1245mm (49")
1500 = 1495mm (58 7/8")

COLOR

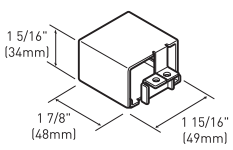
EL25 = 2500K
EL28 = 2800K
EL30 = 3000K
EWW = 3500K
EW = 4200K
EN = 5000K
ED = 6700K
EB = blue
EG = green
ER = red

3 Accessories (Specify separately)

(Requirements will vary according to run lengths or when using individual units)

UFDA-035AP = 120volts, 90mA for dimming signal
UFDC-035AP = 277volts, 40mA for dimming signal
SF = Power Feed Box (for end power feed)
SCI = I - Coupler (for connecting fixtures in runs)
SCL = L - Coupler (for 90 degree corner connection)
SCT = T - Coupler (for connecting fixtures in T shape)
SCX = X - Coupler (for connecting fixtures in cross)

POWER FEED BOX SF



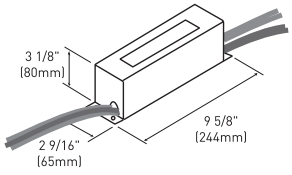
I -COUPLING SCI

DC to PWM Converter Unit

This converter can operate up to 20 fixtures with 0-10Vdc signal from dimming control unit.

UFDA-035AP
120 volts,90mA

UFDC-035AP
277volts,40mA

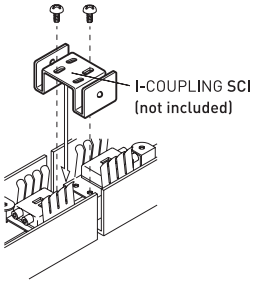


APPENDIX S

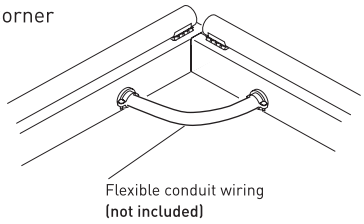
NIPPO seamlessline®

ADJOINING DETAIL

Straight

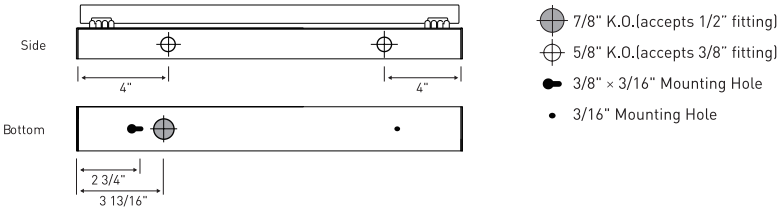


Corner

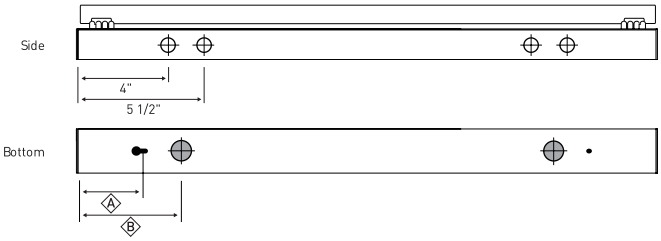


MOUNTING LOCATIONS

20" Fixture



34", 40", 50", 60" Fixture



	Ⓐ	Ⓑ
34"	3 "	4 5/8"
40"	5 15/16"	7 9/16"
50"	8 7/8"	10 1/2"
60"	13 13/16"	15 7/16"

LAMP & BALLAST DATA

	voltage	catalog no.	O.A.length	Input current (A)	Input wattage (W)	Weight (lb)	Lamp wattage (W)	Lumen (lm) *
dimming	120	☐ SAL-UW850AM	33 9/16" (853mm)	0.32	35	2.3	27	2240
		☐ SAL-UW1000AM	39 1/2" (1003mm)	0.36	40	2.4	31	2630
		☐ SAL-UW1250AM	49 5/16" (1253mm)	0.40	46	2.7	38	3350
		☐ SAL-UW1500AM	59 3/16" (1503mm)	0.47	54	2.9	45	3970
	277	☐ SAL-UW850CM	33 9/16" (853mm)	0.18	35	2.3	27	2240
		☐ SAL-UW1000CM	39 1/2" (1003mm)	0.20	40	2.4	31	2630
		☐ SAL-UW1250CM	49 5/16" (1253mm)	0.22	46	2.7	38	3350
		☐ SAL-UW1500CM	59 3/16" (1503mm)	0.24	54	2.9	45	3970
non dimming	120	☐ SAL-UW500A	19 3/16" (503mm)	0.19	22	2.6	17	1350
		☐ SAL-UW850A	33 9/16" (853mm)	0.26	31	3.0	27	2240
		☐ SAL-UW1000A	39 1/2" (1003mm)	0.32	38	3.2	30	2630
		☐ SAL-UW1250A	49 5/16" (1253mm)	0.38	45	3.4	39	3350
		☐ SAL-UW1500A	59 3/16" (1503mm)	0.44	52	3.7	46	3970
	277	☐ SAL-UW500C	19 3/16" (503mm)	0.08	22	2.6	17	1350
		☐ SAL-UW850C	33 9/16" (853mm)	0.12	33	3.0	27	2240
		☐ SAL-UW1000C	39 1/2" (1003mm)	0.14	38	3.2	30	2630
		☐ SAL-UW1250C	49 5/16" (1253mm)	0.17	47	3.4	39	3350
		☐ SAL-UW1500C	59 3/16" (1503mm)	0.19	52	3.7	46	3970

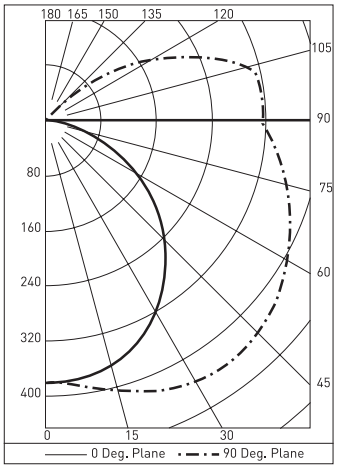
*4200, 3500, 3000, 2800,2500K

APPENDIX S

NIPPO seamlessline phone 732-357-2041 fax 732-357-2096 www.NIPPO-web.com/us
Mitsubishi International PolymerTrade Corporation. 2 PENN PLAZA EAST, 11TH FL., NEWARK, NJ 07105

NIPPO seamlessline®

PHOTOMETRY



Tested by
LUMINARE TESTING LABORATRY,INC.
Test Report #07915 Dated 02-05-2004
Fixture : SAL-UW1000A

ZONAL CAVITY COEFFICIENTS
EFFECTIVE FLOOR CAVITY REFLECTANCE 0.20

CEILING	80				70				50		
WALL RCR	70	50	30	10	70	50	30	10	50	30	10
0	108	108	108	108	103	103	103	103	93	93	93
1	95	89	84	80	90	85	80	76	77	73	70
2	85	76	68	62	80	72	65	60	65	60	55
3	77	66	57	51	73	63	55	49	57	50	45
4	70	58	49	42	66	55	47	40	50	43	38
5	64	50	41	35	60	48	40	33	44	37	31
6	58	45	36	29	55	43	34	28	39	32	26
7	53	40	31	25	50	38	30	24	35	28	23
8	49	36	27	22	46	34	26	21	31	24	19
9	45	32	24	18	43	31	23	18	28	21	17
10	42	29	21	16	40	28	21	16	25	19	15

CANDLE DISTRIBUTION

VERT. ANG.	HORIZONTAL ANGLE 0.0	45.0	90.0	FLUX
0	381	381	381	
5	380	383	383	37
15	366	390	407	110
25	338	391	429	179
35	296	384	440	236
45	243	364	435	272
55	182	335	418	285
65	118	299	391	277
75	57	260	361	253
85	13	223	329	220
90	3	209	316	
95	3	209	314	203
105	2	178	302	172
115	2	110	219	106
125	2	44	132	50
135	2	0	48	12
145	0	0	0	0
155	0	0	0	0
165	0	0	0	0
175	0	0	0	0
180	0	0	0	

LUMEN SUMMARY

ZONE	LUMENS	%LAMP	%FIXTURE
0- 30	326	12.8	13.5
0- 40	562	22.0	23.3
0- 60	1120	43.9	46.4
0- 90	1870	73.3	77.5
90-120	481	18.8	19.9
90-130	530	20.8	22.0
90-150	542	21.3	22.5
90-180	542	21.3	22.5
0-180	2412	94.6	100.0

TOTAL LUMINAIRE

EFFICIENCY: 94.6%
CIE TYPE:SEMI-DIRECT
PLANE:0-DEGÐ90-DEG
SPACING CRITERIA:1.2 1.7

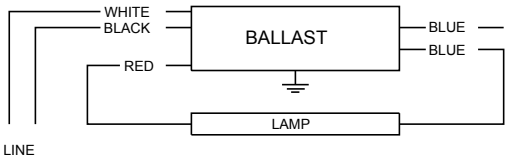
PHILIPS
ADVANCE

REL-2P59-SC	
Brand Name	STANDARD ELEC
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Parallel
Input Voltage	120
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
* F42T6	1	25	32/00	0.32	36	1.20	20	0.98	1.6	3.33
F42T6	2	25	32/00	0.47	56	1.00	20	0.98	1.6	1.79

Wiring Diagram



Diag. 69

Insulate unused blue lead for 1000V

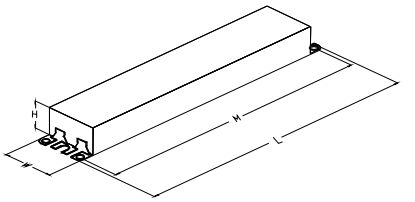
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	22	55.9
White	22	55.9
Blue	46	116.8
Red	70	177.8
Yellow		0
Gray		0
Violet		0

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

Enclosure



Enclosure Dimensions

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

Revised 02/22/2008

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: 866-915-5886

PHILIPS
ADVANCE

REL-2P59-SC	
Brand Name	STANDARD ELEC
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Parallel
Input Voltage	120
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Notes:

Section I - Physical Characteristics

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

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

Section II - Performance Requirements

2.1 Ballast shall be _____ (Instant or Rapid) Start.

2.2 Ballast shall provide Independent Lamp Operation (ILO) for Instant Start ballasts allowing remaining lamp(s) to maintain full light output when one or more lamps fail.

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

2.4 Ballast shall operate from 60 Hz input source of 120V, 277V or 347V as applicable with sustained variations of +/- 10% (voltage and frequency).

2.5 Ballast shall be high frequency electronic type and operate lamps at a frequency between 20 kHz and 30 kHz or above 42 kHz to avoid interference with infrared devices and eliminate visible flicker.

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

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

2.8 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less.

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

2.10 Ballast shall have a Class A sound rating for all 4-foot lamps and smaller.

2.11 Ballast shall have a minimum starting temperature of _____ [-18C (0F) for standard T8 lamps, 10C (50F) for T8/HO, standard T12, Slimline T12 and Long Twin Tube lamps, 0C (32F) for Slimline T8, -29C (-20F) for T12/HO lamps,] for primary lamp application. Ballast shall have a minimum starting temperature of 60F (16C) for energy-saving lamps.

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions.

Section III - Regulatory Requirements

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

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

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

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

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

3.6 Ballast shall comply with NEMA 410 for in-rush current limits.

Section IV - Other

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

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

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

Note: Energy saving T8 lamps (25W, 28W or 30W) may experience lamp striations if operated on ballasts not rated for their use.

Revised 02/22/2008

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

TRIPLES-V 18/6

recessed compact fluorescent downlight/wallwasher

Spec Sheet

COMPACT FLUORESCENT
1-125

FEATURES

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

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

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

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

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

APPLICATIONS

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

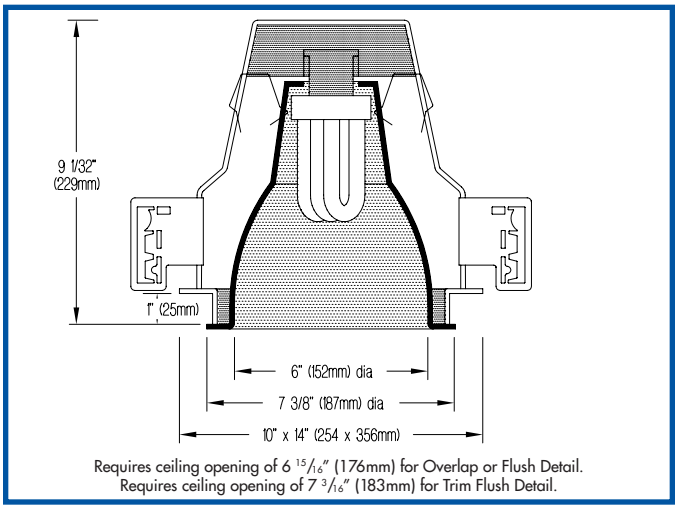
Fixture is c UL us listed for Damp Location (may not be suitable for some outdoor environments). Fixture is prewired with high power factor Class P electronic ballast, suitable for use in a fire rated ceiling, and approved for ten #12 wire 75°C branch circuit pull-through wiring. Removal of the reflector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

NOTE: Under certain conditions, such as installations where there is a pressure differential between the room and ceiling cavity, amalgam based fluorescent lamps may experience reduced lumen output.

MODIFICATIONS AVAILABLE

Contact factory with quantity for pricing; orders may require shop drawing approval.

CHP-: fixture suitable for **Chicago Plenum**; add CHP- as prefix to Product Code.
CONC-: fixture suitable for poured-in-place **concrete**; add CONC- as prefix to Product Code.
EXP-: 'European-style' **install-from-below** fixture; add EXP- as prefix to Product Code.
+2"CLG: fixture suitable for installation in **2" thick ceiling** material; add +2"CLG to Product Code.



Requires ceiling opening of 6 15/16" (176mm) for Overlap or Flush Detail.
Requires ceiling opening of 7 3/16" (183mm) for Trim Flush Detail.

PRODUCT CODE

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

Basic Unit ..... TRPV 18/6

Reflector Type

Downlight	no suffix	Corner Wallwash	CWW
Wallwash	WW	Double Wallwash	DWW

Voltage

120 volt service	120	277 volt service	277

Reflector Color and Detail

	Overlap Flange	*Flush*	*Trim Flush**
EvenTone Clear	VOL	VFL	VTF
OptiTone Clear	COL	CFL	CTF
EasyTone Clear	ECOL	ECFL	ECTF
Champagne Gold	GOL	GFL	GTF
Wheat	WHOL	WHFL	WHTF
Pewter	POL	PFL	PTF
Bronze	ZOL	ZFL	ZTF

Other reflector finishes available on special order.

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

Trim Flush reflector trim requires the use of a **plaster ring Accessory (see below).*

OPTIONS *Specify by adding to the basic unit.*

Dimmable 3-wire ballast ..... – DM

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

⅛" (3mm) thick **clear acrylic shield**, spring-mounted in reflector. Available with downlight or WW reflector only..... – PS

ACCESSORIES *Specify as a separate line item.*

Plaster ring allows use of Trim Flush (-TF) reflector in sheetrock ceiling; 7 3/16" (183mm) dia hole is required..... TF RING/6

▶ For combinations of the Options above, contact factory or Edison Price Lighting representative.
▶ A modified fixture suitable for 347-volt service is available on special order. Contact factory.
▶ Decorative reflector rings are available on special order. Contact factory.

EDISON PRICE LIGHTING

APPENDIX S

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

TRIPLES-V 18/6

EDISON PRICE LIGHTING

PHOTOMETRIC REPORT

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

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

BALLAST INFORMATION

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

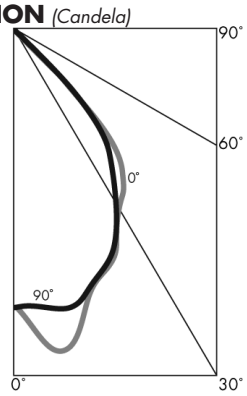
**Consult lamp manufacturers for specific temperatures.*

ZONAL LUMEN SUMMARY

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

CANDLEPOWER DISTRIBUTION *(Candela)*

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



LUMINANCE DATA

(Candela/m²)

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

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

COLOR MULTIPLIERS

OptiTone (C)	1.00
EvenTone (V)	.95
EasyTone (EC)	.88
Champagne Gold (G)	.97
Wheat (WH)	.79
Pewter (P)	.81
Bronze (Z)	.58

COEFFICIENTS OF UTILIZATION – ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 20%

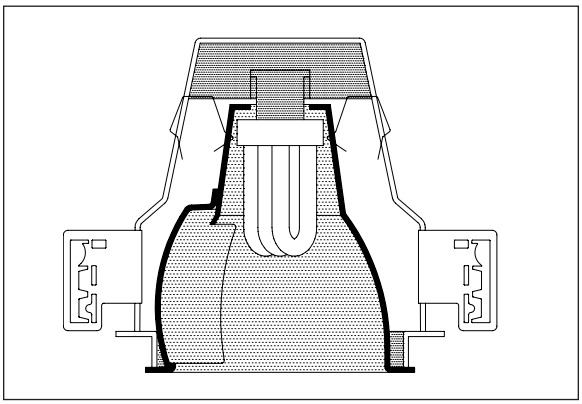
Ceiling Reflectance (%)	*80*				*70*				*50*			*30*			*10*			*0*
Wall Reflectance (%)	*70*	*50*	*30*	*10*	*70*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*50*	*30*	*10*	*0*
Room Cavity Ratio																		
0	76	76	76	76	75	75	75	75	71	71	71	68	68	68	65	65	65	64
1	73	71	69	67	71	69	68	66	67	65	64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

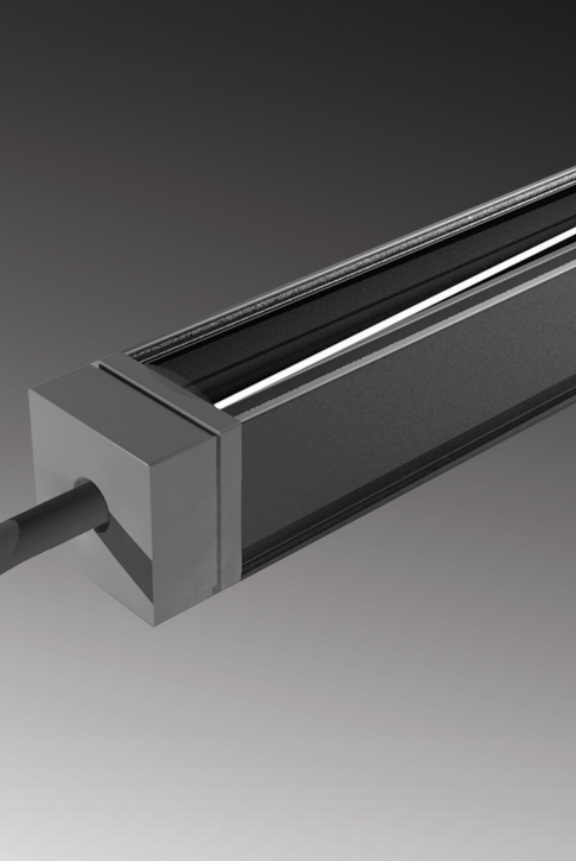
TRIPLES-V 18/6 WW

WALLWASH INFORMATION

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

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





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

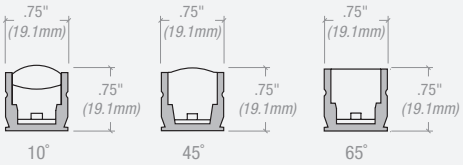
Standard Output: 2.92 w/ft **Mid Output: 5.34 w/ft** **High Output: 7.62 w/ft**

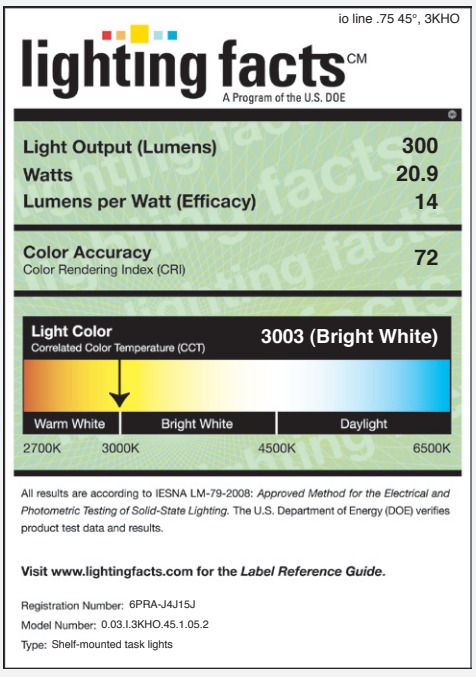
Power consumption does not include power supply losses.

Finish

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

Dimensions



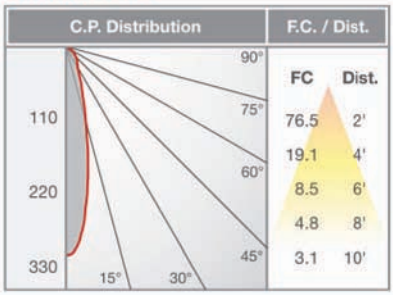


Label references 30" **line .75** symmetric fixture with a 45˚ beam spread in High Output 3000K. Lighting Facts for additional beam spreads and light output levels may be obtained from **io** Lighting.

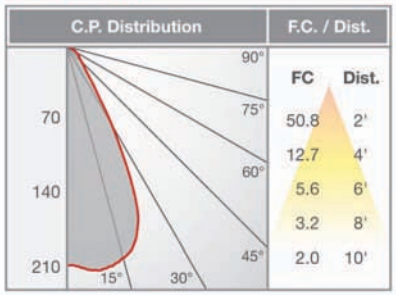
APPENDIX S

Light Output / Distributions / Electrical Feed Options

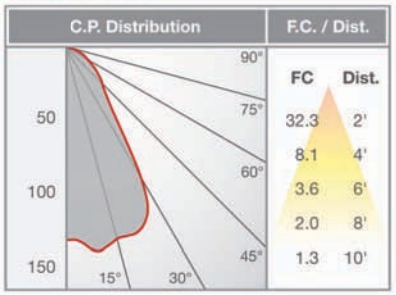
3KHO 10 DEGREE



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)

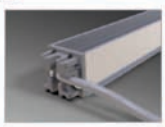
IES format photometrics may be downloaded from ***www.iolighting.com***.

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

NEW FIELD CONFIGURABLE ELECTRICAL FEED

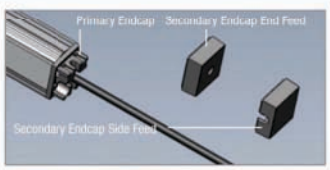

End feed


Right side feed


Left side feed

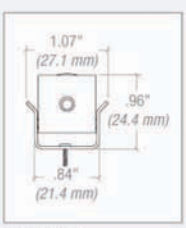

Top feed

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

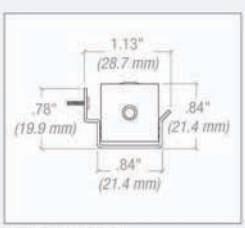


Secondary End Cap

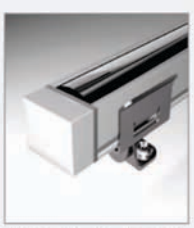
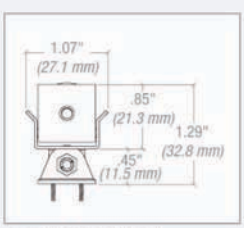
Mounting Options

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 C78.337		
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 w/ft.
3. High Output only available in lengths up to 72".

APPENDIX S

Date: _____ Type: _____

Firm Name: _____

Project: _____

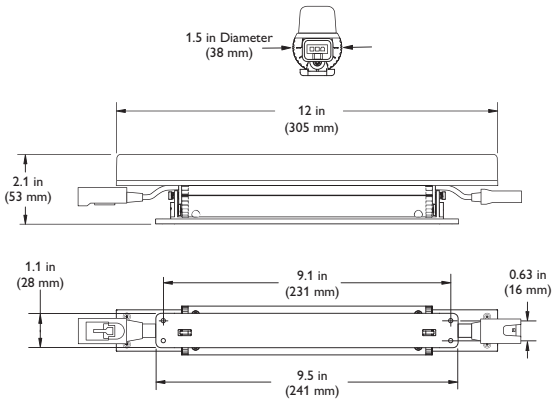
eW Fuse Powercore

3000 K, 10° x 60° Beam Angle

Ultra-compact, high-performance LED grazing fixture

With narrow and medium beams of intense white or solid blue light, eW® Fuse Powercore is an excellent choice for a full range of surface grazing and wall-washing applications. Its ultra-compact form factor permits installation in tight spaces too small to accommodate conventional grazing fixtures with similar light output. Meets or exceeds the performance of comparable linear fluorescent grazing fixtures while lowering installation, energy, and maintenance costs. Offers environmentally-conscious buyers a green, energy-efficient grazing fixture with industry-leading quality and quantity of light.

- Cost-effective alternative — Long useful source life and low-maintenance operation represent a cost-effective alternative to traditional grazing fixtures.
- High-performance beam quality — Available narrow 10° x 60° or medium 30° x 60° beam angle. Superior beam quality delivers striation-free light as close as 6 in (152 mm) from fixture placement. Interlocking connectors for end-to-end installation with no light scalloping between fixtures.
- Multiple color temperatures for design and application flexibility — Available in 2700 K, 3000 K, 3500 K, and 4000 K for applications calling for warm, neutral, or cool white light. Solid blue also available.
- Superior binning algorithm — Exceeds the recognized standards for color quality to guarantee uniformity and consistency of hue and color temperature across LEDs, fixtures, and manufacturing runs.
- Integrates patented Powercore® technology — Powercore rapidly, efficiently, and accurately controls power directly from line voltage, eliminating the need for an external power supply, dramatically simplifying installation, and lowering total system cost.
- Support for multiple voltages — Accepts power input of 100, 120, 208, 220 – 240, and 277 VAC for consistent installation and operation from line voltage in most locations.
- Dimming capability — Patented DIMand® technology offers smooth dimming capability with many electronic low voltage (ELV) dimmers for all input voltages.
- Simple installation — Contractor-friendly installation allows product runs ranging from 50 fixtures at 100 VAC to 139 fixtures at 277 VAC. Easy-to-install 4 ft (1.2 m) mounting tracks allow quick project setup in linear applications.



- Easy mounting and positioning — With end-to-end locking power connectors that can make 180° turns, eW Fuse Powercore fixtures are easy to position in even the most challenging mounting circumstances. Fixtures rotate in 10° increments through 180° for precise aiming and color mixing. Optional mounting tracks support vertical and overhead positioning. 1 ft (305 mm) and 5 ft (1.5 m) jumper cables can add extra space between fixtures.

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

PHILIPS

APPENDIX S

Preliminary Specifications

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

Item	Specification	3000 K*, 10° x 60° beam angle
Output	Lumens†	602
	Efficacy (lm / W)	50.6
	CRI	83
	Lumen Maintenance‡	50,000 hours L70 @ 25° C 37,000 hours L70 @ 50° C 90,000 hours L50 @ 25° C 80,000 hours L50 @ 50° C
Electrical	Input Voltage	100 / 120 / 208 / 220 – 240 / 277 VAC, auto-switching, 50 / 60 Hz
	Power Consumption	13.5 W maximum at full output, steady state
	Power Factor	.99 @ 120 V
Control	Dimming	Compatible with many commercially available ELV, trailing edge, or reverse-phase control dimmers§
Physical	Dimensions *(Height x Width x Depth)*	1.1 x 12 x 2.1 in (28 x 305 x 53 mm)
	Weight	0.98 lbs (.45 kg)
	Housing	Die-cast aluminium, white powder-coated finish
	Lens	Polycarbonate
	Fixture Connections	Integral male / female connectors
	Temperature Ranges	-40° – 122° F (-40° – 50° C) Operating -4° – 122° F (-20° – 50° C) Startup -40° – 176° F (-40° – 80° C) Storage
	Humidity	0 – 95%, non-condensing
	Maximum Fixture Run Length‖	50 @ 100 VAC 60 @ 120 VAC 104 @ 208 VAC 115 @ 220 – 240 VAC 139 @ 277 VAC *Configuration: Fixtures installed end-to-end, 20 A circuit, standard 10 ft (3.1 m) Leader Cable*
Certification and Safety	Certification	UL / cUL, FCC, CE, C-Tick
	LED Class	Class 2 LED product
	Environment	Dry / Damp Location, IP20

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

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

‡ L_{70} = 70% maintenance of lumen output (when light output drops below 70% of initial output).
L_{50} = 50% maintenance of lumen output (when light output drops below 50% of initial output).
Ambient temperatures specified. Based on measurements that comply with IES LM-80-08 testing procedures.
See www.colorkinetics.com/support/appnotes/lm-80-08.pdf for more information.

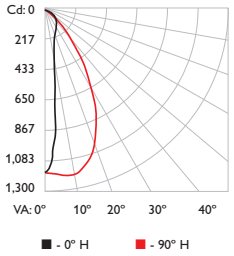
§ See www.colorkinetics.com/support/appnotes/notes/ for specific details.

‖ These figures are accurate for this configuration only. Changing the configuration can affect fixture run lengths.

Photometrics

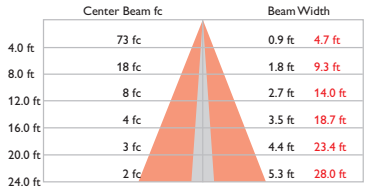
3000 K, 10° x 60° beam angle

Polar Candela Distribution



	0.0	22.5	45.0	67.5	90.0
90°	0	1160	1160	1160	1160	1160
80°	5	741	793	943	1115	1189
	15	209	216	270	601	1131
70°	25	160	157	166	264	836
	35	118	114	112	143	431
	45	114	95	74	56	96
60°	55	63	56	39	27	37
	65	39	31	21	17	22
	75	23	19	13	9	9
50°	85	13	12	8	4	2
	90	10	10	6	3	1

Illuminance at Distance



34 ft (10.4 m)
1 fc maximum distance

■ Vert. Spread: 12.7°
■ Horiz. Spread: 60.6°

For lux multiply fc by 10.7

Lumens	602
Efficacy	50.6 lm / W

OPTIBIN® CK TECHNOLOGY | POWERCORE® CK TECHNOLOGY | DIMAND™ CK TECHNOLOGY

Accessories

Item	Type		Item Number	Philips 12NC
Leader Cable with terminator and strain relief	UL / cUL	10 ft (3 m)	108-000047-00	910503700972
	CE / CCC	10 ft (3 m)	108-000047-01	910503700973
Wiring Compartment with terminator	UL / cUL		120-000077-01	910503700994
Jumper Cable	UL / cUL	1 ft (305 mm)	108-000048-00	910503700974
		5 ft (1.5 m)	108-000048-01	910503700975
	CE / CCC	1 ft (305 mm)	108-000048-02	910503700976
		5 ft (1.5 m)	108-000048-03	910503700977
Terminators	10 / box		120-000099-00	910503701120
Mounting Track, White	Quantity 1	4 ft (1219 mm)	120-000124-00	910503701787

Fixtures

Color Temp.	Beam Angle	Item Number	Philips 12NC
2700 K	10° x 60°	523-000065-00	910503701653
	30° x 60°	523-000065-04	910503701657
3000 K	10° x 60°	523-000065-01	910503701654
	30° x 60°	523-000065-05	910503701658
3500 K	10° x 60°	523-000065-02	910503701655
	30° x 60°	523-000065-06	910503701659
4000 K	10° x 60°	523-000065-03	910503701656
	30° x 60°	523-000065-07	910503701660
Blue	10° x 60°	223-000065-02	910503701676
	30° x 60°	223-000065-06	910503701680

Use Item Number when ordering in North America.

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

APPENDIX S

DAS-000079-03 R01 10-10

Product Datasheet

Design Roberto Pamio | **iGuzzini**

February 2011

Cup -

Product code:
SM19

Technical description:
The luminaire body of Cup 60 is made of extruded and die-cast aluminium, while the lamp unit of Cup 110 is completely made of die-cast aluminium. The click-in system and steel safety springs prevent the release of the glass.

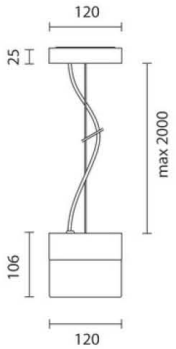
Dimension:
D=120 x 106mm h=2000 mm

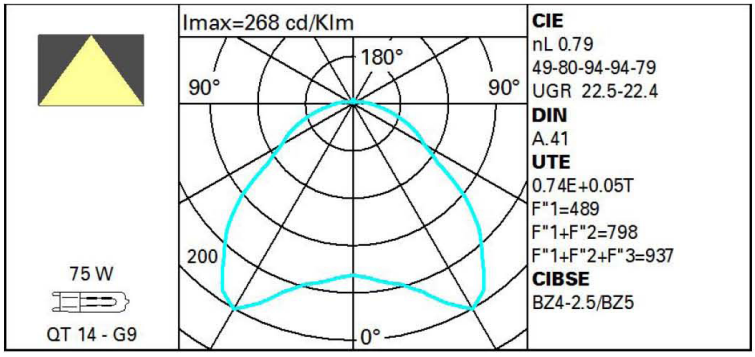
Colour:
White (01)|Grey (15)

Notes:
Luminaires complete with lamp and suspension cable.

Complies with EN605981 and pertinent regulations

850°C IP 20





APPENDIX S

Photometric Diagram

Design Roberto Pamio **iGuzzini**

February 2011

Cup -

Attach\Diagrams\SM19_L116_X1.jpg

Photometric curve code: SP310000.116
Uncorrected UGR values (at 1000 lm bare lamp luminous flux)

Riflect.:											
ceil/cav		0.70	0.70	0.50	0.50	0.30	0.70	0.70	0.50	0.50	0.30
walls		0.50	0.30	0.50	0.30	0.30	0.50	0.30	0.50	0.30	0.30
work pl.		0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Room dim				viewed crosswise					viewed endwise		
x	y										
2H	2H	19.6	20.7	20.0	21.1	21.5	20.0	21.1	20.4	21.4	21.8
	3H	20.6	21.6	21.0	22.0	22.4	20.2	21.2	20.7	21.6	22.0
	4H	21.0	21.9	21.5	22.3	22.8	20.3	21.2	20.7	21.6	22.1
	6H	21.4	22.2	21.8	22.6	23.1	20.3	21.1	20.8	21.6	22.0
	8H	21.5	22.3	22.0	22.8	23.2	20.3	21.1	20.8	21.5	22.0
	12H	21.6	22.4	22.1	22.8	23.3	20.2	21.0	20.7	21.5	22.0
4H	2H	20.0	20.9	20.4	21.3	21.7	21.5	22.4	21.9	22.8	23.3
	3H	21.2	21.9	21.6	22.4	22.9	21.9	22.7	22.4	23.1	23.6
	4H	21.7	22.4	22.2	22.9	23.4	22.1	22.8	22.6	23.3	23.8
	6H	22.1	22.7	22.7	23.3	23.8	22.2	22.8	22.7	23.3	23.9
	8H	22.3	22.9	22.9	23.4	24.0	22.2	22.8	22.8	23.3	23.9
	12H	22.5	23.0	23.0	23.5	24.1	22.2	22.7	22.8	23.3	23.9
8H	4H	21.9	22.4	22.4	22.9	23.5	22.8	23.4	23.3	23.9	24.5
	6H	22.4	22.9	23.0	23.5	24.1	23.0	23.5	23.6	24.1	24.7
	8H	22.7	23.1	23.3	23.7	24.3	23.1	23.5	23.7	24.1	24.8
	12H	23.0	23.3	23.6	23.9	24.6	23.2	23.6	23.8	24.2	24.8
12H	4H	21.9	22.4	22.4	22.9	23.5	23.0	23.5	23.5	24.0	24.6
	6H	22.5	22.9	23.1	23.5	24.1	23.3	23.7	23.9	24.3	24.9
	8H	22.8	23.1	23.4	23.7	24.4	23.4	23.8	24.0	24.4	25.0

Variations with the observer position at spacing:

S =	1.0H	0.3 / -0.3	0.2 / -0.3
	1.5H	0.5 / -0.7	0.5 / -0.7
	2.0H	1.0 / -0.9	1.2 / -0.8

APPENDIX S

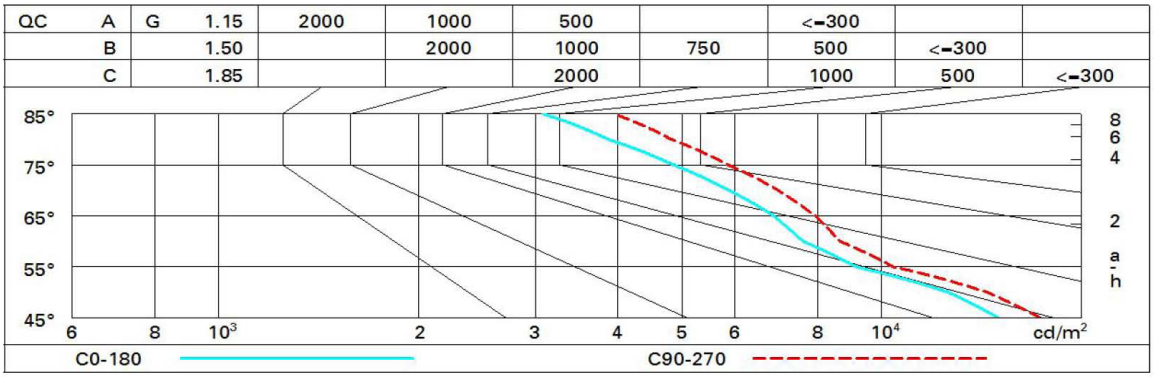
Photometric Diagram

Design Roberto Pamio **iGuzzini**

February 2011

Cup -

Attach\Diagrams\SM19_L116_L1.jpg



Photometric Diagram

Design Roberto Pamio **iGuzzini**

February 2011

Cup -

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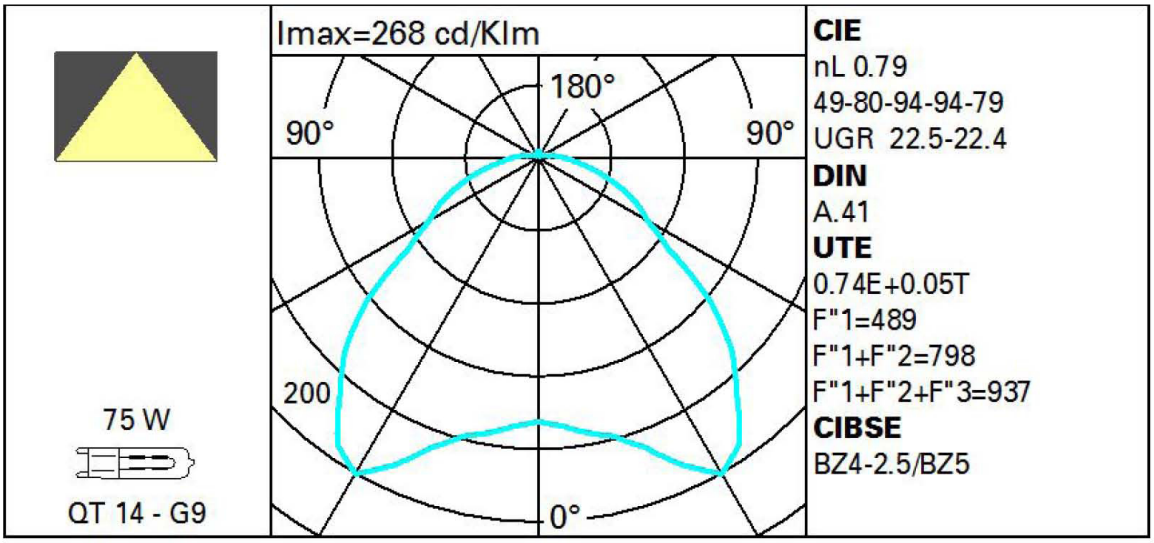

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R	77	75	73	71	55	53	33	00	DRR
K0.8	51	43	37	33	41	36	35	30	40
1.0	56	49	43	39	47	42	41	35	48
1.5	64	58	53	49	56	51	50	44	60
2.0	68	63	59	56	61	57	56	50	68
2.5	71	67	63	60	65	61	60	54	74
3.0	73	69	66	63	67	64	62	57	77
4.0	75	72	70	67	70	68	66	61	82
5.0	77	74	72	70	72	70	67	63	85

iGuzzini NORTH AMERICA

SPECIFICATION SHEET

LIGHT UP WALK #I.B001-____-13
VOLTAGE FINISH

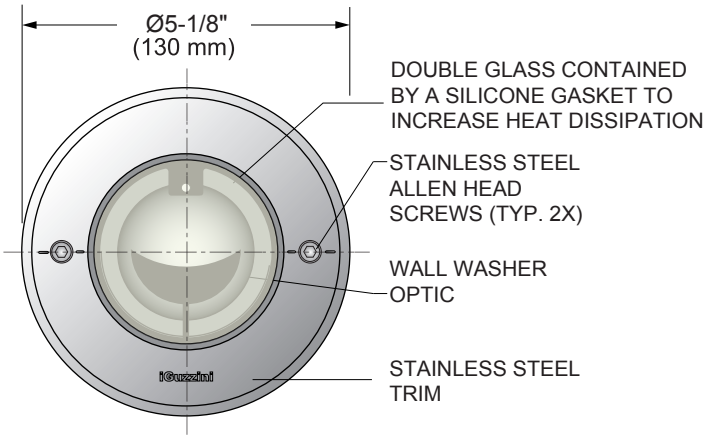
In-ground recessed luminaire with wall washer optic. Cast aluminum body and outer casing. Trim and vandal resistant screws are made of stainless steel. The double layer of tempered glass reduces the surface temperature. The total assembly can whithstand a load of 5000 Kg (11 000 lbs) at a maximum speed of 50 Km/h (31 mph).

LAMPING: 1 X 10 W XELOGEN,12 V LOW VOLTAGE, G4 BASE.

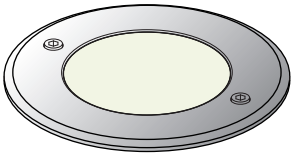
PROJECT NAME: _____

TYPE: _____

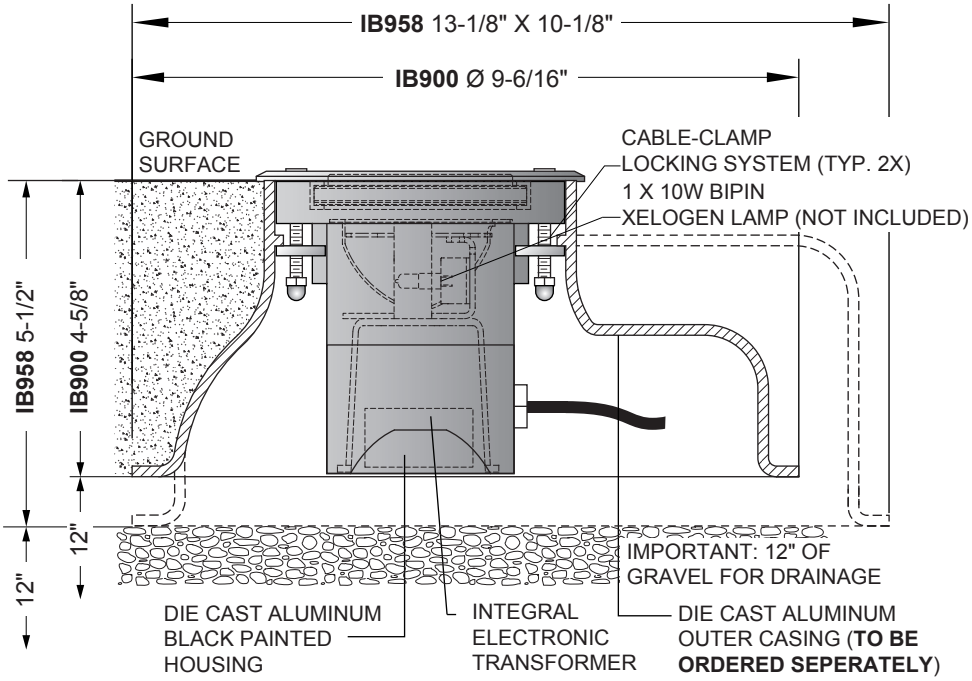
LAST UPDATE: FEBRUARY 24th, 2009



TOP VIEW



ISOMETRIC VIEW



SECTION VIEW

ACCESSORIES
TO BE ORDERED SEPERATELY

◯ I-B900 - CASING

◯ I.B958 - CASING
MULTIPLE FEEDER
13-1/8" X 10-1/8" X 5-1/2" H.

◯ I- B916 - SUCTION CUP

◯ B917 - COLORED FILTERS

05 - RED
06 - YELLOW
09 - BLUE

VOLTAGE ◯ 120 V

METAL FINISH ◯ 13 - STAINLESS STEEL

5455 de Gaspé
suite 100, Montréal (Québec)
Canada H2T 3B3
P.: 514.523.1339 F.: 514.525.6107

APPENDIX S

LIGHT UP WALK PROFESSIONEL

Housing: Die-cast aluminum with integral wiring compartment.

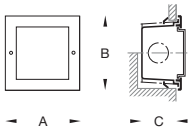
Enclosure: One piece die-cast aluminum faceplate. Optically active, impact resistant, satin matte crystal glass, .21" thick. The faceplate is secured with captive, hex key, flat head stainless steel fasteners threaded into stainless steel inserts in the housing casting. Continuous high temperature U-channel gasket for weather tight operation.

Electrical: Low Voltage; G4 (10W) requires a remote Class 2, 12V safety transformer. Lamp supplied. Through Wiring: Maximum of four (4) No. 12 AWG conductors (plus ground) suitable for 90°C. Two ⅞" knockouts provided for ½" conduit.

Finish: 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 and poured concrete/masonry or stud wall construction. Type non-IC. Protection class:IP 65.

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



		Lamp	Lumen	A	B	C
2303	ADA	1 10W T3 G4,12V	140	3⅛	3⅛	4

WASHLUX-T® 126/6 226/6

recessed compact fluorescent lensed wallwashers

Spec Sheet

COMPACT FLUORESCENT
1-614

FEATURES

Washlux–T 126/6 and Washlux–T 226/6 are efficient compact fluorescent wallwashers for use with 26-watt, 4-pin, triple tube compact fluorescent lamps by GE, Philips or Sylvania. Fixtures provide uniform illumination on vertical surfaces up to the ceiling line. Aperture diameter is 6 ½" and recess depth is only 6 ¾".

The optical assembly consists of a two-part specular internal reflector, Edison Price Lighting's unique flat 85° spread lens, and an external Darklite reflector designed to minimize aperture brightness.

Washlux–T 126/6 uses one 26-watt lamp providing 1800 lumens (more than a 100-watt incandescent) and Washlux–T 226/6 uses two 26-watt lamps providing 3600 lumens (more than a 150-watt incandescent). Compact fluorescent lamps have a 10,000-hour life, a color rendering index (CRI) of 82, and color temperatures as warm as 2700°K (nearly duplicating the color qualities of incandescent).

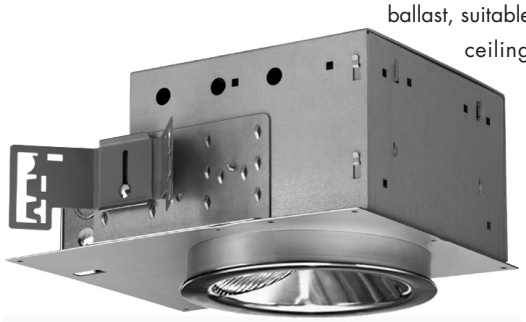
Reflectors are available in clear, natural aluminum in two finishes: **EvenTone**, our standard clear finish, partially diffuse, anti-iridescent and gently luminous in appearance; and **EasyTone**, diffuse and luminous. Additionally, reflectors are available in champagne gold, wheat, pewter, bronze and black.

Washlux–T 126/6 and Washlux–T 226/6 include a pair of mounting bars (¾" x 27" C channel). Specialty bars for wood joist and T-bar installations are available as accessories.

APPLICATIONS

Fixture is recommended for wallwashing in offices, stores, lobbies and public areas. The use of matte wall finishes is recommended to avoid specular reflections.

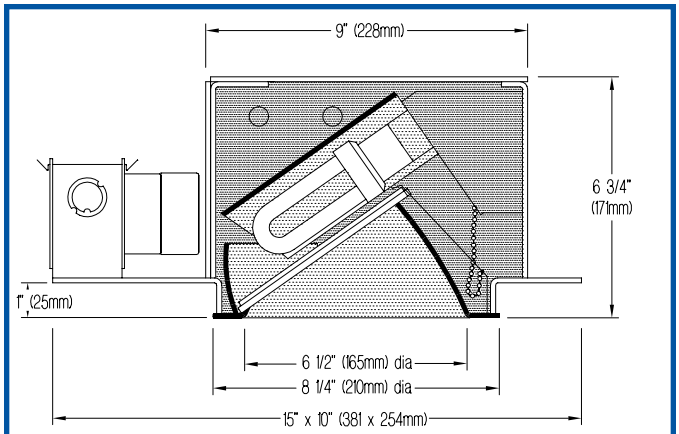
Fixture is c UL us listed for Damp Location (may not be suitable for some outdoor environments). Fixture is prewired with high power factor Class P electronic ballast, suitable for use in a fire rated ceiling and approved for eight #12 wire 75°C branch lighting circuit pull-through wiring. Access to the ballast and wiring compartment is provided by removing a snap-in cover.



MODIFICATIONS AVAILABLE

Contact factory with quantity for pricing; orders may require shop drawing approval.

CHP-: single-lamp fixture suitable for **Chicago Plenum**; add CHP- as prefix to Product Code.
CONC-: single-lamp fixture suitable for poured-in-place **concrete**; add CONC- as prefix to Product Code.
EXP-: 'European-style' **install-from-below** fixture; add EXP- as prefix to Product Code.
+2"CLG: fixture suitable for installation in **2" thick ceiling** material; add +2"CLG to Product Code.



Requires ceiling opening of 7 7/8" (200mm) for Overlap or Flush Detail.
Requires ceiling opening of 8 3/16" (208mm) for Trim Flush Detail.

PRODUCT CODE

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

Basic Unit ..... WLXT 126/6 or WLXT 226/6

Voltage
120 volt service ..... 120 277 volt service 277

Reflector Color and Detail

	Overlap Flange	*Flush*	*Trim Flush**
EvenTone Clear	VOL	VFL	VTF
EasyTone Clear	ECOL	ECFL	ECTF
Champagne Gold	GOL	GFL	GTF
Wheat	WHOL	WHFL	WHTF
Pewter	POL	PFL	PTF
Bronze	ZOL	ZFL	ZTF
Black	BOL	BFL	BTF

Other reflector finishes available on special order.

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

Trim Flush reflector trim requires the use of a **plaster ring Accessory (see below).*

OPTIONS *Specify by adding to the basic unit.*

Dimmable 3-wire ballast. Fixture footprint increases to 17 3/8" x 10" (441 x 254mm). Additional 2" (51mm) height clearance required to remove ballast through aperture ..... – DM

Emergency battery pack operates one lamp in event of power outage. Includes a plate with ready light and test switch for adjacent installation by others. Fixture footprint increases to 17 3/8" x 10" (441 x 254mm). Additional 2 ½" (63mm) height clearance required to remove EM pack through aperture. Not for outdoor application ..... – REM

ACCESSORIES *Specify as a separate line item.*

Plaster ring allows use of Trim Flush (-TF) reflector in sheetrock ceiling; 8 3/16" (208mm) dia hole is required ..... TF RING/7

▶ For combinations of the Options above, contact factory or Edison Price Lighting representative.
▶ A modified fixture suitable for 347-volt service is available on special order. Contact factory.

EDISON PRICE LIGHTING

APPENDIX S

41-50 22ND STREET, LIC NY 11101 TEL 718.685.0700 FAX 718.786.8530 www.epl.com
 09-09

WASHLUX-T 126/6

PHOTOMETRIC REPORT

Luminaire Testing Laboratory Report No. 05979. Original test report furnished upon request.

Luminaire .....recessed lensed wallwasher
Lamps.....one 26-watt triple-tube compact fluorescent, 4-pin, GX24q-3 base, 1800 lumens

WALLWASH INFORMATION

Distance From Ceiling (Feet)	*3' From Wall; 3' O.C.*		*3'6" From Wall; 3' O.C.*		*4' From Wall; 3' O.C.*	
	Below Fixture	*Between Fixtures*	*Below Fixture*	*Between Fixtures*	*Below Fixture*	*Between Fixtures*
1	13	10	9	8	6	5
2	21	20	16	15	12	11
3	25	24	21	20	17	17
4	21	21	20	20	18	18
5	16	16	17	17	16	16
6	12	12	13	13	14	14
7	9	9	10	10	11	11
8	7	7	8	8	9	9
9	6	5	6	6	7	7
10	4	4	5	5	6	5
11	3	3	4	4	4	4
12	3	3	3	3	4	4

All vertical footcandles are initial values with no contribution from ceiling or floor reflectances. Computation performed with a total of five wallwashers.

BALLAST INFORMATION

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

**Consult lamp manufacturers for specific temperatures.*

WASHLUX-T 226/6

PHOTOMETRIC REPORT

Report No. 05980. Original Independent Testing Laboratories, Inc. (ITL) test report furnished upon request.

Luminaire .....recessed lensed wallwasher
Lamps.....two 26-watt triple-tube compact fluorescent, 4-pin, GX24q-3 base, 1800 lumens each

WALLWASH INFORMATION

Distance From Ceiling (Feet)	*3' From Wall; 3' O.C.*		*3'6" From Wall; 3' O.C.*		*4' From Wall; 3' O.C.*	
	Below Fixture	*Between Fixtures*	*Below Fixture*	*Between Fixtures*	*Below Fixture*	*Between Fixtures*
1	20	18	14	13	10	10
2	37	36	28	28	22	21
3	39	39	34	34	29	29
4	32	32	31	31	29	29
5	25	25	25	25	25	25
6	19	19	20	20	21	20
7	14	14	16	15	17	16
8	11	11	12	12	13	13
9	9	9	10	10	11	10
10	7	7	8	8	9	8
11	6	5	6	6	7	7
12	4	4	5	5	6	6

All vertical footcandles are initial values with no contribution from ceiling or floor reflectances. Computation performed with a total of five wallwashers.

BALLAST INFORMATION

Voltage	*120*	*277*
Input Watts	56	56
Line Current (A)	.49	.21
Power Factor (%)	>98	>98
THD (%)	<10	<10
Min. Starting Temp* (°F)	0	0

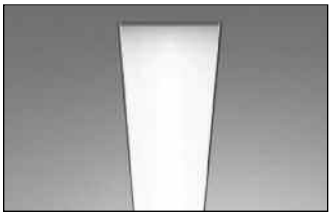
**Consult lamp manufacturers for specific temperatures.*

SLOTLIGHT PRO

Fluorescent
One Lamp Cross-section
T5 or T5 HO

6" Recessed, Flangeless Sheetrock Ceiling, Perimeter or Wall

online Find it Fast 399



Applications: SLOTLIGHT PRO is a lighting solution as unobtrusive as it is sophisticated. The streamlined design with its sleek and contemporary image offering "ribbons of light" harmonizes perfectly with the architecture.

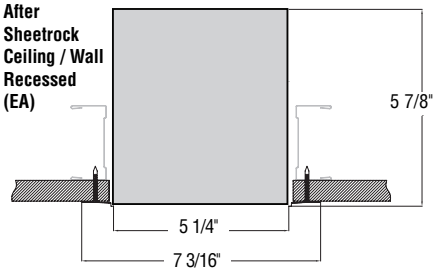
Type: _____ **Quantity:** _____ **Project:** _____

USE THIS CHART FOR INDIVIDUAL FIXTURES ONLY (FOR CONTINUOUS RUNS SEE PAGE 30A)

SLR6NI

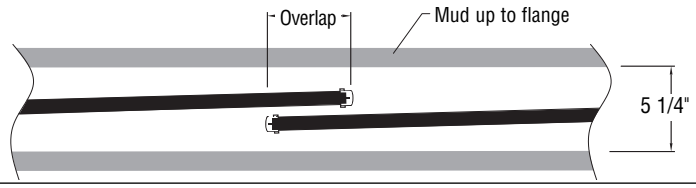
FIXTURE	CEILING/ MOUNTING	LAMP	LENGTH	OPTIC	VOLTAGE/ BALLAST	WIRING OPTIONS	OTHER OPTIONS
SLR6NI SLOTLIGHT PRO, 6" Recessed, Flangeless, Individual	**EB** Before Sheetrock Ceiling **EA** After Sheetrock Ceiling / Wall Recessed **PM** Perimeter Mount, Before Sheetrock Ceiling	**1215** (1) 21W T5 **1395** (1) 39W T5 HO **1285** (1) 28W T5 **1545** (1) 54W T5 HO **1355** (1) 35W T5 **1805** (1) 80W T5 HO **2285** (2) 28W T5 **2545** (2) 54W T5 HO **3285** (3) 28W T5 **3545** (3) 54W T5 HO	**03** 2'-10 5/8" **04** 3'-10 7/16" **05** 4'-10 1/4" **08** 7'-4 9/16" **12** 10'-10 11/16"	**See page 30A for available optics.**	**U** Universal 120/277V **DA_*** Dimming, Analog (0-10V) **DD_*** Dimming, DALI **DE_*** Dimming, Lutron ECO-10™ **DH_*** Dimming, Lutron HiLume® **DSC_*** Dimming, Lutron EcoSystem™, Control Fixture **DSN_*** Dimming, Lutron EcoSystem, Non-control Fixture **STDM_*** Dimming, Step	**MS1** Master-Slave Switching, Single Circuit **AB2** A/B Switching, 2 Circuit **AB3** A/B/C Switching, 3 Circuit	**HP** Higher Performance Option **WF** Whip Flex 3/8" X 6' 14 AWG **WN_*** Whip Flex 3/8" X 6' 14 AWG (NYC) **EM1_*** Standby Battery Pack/ 1 Lamp **CP** Chicago Plenum **F** Fusing **QD** Power Feed Quick Disconnect

End View - After Sheetrock Ceiling / Wall Recessed (EA)



** Specify "1" for 120V or "2" for 277V. Some lamp types may not be available.*
EM not available for (03), (04) or (05) lengths. Must be 8ft minimum length.
EM not available for 347V.
EM for 35W T5 listed as dry location only. Offered as MOD with customer approval.
EM not available for 80W T5 HO lamp.
DA not available for 39W T5 HO (120V/277V) or 80W T5 HO (120V) lamps.
DA for 80W T5 HO (277V) offered as MOD with customer approval.
DD not available for 21W T5, 39W T5 HO and 80W T5 HO lamps (120V/277V).
DE not available for 35W T5 or 80W T5 HO lamps (120V/277V).
DH not available for 21W T5, 28W T5, 35W T5 and 80W T5 HO lamps (120V/277V).
DSC/DSN not available with 80W T5 HO lamps (120V/277V).
STDM not available for 347V.
STDM not available with single lamp 21W T5, 28W T5 (120V/277V).
STDM not available with 39W T5 HO, 54W T5 HO, 35W T5 and 80W T5 HO lamps (120V/277V).

Bottom View



c UL us LISTED

Suitable for Damp Locations
Approved for thru wiring
Above ceiling access not required

IBEW Union Made

Lead Time?Double-click on
http://www.zumtobel.us/PDBXXXXXXXXXXXXXXXXXXXXXXXXXXXX
A = ZOOM! Quick Ship - ships in 2 weeks
B = ships in 4 weeks **C =** ships in 8 weeks

1. Housing - Extruded aluminum housings in various standard lengths. Finish is powder coated high-reflectance white. Post painted. Continuous rows provided with specially designed joiner system allowing uniform appearance with no light leaks. Aluminum endcaps. Feed from top or side.

2. Mounting - Before Sheetrock: Mounting brackets with 1/4-20 threaded rod (by others) and snap-on yoke (by Zumtobel) provided approximately every 4 feet. Fixture does not need to be disassembled for installation. **After Sheetrock Ceiling / Wall:** Flange secured to blocking behind sheetrock ceiling / wall with flat head screws (by others) using screw holes provided every 3 inches. Mud up to flange for clean, flush appearance.

Perimeter Mount: For before sheetrock ceiling installations only. Mount perimeter fixture mounting rail (by Zumtobel) to wall making sure it is level. Hang fixture by yokes (by Zumtobel). Fixture supported by yokes, not ceiling.

3. Lamping and Length - One 21W, 28W or 35W T5, or 39W, 54W or 80W T5 HO staggered lamps in cross-section. Staggered lamping only applicable for 2 or more lamps. Fixture lengths are as noted above. Refer to ordering information to determine lamp type, quantity and wattage.

4. Optic - Choose from Frosted Acrylic or Micro-Pyramidal Lens, Matte or Specular Bivergence® Louver, White Louver. Each optic (except MPO) is available as either flush or regressed. Regressed optics offer a choice of corrugated side or smooth side. All flush louver optics are available with option of Overlay. See page 30A for list of available optics. Choose Higher Performance Option (HP) for any available optic for higher efficiency.

5. Voltage/Ballast - Electronic, universal voltage (120/277V) or 347V. Prewired for thru wiring. Ballasts are mounted in geartray offering entry from below.

6. Dimming - In control fixtures with Lutron EcoSystem dimming, control wires are brought to an interface. Consult factory for location of control wire feed. Consult factory for specific dimming requirements other than those listed above.

7. Wiring Options - Standard wiring is single circuit with 1-lamp ballast. This will be supplied if no wiring option is chosen. Other options available are Single Circuit Master-Slave switching (MS1), 2 Circuit A/B Switching with separate neutral (AB2) and 3 circuit A/B/C switching with common neutral. See page 30D for more information.

8. Standby Battery Pack - Integral standby battery pack with integral test switch.

9. Power Feed Quick Disconnect - Available as an option for quick connection to power supply.

10. Weight - 2.5 lbs per linear foot

COMPANION LUMINAIRE OPTIONS

	FIF #
6" Recessed, Flangeless Sheetrock Ceiling or Perimeter, MR-16	401
6" Recessed, Flangeless Sheetrock Ceiling or Perimeter, Lit Corner	402
6" Recessed, Flanged Sheetrock Ceiling or Wall	395
6" Recessed, T-bar Ceiling or Perimeter	403
6" Recessed, Flangeless Sheetrock Ceiling, Wall Washer	400

Zumtobel Lighting Inc. ©2009
3300 Route 9W
Highland, NY 12528-2630

TEL (845) 691-6262
(800) 932-0633
FAX (845) 691-6289

www.zumtobel.us

USE THIS CHART FOR CONTINUOUS RUNS ONLY

SLR6NS							
SLR6NM							
SLR6NE							

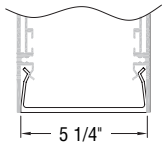
FIXTURE	CEILING/ MOUNTING	LAMP	LENGTH	OPTIC	VOLTAGE/ BALLAST	WIRING OPTIONS	OTHER OPTIONS
SLR6NS SLOTLIGHT PRO, 6" Recessed, Flangeless, Starter **SLR6NM** SLOTLIGHT PRO, 6" Recessed, Flangeless, Mid **SLR6NE** SLOTLIGHT PRO, 6" Recessed, Flangeless, End	**EB** Before Sheetrock Ceiling **EA** After Sheetrock Ceiling / Wall Recessed **PM** Perimeter Mount, Before Sheetrock Ceiling	**1215** (1) 21W T5 **1395** (1) 39W T5 HO **1285** (1) 28W T5 **1545** (1) 54W T5 HO **1355** (1) 35W T5 **1805** (1) 80W T5 HO **2285** (2) 28W T5 **2545** (2) 54W T5 HO **3285** (3) 28W T5 **3545** (3) 54W T5 HO	**03** 2'-8 1/2" (S/E), 2'-6 5/16" (M) **04** 3'-8 5/16" (S/E), 3'-6 1/8" (M) **05** 4'-8 1/8" (S/E), 4'-5 15/16" (M) **08** 7'-2 7/16" (S/E), 7'- 1/4" (M) **12** 10'-8 9/16" (S/E), 10'-6 3/8" (M)	**See page 30A for available optics.**	**U** Universal 120/277V **347** 347V **DA_*** Dimming, Analog (0-10V) **DD_*** Dimming, DALI **DE_*** Dimming, Lutron ECO-10™ **DH_*** Dimming, Lutron HiLume® **DSC_*** Dimming, Lutron EcoSystem™, Control Fixture **DSN_*** Dimming, Lutron EcoSystem, Non-control Fixture **STDM_*** Dimming, Step	**MS1** Master-Slave Switching, Single Circuit **AB2** A/B Switching, 2 Circuit **AB3** A/B/C Switching, 3 Circuit	**HP** Higher Performance Option **WF** Whip Flex 3/8" X 6' 14 AWG **WN_*** Whip Flex 3/8" X 6' 14 AWG (NYC) **EM1_*** Standby Battery Pack/ 1 Lamp **CP** Chicago Plenum **F** Fusing **QD** Power Feed Quick Disconnect

**** Specify "1" for 120V or "2" for 277V. Some lamp types may not be available.***
EM not available for (03), (04) or (05) lengths. Must be 8ft minimum length.
EM not available for 347V.
EM for 35W T5 listed as dry location only. Offered as MOD with customer approval.
EM not available for 80W T5 HO lamp.
DA not available for 39W T5 HO (120V/277V) or 80W T5 HO (120V) lamps.
DA for 80W T5 HO (277V) offered as MOD with customer approval.
DD not available for 21W T5, 39W T5 HO and 80W T5 HO lamps (120V/277V).
DE not available for 35W T5 or 80W T5 HO lamps (120V/277V).
DH not available for 21W T5, 28W T5, 35W T5 and 80W T5 HO lamps (120V/277V).
DSC/DSN not available with 80W T5 HO lamps (120V/277V).
STDM not available for 347V.
STDM not available with single lamp 21W T5, 28W T5 (120V/277V).
STDM not available with 39W T5 HO, 54W T5 HO, 35W T5 and 80W T5 HO lamps (120V/277V).

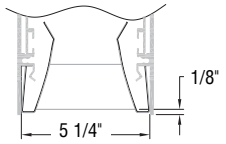
Optics

OLP Frosted Acrylic Lens, Flush
MPO Micro-Pyramidal Lens, Flush
C Matte Bivergence® Louver, Flush
DX Specular Bivergence Louver, Flush
WH White Louver, Flush
OLRC Regressed Frosted Acrylic Lens, Corrugated Side
OLRS Regressed Frosted Acrylic Lens, Smooth Side
CRC Regressed Matte Parabolic Louver, Corrugated Side
CRS Regressed Matte Bivergence Louver, Smooth Side
DXRC Regressed Specular Parabolic Louver, Corrugated Side
DXRS Regressed Specular Bivergence Louver, Smooth Side
WHRC Regressed White Louver, Corrugated Side
WHRS Regressed White Louver, Smooth Side
CO Matte Bivergence Louver, Flush, Opal Overlay
DXO Specular Bivergence Louver, Flush, Opal Overlay
WHO White Louver, Flush, Opal Overlay

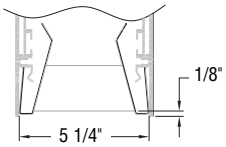
Optic	Side	Finish
Frosted Acrylic Lens	Smooth	High Reflectance White
Frosted Acrylic Lens	Corrugated	High Reflectance White
Matte Bivergence Louver	Smooth	Matte
Matte Bivergence Louver	Corrugated	Matte
Specular Bivergence Louver	Smooth	Specular
Specular Bivergence Louver	Corrugated	Matte
White Louver	Smooth	High Reflectance White
White Louver	Corrugated	High Reflectance White



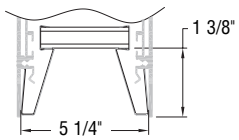
Frosted Acrylic Lens **OLP**
Micro-Pyramidal Lens **MPO**



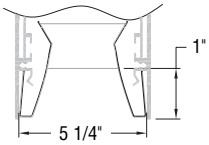
Bivergence Louver
Matte **C**
Specular **DX**



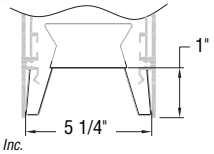
White Louver **WH**



Regressed Frosted Acrylic Lens
Corrugated side **OLRC**
Smooth side **OLRS**



Regressed Bivergence Louver
Matte
(Corrugated/Smooth) **CRC/CRS**
Specular
(Corrugated/Smooth) **DXRC/DXRS**



Regressed White Louver
Corrugated side **WHRC**
Smooth side **WHRS**

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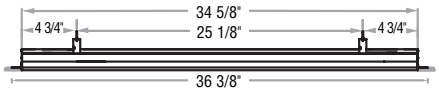
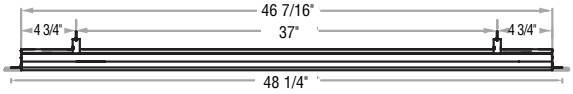
Side Views - Before Sheetrock Ceiling / Perimeter Mount Installation

Individual Fixtures

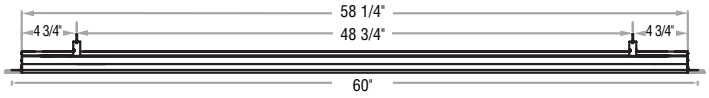
SLR6NI-EB/PM (03) Length Individual Fixture



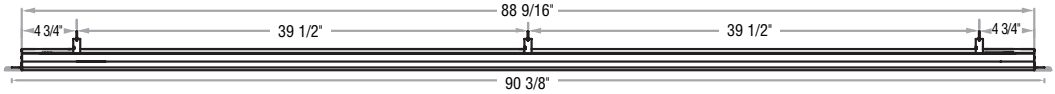
SLR6NI-EB/PM (04) Length Individual Fixture



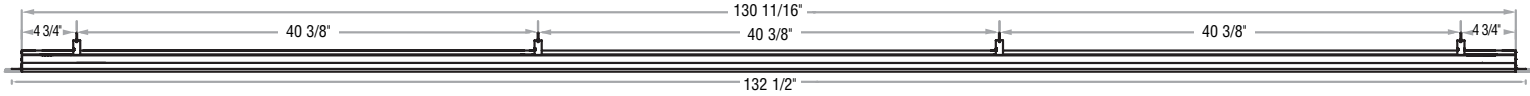
SLR6NI-EB/PM (05) Length Individual Fixture



SLR6NI-EB/PM (08) Length Individual Fixture

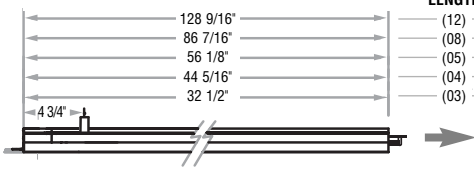


SLR6NI-EB/PM (12) Length Individual Fixture



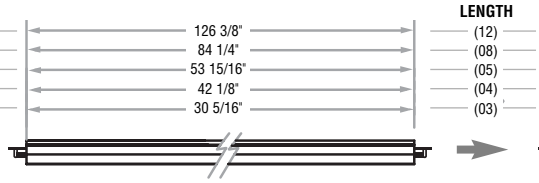
Continuous Run Fixtures

SLR6NS-EB/PM Starter Fixtures
(end flange not included)



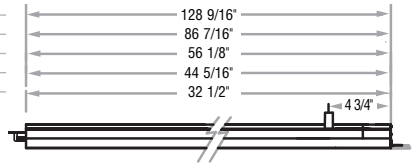
Starter fixture includes an aluminum endcap. Geartray with Cap end designed to extend into next fixture. Supplied with mechanical alignment bars and installation screw installed in housing.

SLR6NM-EB/PM Mid Fixtures

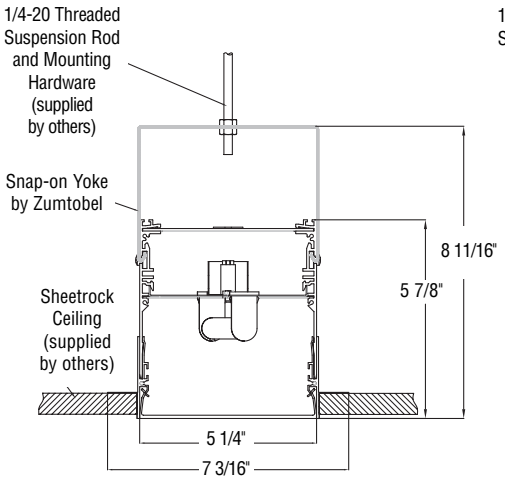


Mid fixture receives Start or Mid fixture on one end and End or Mid fixture on the other end. Quick connector with Plug end designed to extend into Start fixture and Cap end designed to extend into End fixture. Supplied with mechanical alignment bars and installation screws installed in housing.

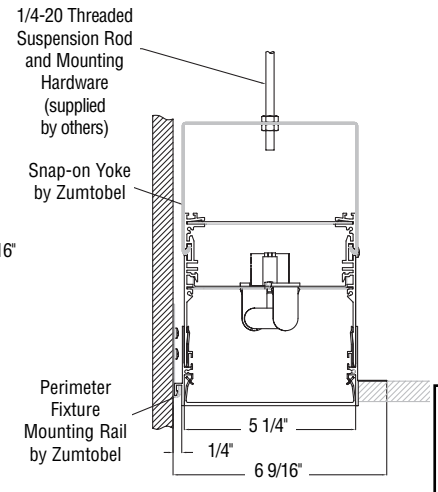
SLR6NE-EB/PM End Fixtures
(end flange not included)



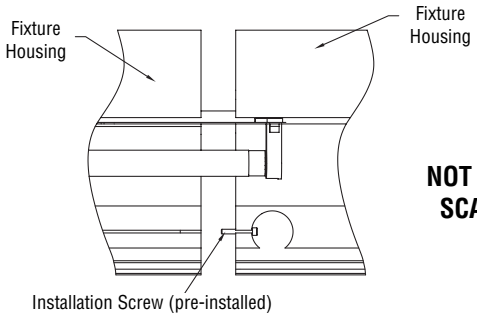
End fixture includes an aluminum endcap. Geartray with Plug end designed to extend into next fixture. Supplied with installation screw installed in housing. No mechanical alignment bars.



Shown with Frosted Acrylic Lens, Flush



Typical Connection Detail



NOT TO SCALE

Maximum length of fixture run per feed*:	(1) 28W T5	(1) 54W T5 HO
120V	172 ft.	88 ft.
277V	400 ft.	212 ft.

**All run lengths based on using ULT ballasts and drawing a maximum of 12 amps on the circuit.*

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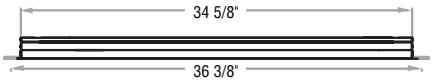
APPENDIX S

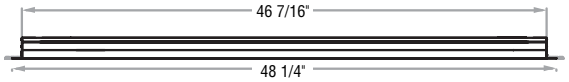
Side Views - After Sheetrock Ceiling / Wall Recessed Installation

Individual Fixtures

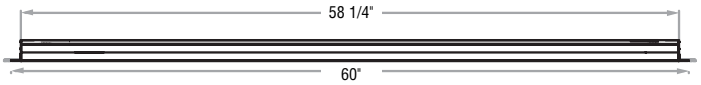
SLR6NI-EA (03) Length Individual Fixture



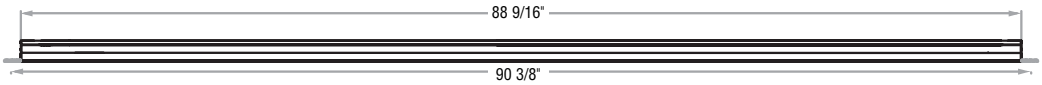
SLR6NI-EA (04) Length Individual Fixture



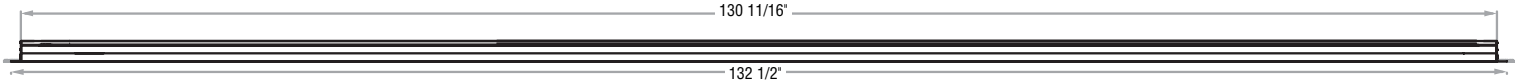
SLR6NI-EA (05) Length Individual Fixture



SLR6NI-EA (08) Length Individual Fixture



SLR6NI-EA (12) Length Individual Fixture

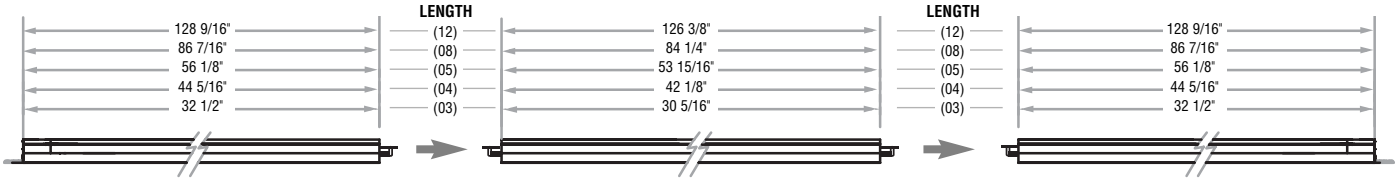


Continuous Run Fixtures

SLR6NS-EA Starter Fixtures
(end flange not included)

SLR6NM-EA Mid Fixtures

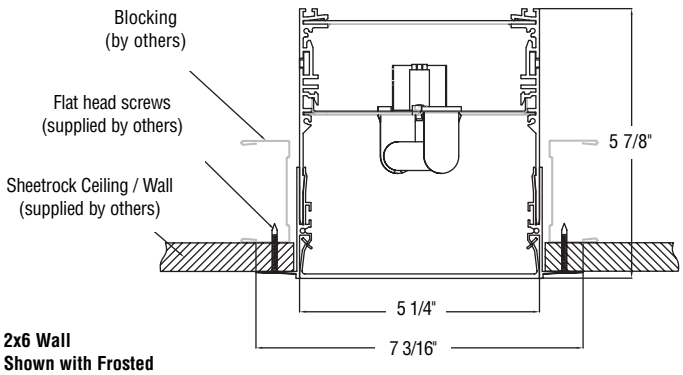
SLR6NE-EA End Fixtures
(end flange not included)



Starter fixture includes an aluminum endcap. Geartray with Cap end designed to extend into next fixture. Supplied with installation screw installed in housing.

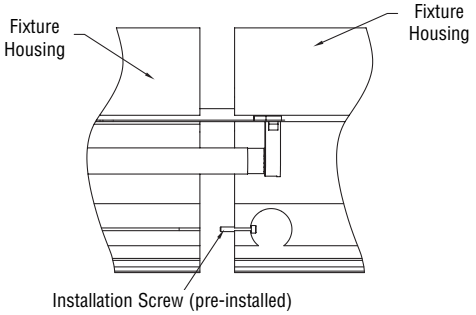
Mid fixture receives Start or Mid fixture on one end and End or Mid fixture on the other end. Quick connector with Plug end designed to extend into Start fixture and Cap end designed to extend into End fixture. Supplied with installation screws installed in housing.

End fixture includes an aluminum endcap. Geartray with Plug end designed to extend into next fixture. Supplied with installation screw installed in housing.



2x6 Wall
Shown with Frosted
Acrylic Lens, Flush

Typical Connection Detail



NOT TO SCALE

Maximum length of fixture run per feed*:		
	(1) 28W T5	(1) 54W T5 HO
120V	172 ft.	88 ft.
277V	400 ft.	212 ft.

**All run lengths based on using ULT ballasts and drawing a maximum of 12 amps on the circuit.*

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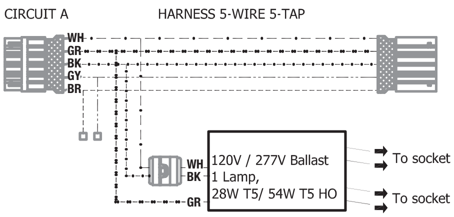
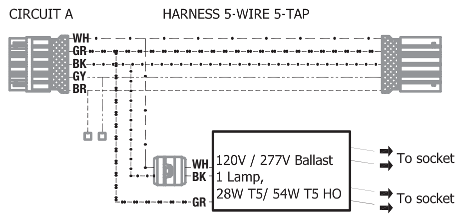
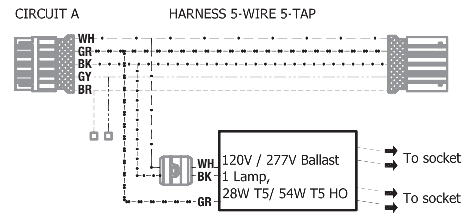
APPENDIX S

Sample Wiring Information

SLOTLIGHT PRO Standard Wiring, 1 Circuit, Common Neutral - (12) Length





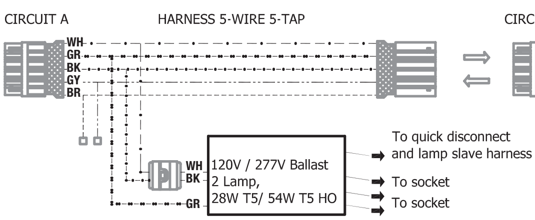


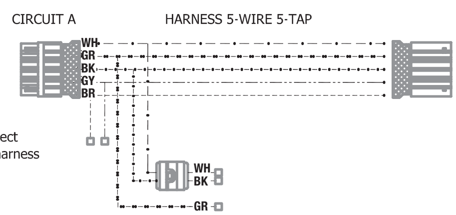
COLOR	STANDARD
WH - WHITE	NEUTRAL
GR - GREEN	GROUND
BK - BLACK	HOT
GY - GREY	NOT USED
BR - BROWN	NOT USED
BALLAST DISCONNECT	

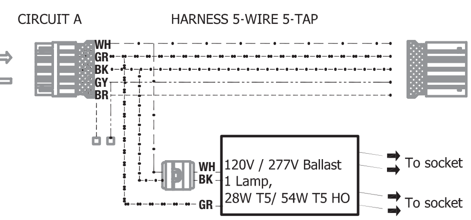
COLOR	STANDARD
WH - WHITE	NEUTRAL
GR - GREEN	GROUND
BK - BLACK	HOT
GY - GREY	NOT USED
BR - BROWN	NOT USED
BALLAST DISCONNECT	

COLOR	STANDARD
WH - WHITE	NEUTRAL
GR - GREEN	GROUND
BK - BLACK	HOT
GY - GREY	NOT USED
BR - BROWN	NOT USED
BALLAST DISCONNECT	

SLOTLIGHT PRO Master-Slave Switching, 1 Circuit, Common Neutral - MS1 - (12) Length







COLOR	STANDARD
WH - WHITE	NEUTRAL
GR - GREEN	GROUND
BK - BLACK	HOT
GY - GREY	NOT USED
BR - BROWN	NOT USED
BALLAST DISCONNECT	

COLOR	STANDARD
WH - WHITE	NOT USED
GR - GREEN	NOT USED
BK - BLACK	NOT USED
GY - GREY	NOT USED
BR - BROWN	NOT USED
BALLAST DISCONNECT	

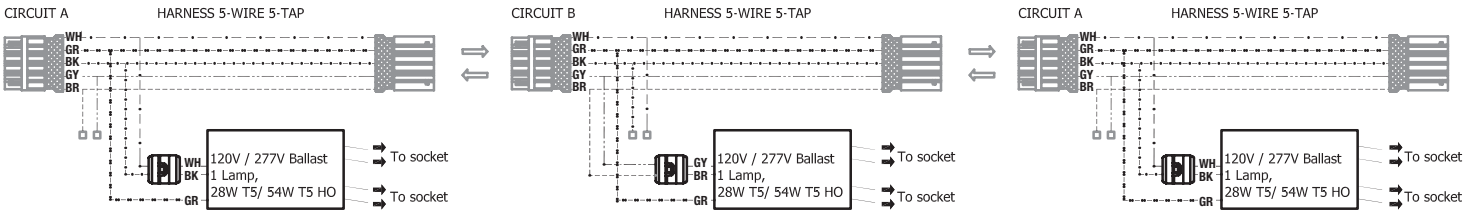
COLOR	STANDARD
WH - WHITE	NEUTRAL
GR - GREEN	GROUND
BK - BLACK	HOT
GY - GREY	NOT USED
BR - BROWN	NOT USED
BALLAST DISCONNECT	

NOTE: Master-Slave Switching not available with one lamp fixtures.

Sample wiring options shown above are for non-dimmed fluorescents only.

Sample Wiring Information

SLOTLIGHT PRO A/B/A Switching, 2 Circuit, Separate Neutral - AB2 - (12) Length



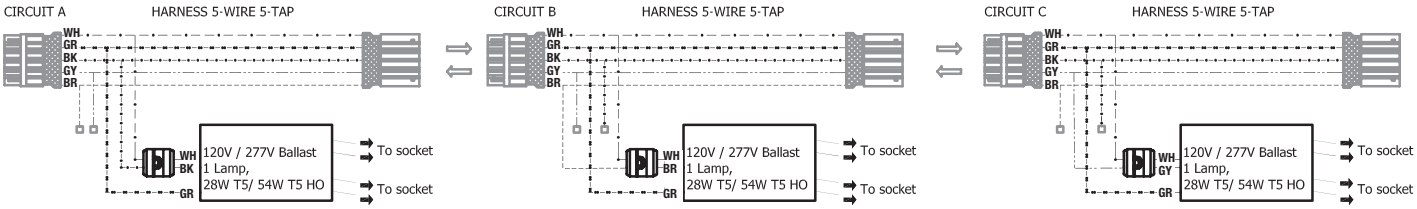
COLOR	STANDARD
WH - WHITE	NEUTRAL
GR - GREEN	GROUND
BK - BLACK	HOT
GY - GREY	NOT USED
BR - BROWN	NOT USED
BALLAST DISCONNECT	

COLOR	STANDARD
WH - WHITE	NOT USED
GR - GREEN	GROUND
BK - BLACK	NOT USED
GY - GREY	NEUTRAL
BR - BROWN	HOT
BALLAST DISCONNECT	

COLOR	STANDARD
WH - WHITE	NEUTRAL
GR - GREEN	GROUND
BK - BLACK	HOT
GY - GREY	NOT USED
BR - BROWN	NOT USED
BALLAST DISCONNECT	

NOTE: A/B/A or A/B Switching not available with one lamp fixtures.

SLOTLIGHT PRO A/B/C Switching, 3 Circuit, Common Neutral - AB3 - (12) Length



COLOR	STANDARD
WH - WHITE	NEUTRAL
GR - GREEN	GROUND
BK - BLACK	HOT
GY - GREY	NOT USED
BR - BROWN	NOT USED
BALLAST DISCONNECT	

COLOR	STANDARD
WH - WHITE	NEUTRAL
GR - GREEN	GROUND
BK - BLACK	NOT USED
GY - GREY	NOT USED
BR - BROWN	HOT
BALLAST DISCONNECT	

COLOR	STANDARD
WH - WHITE	NEUTRAL
GR - GREEN	GROUND
BK - BLACK	NOT USED
GY - GREY	HOT
BR - BROWN	NOT USED
BALLAST DISCONNECT	

NOTE: A/B/C Switching not available with one or two lamp fixtures.

Sample wiring options shown above are for non-dimmed fluorescents only.

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APPENDIX S

SLR6 1545 04 OLP (1) 54W T5 HO

6" WIDE RECESSED FLUORESCENT, FROSTED ACRYLIC LENS, FLUSH

LTL 14341

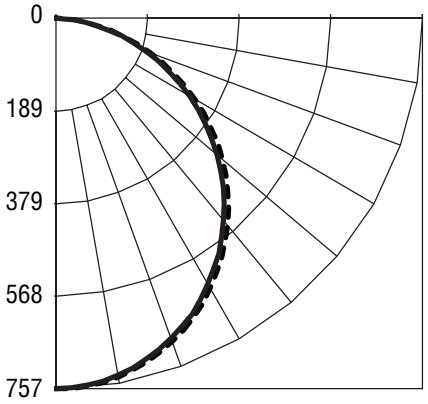
Total Luminaire Efficiency 49%

0% Uplight 100% Downlight

Spacing Criteria

Lateral Plane	0°	90°
	1.26	1.24

TOTAL LAMP LUMENS = 4400
INPUT WATTS = 60



Maximum Candela = 757 Located At Horizontal Angle = 0, Vertical Angle = 0
1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)
2 - Vertical Plane Through Horizontal Angles (90 - 270)

LUMINANCE DATA (cd/sq.m)

Angle In Degrees	Average 0-Deg	Average 45-Deg	Average 90-Deg
45	4612	4538	4483
55	4439	4338	4281
65	4150	4058	3996
75	3664	3564	3539
85	3056	2907	2832

ZONAL LUMEN SUMMARY

Zone	Lumens	%Lamp	%Fixt
0-30	583.46	13.3	27.4
0-40	952.44	21.6	44.7
0-60	1675.75	38.1	78.6
0-90	2131.95	48.5	100
90-120	0	0	0
90-130	0	0	0
90-150	0	0	0
90-180	0	0	0
0-180	2131.95	48.5	100

COEFFICIENTS OF UTILIZATION - ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 0.20

RC	80				70				50			30			10			0
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
0	58	58	58	58	56	56	56	56	54	54	54	52	52	52	49	49	49	48
1	53	50	48	46	51	49	47	46	47	46	44	45	44	43	43	42	41	40
2	48	44	40	38	47	43	40	37	41	39	36	40	37	35	38	36	35	34
3	44	38	34	31	42	38	34	31	36	33	30	35	32	30	34	31	29	28
4	40	34	30	26	39	33	29	26	32	29	26	31	28	26	30	27	25	24
5	37	30	26	23	36	30	26	23	29	25	22	28	25	22	27	24	22	21
6	34	27	23	20	33	27	23	20	26	22	20	25	22	19	24	22	19	18
7	31	25	21	18	31	24	20	17	24	20	17	23	20	17	22	19	17	16
8	29	23	18	16	28	22	18	16	22	18	15	21	18	15	20	18	15	14
9	27	21	17	14	27	20	17	14	20	16	14	19	16	14	19	16	14	13
10	26	19	15	13	25	19	15	13	18	15	13	18	15	13	18	15	13	12

SLR6 1545 04 OLP HP (1) 54W T5 HO

6" WIDE RECESSED FLUORESCENT, FROSTED ACRYLIC LENS, FLUSH

HIGHER PERFORMANCE OPTION

LTL 14350

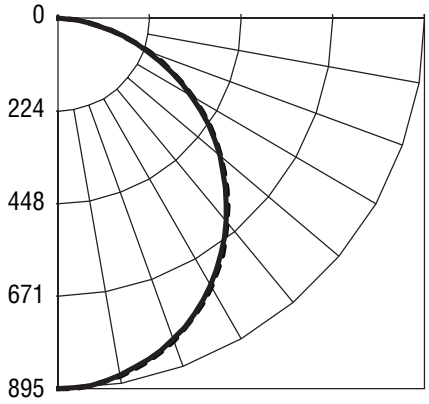
Total Luminaire Efficiency 57%

0% Uplight 100% Downlight

Spacing Criteria

Lateral Plane	0°	90°
	1.26	1.24

TOTAL LAMP LUMENS = 4400
INPUT WATTS = 60



Maximum Candela = 895 Located At Horizontal Angle = 45, Vertical Angle = 2.5
1 - Vertical Plane Through Horizontal Angles (45 - 225) (Through Max. Cd.)
2 - Vertical Plane Through Horizontal Angles (90 - 270)

LUMINANCE DATA (cd/sq.m)

Angle In Degrees	Average 0-Deg	Average 45-Deg	Average 90-Deg
45	5438	5374	5310
55	5232	5142	5085
65	4888	4796	4719
75	4292	4216	4166
85	3577	3428	3354

ZONAL LUMEN SUMMARY

Zone	Lumens	%Lamp	%Fixt
0-30	690.09	15.7	27.4
0-40	1127.02	25.6	44.7
0-60	1983.03	45.1	78.6
0-90	2522.34	57.3	100
90-120	0	0	0
90-130	0	0	0
90-150	0	0	0
90-180	0	0	0
0-180	2522.34	57.3	100

COEFFICIENTS OF UTILIZATION - ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 0.20

RC	80				70				50			30			10			0
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
0	68	68	68	68	67	67	67	67	64	64	64	61	61	61	58	58	58	57
1	62	59	57	55	61	58	56	54	56	54	52	53	52	51	51	50	49	48
2	57	52	48	45	55	51	47	44	49	46	43	47	44	42	45	43	41	40
3	52	45	41	37	50	45	40	37	43	39	36	41	38	35	40	37	35	33
4	47	40	35	31	46	39	35	31	38	34	31	37	33	30	35	32	30	29
5	43	36	31	27	42	35	30	27	34	30	26	33	29	26	32	29	26	25
6	40	32	27	23	39	32	27	23	31	26	23	30	26	23	29	25	23	22
7	37	29	24	21	36	29	24	21	28	24	21	27	23	20	26	23	20	19
8	35	27	22	19	34	26	22	18	26	21	18	25	21	18	24	21	18	17
9	32	25	20	17	31	24	20	17	24	19	17	23	19	16	22	19	16	15
10	30	23	18	15	30	22	18	15	22	18	15	21	18	15	21	17	15	14

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SLR6 1545 04 WHRS (1) 54W T5 HO

6" WIDE RECESSED FLUORESCENT, REGRESSED WHITE LOUVER, SMOOTH SIDE

LTL 14349

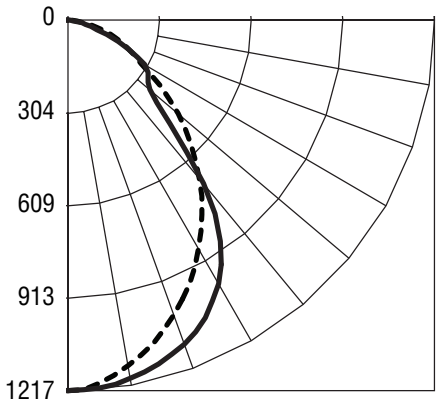
Total Luminaire Efficiency 57%

0% Uplight 100% Downlight

Spacing Criteria

Lateral Plane	0°	90°
	1.10	1.22

TOTAL LAMP LUMENS = 4400
INPUT WATTS = 60



Maximum Candela = 1217 Located At Horizontal Angle = 0, Vertical Angle
1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)
2 - Vertical Plane Through Horizontal Angles (90 - 270)

LUMINANCE DATA (cd/sq.m)

Angle In Degrees	Average 0-Deg	Average 45-Deg	Average 90-Deg
45	5865	6087	4872
55	4670	4096	4083
65	3779	3440	3796
75	3321	2546	2186
85	2547	1808	1644

ZONAL LUMEN SUMMARY

Zone	Lumens	%Lamp	%Fixt
0-30	893.73	20.3	35.9
0-40	1407.63	32	56.5
0-60	2150.2	48.9	86.4
0-90	2489.68	56.6	100
90-120	0	0	0
90-130	0	0	0
90-150	0	0	0
90-180	0	0	0
0-180	2489.68	56.6	100

COEFFICIENTS OF UTILIZATION - ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 0.20

RC	80				70				50			30			10		0
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
0	67	67	67	67	66	66	66	66	63	63	63	60	60	60	58	58	58	57
1	62	60	58	56	61	59	57	55	56	55	53	54	53	52	52	51	50	49
2	57	53	50	47	56	52	49	46	50	48	45	48	46	44	47	45	43	42
3	53	48	43	40	52	47	43	40	45	42	39	44	41	38	42	40	38	37
4	49	43	38	35	48	42	38	35	41	37	34	39	36	34	38	35	33	32
5	45	39	34	31	44	38	34	30	37	33	30	36	32	30	35	32	29	28
6	42	35	30	27	41	35	30	27	34	30	27	33	29	27	32	29	26	25
7	39	32	27	24	38	32	27	24	31	27	24	30	26	24	29	26	24	23
8	37	29	25	22	36	29	25	22	28	24	22	28	24	22	27	24	21	20
9	34	27	23	20	34	27	23	20	26	22	20	26	22	20	25	22	20	19
10	32	25	21	18	32	25	21	18	24	21	18	24	20	18	23	20	18	17

SLR6 1545 04 WHRS HP (1) 54W T5 HO

6" WIDE RECESSED FLUORESCENT, REGRESSED WHITE LOUVER, SMOOTH SIDE

HIGHER PERFORMANCE OPTION

LTL 14355

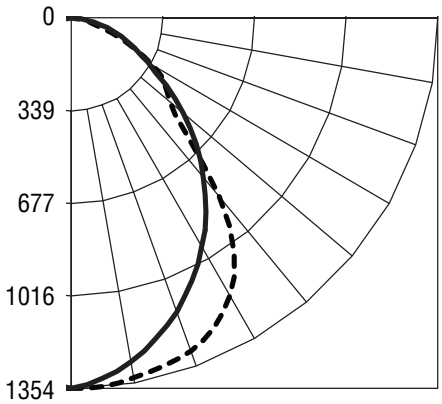
Total Luminaire Efficiency 66%

0% Uplight 100% Downlight

Spacing Criteria

Lateral Plane	0°	90°
	1.10	1.28

TOTAL LAMP LUMENS = 4400
INPUT WATTS = 60



Maximum Candela = 1354 Located At Horizontal Angle = 90, Vertical Angle = 2.5
1 - Vertical Plane Through Horizontal Angles (90 - 270) (Through Max. Cd.)
2 - Vertical Plane Through Horizontal Angles (0 - 180)

LUMINANCE DATA (cd/sq.m)

Angle In Degrees	Average 0-Deg	Average 45-Deg	Average 90-Deg
45	6604	7191	6158
55	5357	4995	5282
65	4389	4050	4355
75	3846	2989	2546
85	3040	2137	1972

ZONAL LUMEN SUMMARY

Zone	Lumens	%Lamp	%Fixt
0-30	1007.89	22.9	34.9
0-40	1603.35	36.4	55.5
0-60	2492.28	56.6	86.3
0-90	2888.77	65.7	100
90-120	0	0	0
90-130	0	0	0
90-150	0	0	0
90-180	0	0	0
0-180	2888.77	65.7	100

COEFFICIENTS OF UTILIZATION - ZONAL CAVITY METHOD

Effective Floor Cavity Reflectance 0.20

RC	80				70				50			30			10		0
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
0	78	78	78	78	76	76	76	76	73	73	73	70	70	70	67	67	67	66
1	72	70	67	65	71	68	66	64	65	63	62	63	61	60	60	59	58	57
2	67	62	58	54	65	60	57	54	58	55	52	56	54	51	54	52	50	49
3	61	55	50	46	60	54	50	46	52	48	45	50	47	44	49	46	44	42
4	57	49	44	40	55	48	44	40	47	43	39	45	42	39	44	41	38	37
5	52	45	39	35	51	44	39	35	42	38	35	41	37	34	40	37	34	33
6	49	40	35	31	47	40	35	31	39	34	31	38	34	30	37	33	30	29
7	45	37	32	28	44	36	31	28	35	31	27	35	30	27	34	30	27	26
8	42	34	29	25	41	33	28	25	33	28	25	32	28	25	31	27	25	23
9	40	31	26	23	39	31	26	23	30	26	23	29	25	22	29	25	22	21
10	37	29	24	21	36	29	24	21	28	24	21	27	23	21	27	23	20	19

Zumtobel Lighting Inc. ©2009
3300 Route 9W
Highland, NY 12528-2630

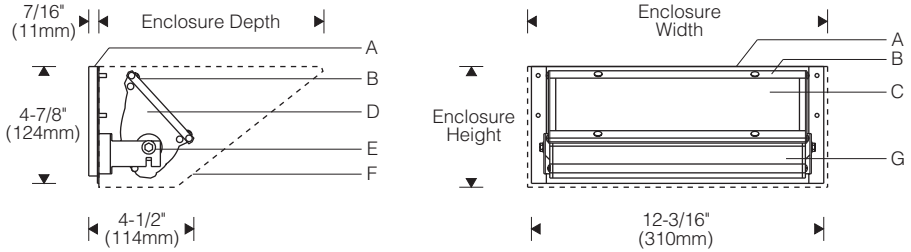
TEL (845) 691-6262
(800) 932-0633
FAX (845) 691-6289

www.zumtobel.us

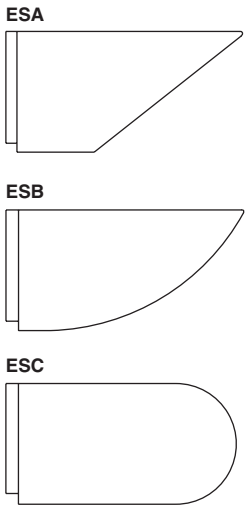
ZUMTOBEL

APPENDIX S

Base Unit 1:8 Scale

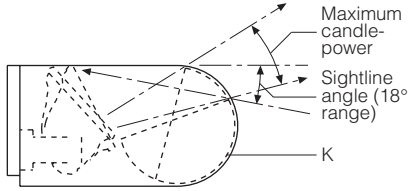


Enclosures 1:8 Scale

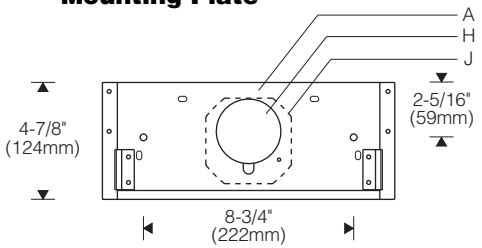


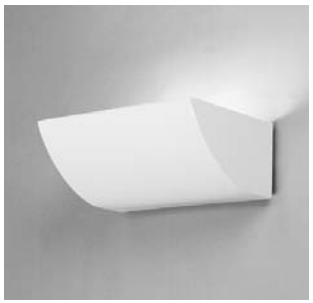
For enclosure dimensions, see ordering information on reverse side.

ESC Enclosure 1:8 Scale



Mounting Plate





Specifications

- **A** Aluminum yoke/mounting plate (forms reveal at wall)
- **B** Overlapping aluminum door frame
- **C** Micro-prismatic tempered glass lens
- **D** Stamped aluminum end plates
- **E** Beveled spring washers
- **F** Sconce enclosure (ordered separately)
- **G** Specular extruded aluminum reflector
- **H** Removable splice access cap
- **J** Outlet box (by others)
- **K** Rotating semi-cylindrical front (allows sightline and aiming angles to vary)

Finish:
Bright clear anodized aluminum reflector with mill finish aluminum door and end plates; black yoke/mounting plate. Enclosure finish specified separately.

Painted surfaces – 6 stage pretreatment and electrostatically applied thermoset powder coat for stable, long lasting and corrosion resistant finish.

Reflector – extruded high purity aluminum with clear anodized specular finish. All luminaire hardware – stainless steel.

Mounting:
Yoke/mounting plate fastens to suitable structure over recessed outlet box, and supports enclosure (ordered separately).

For pendant mounting, yoke/mounting plate attaches to accessory pendant assembly (ordered separately).

Standard:
UL listed or CSA certified for damp locations (Style 451 with gasketed lens recommended for damp locations; see Outdoor Section). Suitable for uplight orientation only.

Electrical:
Use 90°C wire for supply connections.

Tungsten halogen – recessed single contact (RSC) or DC bayonet lampholders retained with patented clamping supports for maximum heat dissipation.

Metal halide – G12 lampholder for use with single ended lamp. Remote encapsulated high reactance autotransformer ballast (35W and 70W) or electronic ballast. Electronic ballast provides improved voltage regulation, energy savings and automatic shut-off feature to eliminate end-of-life lamp cycling.

For complete ballast specifications, see Accessories Section.

Enclosure (ordered separately)**:**

Seam welded, ground smooth cold rolled steel. Edges are rolled to eliminate "oil canning." Attaches to base unit forming a reveal at the wall to prevent light leaks and delineate the form. Thermoset powder coat finish.

ESC enclosure sidearms are brushed clear anodized aluminum. Rotatable semi-cylindrical front allows sightline angle to be adjusted from horizontal to 18° below horizontal.

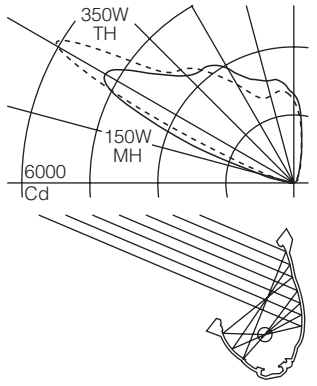
Features

- *Crisp geometric sconce enclosures compliment any space or design your own housing*
- *Unique* ESC *sconce – adjustable shielding and aiming*
- *Compact yet powerful – up to 150W ceramic metal halide, 350W IR halogen (equivalent to 500W)*
- *Non-corrosive – base unit is aluminum and stainless steel*

C 25.0

Performance

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



For complete photometrics, visit www.elliptipar.com

elliptipar

To form a Catalog Number

4 0 3	-		-	W	-	0 0	-		-	
1	2		3	4		5	6		7	8

1 Source

M = Metal halide
T = Tungsten halogen

2 Style

403 = Small Ensconce® base unit, **remote** ballast

3 Lamp

Lamp Code	*Wattage*	*Lamp Number*	*Voltages*	*Remote Distance*
Ceramic Arc Tube Pulse Start Metal Halide (80+ CRI)*				
035G	35	CDM35/T6/830	**1, 2**	15' (4.5m)
			A, B	10' (3m)
070G	70	CDM70/T6/830	**1, 2**	15' (4.5m)
			A, B	20' (6m)
150G	150	CDM150/T6/830	**1, 2**	15' (4.5m)
Tungsten Halogen				
0100	100	Q100DC	**A**	
0150	150	Q150DC	**A**	
0200	200	Q200T3	**A**	
0250	250	Q250DC	**A**	
0350	350	Q350T3/CL/HIR	**A**	

C 25.1

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

4 Mounting

W = Yoke/mounting plate for attachment over recessed outlet box

5 Finish

00 = Bright clear anodized reflector with mill finish door and end plates; black yoke/mounting plate
Note: Specify enclosure finish separately.

6 Voltage/Ballast

Electronic	*Magnetic**
1 = 120V	**A** = 120V
2 = 277V	**B** = 277V

*35W or 70W Metal Halide or Tungsten Halogen (120V)

Project:

7 Option (see Accessories Section for specifications.)

00 = No options
0H = Long distance remote ballast (encapsulated magnetic ballast for 35 and 70W only),
35W: 15' min. up to 50' max. (4.5m - 15m),
70W: up to 50' max. (15m)
0M = MRI medical facility use (tungsten halogen only). Custom enclosure required. Consult factory prior to specification.
0R = Halogen standby lamp with relay field connected at remote ballast. Lamp included (wattage varies).
XX = For modification not listed, include detailed description. Consult factory prior to specification.

8 Standard

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

Example

T403 - 0250 - W - 00 - A - 000

Small Ensconce® base unit with 250W tungsten halogen lamp. Yoke/mounting plate to attach to suitable structure over recessed outlet box. Bright anodized reflector with mill finish door and end plates. Yoke/mounting plate finished black. 120V. UL. Order enclosure separately.

Accessories

Order separately. See Accessories Section for specifications.

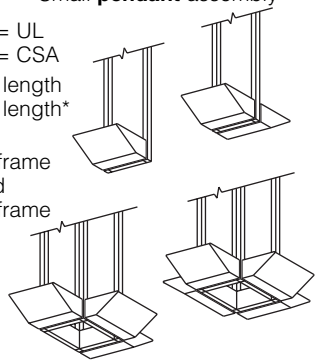
EPS02 - = Small **pendant** assembly

0 = UL
J = CSA

30 = 30" length
54 = 54" length*

S = Surface mounting frame
C = Concealed mounting frame

1 = 1 light/2 stem
2 = 2 light/2 stem
3 = 3 light/4 stem
4 = 4 light/4 stem



*150W M.H. specify 0H option

AFK000X = Ballast **fuse** kit

0 = UL
J = CSA

Type:

Enclosures

Order separately. See Accessories Section for specifications.

ESA **000** **
A

12-1/2" width x
5" height x
9-3/8" depth*

ESB **000** **
A

12-1/2" width x
5" height x
9-3/8" depth*

ESC **000**
A

13" width x
5" height x
9-1/16" depth*

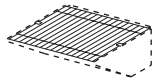
* Add 7/16" (11mm) for reveal at wall.
**Change "000" to "M00" for use in MRI medical facility.

A Enclosure Finish

02 = Semi-gloss white
06 = Dark bronze*
07 = Silver*
08 = Semi-gloss black*
12 = Green*
99 = Custom RAL or computer matched color to be specified, consult sales representative

* Non-white enclosures supplied with white finished interior surfaces.

APG00010 = Wire **paper guard** (available for enclosure styles ESA and ESB only)



ABA08010 = Enclosure **backsplash shield** includes sawtooth baffle and black interior finish to minimize light on wall behind (available for enclosure styles ESA and ESB only)

elliptipar
114 Boston Post Road, West Haven, Connecticut 06516, USA
Voice 203.931.4455 • Fax 203.931.4464 • **www.elliptipar.com**

Pole top luminaires with indirect adjustable light distribution

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

Housing/fitter: Heavy one piece die-cast aluminum optical housing with integrally cast transition "fitter" which slip fits a 3" O.D. pole top or tenon and is secured by six (6) flush, stainless steel set screws. The housing gracefully supports two (2) ¾" diameter stainless steel struts located at 180° as well as a die-cast aluminum diffuser retaining ring. All components function and appear as a unified design.

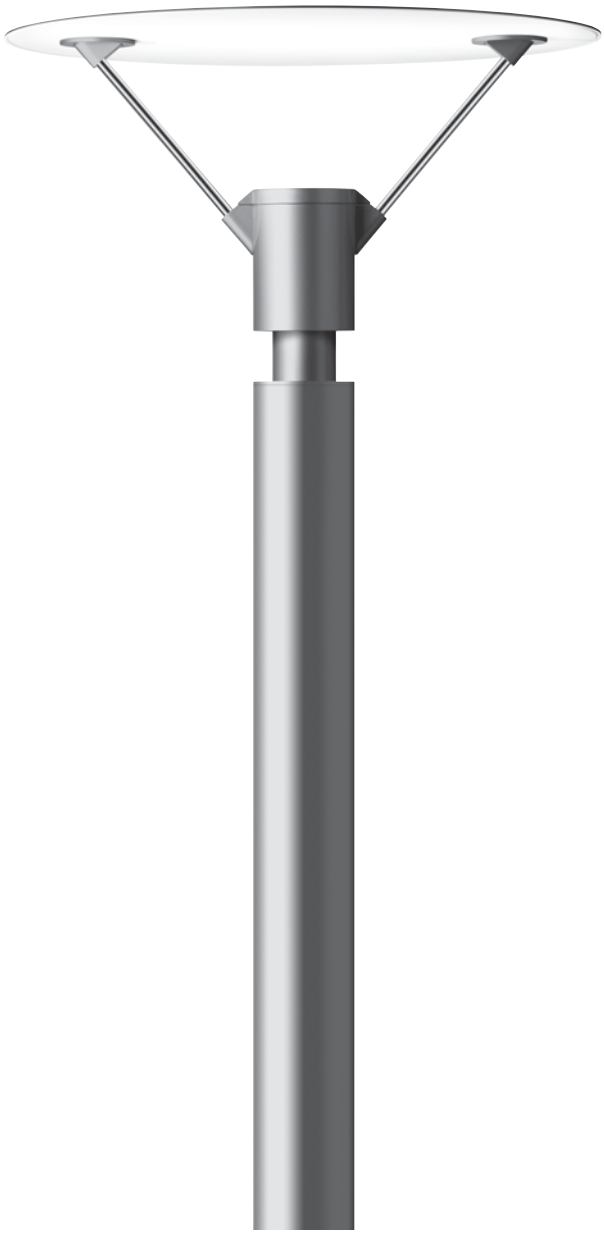
Optical: ¾" thick, machined tempered crystal clear optical glass with a high temperature-rated one piece molded silicone rubber gasket encloses the precise, stippled pure aluminum, wide flood distribution reflector. The glass retaining ring is secured by two (2) hidden stainless steel hex head access screws.

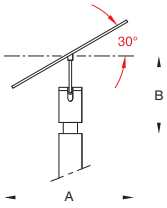
Reflective disk: 31½" diameter x ¼" thick aluminum plate secured by two (2) die-cast aluminum fixed clamping "saddles" which receive the stainless steel struts. A ¼" wide by ⅛" deep "drip" channel is provided around the edge of the underside disk.

Electrical: Lampholder is a single ended porcelain G12, bi-pin with nickel plated contacts supplied, pulse rated 5 KV. Ballast is electronic, universal voltage 120 V through 277 V, located in the base of the selected BEGA pole.

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. Underside of disk is white. Custom colors supplied on special order.

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





	Lamp		Lumen	A	B
8200 MH	1	70 W T6 G12 MH	6600	31½	19⅞

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

Drive-over in-grade luminaires for the illumination of facades

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

Outer housing: Constructed of stainless steel.

Inner housing: One piece stainless steel housing with a cast bronze guard/cover secured together with stainless steel bolts. The entire lamp 'module' is removable for relamping by removing two (2) captive stainless steel bolts. Reflector of pure anodized aluminum with convex molded ½" thick safety glass. One piece molded U-channel, high temperature silicone gasket.

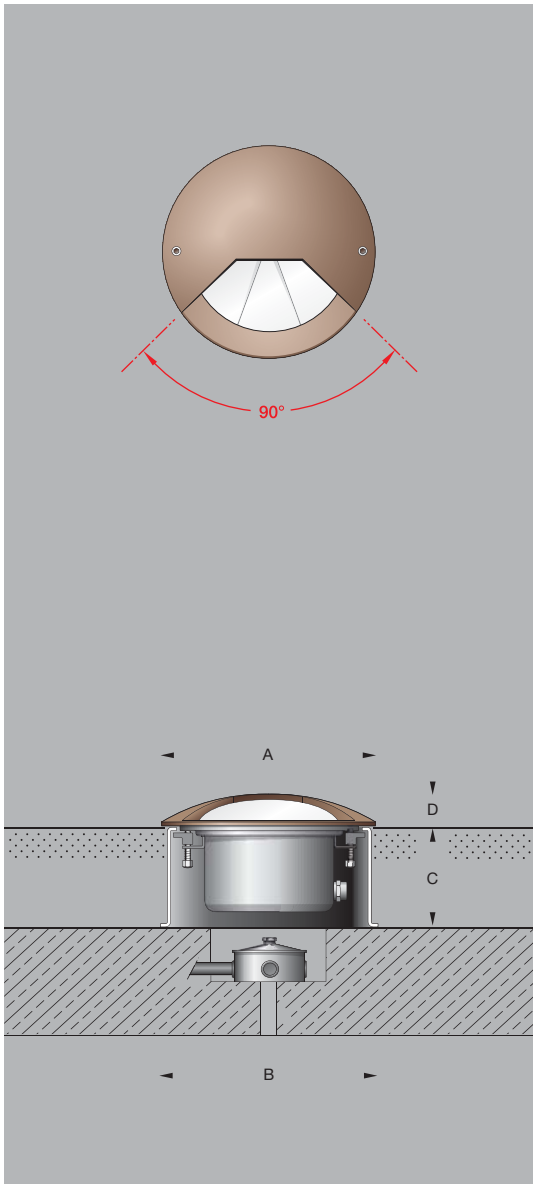
Electrical: Lampholders: GY6.35 bi-pin with ceramic insulator and high temperature leads. Integral electronic transformer 120 V: 11.6 V, available in 120 V only. Lamp included. Inner housing is pre-wired with nine (9) feet of 18/3 waterproof cable with a "water stopper" feature, cable clamp and a waterproof cable gland entry into housing. A separate waterproof wiring box for power supply must be provided (by contractor).

Finish: Natural bronze casting, custom colors are not available.

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

Note: A foundation designed to bear pressure loads up to 6600 lbs. from vehicles with pneumatic tires and proper drainage must be supplied by the customer. The luminaires must not be used for traffic lanes where they are subject to horizontal pressure from vehicles braking, accelerating, and changing direction.

Temperature caution: The column "T" in the chart below indicates the temperature in degree Celsius which is reached on the center of the glass surface during operation. Surface temperatures are for exterior applications. For interior applications add 10° C to the temperature shown.



Round drive over floodlight

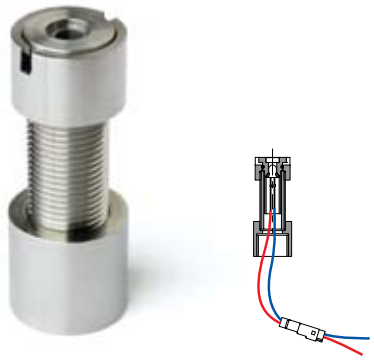
	Lamp	Lumen	T	A	B	C	D
8702	1 35 W T4 GY6.35,12V	600	80°	7 1/8	7 1/8	4 3/4	1 1/2

The following table is a planning aid. The luminaire type and its arrangement are derived from the size of the illuminated object and the required illuminance. LLF=1

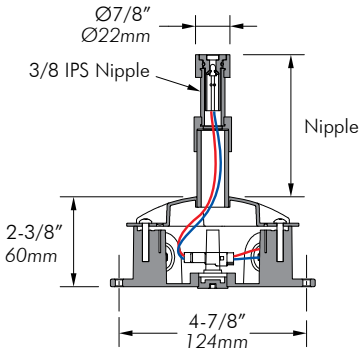
Planning aid	A	H	B	$\bar{E}$	G^1
8702	2'	8'	4'	7.0 fc	16
35 W T4 GY6.35, 12 V	3'	10'	6'	3.8 fc	11.6
	4'	12'	8'	2.3 fc	11.6
	6'	15'	12'	1.2 fc	9.7

A – Distance between luminaires and façade H – Height of façade B – Distance between luminaires
$\bar{E}$ – Average illuminance on façade G^1 – Uniformity of illuminance LLF – Light loss factor

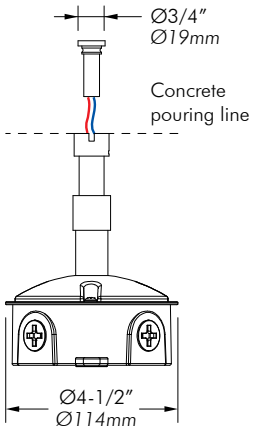
BEGA-US 1000 BEGA Way, Carpinteria, CA 93013 (805) 684-0533 FAX (805) 566-9474 www.bega-us.com



Shown with no base (to 1/2 NPT connector)



Shown with base



0.1W in-ground

L06

SPEC SHEET

Application: Outdoor/indoor indicator light for driveway and sidewalk.

Electrical: 0.1W LED powered by remote constant 6V driver (not included).

Input Current:	20mA
Input Voltage:	6V DC
Power Consumption:	0.1W
Recommended Driver:	TLDDLV6V6W1 (not included). Dimmable driver is not available for this fixture.

Weight: 1.21lbs (0.549kg).

Material: Stainless steel 316.

Mounting: Can be buried in earth/gravel or cast into concrete with or without mounting base.

Approval: Wet and dry locations. Approved to US and Canadian standards by CSA.

c CSA® US IP 67

Type:

Project:

Modified:

Quantity:

Notes:

CODE		*COLOR*		*BASE*	*NIPPLE*	*MATERIAL*
L06	-	**WS27S**	-			**S6**

W27S = 2700K, std CRI

B = with base
N = no base

2 = 2-1/2" (64mm) minimum
4 = 4" (102mm)
8 = 8" (203mm)
X = custom length

S6 = stainless steel 316

MP LIGHTING®
t 1.877.708.1184 f 604.708.1185 www.mplighting.com
16 West 4th Avenue, Vancouver BC V5Y 1G3, Canada

APPENDIX S

0.1W in-ground

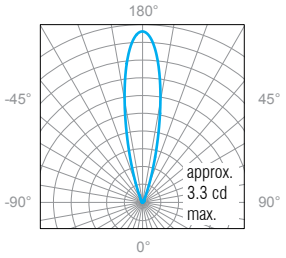
L06

SPEC SHEET

Photometric Data

L06
2700K Std
3.2 lm

Polar Candela Distribution



Illuminance at a Distance

	Center Beam FC	Beam Width	
0.2′	119.21	0.1′	0.1′
0.3′	29.80	0.1′	0.1′
0.5′	13.25	0.2′	0.2′
0.7′	7.45	0.3′	0.3′
0.8′	4.77	0.3′	0.3′
1.0′	3.31	0.4′	0.4′

0° Spread: 23.4°
90° Spread: 23.2°

MP LIGHTING®
t 1.877.708.1184 f 604.708.1185 www.mplighting.com
16 West 4th Avenue, Vancouver BC V5Y 1G3, Canada

APPENDIX S

Note: *Various operating factors may cause differences between lab and field results. As specifications may change without notice, please refer to the LED Lamp Index located in the "Downloads" section of each product webpage for the most current information.*

PL-T Triple 4-Pin Base

PL-T 18W/830 /4PALTO 1CT

Philips Linear Compact Fluorescent Lamps offer designers, specifiers and end-users new levels of efficiencies and versatility in sizes,configurations and application possibilities. With so many elegant fixtures available to complement their small size, high light output and advanced technology, Philips Energy Advantage lamps are fast becoming the preferred choice when maximum effciency and sleek design solutions are required.

Product data

• Product Data

Product number	268029
Full product name	PL-T 18W/830 /4PALTO 1CT
Short product name	PL-T 18W/30/4P/ALTO 12PK
Pieces per Sku	1
eop_pck_cfg	12
Skus/Case	12
Bar code on pack	46677268022
Bar code on case	50046677268027
Logistics code(s)	927910608313
tpd_ilcos_cd	FSM-18/30/1B-E-GX24q=2
eop_net_weight_pp	68.000 gr

• General Characteristics

Base	GX24q-2
Base Information	4P
RatedAvgLife(See Family Notes)	8000 hr
Avg. Hrs. Life	16000 hr

• Electrical Characteristics

Watts	18 W
Lamp Wattage	18 W
Lamp Wattage EL	16.5 W
Lamp Voltage	100 V
Lamp Voltage EL	80 V
Lamp Current	0.220 A
Lamp Current EL	0.210 A
Dimmable	Yes

• Environmental Characteristics

Energy Efficiency Label (EEL)	B

• Light Technical Characteristics

Color Code	830 [CCT of 3000K]
Color Rendering Index	82 Ra8
Color Designation	Warm White
Color Temperature	3000 K
Chromaticity Coordinate X	438 -
Chromaticity Coordinate Y	394 -
Initial Lumens	1200 Lm
Initial Lumens	1200 Lm
Luminous Efficacy Lamp EM	67 Lm/W
Luminous Efficacy Lamp EL	73 Lm/W
Lumen Maintenance 2000h	90 %
Lumen Maintenance EL 2000h	93 %
Lumen Maintenance 5000h	81 %
Lumen Maintenance EL 5000h	86 %
Lumen Maintenance EM 10000h	73 %
Lumen Maintenance EL 10000h	79 %

• Product Dimensions

Base Face to Base Face A	77 mm
Insertion Length B	101.5 mm
Overall Length C	116.4 mm

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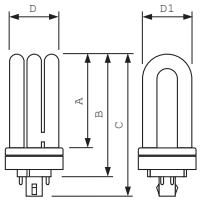
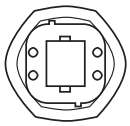
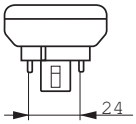
PL-T Triple 4-Pin Base

Diameter D	39.85 mm	Diameter D1	39.65 mm

Dimensional drawing



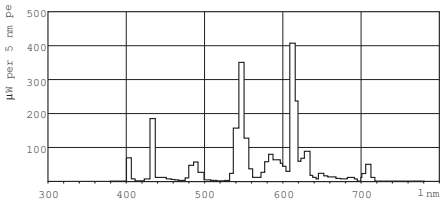




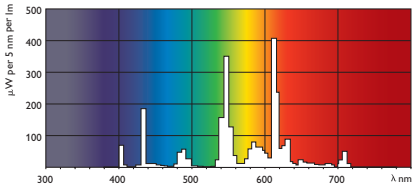
Product	A (Max)	B (Max)	C (Max)	D (Max)	D1 (Max)
PL-T 18W/830/4P	77	101.5	116.4	39.85	39.65

PL-T Triple 4-Pin Base

Photometric data



Lightcolor /830



Lightcolor /830

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2011, March 18
data subject to change

Bulb Shape	Base Type	Watts	Order Code	Description	Volts	Case Qty	Filament Type	MOL (in)	LCL (in)	Rated Life (hrs)	Initial Lumens	Initial Color Temp	CBCP	Reduced Wattage	Warning and Caution Notices	Additional Information
Quartzline®																
HIR™ Recessed Single Contact (R7s)																
T2.5	R7s	350	13894	Q350T3/CL/HIR	120	6	C-8	4.69	2.25	2000	10000	3075		✓	1a,2a,2j,2k,4a,4c,4d, 4e,4f,4g,8a,9a,9d, 10b,10c,12b	IR, Clear, Horizontal
		350	14311	Q350T3/CL/HIR	130/120	6	C-8	4.69	2.25	2000	9600	3000		✓	1a,2a,2j,2k,4a,4c,4d, 4e,4f,4g,8a,9a,9d, 10b,10c,12b	IR, Clear, Horizontal
		900	13642	Q900T3/CL/HIR	240	6	C-8	10.06	6.13	2000	32000	3160		✓	1a,2a,2j,2k,4a,4c,4d, 4e,4f,4g,8a,9a,9d, 10b,10c,12b	IR, Clear, Horizontal
		900	14335	Q900T3/CL/HIR	277	6	C-8	10.06	6.13	2000	31000	3160		✓	1a,2a,2j,2k,4a,4c,4d, 4e,4f,4g,8a,9a,9d, 10b,10c,12b	IR, Clear, Horizontal, Halogen
Halogen G9																
T4	G9	25	16754	Q25G9/CD	120	5	CC-8	1.77	1.26	3000	240	6250			1a,2a,2b,2e,4f,4i,9a, 10b,10c	Carded
		25	81300	Q25G9/F/CD	120	5	CC-8	1.77	1.26	3000					1a,2a,2b,2e,4f,4i, 9a,10b,10c	Frosted, Carded
		40	16755	Q40G9/CD	120	5	CC-8	1.77	1.26	3000	480	2750			1a,2a,2b,2e,4f,4i,9a, 10b,10c	Carded
		40	81301	Q40G9/F/CD	120	5	CC-8	1.77	1.26	3000					1a,2a,2b,2e,4f,4i,9a, 10b,10c	Frosted, Carded
		60	16756	Q60G9/CD	120	5	CC-8	1.77	1.26	3000	780	2800			1a,2a,2b,2e,4f,4i,9a, 10b,10c	Carded
		60	81468	Q60G9/F/CD	120	5	CC-8	1.77	1.26	3000					1a,2a,2b,2e,4f,4i,9a, 10b,10c	Frosted, Carded
		75	16759	Q75G9/CD	120	5	CC-8	1.77	1.26	3000	1100	2850			1a,2a,2b,2e,4f,4i,9a, 10b,10c	Carded
		75	81469	Q75G9/F/CD	120	5	CC-8	1.77	1.26	3000					1a,2a,2b,2e,4f,4i,9a, 10b,10c	Frosted, Carded
Halogen Double Contact Bayonet (BA15d)																
T4	D C Bay BA15d	100	16451	Q100DC	120	6	CC-8	2.44	1.38	2000	1550	2950			1a,2a,2j,4a,4c,4e,4f, 4g,8a,9a,9d,10b,10c	Frosted
		100	15508	Q100CL/DC	120	6	CC-8	2.44	1.38	2000	1600	2950			1a,2a,2j,4a,4c,4e,4f, 4g,8a,9a,9d,10b,10c	Clear
		100	44386	Q100CL/DC/2V	120	6	CC-2V	2.44	1.38	750 h	1800	2950			1a,2a,2j,4a,4c,4e,4f, 4g,8a,9a,9d,10b,10c	Clear
		150	44653	Q150DC	120	6	CC-8	2.50	1.38	2000	2700	2950			1a,2a,2j,4a,4c,4e,4f, 4g,8a,9a,9d,10b,10c	Frosted
		150	43693	Q150CL/DC	120	6	CC-8	2.50	1.38	2000	2800	2950			1a,2a,2j,4a,4c,4e,4f, 4g,8a,9a,9d,10b,10c	Clear
		150	44384	Q150CL/DC/2V	120	6	CC-2V	2.44	1.38	1000	2800	2950			1a,2a,2j,4a,4c,4e,4f, 4g,8a,9a,9d,10b,10c	Clear
		250	43701	Q250DC	120	6	CC-8	3.00	1.63	2000	4850	2950			1a,2a,2j,4a,4c,4e,4f, 4g,8a,9a,9d,10b,10c	Frosted
		250	43702	Q250DC	130/120	6	CC-8	3.00	1.63	2000	4850	2950			1a,2a,2j,4a,4c,4e,4f, 4g,8a,9a,9d,10b,10c	Frosted
		250	43697	Q250CL/DC	120	6	CC-8	3.00	1.63	2000	5000	2950			1a,2a,2j,4a,4c,4e,4f, 4g,8a,9a,9d,10b,10c	Clear
		250	43698	Q250CL/DC	130/120	6	CC-8	3.00	1.63	2000	5000	2950			1a,2a,2j,4a,4c,4e,4f, 4g,8a,9a,9d,10b,10c	Clear
		500	43709	Q500DC	120	6	CC-8	3.44	2.13	2000	10100	2950			1a,2a,2j,4a,4c,4e,4f, 4g,8a,9a,9d,10b,10c	Frosted
		500	43710	Q500CL/DC	120	6	CC-8	3.44	2.13	2000	10450	2950			1a,2a,2j,4a,4c,4e,4f, 4g,8a,9a,9d,10b,10c	Clear
Halogen Recessed Single Contact (R7s)																
T3	R7s	100	73286	Q100T3/SCD-5PK	210	5	C-8	3.13	1.25	1500	1650	2950			1a,2a,2j,4a,4c,4e,4f, 4g,9a,9d,10b,10c,11a	Torchiere, Motion-Sensing and Security, Small Card
		100	22489	Q100T3/CL/CD 5PK	210	60	C-8	3.13	1.25	1500	1650	2950			1a,2a,2j,4a,4c,4e,4f, 4g,9a,9d,10b,10c,11a	Clear, Horizontal, Carded
		150	27449	Q150T3/117/CL/CD	120	60	C-8	4.69	2.25	1500	2400	2950			1a,2a,2j,4a,4c,4d,4e,4f, 4g,9a,9d,10b,10c,11a	Clear, Horizontal, Carded
		150	19378	Q150T3/CL/CD 5PK	120	60	C-8	3.13	1.25	1500	2400	2950			1a,2a,2j,4a,4c,4e,4f,4g, 9a,9d,10b,10c,11a	Clear, Horizontal, Carded
		150	97672	Q150T3/HD/SCD2	120	25	C-8	3.13	1.25	2000	2400	2950			1a,2a,2j,4a,4c,4e,4f,4g, 9a,9d,10b,10c,11a	Torchiere, Motion-Sensing and Security, Small Card

Low Voltage Capsules

LV Capsule 10W G4 12V T3 CL 1BC

Philips Halogen Low Voltage Capsules provide sparkling, white light. These lamps offer an average rated life of 2000 hours making them perfect for undercabinet or task lighting.

Product data

• Product Data

Product number	203612
Full product name	LV Capsule 10W G4 12V T3 CL 1BL
Pieces per Sku	1
eop_pck_cfg	12
Skus/Case	12
Bar code on pack	46677203610
Bar code on case	50046677203615
Logistics code(s)	924062117191
eop_net_weight_pp	0.001 kg

• General Characteristics

Base	G4
Base Information	na [-]
Bulb	T3 [Diameter: 9 mm /.354 inch]
Bulb Finish	Clear
Operating Position	Universal [Any or Universal (U)]
RatedAvgLife(See Family Notes)	2000 hr

• Electrical Characteristics

Watts	10 W
Lamp Wattage Technical	10 W
Voltage	12 V
Lamp Current	0.83 A
Dimmable	Yes

• Light Technical Characteristics

Color Rendering Index	100 Ra8
Color Temperature	3000 K
Color Temperature technical	3000 K
Initial lumen	100 Lm
Luminous Efficacy Lamp	10 Lm/W

• Product Dimensions

Overall Length C	33 mm
Diameter D	10 mm
Light Center Length L	22.2 mm

• Luminaire Design Requirements

Pinch Temperature	350 C
Bulb Temperature	220 C

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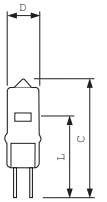
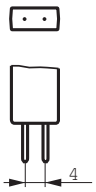
Dimensional drawing





Product	C (Max)	D (Max)	L (Norm)
CAP Fighter 10W G4 12V CL	33	10	22.2

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2011, March 14
data subject to change

Low Voltage Capsules

LV Capsule 10W G4 12V T3 CL 1BC

Philips Halogen Low Voltage Capsules provide sparkling, white light. These lamps offer an average rated life of 2000 hours making them perfect for undercabinet or task lighting.

Product data

• Product Data

Product number	203612
Full product name	LV Capsule 10W G4 12V T3 CL 1BL
Pieces per Sku	1
eop_pck_cfg	12
Skus/Case	12
Bar code on pack	46677203610
Bar code on case	50046677203615
Logistics code(s)	924062117191
eop_net_weight_pp	0.001 kg

• General Characteristics

Base	G4
Base Information	na [-]
Bulb	T3 [Diameter: 9 mm /.354 inch]
Bulb Finish	Clear
Operating Position	Universal [Any or Universal (U)]
RatedAvgLife(See Family Notes)	2000 hr

• Electrical Characteristics

Watts	10 W
Lamp Wattage Technical	10 W
Voltage	12 V
Lamp Current	0.83 A
Dimmable	Yes

• Light Technical Characteristics

Color Rendering Index	100 Ra8
Color Temperature	3000 K
Color Temperature technical	3000 K
Initial lumen	100 Lm
Luminous Efficacy Lamp	10 Lm/W

• Product Dimensions

Overall Length C	33 mm
Diameter D	10 mm
Light Center Length L	22.2 mm

• Luminaire Design Requirements

Pinch Temperature	350 C
Bulb Temperature	220 C

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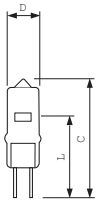
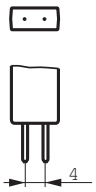
Dimensional drawing





Product	C (Max)	D (Max)	L (Norm)
CAP Fighter 10W G4 12V CL	33	10	22.2

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2011, March 14
data subject to change

PL-T Triple 4-Pin Base

PL-T 26W/830/4P 1CT

Philips Linear Compact Fluorescent Lamps offer designers, specifiers and end-users new levels of efficiencies and versatility in sizes,configurations and application possibilities. With so many elegant fixtures available to complement their small size, high light output and advanced technology, Philips Energy Advantage lamps are fast becoming the preferred choice when maximum effciency and sleek design solutions are required.

Product data

• Product Data

Product number	268235
Full product name	PL-T 26W/830/4P 1CT
Short product name	PL-T 26W/30/4P/ALTO 12PK
Pieces per Sku	1
eop_pck_cfg	12
Skus/Case	12
Bar code on pack	46677268237
Bar code on case	50046677268232
Logistics code(s)	927911608313
tpd_ilcos_cd	FSM-26/30/1B-E-GX24q=3
eop_net_weight_pp	74.000 gr

• General Characteristics

Base	GX24q-3
Base Information	4P
RatedAvgLife(See Family Notes)	8000 hr
Avg. Hrs. Life	16000 hr

• Electrical Characteristics

Watts	26 W
Lamp Wattage	26.0 W
Lamp Wattage EL	24.0 W
Lamp Voltage	105 V
Lamp Voltage EL	80 V
Lamp Current	0.325 A
Lamp Current EL	0.300 A
Dimmable	Yes

• Environmental Characteristics

Energy Efficiency Label (EEL)	B

• Light Technical Characteristics

Color Code	830 [CCT of 3000K]
Color Rendering Index	82 Ra8
Color Designation	Warm White
Color Temperature	3000 K
Chromaticity Coordinate X	440 -
Chromaticity Coordinate Y	403 -
Initial Lumens	1800 Lm
Initial Lumens	1800 Lm
Luminous Efficacy Lamp EM	69 Lm/W
Luminous Efficacy Lamp EL	75 Lm/W
Lumen Maintenance 2000h	90 %
Lumen Maintenance EL 2000h	93 %
Lumen Maintenance 5000h	81 %
Lumen Maintenance EL 5000h	86 %
Lumen Maintenance EM 10000h	73 %
Lumen Maintenance EL 10000h	79 %

• Product Dimensions

Base Face to Base Face A	87 mm
Insertion Length B	111.5 mm
Overall Length C	126.4 mm

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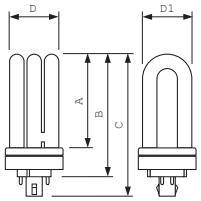
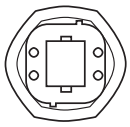
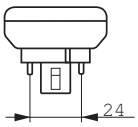
PL-T Triple 4-Pin Base

Diameter D	39.85 mm	Diameter D1	39.65 mm

Dimensional drawing



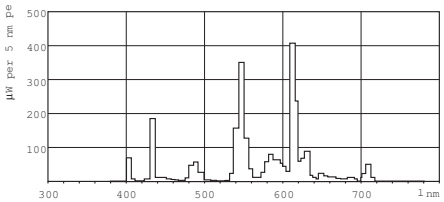




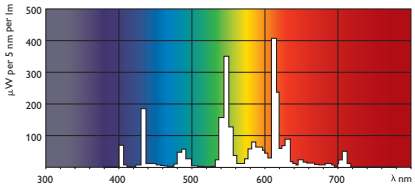
Product	A (Max)	B (Max)	C (Max)	D (Max)	D1 (Max)
PL-T 26W/830/4P	87	111.5	126.4	39.85	39.65

PL-T Triple 4-Pin Base

Photometric data



Lightcolor /830



Lightcolor /830

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2011, March 18
data subject to change

T5 Retail Sales

F28T5/835 ALTO UPC

Product data

• Product Data

Product number	206136
Full product name	F28T5/835 ALTO UPC
Short product name	F28T5/835 ALTO UPC
Pieces per Sku	1
Skus/Case	15
Bar code on pack	046677206130
Bar code on case	50046677206135
Logistics code(s)	927876083503

• General Characteristics

System Description	High Efficiency
Base	Miniature Bipin
Base Information	Green [Green Base]
Bulb	T5 [16 mm]
Rated Avg. Life	24000 hr
Life to 10% fail	19000 hr
Preheat EL,3h	
LSF HF Preheat 20000h Rated,3h	85 %
LSF HF Preheat 12000h Rated,3h	95 %
LSF HF Preheat 8000h Rated,3h	97 %
LSF HF Preheat 6000h Rated,3h	98 %
LSF HF Preheat 4000h Rated,3h	98 %
LSF HF Preheat 2000h Rated,3h	99 %
LSF HF Preheat 16000h Rated,3h	94 %

• Electrical Characteristics

Watts	28 W
Lamp Voltage EL 25°C	166 V
Lamp Current EL 25°C	0.170 A
Dimmable	Yes
Lamp Wattage EL 35°C	27.8 W
Lamp Current EL 35°C	0.170 A
Lamp Voltage EL 35°C	167 V
Lamp Wattage EL 25°C, Rated	28.2 W
Lamp Wattage EL 25°C, Nominal	28 W

• Environmental Characteristics

Energy Efficiency Label (EEL)	A
Mercury (Hg) Content	1.4 mg

• Light Technical Characteristics

Color Code	835 [CCT of 3500K]
Color Rendering Index	85 Ra8
Color Designation	835
Color Temperature	3500 K
Chromaticity Coordinate X	409 -
Chromaticity Coordinate Y	397 -
Initial Lumens	2900 Lm
Luminance Average EL 25°C	1.5 cd/cm2

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T5 Retail Sales

Lum Efficacy Rated HF 25°C	93 Lm/W
Lum Efficacy Rated HF 35°C	104 Lm/W
LLMF HF 20000h Rated	88 %
LLMF HF 16000h Rated	90 %
LLMF HF 12000h Rated	91 %
LLMF HF 8000h Rated	93 %
LLMF HF 6000h Rated	94 %
LLMF HF 4000h Rated	95 %
LLMF HF 2000h Rated	96 %
Luminous Flux EL 25°C, Rated	2625 Lm
Luminous Flux EL 25°C, Nominal	2625 Lm
Design Temperature	35 C

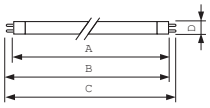
- Product Dimensions

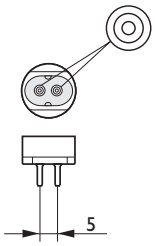
Base Face to Base Face A	1149.0 mm
Insertion Length B	1153.7 (min), 1156.1 (max) mm
Overall Length C	1163.2 mm
Diameter D	17 mm

- Measuring Conditions

Calibration Current	0.170 A
HF Generator Rated Voltage	329 V
Resistor	950 ohm

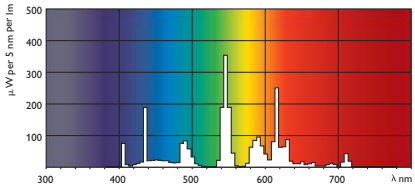
Dimensional drawing





Product	A (Max)	B (Min)	B (Max)	C (Max)	D (Max)
TL5 F28T5 28W/835 ALTO	1149.0	1153.7	1156.1	1163.2	17

Photometric data



www.philips.com/lighting

T5 High Output

F54T5/835 ALTO HO A

Philips T5 HO lamps are environmentally-responsible, ultra-slim and have extraordinary light output and longer life.

Product data

• Product Data

Product number	217661
Full product name	F54T5/835 ALTO HO A
Short product name	F54T5/835/HO/A/ALTO 40/1
Pieces per Sku	1
Skus/Case	40
Bar code on pack	46677217662
Bar code on case	50046677217667
Logistics code(s)	927993383534
tpd_ilcos_cd	FDH-54/35/1B-L/P-G5-16/850
eop_net_weight_pp	162.900 gr

• General Characteristics

System Description	High Output
Base	Miniature Bipin
Base Information	Green [Green Base]
Bulb	T5 [16 mm]
Rated Avg. Life	24000 hr
Life to 10% fail	19000 hr
Preheat EL,3h	
LSF HF Preheat 20000h Rated,3h	85 %
LSF HF Preheat 12000h Rated,3h	95 %
LSF HF Preheat 8000h Rated,3h	97 %
LSF HF Preheat 6000h Rated,3h	98 %
LSF HF Preheat 4000h Rated,3h	98 %
LSF HF Preheat 2000h Rated,3h	99 %
LSF HF Preheat 16000h Rated,3h	94 %

• Electrical Characteristics

Watts	54 W
Lamp Voltage EL 25°C	118 V
Lamp Current EL 25°C	0.460 A
Dimmable	Yes
Lamp Wattage EL 35°C	53.8 W
Lamp Current EL 35°C	0.460 A
Lamp Voltage EL 35°C	118 V
Lamp Wattage EL 25°C, Rated	54.3 W
Lamp Wattage EL 25°C, Nominal	54 W

• Environmental Characteristics

Energy Efficiency Label (EEL)	A
Mercury (Hg) Content	2.2 mg

• Light Technical Characteristics

Color Code	835 [CCT of 3500K]
Color Rendering Index	85 Ra8
Color Designation	White
Color Temperature	3500 K
Chromaticity Coordinate X	409 -
Chromaticity Coordinate Y	397 -
Initial Lumens	5000 Lm

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T5 High Output

Luminance Average EL 25°C	2.8 cd/cm2
Lum Efficacy Rated HF 25°C	88 Lm/W
Lum Efficacy Rated HF 35°C	93 Lm/W
LLMF HF 20000h Rated	88 %
LLMF HF 16000h Rated	90 %
LLMF HF 12000h Rated	91 %
LLMF HF 8000h Rated	93 %
LLMF HF 6000h Rated	94 %
LLMF HF 4000h Rated	95 %
LLMF HF 2000h Rated	96 %

Luminous Flux EL 25°C, Rated	4750 Lm
Luminous Flux EL 25°C, Nominal	4750 Lm
Design Temperature	20 (min), 75 (max) C

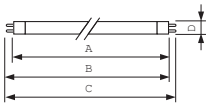
- Product Dimensions

Base Face to Base Face A	1149.0 mm
Insertion Length B	1153.7 (min), 1156.1 (max) mm
Overall Length C	1163.2 mm
Diameter D	17 mm

- Measuring Conditions

Calibration Current	0.460 A
HF Generator Rated Voltage	235 V
Resistor	255 ohm

Dimensional drawing



Product	A (Max)	B (Min)	B (Max)	C (Max)	D (Max)
TL5 F54T5 54W/835/GC ALTO® HO A	1149.0	1153.7	1156.1	1163.2	17

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2011, March 14
data subject to change

CDM

CDM-SA/R 150W/942 UNP

CDM short arc reflector lamps – perfect colors, long lifeThe perfect color rendering and long life of these Ceramic Discharge Metal-halide lamps make them ideal for fiber optics lighting systems in shop displays, decorative lighting and swimming pool illumination. They can be mounted in color changing projectors.

Product data

• Product Data

Product number	382788
Full product name	CDM-SA/R 150W/942 UNP
Short product name	CDM-SA/R 150W/942 UNP/1
Pieces per Sku	1
eop_pck_cfg	1
Skus/Case	1
Bar code on pack	8711500201508
Bar code on case	8711500201508
Logistics code(s)	928086805303
eop_net_weight_pp	0.192 kg

• General Characteristics

Cap-Base	Ceramic Cap-Cable
Cap-Base Information	Cable 250mm
Operating Position	any
Main Application	Fiber Optics
Life to 50% failures	6000 hr

• Electrical Characteristics

Watts	150 W
Lamp Wattage Technical	152 W
Lamp Current	1.8 A
Ignition Supply Voltage	198 V
Dimmable	No

• Light Technical Characteristics

Color Code	942
Color Rendering Index	96 Ra8
Color Designation (text)	Cool White
Color Temperature	4200 K
Color Temperature Technical	4000 K
Chromaticity Coordinate X	361 -
Chromaticity Coordinate Y	351 -
Luminous Flux Lamp EM	2300 (min), 2750 (nom) Lm
Luminous Efficacy Lamp EM	19 Lm/W

• Product Dimensions

Overall Length C	106 mm
Diameter D	95.3 mm
Cable Length X	280 mm

• Luminaire Design Requirements

Pinch Temperature	350 C
Bulb Temperature	650 C

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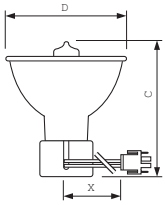
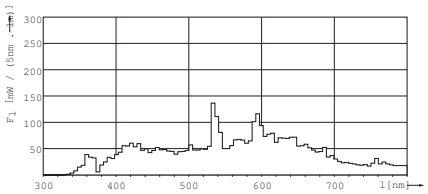
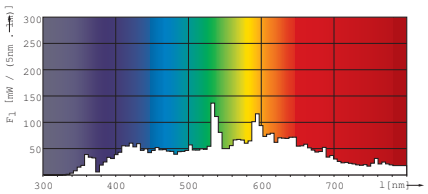
Dimensional drawing



Product	C (Max)	D (Max)	X (Norm)
CDM-SA/R 150W/942	106	95.3	280

Photometric data





www.philips.com/lighting

2011, March 18
data subject to change

MasterColor® CDM-T T6 Elite

MasterColor CDM-T Elite 70W/930 T6 1CT

The Elite family is at the very top of the MasterColor® CDM range, and gives a unique combination of unbeatable light quality and consistent performance over lifetime. While keeping running costs low. MasterColor metal halide lamps deliver consistent white light and higer color rendering than any standard metal halide source for architectural lighting.

Product data

• Product Data

Product number	148361
Full product name	MasterColor CDM-T Elite 70W/930 T6 1CT
Short product name	CDM T6 70W ELITE 930
Pieces per Sku	1
eop_pck_cfg	12
Skus/Case	12
Bar code on pack	46677148362
Bar code on case	50046677148367
Logistics code(s)	928092605117
tpd_ilcos_cd	MT-70/30/1A-H-G12
eop_net_weight_pp	0.029 kg

• General Characteristics

Base	G12
Bulb	T6 [Diameter: 6/8 inch /19mm]
Bulb Finish	Clear
Operating Position	Universal [Any or Universal (U)]
Life to 5% failures	9000 hr
Life to 10% failures	10000 hr
Life to 20% failures	11000 hr
Avg. Hrs. Life	12000 hr
Life to 5% failures EL	6000 hr
Life to 20% failures EL	9000 hr

• Electrical Characteristics

System Power EL	80 W
Watts	70 W
Lamp Wattage	75 W
Lamp Wattage EL	73 W
Lamp Voltage	87 V
Lamp Current EM	0.840 A
Lamp Current EL	0.840 A
Ignition Time	30 s
Run-up time 90%	3 min
Ignition Peak Voltage	3500 V
Re-ignition Time [min]	15 min
Dimmable	No

• Environmental Characteristics

Mercury (Hg) Content	8.5 mg

• Light Technical Characteristics

Color Code	930 [CCT of 3000K]
Color Rendering Index	90 Ra8
Color Designation	Warm White
Color Temperature	3000 K
Color Temperature technical	3000 K
Chromaticity Coordinate X	0.434 -
Chromaticity Coordinate Y	0.395 -
Initial Lumens	7300 Lm
Luminous Efficacy Lamp EM	98 Lm/W
Luminous Efficacy Lamp EL	100 Lm/W
Lumen Maintenance EM 2000h	95 %
Lumen Maintenance EL 2000h	95 %
Lumen Maintenance EM 5000h	88 %

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MasterColor® CDM-T T6 Elite

Lumen Maintenance EL 5000h	88 %
Lumen Maintenance 10000h	83 %
Lumen Maintenance 12000h	80 %

- UV-related Characteristics

PET (NIOSH)	64 h.klx
Damage Factor D/fc	0.22 -

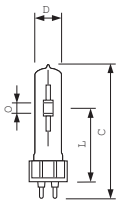
- Product Dimensions

Reference Length A	90 mm
Overall Length C	103 mm
Diameter D	20 mm
Light Center Length L	55 (min), 56 (nom), 57 (max) mm
Arc Length O	6 mm
Light Center Length L	2.2 in
Max Overall Length (MOL) - C	3.94 in
Diameter D	0.75 in

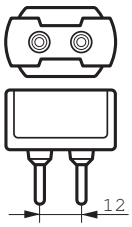
- Luminaire Design Requirements

Cap-Base Temperature	250 C
Pinch Temperature	350 C
Bulb Temperature	500 C

Dimensional drawing

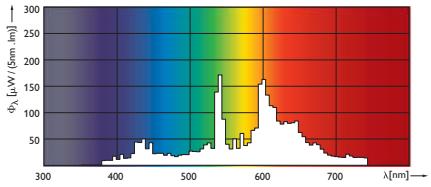


Product	C (Max)	D (Max)	L (Min)	L (Norm)	L (Max)	O (Min)	O (Norm)	O (Max)
CDM-T 70W/930 G12	103	20	55	56	57	-	6	-



MasterColor® CDM-T T6 Elite

Photometric data



MASTERColour CDM-T Elite 70W /930

www.philips.com/lighting

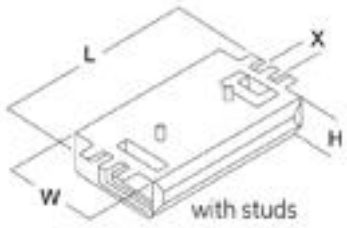
2011, March 14
data subject to change

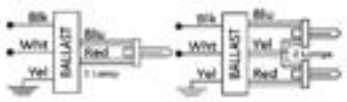
GE Lighting

71432 - GEC218-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- CFQ18W/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	71432
Description	GEC218-MVPS-BES
Standard Package	Case
Standard Package GTIN	10043168714324
Standard Package Quantity	10
Sales Unit	Individual Pack
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	10
UPC	043168714327

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	1.1 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)
CFTR26W/4P	1	120	28	0.24 A	1.00	3.57	99	1.6	12	-20.0 / -29
CFTR26W/4P	1	277	28	0.1 A	1.00	3.57	96	1.6	12	-20.0 / -29
CFTR18W/4P	1	120	20	0.17 A	1.05	NaN	97	1 1/2	10	-20.0 / -29
CFTR18W/4P	1	277	20	0.08 A	1.05	NaN	97	1 1/2	10	-20.0 / -29
CFTR18W/4P	2	120	39	0.33 A	1.05	2.69	97	1 1/2	10	-20.0 / -29
CFTR18W/4P	2	277	39	0.14 A	1.05	2.69	97	1 1/2	10	-20.0 / -29
CFS28W/4P	1	120	31	0.26 A	1.00	3.23	99	1 1/2	10	-20.0 / -29
CFS28W/4P	1	277	31	0.11 A	1.00	3.23	97	1 1/2	10	-20.0 / -29
CFS21W/4P	1	120	20	0.16 A	0.90	NaN	97	1 1/2	15	-20.0 / -29
CFS21W/4P	1	277	20	0.07 A	0.90	NaN	97	1 1/2	15	-20.0 / -29
CFS21W/4P	2	120	40	0.33 A	0.91	2.28	99	1 1/2	10	-20.0 / -29
CFS21W/4P	2	277	40	0.14 A	0.91	2.28	99	1 1/2	10	-20.0 / -29
CFS16W/4P	2	120	37	0.31 A	1.00	2.70	99	1 1/2	10	-20.0 / -29
CFS16W/4P	2	277	37	0.13 A	1.00	2.70	99	1 1/2	10	-20.0 / -29
CFQ26W/4P	1	120	28	0.24 A	1.00	3.57	99	1.6	12	-20.0 / -29
CFQ26W/4P	1	277	28	0.1 A	1.00	3.57	96	1.6	12	-20.0 / -29
CFQ18W/4P	1	120	19	0.16 A	0.95	5.00	99	1 1/2	10	-20.0 / -29
CFQ18W/4P	1	277	19	0.07 A	0.95	5.00	99	1 1/2	10	-20.0 / -29
CFQ18W/4P	2	120	35	0.3 A	1.00	2.86	97	1 1/2	10	-20.0 / -29
CFQ18W/4P	2	277	35	0.13 A	1.00	2.86	97	1 1/2	10	-20.0 / -29

WARRANTY INFORMATION

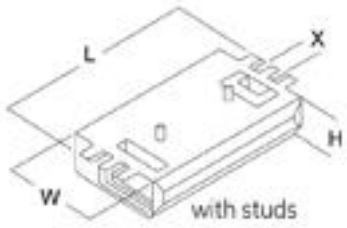
GE Lighting warrants to the purchaser that each ballast will be free from defects in material or workmanship for period as defined in the attached documents from the date of manufacture when properly installed and under normal conditions of use.

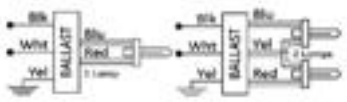
GE Lighting

71432 - GEC218-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- CFQ18W/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	71432
Description	GEC218-MVPS-BES
Standard Package	Case
Standard Package GTIN	10043168714324
Standard Package Quantity	10
Sales Unit	Individual Pack
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	10
UPC	043168714327

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	1.1 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)
CFTR26W/4P	1	120	28	0.24 A	1.00	3.57	99	1.6	12	-20.0 / -29
CFTR26W/4P	1	277	28	0.1 A	1.00	3.57	96	1.6	12	-20.0 / -29
CFTR18W/4P	1	120	20	0.17 A	1.05	NaN	97	1 1/2	10	-20.0 / -29
CFTR18W/4P	1	277	20	0.08 A	1.05	NaN	97	1 1/2	10	-20.0 / -29
CFTR18W/4P	2	120	39	0.33 A	1.05	2.69	97	1 1/2	10	-20.0 / -29
CFTR18W/4P	2	277	39	0.14 A	1.05	2.69	97	1 1/2	10	-20.0 / -29
CFS28W/4P	1	120	31	0.26 A	1.00	3.23	99	1 1/2	10	-20.0 / -29
CFS28W/4P	1	277	31	0.11 A	1.00	3.23	97	1 1/2	10	-20.0 / -29
CFS21W/4P	1	120	20	0.16 A	0.90	NaN	97	1 1/2	15	-20.0 / -29
CFS21W/4P	1	277	20	0.07 A	0.90	NaN	97	1 1/2	15	-20.0 / -29
CFS21W/4P	2	120	40	0.33 A	0.91	2.28	99	1 1/2	10	-20.0 / -29
CFS21W/4P	2	277	40	0.14 A	0.91	2.28	99	1 1/2	10	-20.0 / -29
CFS16W/4P	2	120	37	0.31 A	1.00	2.70	99	1 1/2	10	-20.0 / -29
CFS16W/4P	2	277	37	0.13 A	1.00	2.70	99	1 1/2	10	-20.0 / -29
CFQ26W/4P	1	120	28	0.24 A	1.00	3.57	99	1.6	12	-20.0 / -29
CFQ26W/4P	1	277	28	0.1 A	1.00	3.57	96	1.6	12	-20.0 / -29
CFQ18W/4P	1	120	19	0.16 A	0.95	5.00	99	1 1/2	10	-20.0 / -29
CFQ18W/4P	1	277	19	0.07 A	0.95	5.00	99	1 1/2	10	-20.0 / -29
CFQ18W/4P	2	120	35	0.3 A	1.00	2.86	97	1 1/2	10	-20.0 / -29
CFQ18W/4P	2	277	35	0.13 A	1.00	2.86	97	1 1/2	10	-20.0 / -29

WARRANTY INFORMATION

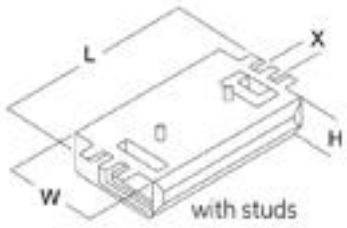
GE Lighting warrants to the purchaser that each ballast will be free from defects in material or workmanship for period as defined in the attached documents from the date of manufacture when properly installed and under normal conditions of use.

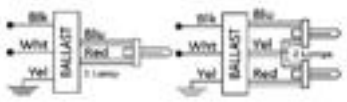
GE Lighting

71443 - GEC226-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-CFQ26W, FT24 or 1-42W, CFTR32 Bottom Exit w 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	75 °C(167 °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	71443
Description	GEC226-MVPS-BES
Standard Package	Case
Standard Package GTIN	10043168714430
Standard Package Quantity	10
Sales Unit	Individual Pack
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	10
UPC	043168714433

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	12 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)
FT24W/2G10	2	120	48	0.41 A	0.93	NaN	99	1 1/2	10	-20.0 / -29
FT24W/2G10	2	277	48	0.18 A	0.93	NaN	99	1 1/2	10	-20.0 / -29
FC16T9/40W	1	120	43	0.16 A	1.00	2.33	97	1 1/2	10	-20.0 / -29
FC16T9/40W	1	277	43	0.16 A	1.00	2.33	97	1 1/2	10	-20.0 / -29
FC16T9	1	120	43	0.16 A	1.00	2.33	97	1 1/2	10	-20.0 / -29
FC16T9	1	277	43	0.16 A	1.00	2.33	97	1 1/2	10	-20.0 / -29
F24T5/HO	2	120	51	0.44 A	1.00	1.96	99	1 1/2	10	-20.0 / -29
F24T5/HO	2	277	51	0.19 A	1.00	1.96	98	1 1/2	10	-20.0 / -29
CFTR42W/4P	1	120	46	0.38 A	0.98	2.13	98	1 1/2	10	-20.0 / -29
CFTR42W/4P	1	277	46	0.17 A	0.98	2.13	98	1 1/2	10	-20.0 / -29
CFTR32W/4P	1	120	36	0.31 A	0.98	2.72	98	1 1/2	10	-20.0 / -29
CFTR32W/4P	1	277	36	0.13 A	0.98	2.72	98	1 1/2	10	-20.0 / -29
CFTR26W/4P	1	120	29	0.24 A	1.10	3.79	98	1 1/2	10	-20.0 / -29
CFTR26W/4P	1	277	29	0.11 A	1.10	3.79	98	1 1/2	10	-20.0 / -29
CFTR26W/4P	2	120	54	0.45 A	1.00	1.85	99	1 1/2	10	-20.0 / -29
CFTR26W/4P	2	277	54	0.2 A	1.00	1.85	99	1 1/2	10	-20.0 / -29
CFS21W/4P	2	120	51	0.42 A	1.12	2.20	99	1 1/2	10	-20.0 / -29
CFS21W/4P	2	277	51	0.18 A	1.12	2.20	99	1 1/2	10	-20.0 / -29
CFQ26W/4P	1	120	27	0.23 A	1.00	3.70	99	1 1/2	10	-20.0 / -29
CFQ26W/4P	1	277	27	0.1 A	1.00	3.70	99	1 1/2	10	-20.0 / -29

CFQ26W/4P	2	120	51	0.43 A	1.00	1.96	98	1 1/2	10	-20.0 / -29
CFQ26W/4P	2	277	51	0.19 A	1.00	1.96	98	1 1/2	10	-20.0 / -29

WARRANTY INFORMATION

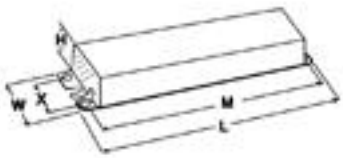
GE Lighting warrants to the purchaser that each ballast will be free from defects in material or workmanship for period as defined in the attached documents from the date of manufacture when properly installed and under normal conditions of use.

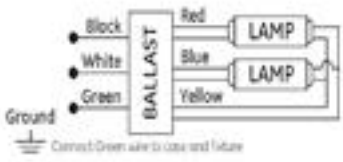
GE Lighting

99653 - GE228MVPSH-A

GE LFL UltraStart® Electronic Program / Rapid Start Ballast

- High Efficiency T5 ballast with Continuous Cathode Cutout Technology
- Lower Maintenance Costs with Parallel Lamp Operation
- Fast Starting Time <700ms
- Multi-Voltage technology means a single ballast handles voltage from 108V to 305V
- Auto-Restart withstands temporary losses in power without the need to cycle power
- UltraCool™ Operation 90C case rating
- Anti-Striation Control for better light quality, with no striations.





GENERAL CHARACTERISTICS

Application	2 or 1 - F14-F35HE 120 to 277 UltraStart PRS High Light 1.15 BF A Can
Category	Linear Fluorescent
Ballast Type	Electronic - Program / Rapid Start
Starting Method	Programmed start
Lamp Wiring	Parallel
Line Voltage Regulation (+/-)	10 %
Case Temperature	90 °C(194 °F)
Ballast Factor	High (1.18)
Power Factor Correction	Active
Sound Rating	A (20-24 decibels)
Enclosure Type	Metal
Additional Info	Auto-restart/End of Life Protection (EOL)/Thermally protected/Universal voltage

PRODUCT INFORMATION

Product Code	99653
Description	GE228MVPSH-A
Standard Package	Case
Standard Package GTIN	10043168996539
Standard Package Quantity	10
Sales Unit	Standard Pack
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	10
UPC	043168996532

DIMENSIONS

Case dimensions			
Length (L)		9.5 in(241.30 mm)	
Width (W)		1.7 in(43.18 mm)	
Height (H)		1.2 in(30.48 mm)	
Mounting dimensions			
Mount Length (M)		8.9 in(226.06 mm)	
Mount Slots (MS)		0.2 in(6.35 mm)	
Weight		1.49 lb	
Exit Type		Side	
Remote Mounting Distance		8 ft	
Remote Mounting Wire Gauge		18 AWG	
Lead lengths	Qty	Exit	Length (± 1 in.)
Black	1	Left/Right	25.0 (635mm)
Blue	2	Left/Right	34.0 (864mm)
Green	1	Left/Right	3.5 (89mm)
Red	2	Left/Right	34.0 (864mm)
White	1	Left/Right	25.0 (635mm)
Yellow	2	Left/Right	45 (1143mm)

ELECTRICAL CHARACTERISTICS

Supply Current Frequency	50 Hz/60 Hz

SAFETY & PERFORMANCE

- CSA
- FCC - CLASS A Non-Consumer
- UL Class P
- UL Listed
- UL Type 1 Outdoor
- UL Type CC
- UL Type HL
- RoHs Compliant
- Meets ANSI Standard C82.11-Cons 2002
- Meets ANSI Standard C62.41-1991
- High Temperature Rated: Suitable for high temperature applications
- 70C max case temp 5 yr warranty or 90C max case temp 3 yr warranty

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)
F28T5/WM	1	120	43	0.36 A	1.22	2.84	99	1 1/2	9	5.0 / -15
F28T5/WM	1	277	43	0.17 A	1.22	2.84	92	1 1/2	9	5.0 / -15
F28T5/WM	2	120	68	0.57 A	1.16	1.71	99	1 1/2	9	5.0 / -15
F28T5/WM	2	277	67	0.25 A	1.16	1.73	96	1 1/2	10	5.0 / -15
F28T5/HL	1	120	45	0.37 A	1.21	2.69	99	1 1/2	9	5.0 / -15
F28T5/HL	1	277	45	0.17 A	1.21	2.69	93	1 1/2	9	5.0 / -15
F28T5/HL	2	120	72	0.6 A	1.16	1.61	99	1.6	9	5.0 / -15

F28T5/HL	2	277	70	0.25	A	1.16	1.66	97	1.6	10	5.0 / -15
F28T5/HE	1	120	45	0.37	A	1.21	2.69	99	1 1/2	9	5.0 / -15
F28T5/HE	1	277	45	0.17	A	1.21	2.69	93	1 1/2	9	5.0 / -15
F28T5/HE	2	277	70	0.25	A	1.16	1.66	97	1.6	10	5.0 / -15
F28T5/HE	2	120	72	0.6	A	1.16	1.61	99	1.6	9	5.0 / -15
F21T5/WM	1	120	34	0.29	A	NaN	3.68	99	1 1/2	9	5.0 / -15
F21T5/WM	1	277	34	0.15	A	NaN	3.68	86	1 1/2	9	5.0 / -15
F21T5/WM	2	120	54	0.45	A	1.17	2.17	99	1 1/2	9	5.0 / -15
F21T5/WM	2	277	53	0.21	A	1.17	2.21	95	1 1/2	8	5.0 / -15
F21T5/HE	1	120	36	0.3	A	1.24	3.44	99	1 1/2	10	5.0 / -15
F21T5/HE	1	277	36	0.14	A	1.24	3.44	90	1 1/2	10	5.0 / -15
F21T5/HE	2	120	57	0.47	A	1.17	2.05	99	1 1/2	8	5.0 / -15
F21T5/HE	2	277	56	0.21	A	1.17	2.09	95	1 1/2	8	5.0 / -15
F14T5/WM	1	120	25	0.21	A	1.26	5.04	99	1 1/2	9	5.0 / -15
F14T5/WM	1	277	25	0.12	A	1.26	5.04	78	1 1/2	9	5.0 / -15
F14T5/WM	2	120	38	0.32	A	1.17	3.08	99	1 1/2	10	5.0 / -15
F14T5/WM	2	277	38	0.15	A	1.17	3.08	91	1 1/2	10	5.0 / -15
F14T5/HE	1	120	26	0.22	A	1.28	4.92	99	1.7	10	5.0 / -15
F14T5/HE	1	277	26	0.12	A	1.28	4.92	81	1 1/2	9	5.0 / -15
F14T5/HE	2	120	40	0.34	A	1.18	2.95	99	1 1/2	9	5.0 / -15
F14T5/HE	2	277	40	0.16	A	1.18	2.95	92	1 1/2	9	5.0 / -15

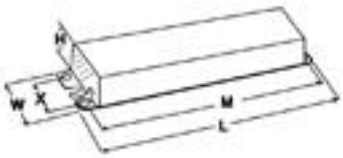
WARRANTY INFORMATION

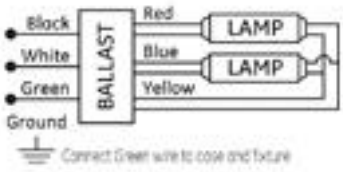
GE Lighting warrants to the purchaser that each ballast will be free from defects in material or workmanship for period as defined in the attached documents from the date of manufacture when properly installed and under normal conditions of use.

99651 - GE254MVPS90-F

GE LFL UltraStart® Electronic Program / Rapid Start Ballast

- High Efficiency T5 ballast with Continuous Cathode Cutout Technology
- Lower Maintenance Costs with Parallel Lamp Operation
- Fast Starting Time <700ms
- Multi-Voltage technology means a single ballast handles voltage from 108V to 305V
- Auto-Restart withstands temporary losses in power without the need to cycle power
- UltraCool™ Operation 90C case rating
- Anti-Striation Control for better light quality, with no striations.





GENERAL CHARACTERISTICS

Application	2 or 1 - F54T5HO 120 to 277 UltraStart PRS Hight Temp F Can
Category	Linear Fluorescent
Ballast Type	Electronic - Program / Rapid Start
Starting Method	Programmed start
Lamp Wiring	Parallel
Line Voltage Regulation (+/-)	10 %
Case Temperature	90 °C(194 °F)
Ballast Factor	Normal
Power Factor Correction	Active
Sound Rating	A (20-24 decibels)
Enclosure Type	Metal
Additional Info	Auto-restart/End of Life Protection (EOL)/Thermally protected/Universal voltage

PRODUCT INFORMATION

Product Code	99651
Description	GE254MVPS90-F
Standard Package	Case
Standard Package GTIN	10043168996515
Standard Package Quantity	10
Sales Unit	Standard Pack
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	10
UPC	043168996518

DIMENSIONS

Case dimensions	
Length (L)	11.8 in(298.45 mm)
Width (W)	1.7 in(43.18 mm)
Height (H)	1.2 in(30.48 mm)
Mounting dimensions	
Mount Length (M)	11.1 in(282.96 mm)
Mount Slots (MS)	0.2 in(6.35 mm)
Weight	1.85 lb
Exit Type	Side
Remote Mounting Distance	8 ft
Remote Mounting Wire Gauge	18 AWG

Lead lengths	Qty	Exit	Length (± 1 in.)
Black	1	Left/Right	25.0 (635mm)
Blue	2	Left/Right	34.0 (864mm)
Green	1	Left/Right	3.5 (89mm)
Red	2	Left/Right	34.0 (864mm)
White	1	Left/Right	25.0 (635mm)
Yellow	1	Left/Right	45.0 (1143mm)
Yellow	2	Left/Right	45 (1143mm)

ELECTRICAL CHARACTERISTICS

Supply Current Frequency	50 Hz/60 Hz

SAFETY & PERFORMANCE

- CSA
- FCC - CLASS A Non-Consumer
- UL Class P
- UL Listed
- UL Type 1 Outdoor
- UL Type CC
- UL Type HL
- RoHs Compliant
- Meets ANSI Standard C82.11-Cons 2002
- Meets ANSI Standard C62.41-1991
- High Temperature Rated: Suitable for high temperature applications
- 70C max case temp 5 yr warranty or 90C max case temp 3 yr warranty

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)
FT55W/4P	1	120	67	0.56 A	1.04	1.55	99	1.6	6	5.0 / -15
FT55W/4P	2	120	106	0.89 A	0.86	0.81	99	1.7	9	5.0 / -15
FT55W/4P	1	277	67	0.25 A	1.04	1.55	97	1.6	6	5.0 / -15
FT55W/4P	2	277	105	0.39 A	0.86	0.82	98	1.7	7	5.0 / -15
FT50W/4P	1	120	72	0.61 A	1.21	1.68	99	1.6	5	5.0 / -15
FT50W/4P	1	277	72	0.27 A	1.21	1.68	97	1.6	7	5.0 / -15

FT50W/4P	2	120	117	0.99 A	1.05	0.90	99	1.7	10	5.0 / -15
FT50W/4P	2	277	115	0.43 A	1.05	0.91	98	1.7	8	5.0 / -15
FT39W/4P	1	120	51	0.43 A	1.29	2.53	99	1.6	4	5.0 / -15
FT39W/4P	1	277	51	0.19 A	1.28	2.51	96	1.6	7	5.0 / -15
FT39W/4P	2	120	85	0.71 A	1.17	1.38	99	1.6	4	5.0 / -15
FT39W/4P	2	277	84	0.31 A	1.17	1.39	98	1.6	8	5.0 / -15
FC12T5HO	1	120	69	0.58 A	1.04	1.51	99	1.6	6	5.0 / -15
FC12T5HO	1	277	69	0.26 A	1.04	1.51	97	1.6	7	5.0 / -15
FC12T5HO	2	120	111	0.92 A	0.90	0.81	99	1.7	7	5.0 / -15
FC12T5HO	2	277	109	0.4 A	0.90	0.83	98	1.7	7	5.0 / -15
F58T8	2	120	106	0.89 A	0.95	0.90	99	1.6	9	5.0 / -15
F58T8	1	120	65	0.55 A	1.09	1.68	99	1.6	5	5.0 / -15
F58T8	2	277	104	0.38 A	0.95	0.91	98	1.6	10	5.0 / -15
F58T8	1	277	65	0.24 A	1.09	1.68	97	1.6	7	5.0 / -15
F54T5/WM	2	277	107	0.4 A	1.00	0.93	97	1.7	8	5.0 / -15
F54T5/WM	1	277	66	0.25 A	1.12	1.70	97	1.6	7	5.0 / -15
F54T5/WM	2	120	109	0.91 A	1.00	0.92	99	1.7	8	5.0 / -15
F54T5/WM	1	120	66	0.56 A	1.12	1.70	99	1.6	5	5.0 / -15
F54T5/HO	1	120	71	0.6 A	1.11	1.56	99	1.6	4	5.0 / -15
F54T5/HO	1	277	71	0.26 A	1.11	1.56	97	1.6	7	5.0 / -15
F54T5/HO	2	120	116	0.98 A	1.00	0.86	99	1.7	10	5.0 / -15
F54T5/HO	2	277	114	0.43 A	1.00	0.88	98	1.7	8	5.0 / -15
F54T5/47W	1	120	64	0.54 A	1.10	NaN	99	1.7	8	32.0 / 0
F54T5/47W	1	277	63	0.24 A	1.10	1.75	99	1.6	5	32.0 / 0
F54T5/47W	2	120	105	0.9 A	1.00	0.95	97	1.7	8	32.0 / 0
F54T5/47W	2	277	103	0.38 A	1.00	0.97	97	1.6	7	32.0 / 0

WARRANTY INFORMATION

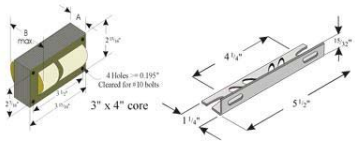
GE Lighting warrants to the purchaser that each ballast will be free from defects in material or workmanship for period as defined in the attached documents from the date of manufacture when properly installed and under normal conditions of use.

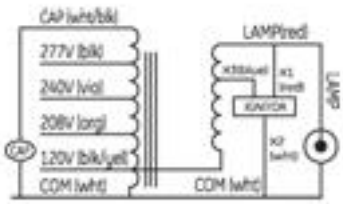
GE Lighting

86718 - GEM150MLTLC3D-5

GE HID Distributor Replacement Kit Magnetic Core & Coil Ballast

- Magnetic ballast construction ideal for a wide variety of lighting applications.
- Precision-wound coils, ensuring even heat dissipation and the highest electrical integrity.
- Distributor replacement kit contains the appropriate core & coil with color coded leads, a properly rated capacitor and ignitor (if required) and all other components required for ballast replacement
- Quad ballast (120, 208, 240, 277)





GENERAL CHARACTERISTICS

Application	1- 150w MH M102 or M142 Quad
Category	High Intensity Discharge
Ballast Type	Magnetic - Core & Coil
Type	Replacement kit
Line Voltage Regulation (+/-)	5 %
Ballast Factor	Normal
Circuit Type	HX-HPF
Insulation Class	180C
Enclosure Type	None
Capacitance	16 µF
Capacitor Temperature Rating	90 °C(194 °F)
Distance to Lamp	5 ft

PRODUCT INFORMATION

Product Code	86718
Description	GEM150MLTLC3D-5
Standard Package	Master
Standard Package GTIN	
Standard Package Quantity	6
Sales Unit	Distributor Kit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	6
UPC	043168867184

DIMENSIONS

Case dimensions	
Length (L)	4.0 in(101.60 mm)
Width (W)	2.8 in(71.45 mm)
Mounting dimensions	
Bracket Length (BL)	5.5 in(139.70 mm)
Mount Length (M)	3.5 in(88.90 mm)
Mount Width (X or F)	2.4 in(61.93 mm)
Mount Slots (MS)	0.2 in(4.95 mm)
Weight	7 lb
Exit Type	Side
Diameter	1.6 in
Nominal Length	2.7 in
Frame size (H x L)	2.813 x 3.939 in

ELECTRICAL CHARACTERISTICS

Supply Current Frequency	60 Hz
Voltage	300

SAFETY & PERFORMANCE

- cUL Listed
- UL Listed

SPECIFICATIONS BY LAMP & LINE VOLTAGE

Lamp	# of Lamps	Specifications by Line Voltage	System Wattage	Nominal Current	Ballast Factor	Ballast Efficiency	Max.Input Current	Starting Current	Open Circuit Voltage	Drop Out Voltage	Power factor	Min.starting temperature	Fuse rating	UL bench top rise
M142	1	120	186.0	1.6A	1	0.806	3.37A	1.86A	257V	75V	0.9	-22.0°F	10	A
M142	1	208	186.0	1.0A	1	0.806	1.95A	1.03A	257V	125V	0.9	-22.0°F	5	B
M142	1	240	186.0	0.8A	1	0.806	1.68A	0.89A	257V	150V	0.9	-22.0°F	5	A
M142	1	277	186.0	0.7A	1	0.806	1.39A	0.77A	257V	160V	0.9	-22.0°F	4	A
M102	1	120	186.0	1.6A	1	0.806	3.37A	1.86A	257V	75V	0.9	-22.0°F	10	A
M102	1	208	186.0	1.0A	1	0.806	1.95A	1.03A	257V	125V	0.9	-22.0°F	5	B
M102	1	240	186.0	0.8A	1	0.806	1.68A	0.89A	257V	150V	0.9	-22.0°F	5	A
M102	1	277	186.0	0.7A	1	0.806	1.39A	0.77A	257V	160V	0.9	-22.0°F	4	A

CAUTIONS & WARNINGS

Warning

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ACCESSORIES

Ignitors	
Product Code	86864
Description	MH100-3A
Dry Film Capacitor	
Product Code	75428
Description	GECAP-16/280V-D
Ignitors	
Product Code	75440
Description	MH350-1A

NOTES

• Kit contains the appropriate core & coil with color coded leads, a properly rated capacitor and ignitor (if required) and all other components required for ballast replacement

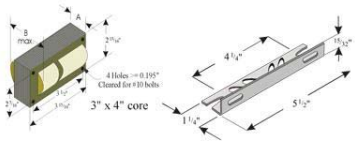
WARRANTY INFORMATION

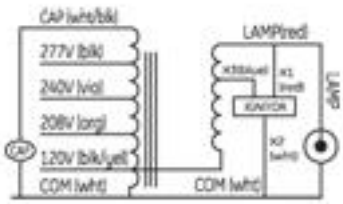
GE Lighting warrants to the purchaser that each ballast will be free from defects in material or workmanship for period as defined in the attached documents from the date of manufacture when properly installed and under normal conditions of use.

86847 - GEM70MLTLC3D-5

GE HID Distributor Replacement Kit Magnetic Core & Coil Ballast

- Magnetic ballast construction ideal for a wide variety of lighting applications.
- Precision-wound coils, ensuring even heat dissipation and the highest electrical integrity.
- Distributor replacement kit contains the appropriate core & coil with color coded leads, a properly rated capacitor and ignitor (if required) and all other components required for ballast replacement
- Quad ballast (120, 208, 240, 277)





GENERAL CHARACTERISTICS

Application	1- 70w MH M 98 or M143 Quad
Category	High Intensity Discharge
Ballast Type	Magnetic - Core & Coil
Type	Replacement kit
Line Voltage Regulation (+/-)	5 %
Ballast Factor	Normal
Circuit Type	HX-HPF
Insulation Class	180C
Enclosure Type	None
Capacitance	8 µF
Capacitor Temperature Rating	100 °C(212 °F)
Distance to Lamp	5 ft

PRODUCT INFORMATION

Product Code	86847
Description	GEM70MLTLC3D-5
Standard Package	Master
Standard Package GTIN	
Standard Package Quantity	6
Sales Unit	Distributor Kit
No Of Items Per Sales Unit	1
No Of Items Per Standard Package	6
UPC	043168868471

DIMENSIONS

Case dimensions	
Length (L)	4.0 in(101.60 mm)
Width (W)	2.8 in(71.45 mm)
Mounting dimensions	
Bracket Length (BL)	5.5 in(139.70 mm)
Mount Length (M)	3.5 in(88.90 mm)
Mount Width (X or F)	2.4 in(61.93 mm)
Mount Slots (MS)	0.2 in(4.95 mm)
Weight	5 lb
Exit Type	Side
Diameter	1.6 in
Nominal Length	2.7 in
Frame size (H x L)	2.813 x 3.939 in

ELECTRICAL CHARACTERISTICS

Supply Current Frequency	60 Hz
Voltage	280

SAFETY & PERFORMANCE

- cUL Listed
- UL Listed

SPECIFICATIONS BY LAMP & LINE VOLTAGE

Lamp	# of Lamps	Specifications by Line Voltage	System Wattage	Nominal Current	Ballast Factor	Ballast Efficiency	Max.Input Current	Starting Current	Open Circuit Voltage	Drop Out Voltage	Power factor	Min.starting temperature	Fuse rating	UL bench top rise
M98	1	120	88.0	0.9A	1	0.795	1.51A	0.96A	257V	30V	0.9	-22.0°F	4	A
M98	1	208	88.0	0.5A	1	0.795	0.88A	0.59A	257V	150V	0.9	-22.0°F	3	A
M98	1	240	88.0	0.4A	1	0.795	0.75A	0.49A	257V	175V	0.9	-22.0°F	3	A
M98	1	277	88.0	0.4A	1	0.795	0.66A	0.44A	257V	208V	0.9	-22.0°F	2	A

CAUTIONS & WARNINGS

Warning

•

ACCESSORIES

Dry Film Capacitor

Product Code	75426
Description	GECAP-8/280V-D

Ignitors

Product Code	75440
Description	MH350-1A

NOTES

• Kit contains the appropriate core & coil with color coded leads, a properly rated capacitor and ignitor (if required) and all other components required for ballast replacement

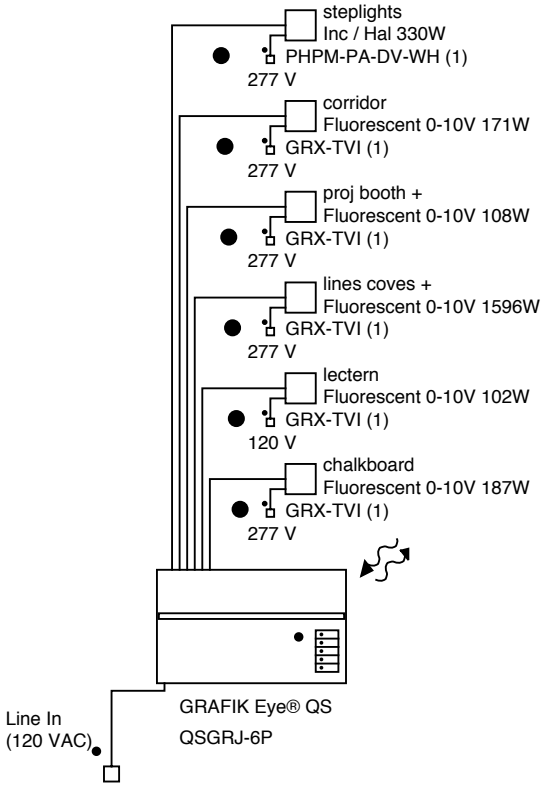
WARRANTY INFORMATION

GE Lighting warrants to the purchaser that each ballast will be free from defects in material or workmanship for period as defined in the attached documents from the date of manufacture when properly installed and under normal conditions of use.

Appendix C

GRAFIK Eye® QS

One Line Diagram



Wiring Notes:	● 2 #12 AWG (2.5 mm²)	▼ 2 #18 AWG (1.0 mm²)	■ 277 VAC Input Power	▲ Lutron GRX-CBL-346S or GRX-PCBL-346S
	▽ 3 #18 AWG (1.0 mm²)	□ 120 VAC Input Power	✱ Only connect 3 wires (Common, mux, mux)	

Lutron

APPENDIX C

Project Name: New Project	
Project Number:	**Page:** 1

Description	Model Number	Qty.
GRAFIK Eye® QS Wireless Control Unit	QSGRJ-6P	1
GRAFIK Eye® QS Faceplate Kit	QSGFP-WH-NST	1
Power Module	GRX-TVI	5
Power Module	PHPM-PA-DV-WH	1

Lutron

GRAFIK Eye® QS

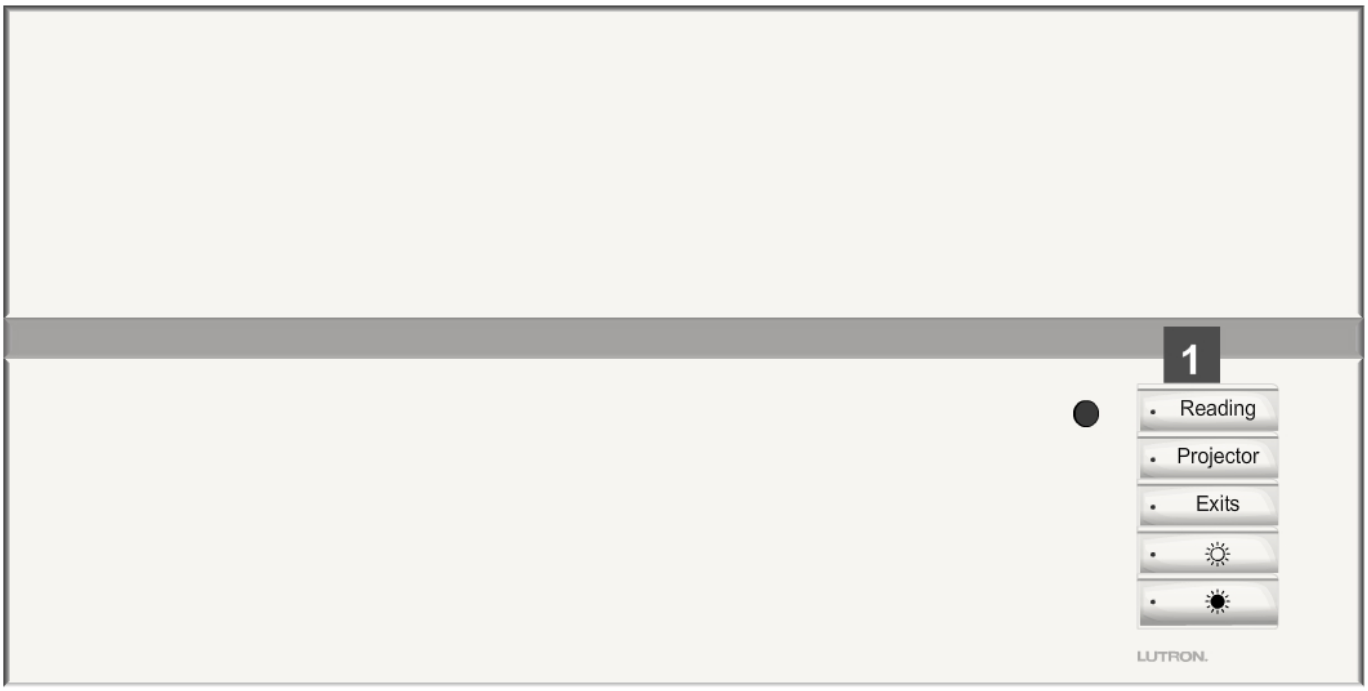
Button Kit Engraving Form

Project Information

Project Name: New Project
Installer Company: _____
Installer Name: _____
Phone: _____

Shipping Information

Name: _____
Company: _____
Address: _____
City: _____ State: _____ Zip: _____
Phone: _____ Fax: _____



	Type:	Model Number:	Engraving Certificate Number:	Button color:
1	Scene Control			white (WH)

Lutron Electronics Co. Inc.
Dept 309 engraving
7200 Suter Road
Coopersburg, PA 18036
www.lutron.com
Phone: 610.282.3800

LUTRON®

Project Name: New Project

Lutron Project #:

P.O.#:

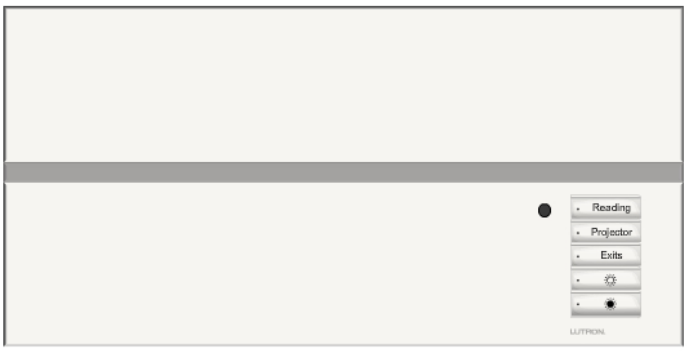
Lutron Order #:

APPENDIX C

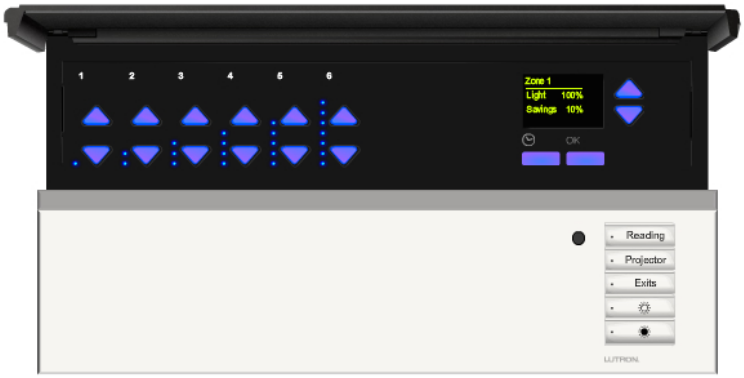
Model Number: QSGRJ-6P

Phase Control Zones

Zone	Name	Load Type	No. Fixtures	Wattage/Fixture	Total Wattage
1	chalkboard	Fluorescent 0-10V	11	17	187
2	lectern	Fluorescent 0-10V	6	17	102
3	lines coves +	Fluorescent 0-10V	28	57	1596
4	proj booth +	Fluorescent 0-10V	6	18	108
5	corridor	Fluorescent 0-10V	3	57	171
6	steplights	Inc / Hal	33	10	330



GRAFIK Eye® QS with lid closed.



GRAFIK Eye® QS with lid open.

Actual colors may vary slightly.

Light Zones:	Colors:	
6	**Faceplate:**	white (WH)
Shade Groups:	**Stripe:**	gray (GR)
0	**Buttons:**	white (WH)

Model Number:			
Unit:	QSGRJ-6P	**Quantity:**	1

GRAFIK Eye® QS

Full-size Image

Actual colors may vary slightly.

Selected Wall Color

Benjamin Moore® Paints

Affinity Colors:

Fusion

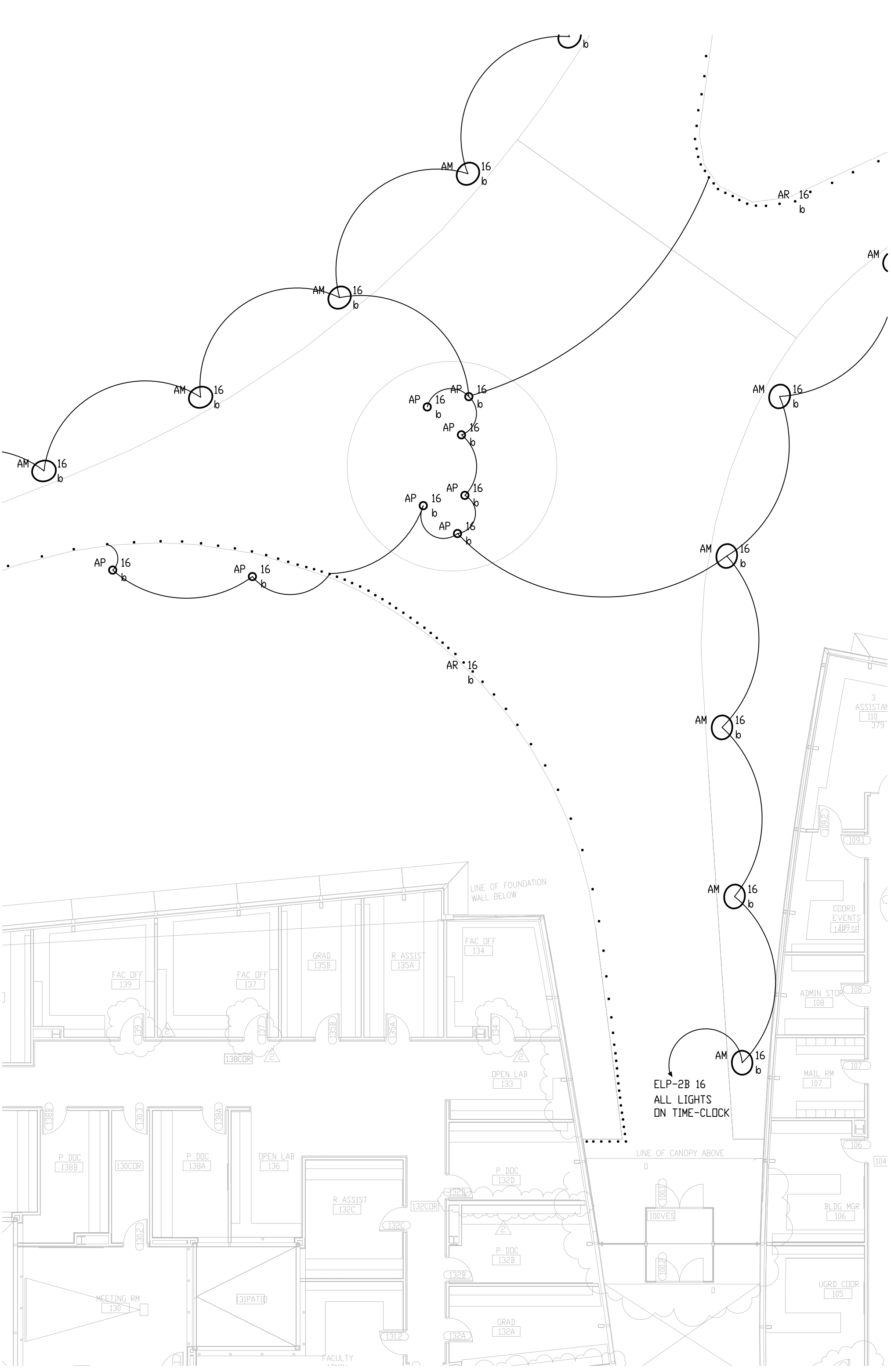
www.myaurapaints.com

*Actual color may differ slightly; please refer to paint chips for most accurate representation.

LUTRON.

Project Name:	New Project		
Project Number:		**Page:**	6

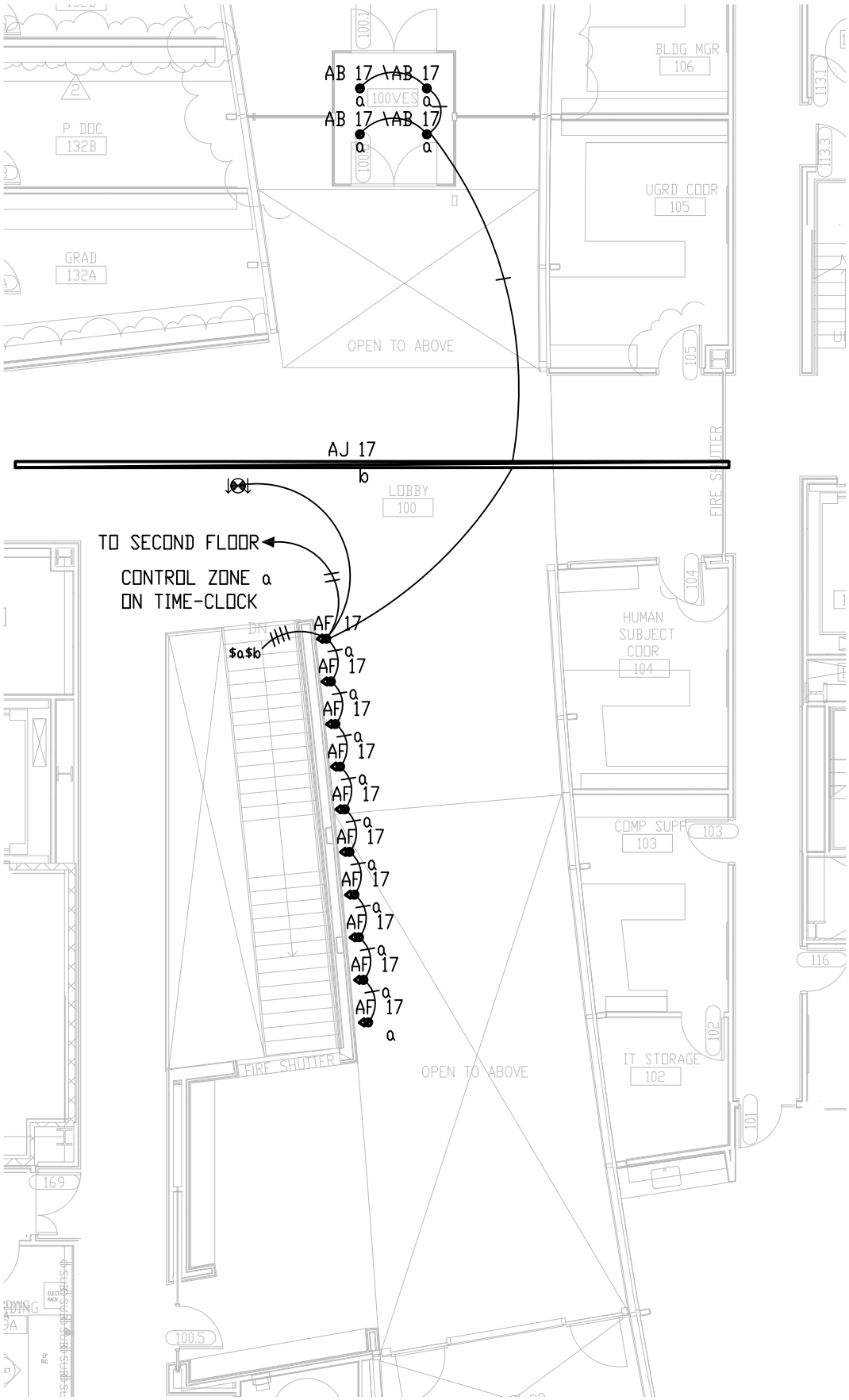
Appendix E



ELECTRICAL PLAN

SCALE: 3/32"= 1'-0"

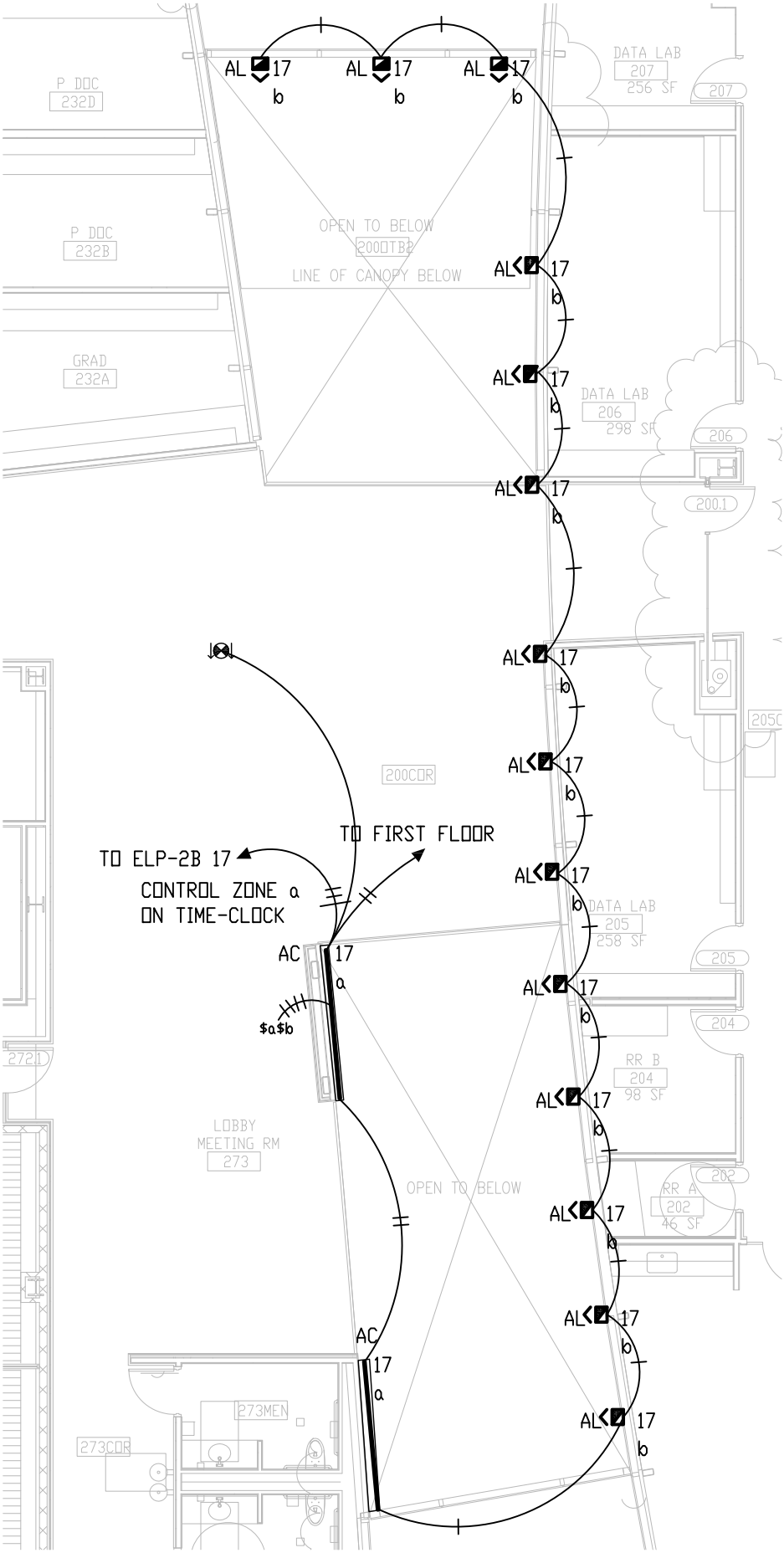
APPENDIX E



ELECTRICAL PLAN

SCALE: 3/32"= 1'-0"

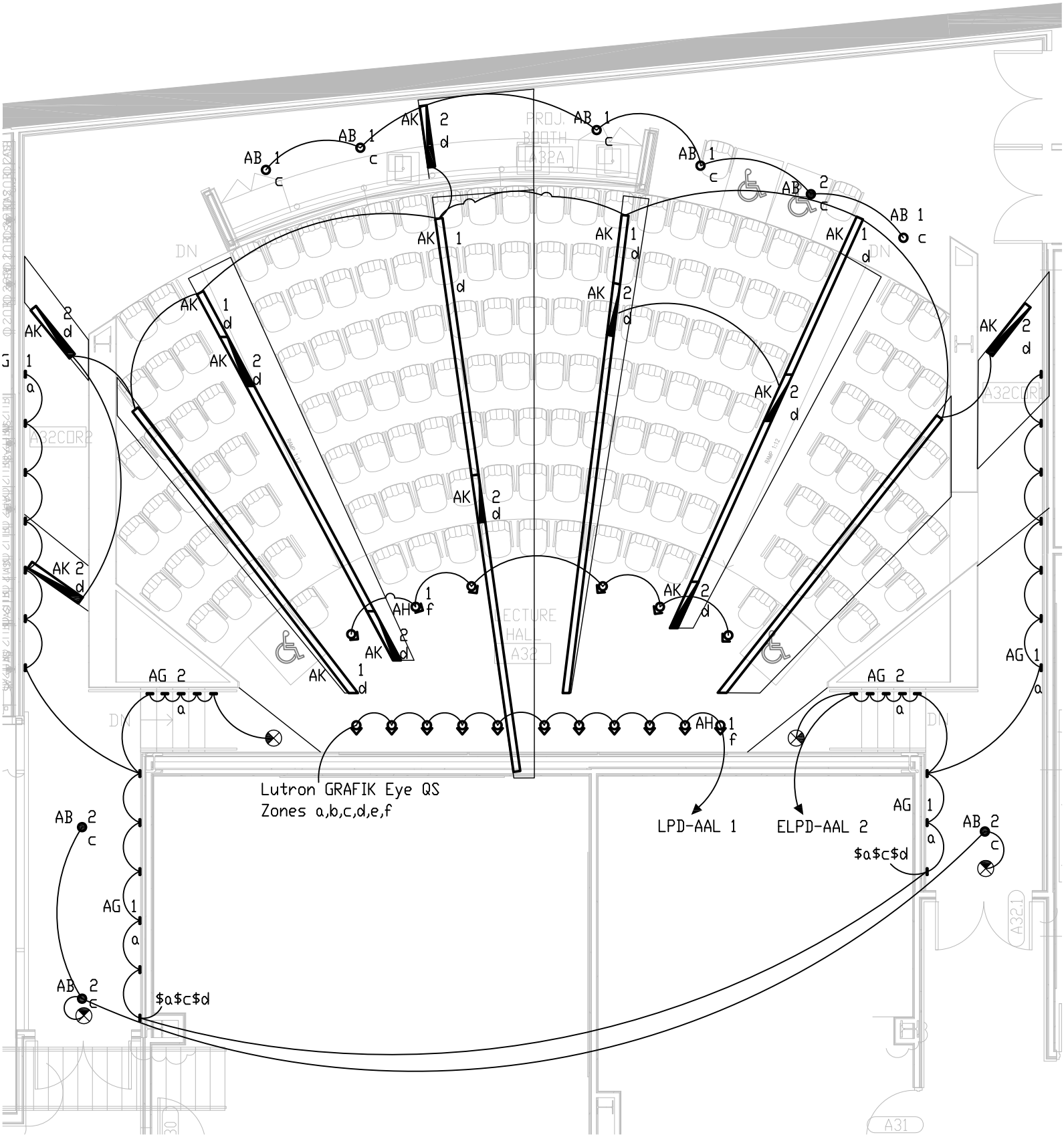
APPENDIX E



ELECTRICAL PLAN

SCALE: 3/32"= 1'-0"

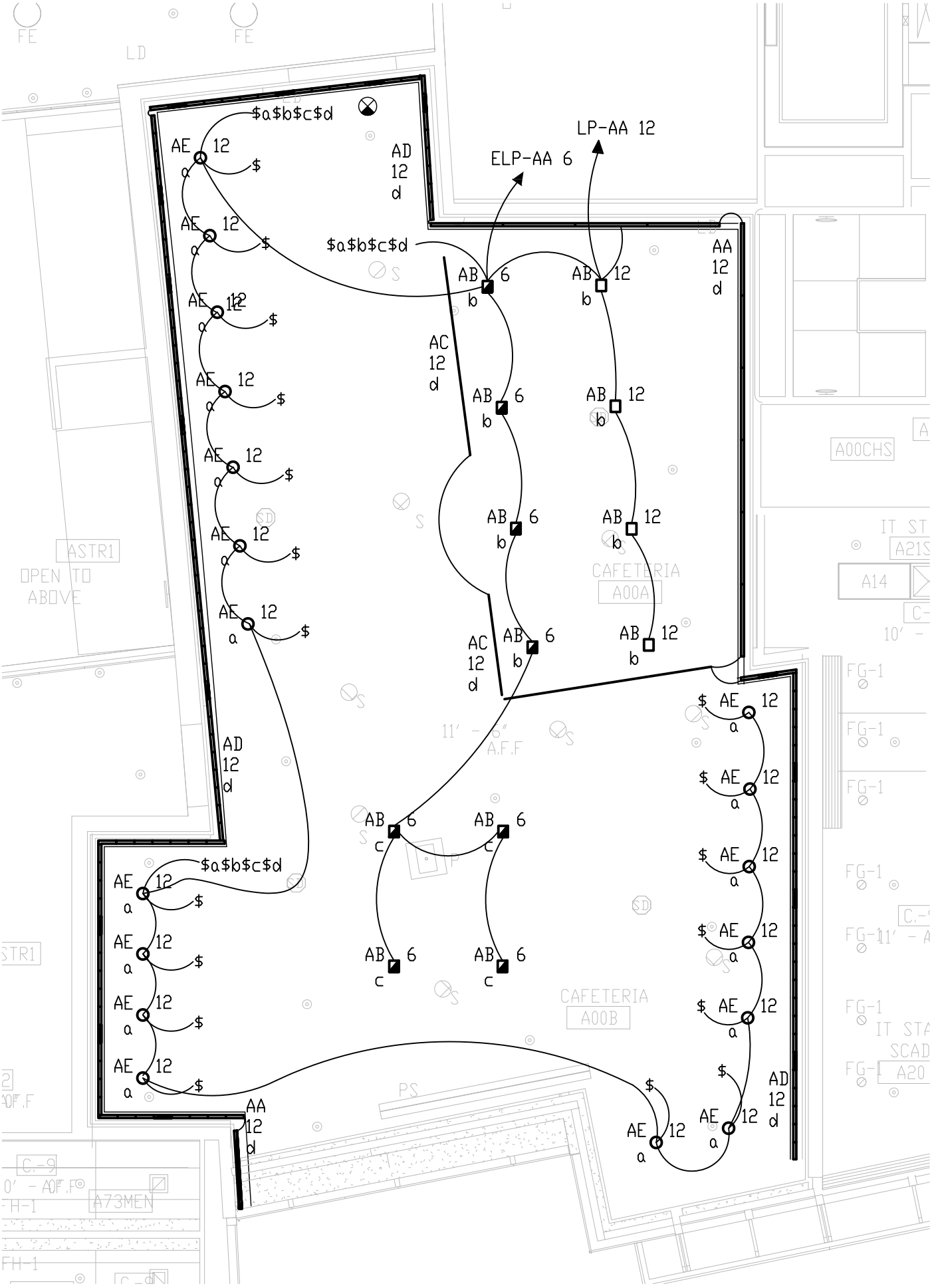
APPENDIX E



ELECTRICAL PLAN

SCALE: 1/8" = 1'-0"

APPENDIX E



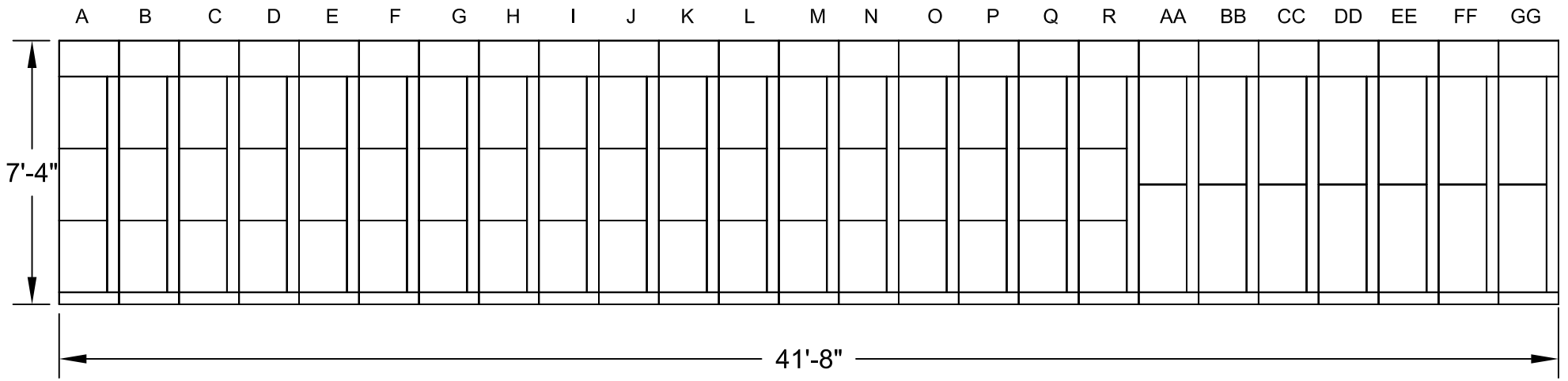
ELECTRICAL PLAN

SCALE: 1/8"= 1"-0"

APPENDIX E

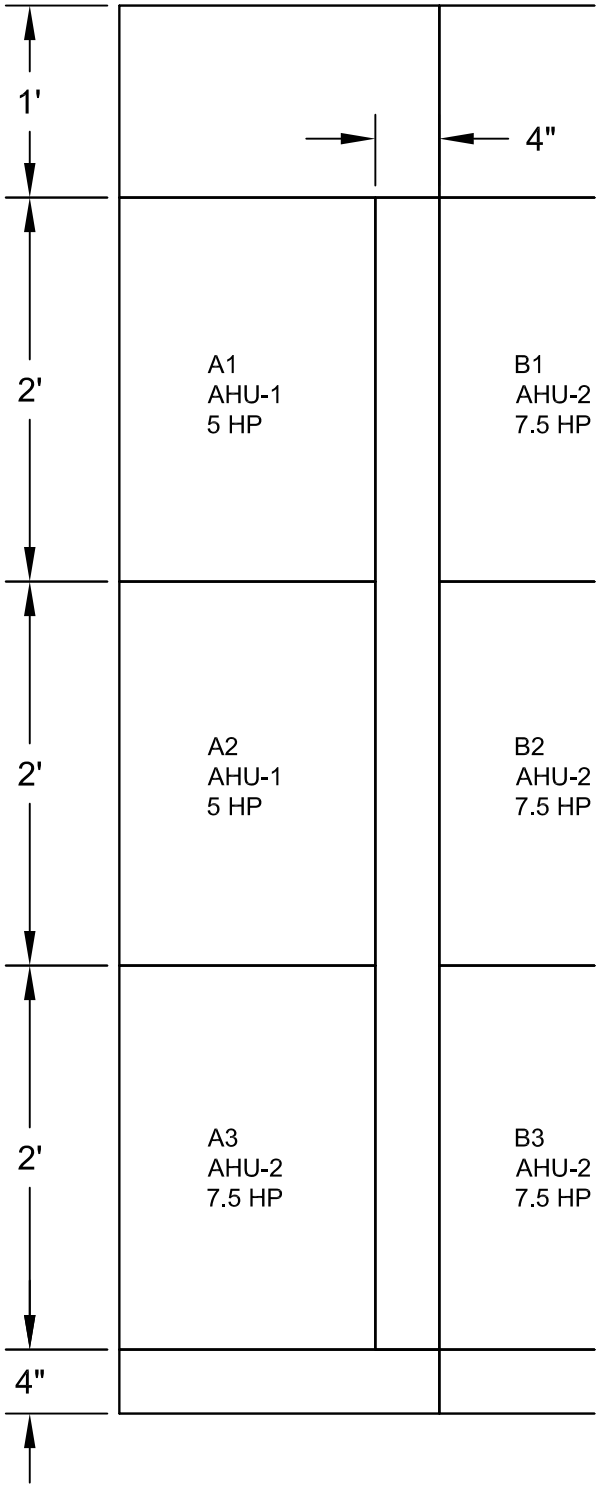
Appendix P

APPENDIX P



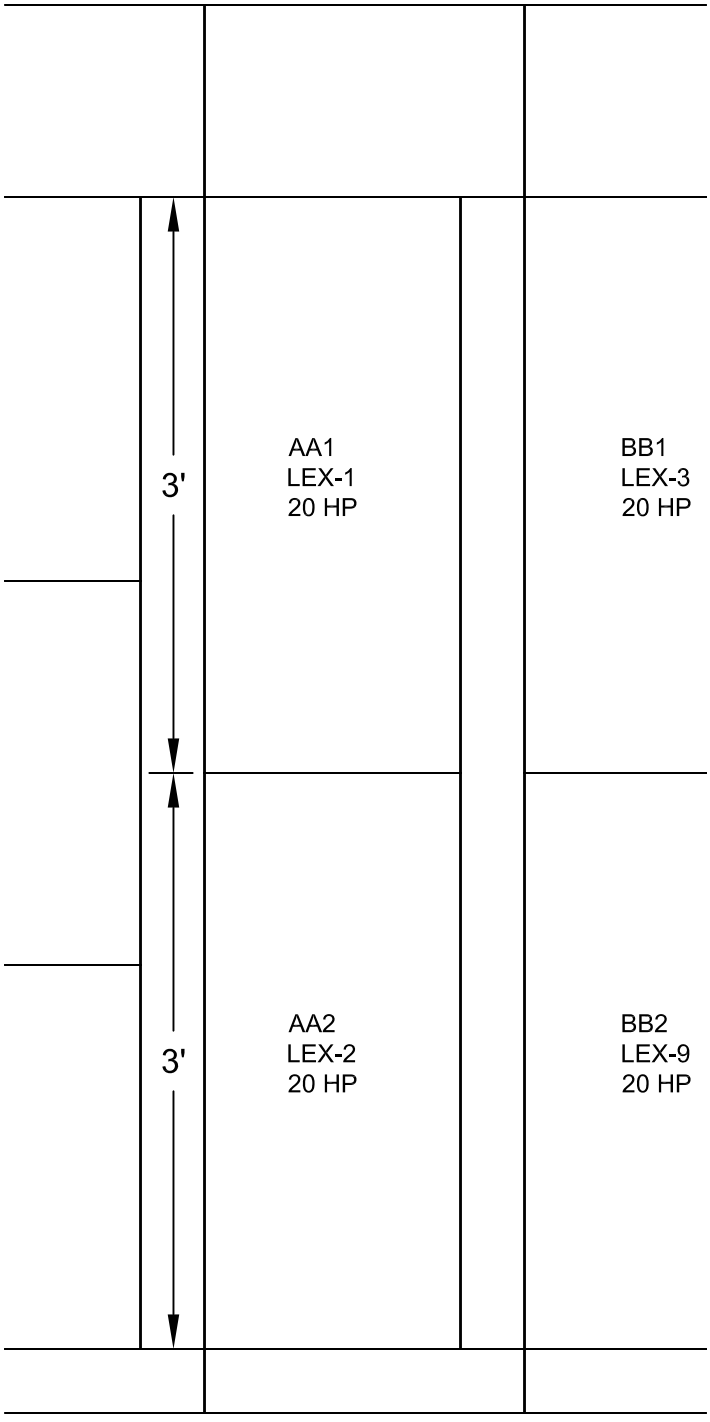
MCC ELEVATION

SCALE : NTS



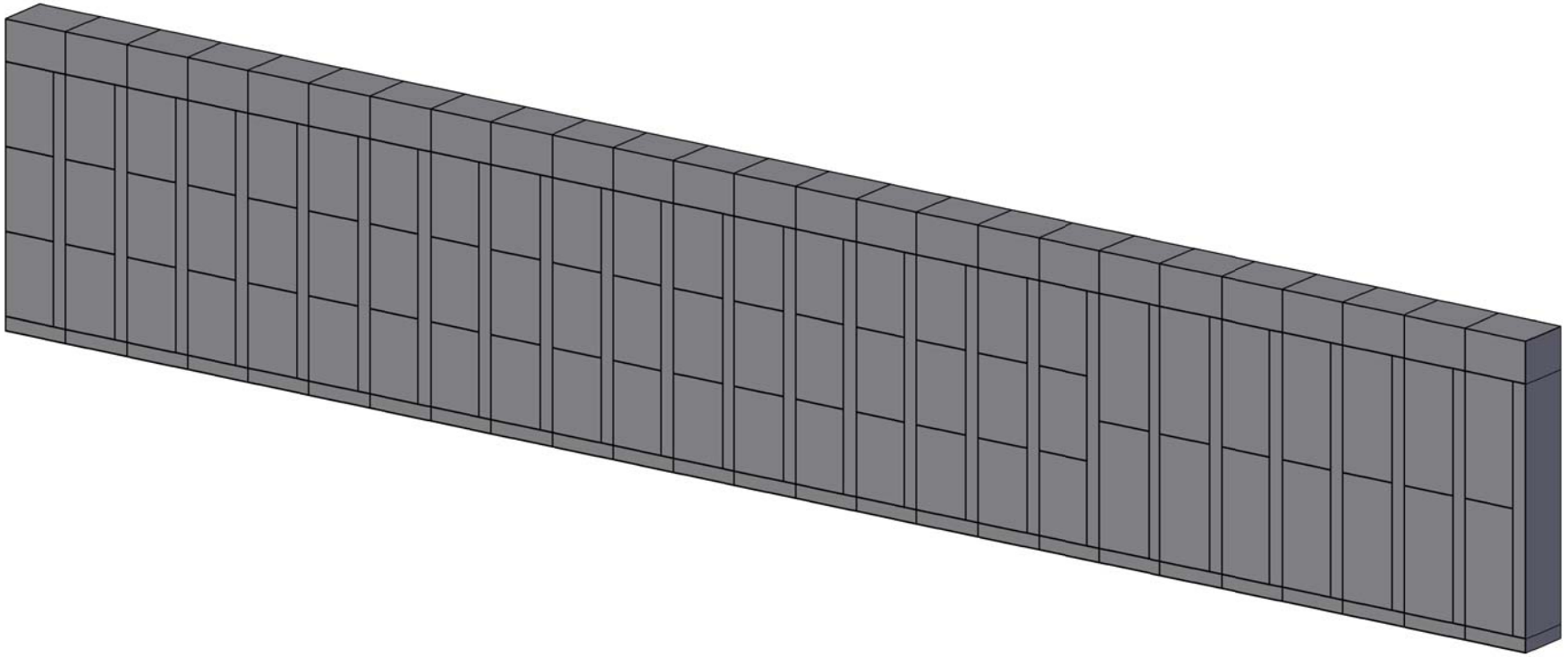
MCC ELEVATION DETAIL

SCALE : 1"=1'



MCC ELEVATION DETAIL

SCALE : 1"=1'



MCC 3D VIEW

SCALE : NTS

GE Consumer & Industrial
Electrical Distribution

AD Plus Lighting Panelboards

Catalog/Selection Guide

imagination at work

APPENDIX P

AD Plus Lighting Panelboards

Short circuit ratings	35kAIC @ 600Y/347V, 100kAIC @ 480Y/277V (fully rated)
Main bus ratings	Up to 800A UL (600A CSA)
Mains	Breaker or lug
Enclosures	NEMA 3R, 12, 4X (stainless steel)
Dimensions	20" wide x 5 3/4" deep standard, 30" wide available
Mounting	Flush or surface, concealed hardware and hinges standard, door-within-door and front-hinged-to-box options available
Approvals	UL & CSA

AD Plus Lighting Panelboards
600Vac, Factory Assembled – Three-Phase, 3-Wire/4-Wire

1. Select Interior and Main

Main Lug Interiors①④

Use E150 Line Bolt-on Branch Breakers		Single Main Lugs			Subfeed Main Lugs		
Panel Amps Max	Branch Space Required	Interior Catalog Number	**List Price, GO-101**	Size (inches)	Interior Catalog Number	**List Price, GO-101**	Size (inches)
125	0-12	ADF3121MB	**$579.00**	25.5	ADF3121SB	**$616.00**	28.5
	13-18	ADF3181MB	**633.00**	28.5	ADF3181SB	**670.00**	34.5
	19-24	ADF3241MB	**728.00**	31.5	ADF3241SB	**764.00**	37.5
	25-30	ADF3301MB	**821.00**	34.5	ADF3301SB	**858.00**	40.5
	31-36	ADF3361MB	**915.00**	37.5	ADF3361SB	**951.00**	46.5
	37-42	ADF3421MB	**1009.00**	40.5	ADF3421SB	**1046.00**	49.5
225	0-12	ADF3122MB	**648.00**	31.5	ADF3122SB	**689.00**	31.5
	13-18	ADF3182MB	**703.00**	37.5	ADF3182SB	**743.00**	37.5
	19-24	ADF3242MB	**796.00**	40.5	ADF3242SB	**836.00**	40.5
	25-30	ADF3302MB	**890.00**	43.5	ADF3302SB	**930.00**	43.5
	31-36	ADF3362MB	**984.00**	49.5	ADF3362SB	**1024.00**	49.5
	37-42	ADF3422MB	**1077.00**	52.5	ADF3422SB	**1117.00**	52.5
400	0-12	ADF3124MB	**812.00**	40.5	ADF3124SB	**907.00**	46.5
	13-18	ADF3184MB	**890.00**	46.5	ADF3184SB	**985.00**	49.5
	19-24	ADF3244MB	**976.00**	49.5	ADF3244SB	**1071.00**	52.5
	25-30	ADF3304MB	**1070.00**	52.5	ADF3304SB	**1164.00**	58.5
	31-36	ADF3364MB	**1163.00**	58.5	ADF3364SB	**1258.00**	61.5
	37-42	ADF3424MB	**1256.00**	61.5	ADF3424SB	**1351.00**	64.5
600	0-12	ADF3126MB	**953.00**	46.5	–	**–**	–
	13-18	ADF3186MB	**1033.00**	49.5	–	**–**	–
	19-24	ADF3246MB	**1120.00**	52.5	–	**–**	–
	25-30	ADF3306MB	**1214.00**	58.5	–	**–**	–
	31-36	ADF3366MB	**1308.00**	61.5	–	**–**	–
	37-42	ADF3426MB	**1401.00**	64.5	–	**–**	–
800②	0-12	ADF3128MB	**1350.00**	55.5	–	**–**	–
	13-18	ADF3188MB	**1545.00**	55.5	–	**–**	–
	19-24	ADF3248MB	**1740.00**	55.5	–	**–**	–
	25-30	ADF3308MB	**1935.00**	55.5	–	**–**	–
	31-36	ADF3368MB	**2130.00**	61.5	–	**–**	–
	37-42	ADF3428MB	**2325.00**	64.5	–	**–**	–

Service Information:
3-ph, 4w 120/208Vac
3-ph, 3w 480Vac
3-ph, 4w 480Y/277Vac
3-ph, 3w 600Vac
3-ph, 4w 600Y/347Vac
UL Listed
CSA Certified

Mains:
150A - THED, SE
225A - TFJ, SF
400A - TJJ, SG
600A - SG
800A - SK (UL only)
150-800A MLO

Branch Breakers:
15-100A 1P, 2P;
15-150A 3P
220A max. double branch (100A/120A)

Main Breaker Interiors①④

Use E150 Line Bolt-on Branch Breakers		Interrupting Rating														
		25kA 480Vac③			35kA 480Vac			65kA 480Vac			100kA 480Vac			35kA 600Y/347Vac		
Panel Amps Max.	Branch Space Required	Interior Catalog Number	**List Price, GO-101**	Sizing Dim's (In's)	Interior Catalog Number	**List Price, GO-101**	Sizing Dim's (In's)	Interior Catalog Number	**List Price, GO-101**	Sizing Dim's (In's)	Interior Catalog Number	**List Price, GO-101**	Sizing Dim's (In's)	Interior Catalog Number	**List Price, GO-101**	Sizing Dim's (In's)
150	0-12	ADF3121TB	**$974.00**	31.5	ADF3121KB	**$1174.00**	28.5	ADF3121DB	**$1644.00**	28.5	ADF3121GB	**$2160.00**	28.5	ADF3121DB	**$1644.00**	28.5
	13-18	ADF3181TB	**1028.00**	37.5	ADF3181KB	**1228.00**	37.5	ADF3181DB	**1700.00**	31.5	ADF3181GB	**2217.00**	31.5	ADF3181DB	**1700.00**	31.5
	19-24	ADF3241TB	**1121.00**	40.5	ADF3241KB	**1321.00**	40.5	ADF3241DB	**1796.00**	34.5	ADF3241GB	**2312.00**	34.5	ADF3241DB	**1796.00**	34.5
	25-30	ADF3301TB	**1215.00**	43.5	ADF3301KB	**1415.00**	43.5	ADF3301DB	**1892.00**	37.5	ADF3301GB	**2408.00**	37.5	ADF3301DB	**1892.00**	37.5
	31-36	ADF3361TB	**1309.00**	49.5	ADF3361KB	**1509.00**	49.5	ADF3361DB	**1988.00**	40.5	ADF3361GB	**2504.00**	40.5	ADF3361DB	**1988.00**	40.5
	37-42	ADF3421TB	**1400.00**	52.5	ADF3421KB	**1600.00**	52.5	ADF3421DB	**2084.00**	43.5	ADF3421GB	**2600.00**	43.5	ADF3421DB	**2084.00**	43.5
225	0-12	ADF3122TB	**1713.00**	43.5	ADF3122KB	**923.00**	43.5	ADF3122DB	**3343.00**	43.5	ADF3122GB	**3610.00**	43.5	ADF3122DB	**3343.00**	43.5
	13-18	ADF3182TB	**1767.00**	49.5	ADF3182KB	**923.00**	49.5	ADF3182DB	**3398.00**	49.5	ADF3182GB	**3664.00**	49.5	ADF3182DB	**3398.00**	49.5
	19-24	ADF3242TB	**1859.00**	52.5	ADF3242KB	**923.00**	52.5	ADF3242DB	**3493.00**	52.5	ADF3242GB	**3761.00**	52.5	ADF3242DB	**3493.00**	52.5
	25-30	ADF3302TB	**1954.00**	55.5	ADF3302KB	**923.00**	55.5	ADF3302DB	**3590.00**	55.5	ADF3302GB	**3857.00**	55.5	ADF3302DB	**3590.00**	55.5
	31-36	ADF3362TB	**2047.00**	61.5	ADF3362KB	**923.00**	61.5	ADF3362DB	**3685.00**	61.5	ADF3362GB	**3952.00**	61.5	ADF3362DB	**3685.00**	61.5
	37-42	ADF3422TB	**2140.00**	64.5	ADF3422KB	**2785.00**	64.5	ADF3422DB	**3742.00**	64.5	ADF3422GB	**4049.00**	64.5	ADF3422DB	**3742.00**	64.5
400	0-12	ADF3124TB	**2577.00**	49.5	ADF3124KB	**3410.00**	49.5	ADF3124DB	**4305.00**	49.5	ADF3124GB	**4599.00**	49.5	ADF3124DB	**4305.00**	49.5
	0-18	ADF3184TB	**2666.00**	55.5	ADF3184KB	**3499.00**	55.5	ADF3184DB	**4396.00**	55.5	ADF3184GB	**4690.00**	55.5	ADF3184DB	**4396.00**	52.5
	19-24	ADF3244TB	**2758.00**	58.5	ADF3244KB	**3591.00**	58.5	ADF3244DB	**4489.00**	58.5	ADF3244GB	**4783.00**	58.5	ADF3244DB	**4489.00**	55.5
	25-30	ADF3304TB	**2853.00**	61.5	ADF3304KB	**3686.00**	61.5	ADF3304DB	**4584.00**	61.5	ADF3304GB	**4878.00**	61.5	ADF3304DB	**4584.00**	61.5
	31-36	ADF3364TB	**2946.00**	67.5	ADF3364KB	**3779.00**	67.5	ADF3364DB	**4680.00**	67.5	ADF3364GB	**4975.00**	67.5	ADF3364DB	**4680.00**	67.5
	37-42	ADF3424TB	**3038.00**	70.5	ADF3424KB	**3871.00**	70.5	ADF3424DB	**4775.00**	70.5	ADF3424GB	**5070.00**	70.5	ADF3424DB	**4775.00**	70.5
600	0-12	–	**–**	–	ADF3126KB	**5389.00**	49.5	ADF3126DB	**6284.00**	49.5	–	**–**	–	ADF3126DB	**6284.00**	49.5
	0-18	–	**–**	–	ADF3186KB	**5480.00**	55.5	ADF3186DB	**6375.00**	55.5	–	**–**	–	ADF3186DB	**6375.00**	52.5
	19-24	–	**–**	–	ADF3246KB	**5572.00**	58.5	ADF3246DB	**6467.00**	58.5	–	**–**	–	ADF3246DB	**6467.00**	55.5
	25-30	–	**–**	–	ADF3306KB	**5666.00**	61.5	ADF3306DB	**6561.00**	61.5	–	**–**	–	ADF3306DB	**6561.00**	61.5
	31-36	–	**–**	–	ADF3366KB	**5759.00**	67.5	ADF3366DB	**6654.00**	67.5	–	**–**	–	ADF3366DB	**6654.00**	64.5
	37-42	–	**–**	–	ADF3426KB	**5851.00**	70.5	ADF3426DB	**6748.00**	70.5	–	**–**	–	ADF3426DB	**6748.00**	70.5

① Bottom feed supplied as standard. Change last character in catalog number from B to T for top feed.
② Box is 30" wide x 7.81" deep.
③ TFJ main rated 22,000AIC
④ Available up through 78 circuits CSA. Consult Speedi for more information.

For functional pricing only. Use Speedi-Win/Plus for exact quotation and order entry.

2. Select Branch Breakers

Branch Breakers – E150-Line, Bolt-on

Max. Volts	Frame	Trip	List Price Each, GO-101 Per Circuit			Frame	Trip	List Price Each, GO-101 Per Circuit		
			1 pole	2 pole	3 pole			1 pole	2 pole③	3 pole
277V	TED①②	15-60	**$76.00**	—	—	THED①②	15-30	**$90.00**	—	—
		70-100	**175.00**	—	—					
480V	TED4①②	15-60	—	**$205.00**	**$270.00**	THED4①②	15-60	—	**$263.00**	—
		70-110	—	**284.00**	**338.00**		70-110	—	**344.00**	**$765.00**
		125-150	—	—	**476.00**		125-150	—	—	—
	SEHA①②④	15-60	—	**642.00**	**747.00**	SELA①②④	15-60	—	**661.00**	**868.00**
		70-100	—	**746.00**	**849.00**		70-100	—	**856.00**	**1010.00**
		110-150	—	**1539.00**	**1930.00**		110-150	—	**1920.00**	**2280.00**
600V	TED6①②	15-60	—	**263.00**	**302.00**	THED6①②	15-60	—	—	**397.00**
		70-110	—	—	**379.00**		70-110	—	—	**447.00**
		125-150	—	—	**650.00**		125-150	—	—	**765.00**
	FBV (22 kA)	15-60	**156.18**	**218.12**	**357.27**					
		70-100	**256.88**	**302.18**	**448.36**					
	FBN (25 kA)	15-60	**181.79**	**254.00**	**415.85**					
		70-100	**299.00**	**351.88**	**521.88**					
	FBH (35 kA)	15-60	**281.66**	**383.15**	**626.95**					
		70-100	**463.25**	**530.80**	**786.80**					
	FBL (42 kA)⑤	15-60	**366.40**	**511.89**	**838.05**					
		70-100	**602.63**	**709.15**	**1051.73**					

① 220A double branch maximum (100/120A, 90/130A, etc.).
② Mounting of branch breaker in future space requires hardware kit ASPTED3P, **$83.50 List Price, GO-134B**. Provides hardware sufficient to mount (3) 1-pole or (1) 3-pole breaker.
③ Requires 3 poles of branch space.
④ Spectra branch breakers require barrier ASP25AD65KA.
⑤ Max. panel rating is 35kAIC @ 600Y/347V.

Short Circuit Current Ratings (kAIC)

C/B Frame	System Voltages		
	120Y/208V	480Y/277V	600Y/347V
TED	18	18	–
THED	65	25	18
SEHA	65	25	–
SELA	100	65	25
SEPA	100	100	25
FBV	**65**	**35**	**22**
FBN	**100**	**65**	**25**
FBH	**100**	**100**	**35**
TFJ	25	22	18
SFHA	65	35	–
SFLA	100	65	25
SFPA	100	100	25
TJJ	42	25	22
SGHA	42	25	25
SGLA	65	65	35
SGPA	100	100	35

3. Select Subfeed (if required)

Subfeed Breakers – 3 pole maximum

Max. Volts	Frame	Trip	List Price, GO-101	
			2 pole	3 pole
480V	SFHA	175-225	**$1256.00**	**$1571.00**
	SELA 4	175-225	**2297.00**	**2761.00**
600V	TFJ	110-225	**855.00**	**951.00**

4. Select Interior Options

Interior Options

Note: Sizing dimensions to be used only for estimating enclosure selection, not to determine interior length.

Options	Description	Catalog Number Option Suffix	125/150A		225A		400A		600A		800A	
			Sizing Adder	**List Price Adder, GO-101**	Sizing Adder	**List Price Adder, GO-101**	Sizing Adder	**List Price Adder, GO-101**	Sizing Adder	**List Price Adder, GO-101**	Sizing Adder	**List Price Adder, GO-101**
Optional Lugs①	Compression AL	L1	—	**$ 30.00**	—	**$ 50.00**	—	**$130.00**	—	**$175.00**	—	**—**
	Pressure CU	L2	—	**49.00**	—	**49.00**	—	**92.00**	—	**114.00**	—	**—**
	Comp. AL Oversize	L3	—	**152.00**	9"	**152.00**	—	**461.00**	—	**461.00**	—	**—**
	Press. AL Oversize	L4	—	**54.00**	9"	**54.00**	—	**330.00**	—	**330.00**	—	**—**
Subfeed Breaker	2 or 3 Pole TFJ	F1	N/A	**—**	12"	**Price by Device**	18"	**Price by Device**	18"	**Price by Device**	—	**—**
Feed Thru	Feed Thru Lugs②	T1	9"	**164.00**	9"	**164.00**	3"	**286.00**	6"	**286.00**	6"	**$451.00**
Busbar	600 APSI AL	B1	—	**595.00**	—	**595.00**	—	**759.00**	—	**—**	—	**N/A**
	750 APSI AL	B2	—	**135.00**	—	**135.00**	—	**Std.**	—	**Std**	—	**Std.**
	800 APSI CU	B3	—	**476.00**	—	**476.00**	—	**625.00**	—	**—**	—	**N/A**
	1000 APSI CU③	B4	—	**103.00**	—	**103.00**	—	**182.00**	—	**246.00**	—	**459.00**
200% Rated Neutrals④	—	N2	—	**60.00**	—	**100.00**	—	**140.00**	—	**280.00**	N/A	**N/A**
	—	N3	—	**60.00**	—	**100.00**	—	**140.00**	—	**N/A**	N/A	**N/A**

① Oversize lugs available on single main lug panels only.
② Feed thru lugs not available on subfeed or oversized main lug panels.
③ 7 For silver or tin plating 1000 APSI Cu only add $100 **List, GO-101**.
④ 200% rated neutrals in 600A panels require 30" W box.

5. Select Box and Front Options (NEMA 1 included as standard)

Front Filler Plates TEDFP1

Field installed
List Price $1.00 each, GO-101
Standard pack: 50

Box Options

Description	Box Catalog Number Suffix	List Price, GO-101
Blank Endwalls	B	①
Painted Box	P	**$160.00**
30" Wide	W	**250.00**
NEMA 3R/12	3	**950.00**
Knockout	K	①
NEMA 4X	4S	**4950.00**

① No charge if included on original order.

Front Options

Description	Front Catalog Number Suffix	List Price, GO-101
Screw Cover	C	**$61.00**
Hinged Door-in-Door	D	**110.00**
Optional Lock: Yale 511S	Y	**300.00**
Optional Lock: Corbin 15767	L	**146.00**
Nameplate	N	**27.00**
Door within a Door①	P	**238.00**
Stainless Steel Front②	S	**1467.00**
30" Wide	W	**250.00**
Screw-on nameplates	U	**74.00**
Metal directory card holder	M	**50.00**

① Consists of two lockable doors – one over panel interior and one over box wiring gutters. Yale locks not available.
② Flush only. Available with C and N options.

6. Select TVSS

TVSS Transient Voltage Surge Suppression①

Maximum Surge Current per Mode	Maximum Surge Current per Phase	Description	List Price GO-101
65kA	130kA	TVSS UL1449,UL1283	**$6350.00**
80kA	160kA	TVSS UL1449,UL1283	**$7000.00**
100kA	200kA	TVSS UL1449,UL1283	**$8500.00**
100kA	200kA	TVSS UL1449, no counter	**$2875.00**
100kA	200kA	TVSS UL1449	**$3575.00**

① For factory installed transient voltage surge suppression (TVSS) units in 10" module, add T6 suffix to interior catalog number and 10" to box height.

7. Accessories

Enclosures①

Sizing Dimensions (Inches)	Box Catalog Number	Inside Box Dim.'s (Inches)			Front Catalog Number
		Length	Width	Depth	
28.5-31.5	AB31	31.5	20	5.81	AF31F,S
34.5-37.5	AB37	37.5	20	5.81	AF37F,S
40.5-43.5	AB43	43.5	20	5.81	AF43F,S
46.5-49.5	AB49	49.5	20	5.81	AF49F,S
52.5-55.5	AB55	55.5	20	5.81	AF55F,S
57.5-64.5	AB64	64.5	20	5.81	AF64F,S
67.5-76.5	AB76	76.5	20	5.81	AF76F,S

Flush fronts are 1.5 inches larger than box. Surface fronts are .25 inches larger than box.

① Box supplied as standard for 225A 150kA and 400A 65 and 100kA ratings is 7.81 inches deep, when used with THLC.

AD Plus Lighting Panelboards

Accessories – Field Installed Kits/Replacement Parts

Enclosures①

Panel Size	Box Catalog Number	Box Size Inches②	**List Price③, GO-134B**	Front Catalog Number④	**List Price③, GO-134B**
0-25.5	AB25B	25.5	**$166.00**	AF25F,S	**$170.00**
28.5-31.5	AB31B	31.5	**170.00**	AF31F,S	**174.00**
34.5-37.5	AB37B	37.5	**182.00**	AF37F,S	**191.00**
40.5-43.5	AB43B	43.5	**204.00**	AF43F,S	**218.00**
46.5-49.5	AB49B	49.5	**233.00**	AF49F,S	**257.00**
52.5-55.5	AB55B	55.5	**261.00**	AF55F,S	**299.00**
57.5-64.5	AB64B	64.5	**286.00**	AF64F,S	**326.00**
67.5-76.5	AB76B	76.5	**324.00**	AF76F,S	**367.00**

Box Options

Description	Box Catalog Number Suffix⑤	**List Price, GO-101**
7.81 deep⑥	D	**$200.00**
Painted Box	P	**200.00**
30" Wide⑦	W	**250.00**
NEMA 3R/12	3	**950.00**

Front Options

Description	Front Catalog Number Suffix⑧	**List Price, GO-101**
Screw Cover	C	**$61.00**
Front hinged to box	D	**110.00**
Optional Lock: Yale 5116 w/Rosette	Y	**300.00**
Optional Lock: Corbin 15767	L	**146.00**
Door within a Door⑨	P	**238.00**
Stainless Steel⑩	S	**1467.00**
30" Wide	W	**82.00**
Nameplate	N	**27.00**
Screw-on nameplate	U	**74.00**
Metal directory	M	**50.00**

① "B" suffix provides blank end walls. Order "K" suffix for endwalls with knockouts.
② Standard boxes are 20" wide by 5.81 inches deep.
③ Use when ordering items separately for replacement. Do not deduct from panel list price to obtain interior only pricing.
④ Flush fronts are 11/2" larger than box. Surface fronts are 1/4" larger.
⑤ Add to base box catalog number.
⑥ K frame main only.
⑦ Includes field installable gutter barrier.
⑧ Add to base front catalog number.
⑨ Consists of two lockable doors – one over panel interior and one over box wiring gutters. Yale locks not available.
⑩ Flush only. Available with C and N options.

Box Extensions

Bolts to box with or without endwall inplace. Extensions can be combined.

Box Width and Depth	Box Mounting	Box Extension Length (Inches)	Box Extension Catalog Number	**List Price, GO-101**
20 x 5.81	Flush	9	ABX2509F	**$145.00**
		18	ABX2518F	**167.00**
		24	ABX2524F	**194.00**
	Surface	9	ABX2509S	**145.00**
		18	ABX2518S	**167.00**
		24	ABX2524S	**194.00**
		31	ABX2531S	**220.00**
		37	ABX2537S	**240.00**
		43	ABX2543S	**271.00**
		49	ABX2549S	**311.00**
		55	ABX2555S	**358.00**
		64	ABX2564S	**353.00**
		76	ABX2576S	**440.00**
20 x 7.81	Flush	18	ABX2718F	**184.00**
		24	ABX2724F	**206.00**
	Surface	18	ABX2718S	**184.00**
		24	ABX2724S	**206.00**
30 x 5.81	Flush	18	ABX3518F	**194.00**
		24	ABX3524F	**223.00**
	Surface	18	ABX3518S	**194.00**
		24	ABX3524S	**223.00**
30 x 7.81	Flush	18	ABX3718F	**223.00**
		24	ABX3724F	**250.00**
	Surface	18	ABX3718S	**223.00**
		24	ABX3724S	**250.00**

Box Extensions Covers Only – 10 covers per kit

Description	Catalog Number	**List Price, GO-101**
9" Covers Surface	ASPABX09S	**$145.00**
9" Covers Flush	ASPABX09F	**155.00**
18" Covers Surface	ASPABX18S	**285.00**
18" Covers Flush	ASPABX18F	**300.00**

AD Plus Lighting Panelboards

Accessories – Field Installed Kits/Replacement Parts *(continued)*

Filler Plates

Breaker Type	Catalog Number	**List Price**
THQB, THHQB, THQL, THHQL, TEY	TQLFP1	**$2.50 (GO-137A)**
TQD, THQD, TED4	TEDFP1	**1.00 (GO-101)**

Breaker Mounting Hardware Kits

Use to mount breaker in existing space.

Breaker Type	Catalog Number	**List Price, GO-134B**
TED, THED4	ASPTED3P	**$83.50**
TQD, THQD	ASPTQD3P	**83.50**

Endwall Kits

1 each, field installed, for standard 20"W x 5.81"D boxes.

Description	Catalog Number	**List Price, GO-134B**
Blank	ABEW2	**$31.00**
Knockout	ASKEW2	**21.00**

Panelboard Parts

Description	Catalog Number	**List Price, GO-101**
Directory Card	139C5612P1	**$ 2.00**
Replacement Panel Lock	569B737P1	**22.00**
Additional Keys for Above Lock	569B737P5	**2.00**
Circuit Numbering Strips 1-48	569B806G1	**4.00**
Circuit Numbering Strips 49-84	569B806G2	**4.00**
Circuit Numbering Strips 85-120	569B806G3	**4.00**
Adhesive Backed Lamicoid Nameplate 1 in. x 3 in.	315A7190P1	**27.00**
Metal Directory Card Holder	139C5491G1	**50.00**
Directory Card Holder	139C5491P4	**10.00**
Screw and Clip Kit to Convert Up to 12 Poles of Old Style THQB Breakers to Captive Screw Construction	139C5703G20	**5.00**
Delta Hi-leg Conversion Kit to Add B-Phase to Plug on AL Panels	APHBL	**60.00**
Delta Hi-leg Conversion Kit to Add B-Phase to Bolt on AE/AQ Panels	APHBQ	**60.00**
NEMA 3R/12 Tamper Proof Tork Screw Kit	NEMATRX	**30.00**
2P to 3P TQD Conv. Kit	ASP2PTQD3P	**100.00**
2P to 3P TFJ Conv. Kit for horizontal subfeed	ASP2PTFJ3P	**100.00**
125/225A MLO Dual Lug Kit	ASPFT225	**100.00**
Barrier Kit①	ASP25AD65KA	**100.00**
Service Entrance Kit	ASPSERENT	**50.00**

① Included in factory assembled panels. Panels retrofitted with Spectra branch breakers require barrier kit.

Permanent Circuit Number Kits

Description	Catalog Number	**List Price, GO-134B**
Numbers 1-48	APN48AD	**$116.00**
Numbers 49-84	APN84AD	**116.00**

GE Consumer & Industrial
Electrical Distribution

A-Series AD Plus Lighting Panelboard

- **As little as 1/3 the size and price of prior offering**
- 35kAIC @ 600Y/347V (fully rated)
- 100kAIC @ 480Y/277V (fully rated)
- 1, 2 and 3 pole current limiting Record Plus FB branch breakers
- Double branch rated at 220A (UL & CSA)
- Up to 78 circuits in single section (CSA)

imagination at work

GE introduces AD Plus – the first A-Series panel that incorporates a specially designed line of 1, 2 & 3 pole current limiting Record Plus FB circuit breakers. With high-tier interrupting ratings (fully rated) of 35kAIC @ 600Y/347V and 100kAIC @ 480Y/277V, this offering meets or exceeds that of all major makers in both the Canadian and US markets. It is an ideal choice for all commercial and industrial project construction.

Before
Spectra Series Panel

After
AD Plus Panel

The lighting panel you need – in 1/3 the space, for 1/3 the cost!

Short circuit ratings	35kAIC @ 600Y/347V, 100kAIC @ 480Y/277V (fully rated)
Main bus ratings	Up to 800A UL (600A CSA)
Mains	Breaker or lug
Enclosures	NEMA 3R, 12, 4X (stainless steel)
Dimensions	20" wide x 5 3/4" deep standard, 30" wide available
Mounting	Flush or surface, concealed hardware and hinges standard, door-within-door and front-hinged-to-box options available
Approvals	UL & CSA

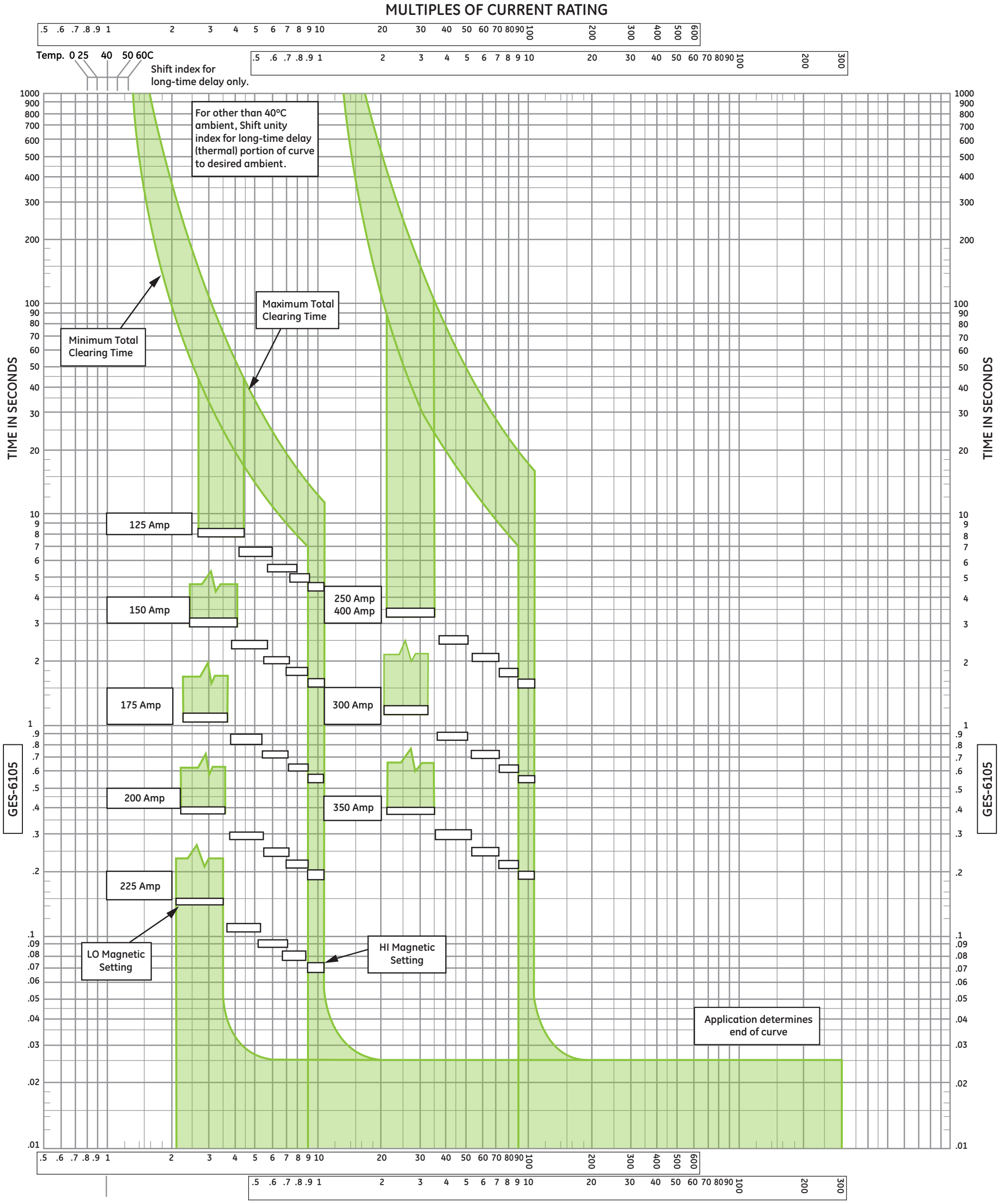
For more information

A-Series AD Plus Catalog/Selection Guide	DEP-134
Record Plus FB 100 Circuit Breakers Catalog/Selection Guide	DEP-131
Record Plus FB 100 Circuit Breakers Fact Sheet	DET-406

GE Consumer & Industrial
41 Woodford Avenue, Plainville, CT 06062
www.GEindustrial.com

imagination at work

APPENDIX P



GE Consumer & Industrial - Electrical Distribution

Current Ratings

125, 150, 175, 200, 225, 250, 300, 350, and 400 Amperes

Voltage Ratings

600 Vac, 250 Vdc

Frequency Ratings

Dc or 60 cycles

Molded Case Circuit Breaker K 1000 LINE

Types TKM & THKM (125–400 Amperes)

Long-time Delay and Instantaneous Time-current Curves

Curves show circuit breaker in open air, 40°C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use rating shift index at top of sheet.

GES-6105

Adjustments

Long-time delay thermal trip: not adjustable.

Instantaneous magnetic trip, five settings, factory set on HI. Blocks show trip range at each setting.

APPENDIX P

MULTIPLES OF CURRENT RATING

.5 .6 .7 .8 .9 1 2 3 4 5 6 7 8 9 10 20 30 40 50 60 70 80 90 100 200 300 400 500 600

Temp. 0 25 40 50 60 C — Shift index for long-time delay only

.5 .6 .7 .8 .9 1 2 3 4 5 6 7 8 9 10 20 30 40 50 60 70 80 90 100 200 300

For other than 40 C ambient, shift unity index for long-time delay (thermal) portion of curve to desired ambient.

TIME IN SECONDS

1000 900 800 700 600 500 400 300 200 100 90 80 70 60 50 40 30 20 10 9 8 7 6 5 4 3 2 1 .9 .8 .7 .6 .5 .4 .3 .2 .1 .09 .08 .07 .06 .05 .04 .03 .02 .01

Minimum Total Clearing Time

Maximum Total Clearing Time

125 Amp

150 Amp

175 Amp

200 Amp

225 Amp

250 Amp

400 Amp

300 Amp

350 Amp

LO Magnetic Setting

HI Magnetic Setting

Application determines end of curve

GES-6105

.5 .6 .7 .8 .9 1 2 3 4 5 6 7 8 9 10 20 30 40 50 60 70 80 90 100 200 300 400 500 600

.5 .6 .7 .8 .9 1 2 3 4 5 6 7 8 9 10 20 30 40 50 60 70 80 90 100 200 300

MULTIPLES OF CURRENT RATING

GENERAL ELECTRIC

MOLDED-CASE CIRCUIT BREAKERS

K-1000 LINE

Types TKM and THKM (125–400 Amperes) Long-time Delay and Instantaneous Time-current Curves

(Curves show circuit breaker in open air, 40 C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients use rating shift index at top of sheet.)

GES-6105

Current Ratings
125, 150, 175, 200, 225, 250, 300, 350 and 400 Amperes

Voltage Ratings
600 Volts, A-c (250 Volts, D-c)

Frequency Ratings
D-c or 60 Cycles

Adjustments

Long-time delay thermal trip: not adjustable.

Instantaneous magnetic trip, five settings, factory set on HI. Blocks show trip range at each setting.

2-62 (3M)

CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN.

K215-16C