KRISTIN MARUSZEWSKI

SENIOR THESIS
SPRING 2008

ST FRANCIS FRIARY

ADVISOR: DR. HOUSER
DUE: APRIL 9, 2008

†KRISTIN MARUSZEWSKI
†LIGHTING/ELECTRICAL CONCENTRATION
†THESIS 2007/2008

ST. FRANCIS FRIARY

Project Description

Size: 59,962 SF
Levels: 2
Construction: Summer 2008
Delivery Method: Design – Bid - Build

Project Team

Owner: Father Dominic
Architect: Franck, Lohsen, McCrery
Structural Engineer: Spiegel, Zamecnik & Shah, Inc
MEP Engineer: META Engineering

Structural

5” Concrete slab on metal decking poured on site.
Concrete load bearing walls with steel reinforcement.
Roofing is composed of Steel and Wood Trusses exposed in the Chapel and Refectory.

Mechanical

8-Air Handling Units on lower level supply 4380 CFM O.A. Under the slab system. The supply ductwork runs below the floor, allowing for flexibility in design, i.e. the exposed truss system in the Chapel and Refectory.

Electrical

Primary Service. Cullman Electric Power is stepped down by a single transformer to distribute power throughout the building at 208/120V.
Emergency Service. A 125 KW Standby Generator serves the receptacles, lighting, and mechanical equipment for the Chapel, Kitchen, and Corridors.

Lighting

Exterior Lighting. Metal Halide floodlights wash the façade while Incandescent spotlights accent landscape features.
Interior Lighting. Layers of Incandescent/Fluorescent light provide ambient and decorative lighting in the main spaces.

Special Features

Landscape Architecture. Statues of the Stations of the Cross positioned along an arced walkway surrounding the Chapel provide the Friars with a quiet escape from everyone but God.

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EXECUTIVE SUMMARY

LIGHTING DEPTH

The lighting depth explores a redesign of the current lighting systems for four of the main spaces in the friary. Though the current design is a good solution to the spaces, the redesign will approach the challenge of lighting these spaces from a different angle. The redesign will cover the following spaces: the library, the foyer to the chapel, the chapel itself, and the courtyard that surrounds the chapel on three sides.

ELECTRICAL DEPTH

The electrical depth determines the impact of the proposed lighting redesign as well as the mechanical redesign on the electrical load. This is used to determine whether the current electrical equipment is adequate or whether it will need to be resized. A short circuit analysis was completed for a single path from the main distribution equipment to a local panelboard to ensure that the AIC ratings on each piece of equipment are adequate. The study also includes looking at cost savings associated with changes in feeder material.

MECHANICAL BREADTH

The current mechanical system utilizes a four pipe system with a centralized chiller and boiler serving the air handling and fan coil units. A geothermal system is investigated in the mechanical breadth in place of this existing system. The implementation of a geothermal heat pump system could allow for the elimination of the chiller and boiler and the addition of heat pumps which results in a lessened electrical load. The mechanical breadth looks at this advantage and determines what the extent of the benefits are of the geothermal system in terms of lowered electrical load and emissions. The goal of this section is to prove that a more environmentally conscious system may be advantageous to the owner.

CONSTRUCTION MANAGEMENT BREADTH

The construction management breadth continues the study of the geothermal heat pump system. This portion develops a study of the potential benefits of a horizontal piping configuration to support the geothermal heat pumps verses a vertical configuration. Identifying vertical boring as the most appropriate solution, the construction management breadth then determines what implications this will have on the site. The last item developed in the construction management study was the time difference required to construct a geothermal system as opposed to the current system.

PROJECT BACKGROUND

St. Francis Friary is a friary located in Hanceville, Alabama. By definition a friary is a building that houses a room reserved for prayer as well as domestic quarters and a workplace for friars. This friary in particular was designed to house 20-30 Franciscan Friars. There are a variety of spaces in this building including those necessary to meet all the typical living accommodations as well as offices, a chapel, study, gathering space, courtyard, and library. The building is a box shaped configuration with a courtyard cut out of the middle. The grand chapel juts out of the east side of the building and is surrounded by a second courtyard on three side. The friary is located in a very remote location allowing the friars to be secluded from the remainder of the world. The chapel is a holy place set apart for the Friars to have one focus, worshipping their God. The project design for this building is complete. The site has been cleared, however, construction has not begun and is not anticipated to do so until the summer of 2008 due to funding shortfalls.

BUILDING STATISTICS

PROJECT BACKGROUND INFORMATION

Project Name:	St. Francis Friary
Location:	2100 County Road
	Hanceville, Alabama
Building Occupant:	Archdiocese
Occupancy Type:	Mixed Use: A-3 Assembly, R-2 Residential
Size:	59,962 square feet, 2 stories above grade

PROJECT DESIGN TEAM

Architect:	Franck, Lohsen, McCrery Architects
Structural Engineer:	Spiegel, Zamecnik, & Shah, Inc.
MEP Engineer:	Meta Engineers

PROJECT DESIGN INFORMATION

ARCHITECTURE:

The Friary was designed to house 20-30 friars. While including all the necessary accommodations for living, the friary still gives the impression of seclusion and holiness. The building consists of a variety of spaces laid out on two floors. The first floor contains offices, a kitchen and refectory, mailroom, and an exercise room as well as three of the spaces studied in the lighting depth. These spaces include the library, foyer to the chapel, and the chapel itself. The second floor contains the bedrooms referred to as “cells”, a gathering space, music room, laundry room and study area. These two floors were designed to surround an inner courtyard. This inner courtyard is divided into four quadrants allowing for more privacy as well as displaying the statue of St. Pascal in the center. Leading off of the inner courtyard is the foyer that leads to the chapel. The chapel, a multi-story space, is the main focus of the friary and thus the architectural design reflects the importance. High quality materials of fieldstone, mahogany, and travertine were used throughout the space. The chapel has exits to the exterior on both the North and South walls. These exits open onto a clay paver sidewalk that travels through a courtyard to the perimeter of the site. At the perimeter of the site stand twelve statues of the stations of the cross.

MAJOR BUILDING CODES:

ACI 318 “Building code requirements for reinforced concrete”

2003 International Building Code(IBC)

2003 International Energy Conservation Code (IECC)

2002 National Electric Code (NEC)

2002 National Fire Protection Association Standard (NFPA)

BUILDING STATISTICS

MAJOR BUILDING CODES(CONT'D.):

TMS 402/ACI 530/ASCE 5 "Building Requirements for Masonry Structure

BUILDING ENVELOPE:

The floors are concrete slab poured on site with metal decking, steal beams and girders. Walls are 10" thick CMU masonry with 32" OC #6 vertical reinforcement. The façade is stone for the interior spaces of higher importance, the main foyer, the chapel, and the refectory. The remainder of the building façade is stucco. A light gage cold-formed steel truss system is used for the room with tongue and groove plywood sheathing below the

ELECTRICAL:

The primary service is delivered by Cullman Electrical Cooperative and stepped down to 208Y/120V and distributed throughout the entire friary. This 208Y/120, 3PH, 4W system feeds the panelboards which serve the lighting, receptacles, heating and cooling equipment, kitchen equipment, elevator, and general electrical loads. An automatic transfer switch located in the main electrical room in the basement switches to emergency power in the event of a failure of the main distribution equipment. The 125 KW generator is powered by natural gas and a 12V battery start-up motor. The emergency power serves the receptacles, lighting, and mechanical equipment for the chapel, kitchen and corridors.

LIGHTING:

The interior lighting in the friary is comprised of incandescent and fluorescent lamps. This provides a warm and welcoming appearance to the spaces. The bronze colored fixtures give the atmosphere a rustic and antique feel. The exterior lighting uses metal halide to provide a crisp and cool light to wash the stone façade while incandescent spotlights accent the statues of the stations of the cross.

CONSTRUCTION:

The delivery method of the construction of the friary is design-bid-build. The site was cleared for construction by October of 2006. The project was put on hold due to funding and is anticipated to continue the summer of 2008.

MECHANICAL:

The mechanical system was designed to cause the least interference with the other design options. A central chiller is located on the southeast corner of the site and serves chilled water to the AHUs and FCUs throughout the building. A natural gas powered boiler also serves the AHUs and FCUs. The system is a 4-pipe system which allows for more flexibility in heating and cooling throughout the building.

BUILDING STATISTICS

STRUCTURAL:

The building façade is a mixture of stone and stucco. The stone is presented in the main, grand spaces while the stucco fills in for the less important areas. This creates a way to express the importance of the interior spaces by the composition of the exterior. The flooring is 5" slab on metal decking, the load bearing walls are concrete with steel reinforcement. Steel and wood trusses exposed in the chapel and refectory make up the roof system.

FIRE PROTECTION:

The fire protection system in the St. Francis Friary consists of flow and tamper switches, fire alarm pull stations at all the exits, integrated strobes and speakers, fireman's telephones by elevators in stairways and in the electric room, cut smoke detectors, exit signs, and emergency lighting in the corridors.

TRANSPORTATION:

One elevator is provided in the southeast corner of the building. The elevator is fed by the main switchboard distribution panel protected by a 350A trip. It travels between the basement, first and second floors.

TELECOMMUNICATIONS:

The telecom is pulled through the basement main mechanical room. The 4" PVC telecom conduit pull wire is stubbed at the property line for the local telecommunications company to provide. It is pulled through the mechanical room then under the slab to the first floor.

LIGHTING

INTRODUCTION

St. Francis Friary is a dwelling place as well as an area of worship. The four spaces chosen for redesign are the Foyer, Library, Chapel, and Courtyard. Each space is unique in the attributes it offers to the friary. The original design was well done making it difficult to identify potential improvements. The redesign therefore focuses on providing alternative approaches for the owner to consider.

The redesign looks at each space with the intent of drawing to the surface the meaning and reality of each space's function. As such, the library was designed to offer a space secluded from the remainder of the building and provide adequate illumination to aid in writing, reading and locating reference material. The architecture in the library provides the comfortable atmosphere and hence was the main focus of the library design. The foyer was designed to provide circulation as well as create a feeling of anticipation for the main event space, the chapel. The chapel was designed to represent purity. The light was designed to be shared with the incomers without distracting from any of the space's beauty. Thus, an attempt was made to hide all sources from view. Upon exiting the chapel, the courtyard provides an exterior area of refuge. The design in this haven focuses on a feeling of safety and security. In addition, the lighting is used to present the statues of Jesus on the cross in honor of his sacrifice.

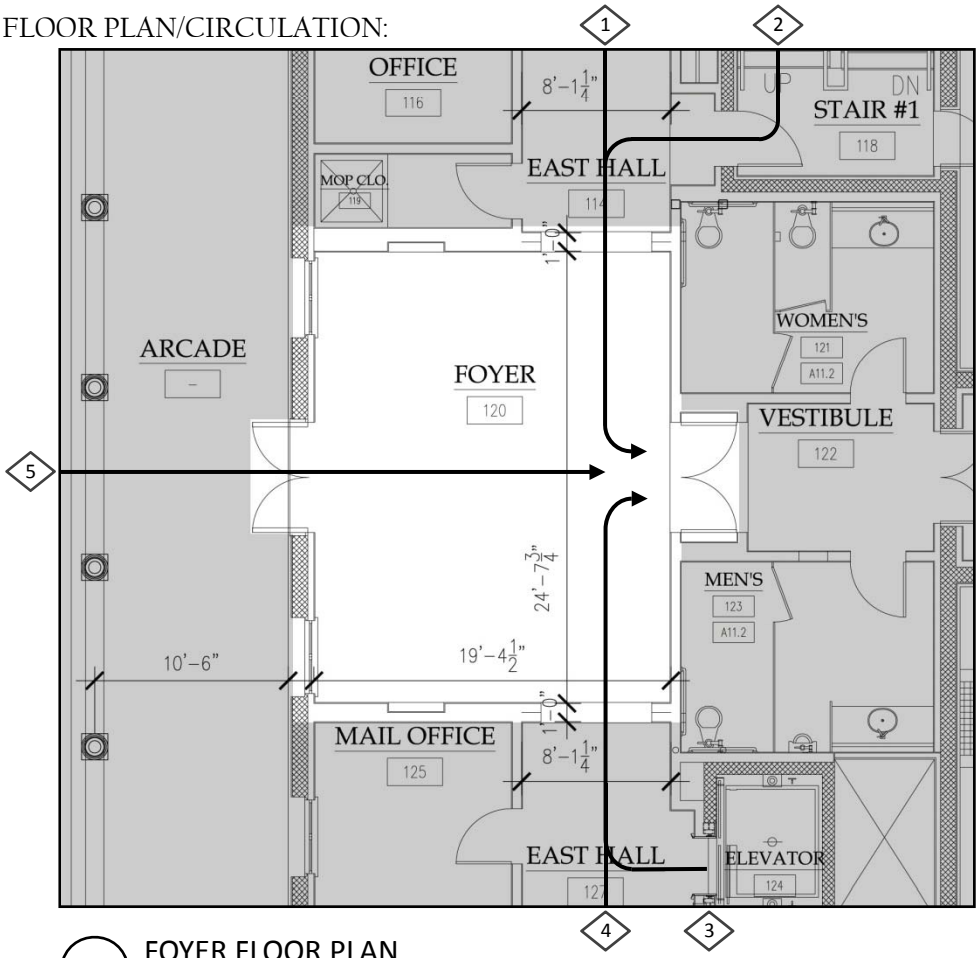
The following depth will present each space, its characteristics, and the design chosen to portray the interpretation of the space's function.

LIGHTING

DESCRIPTION:

The foyer is a rectangular shaped space located on the centerline of the east side of the friary. Used as a means of circulating traffic from all areas of the friary into the chapel, the foyer serves the inner courtyard on the west and the east hall coming from both the north and south. The majority of traffic will be coming from the stairwell and the elevator serving the 2nd floor cells, located on opposite sides of the foyer in the east hall. The foyer is more than double the width of the hallway and the ceiling height is raised four inches. From the viewpoint of the hall, the main focal point will be the grand mahogany entrance to the chapel along the east wall. Upon entering the foyer, the other focal points include the paintings on the north and south walls and the views to the inner courtyard. The circulation, dimensions, focal points, and materials of the foyer and adjacent spaces are shown in more detail below.

FLOOR PLAN/CIRCULATION:



FOYER FLOOR PLAN

SCALE: NONE

1. Offices, Main Foyer
2. Stairs to 2nd Floor Cells
3. Elevator to 2nd Floor Cells
4. Library, Refectory
5. Inner Courtyard

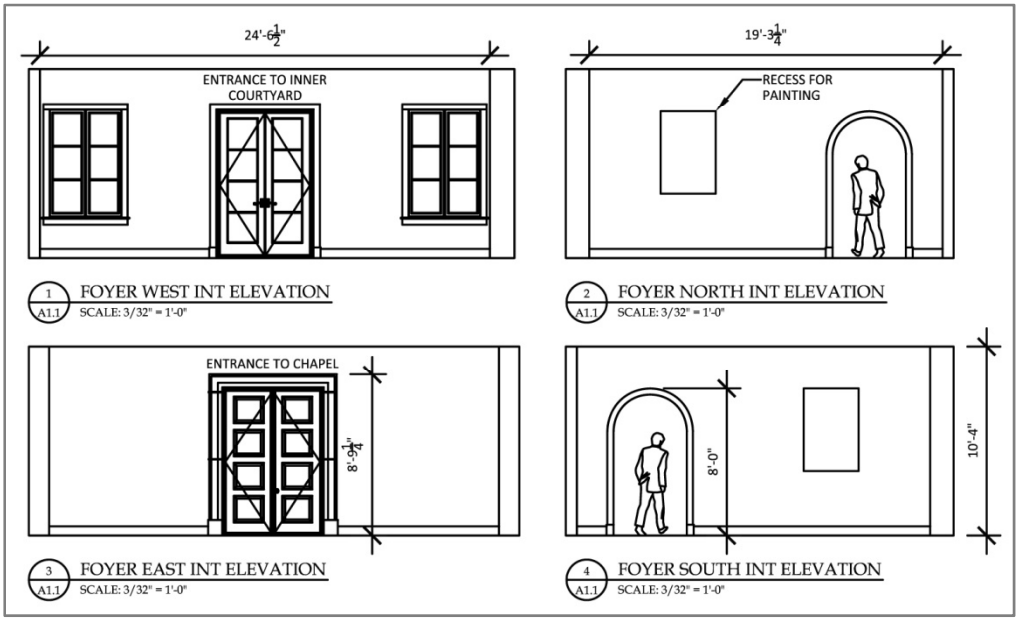
LIGHTING

DIMENSIONS:

	FOYER	EAST HALL	VESTIBULE
North-South 24’ 6 ½”	-	8’ 1 ¼”	
West-East 19’ 4 ½”	8’ 1 ¼”	-	
Ceiling Height	10’ 4”	10’ 0”	10’ 0”
Floor Area 476 ft^2	-	-	

FOCAL POINTS:

West Elevation	View to the inner courtyard through windows and glass door
North Elevation	Recess in wall for painting
East Elevation	Grand mahogany entrance to the vestibule to the chapel
South Elevation	Recess in wall for painting



FOYER INTERIOR ELEVATIONS

SCALE: 3/32”=1’-0”

MATERIALS/REFLECTANCES:

The materials used in the Foyer are continued from the east hall into the foyer and vestibule. The properties of these materials are shown below:

Surface	Material	Reflectance
Ceiling	Benjamin Moore Paint: Wood Ash	0.88
Wall	Benjamin Moore Paint: Stone House	0.73
Woodwork	Honduras Mahogany	0.05
Flooring	Cork Polyurethane Finish	0.43

LIGHTING

(Very Important)

MODELING OF FACES AND OBJECTS

Upon exiting the chapel, the foyer becomes not just a means of travel, but a gathering space as well. Good facial modeling, achieved by using several layers of light and a vertical illuminance is essential as the friars converse, fellowship, and interact with one another.

POINTS OF INTEREST

The main focal point in the foyer is the entrance to the chapel along the east wall. Higher illuminance levels will be needed to draw attention to and direct traffic to the main door to the vestibule and into the chapel. Paintings on the north and south wall should also be highlighted as a means of decoration.

POWER ALLOWANCE

According to ASHRAE 90.1- 2004 Energy Standard for Building's Space-by-Space method, the allowable power density for a foyer is 1.1 W/ft^2.

PSYCHOLOGICAL ASPECTS

The foyer will serve two purposes. On the way into the chapel, the foyer will be used for circulation. Thus, the lighting will be used as a directional element with a higher illuminance level near the entrance, preparing the friars to move onto the next space. Upon exiting the chapel, the foyer will serve as a place of gathering. During this time, the lighting should create a comfortable and inviting space with a uniform distribution throughout the foyer. One lighting design should be used to bring across both scenes.

SHADOWS

The windows and glass door allow for sunlight to enter the west side of the space during the day, though some will be blocked by the covered walkway that runs parallel to these windows. As the highest importance in the hierarchy of the space, the entrance to the chapel on the opposite wall should not be in shadow. In addition, when there is no sunlight, it is important that there are no shadows or dark spot in the corners on the west that would make the foyer appear dark and uninviting. Shadows should be purposely placed to bring out the highlighted areas and create a feeling of anticipation.

(Important)

COMPARISON TO ADJACENT SPACES

As a circulation space, the brightness of the foyer should be balanced with respect to the adjacent spaces. The ratio of the illuminance of the foyer to the adjacent corridor and vestibule should not be more than 5:1.

DIRECT GLARE

The arcade, located parallel to the windows along the west wall of the foyer will prevent direct glare from the sunlight. Special care will be taken when choosing and placing luminaires to ensure that there will also be no direct glare from the electric lighting.

LIGHTING

IESNA ILLUMINANCE RECOMMENDATIONS:

Horizontal:	Category B	Simple orientation for short visits	50 lx (5 fc)
Vertical:	Not Critical		

FOYER DESIGN INTENT

The foyer is used as a means of circulation to the main chapel. All traffic will flow through the foyer to the main entrance of the chapel. Thus, the main function and goal of the lighting design for the foyer is to direct the circulation route. The east hallway to the north of the foyer serves the traffic from the offices and the 2nd floor cells by means of the stairwell. The east hallway to the south serves the refectory, library and remainder of the 2nd floor cells by means of the elevator.

The current lighting design for the east hallway uses pendant fixtures that are placed at even intervals down the center of the space. The linear nature of this design makes the hallway appear long, continuous, and unending. The location of the foyer in the center of this hallway provides a great opportunity to create a visual break in this line of pendants. The proposed foyer lighting design accomplishes this task by placing wall sconces at the chapel door. This break in the line gives a visual cue to cease travel and change directions.

The secondary intent of the foyer is to create a sense of anticipation for the grand space ahead. To create this feeling of anticipation, and as allowed by the IES criteria, the light level in the foyer is lower than the hallway and the chapel. It is not uniform and all light is kept to the lower portion of the room. The walls are washed from the bottom up causing the focal interest to be on the lower portion of the wall and the cork flooring. Pictures are highlighted in recesses in the wall to provide a focal point in the room. Gimbal lamps are recessed in the ledge above the pictures to keep the lighting elements from the ceiling. The intent of leaving the ceiling uninterrupted and the visual interest at or below eye level is to make the ceiling feel low because the eye will never process the height of the ceiling. This will create a sharp contrast to the great heights of the chapel.

LIGHTING

LUMINAIRE SCHEDULE: FOYER

TYPE	IMAGE	DESCRIPTION	LAMPS	VOLTS	MOUNTING	MANUFACTURER	CATALOG NO.
F1		FOYER - BOWL WALL SCONCE	(2) 60 W A-19	120	SCONCE	WINONA	3203-I-120-FAH7-PB
F2		FOYER - PICTURE ACCENT LIGHT	QR CBC 20	120	RECESSED	ERCO	88100
F3		FOYER - RECESSED PROJECTOR	T2 - 11W (L1)	120	INGRADE	EXTERIERVERT	MERCURE M2-RMA-120-MER-LOL
		FOYER - WINDOW LEDGE CANDLE		BATTERY	WINDOW	CANDLE IMPRESSIONS	CA10808

LAMP SCHEDULE: FOYER

TYPE	FIXTURE	BALLAST	DESCRIPTION	WATTAGE	CRI	CCT	OUTPUT	RATED LIFE	MANUFACTURER	CATALOG NO.
L1	F1	N/A	A-19 INCANDESCENT - SOFT WHITE, LONG LIFE	60W	-	-	830 LMNS	1500 HRS	PHILIPS	60A/WL 12/4
L2	F2	B2	LOW VOLTAGE HALOGEN	20W	81	3000K	310 LMS	6000 HRS	PHILIPS	20MRC16/SP10-ESX
L3	F3	B3	T2 LINEAR FLUORESCENT 19" - WARM WHITE	11W	77	3000 K	620 LMNS	7000 HRS	NANJING JRIGHT ILLUMINATING SOURCE	YRY7-11WW
			AURELLE LED CANDLE ROUND	1W	-	-	-	350 HRS	PHILIPS	14589-6

BALLAST SCHEDULE: FOYER

TYPE	FIXTURE	LAMP	NO. LAMPS	VOLTAGE	START METHOD	INPUT (W)	BALLAST FACTOR	POWER FACTOR	THD(%)	MANUFACTURER	CATALOG NO.
B3	F3	L3	1	120	PROGRAM RAPID START	11W	> 0.97	1.00	< 10	TRIAD ELECTRONIC BALLASTS	ES1786X

LIGHT LOSS FACTORS: FOYER

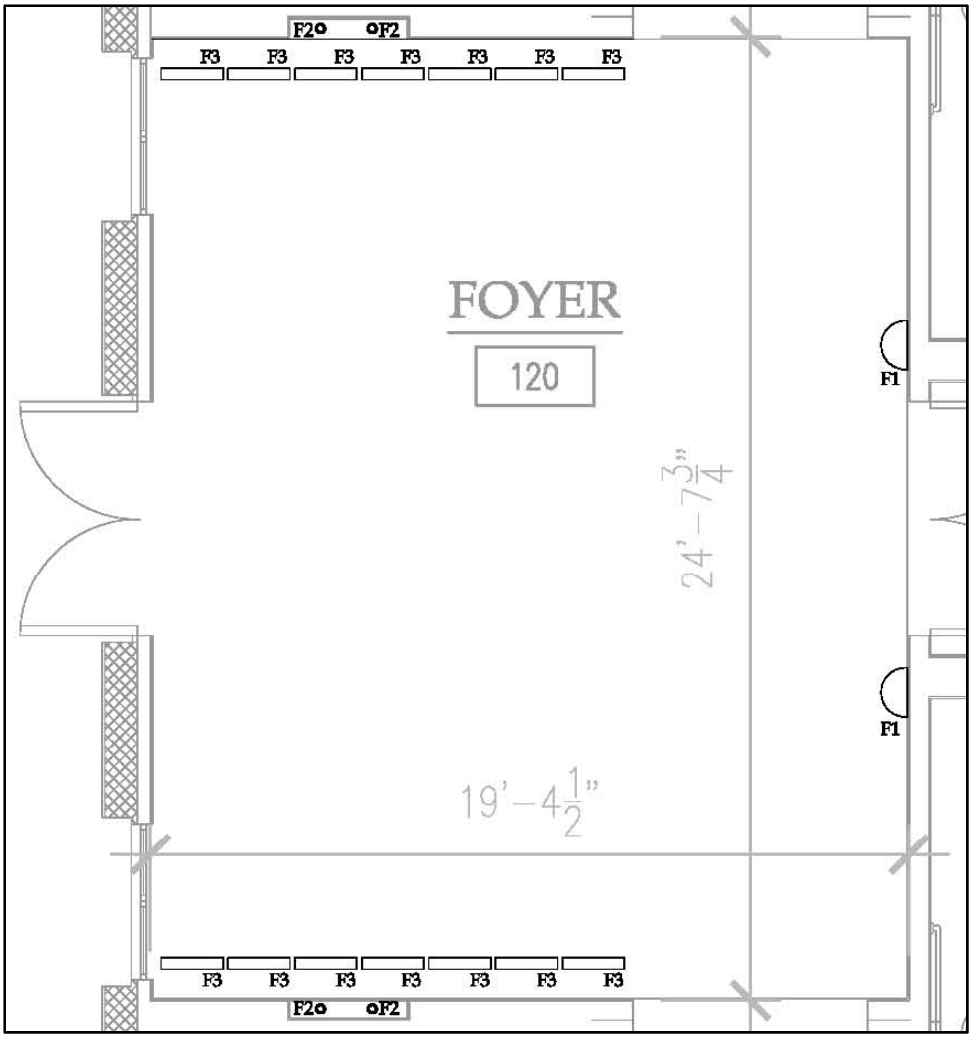
FIXTURE	MAINTENANCE CATEGORY	DISTRIBUTION	DIRT CONDITION	CLEANING CYCLE	LLD	LDD	RSDD	BF	TOTAL LLF
F1	II	INDIRECT	CLEAN	6 MONTHS	0.86	0.97	0.9	1	0.75
F2	IV	DIRECT	CLEAN	6 MONTHS	0.89	0.94	0.98	1	0.82
F3	II	INDIRECT	CLEAN	6 MONTHS	0.95	0.97	0.9	0.97	0.80

POWER DENSITY: FOYER

FIXTURE DESIGNATION	LAMPS PER FIXTURE	NO OF FIXTURES	INPUT WATTS	TOTAL INPUT WATTS
F1	2	2	60	240
F2	2	2	20	80
F3	1	14	11	154
				474

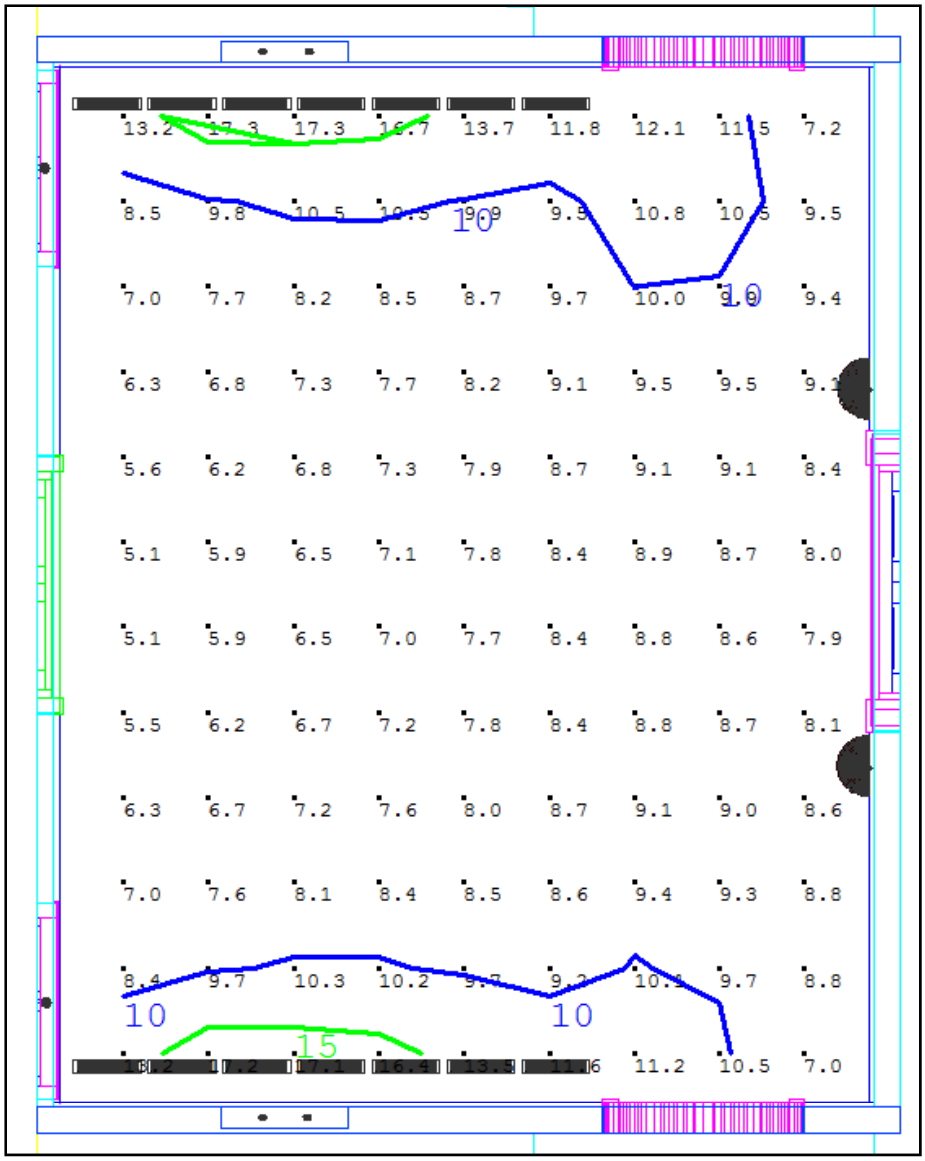
AREA OF ROOM	POWER DENSITY	ASHRAE STANDARD	OK?
476	1.0	1.1	OK

LIGHTING



FOYER LIGHTING LAYOUT
SCALE: NONE

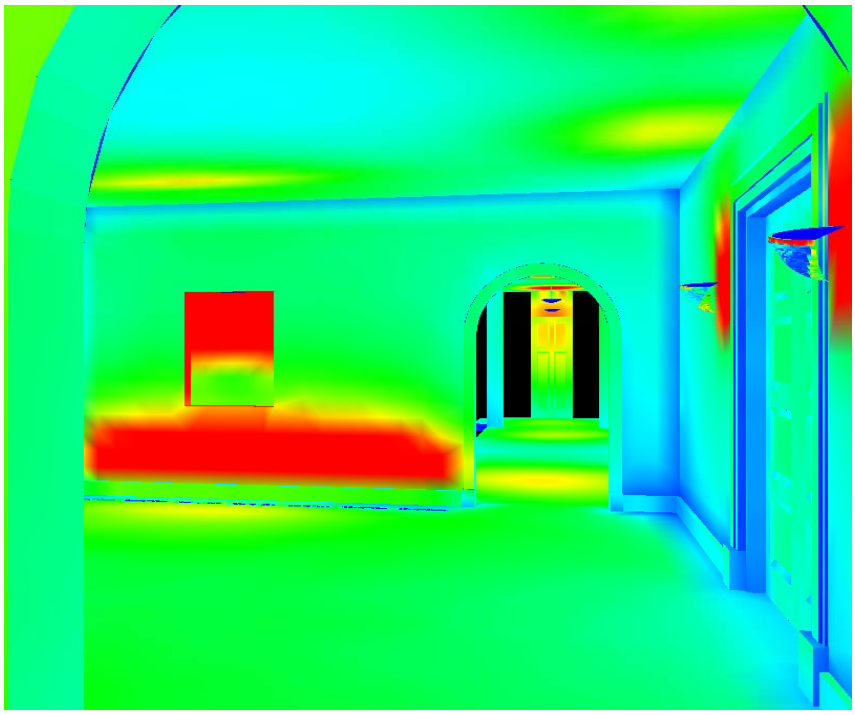
LIGHTING

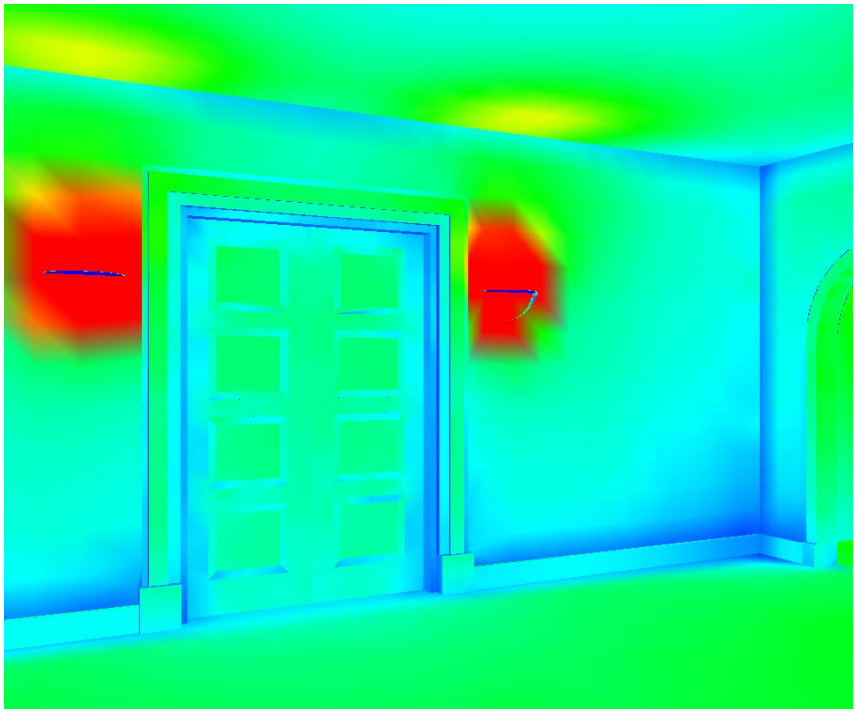


FOYER ILLUMINANCE CALCULATION GRID
SCALE: NONE

CALC GRID	FOYER HORIZONTAL
AVERAGE	9.1 FC
MAXIMUM	17.3 FC
MINIMUM	5.1 FC
MAX:MIN RATIO	3.39
AVG: MIN RATIO	1.78

LIGHTING

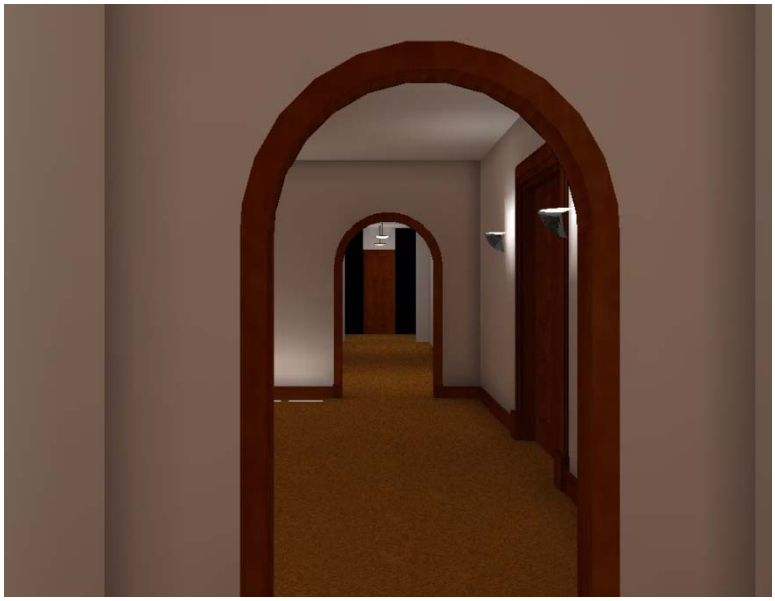




LIGHTING

VIEW INTO FOYER FROM NORTHEAST HALL

VIEW INTO FOYER FROM SOUTHEAST HALL



LIGHTING

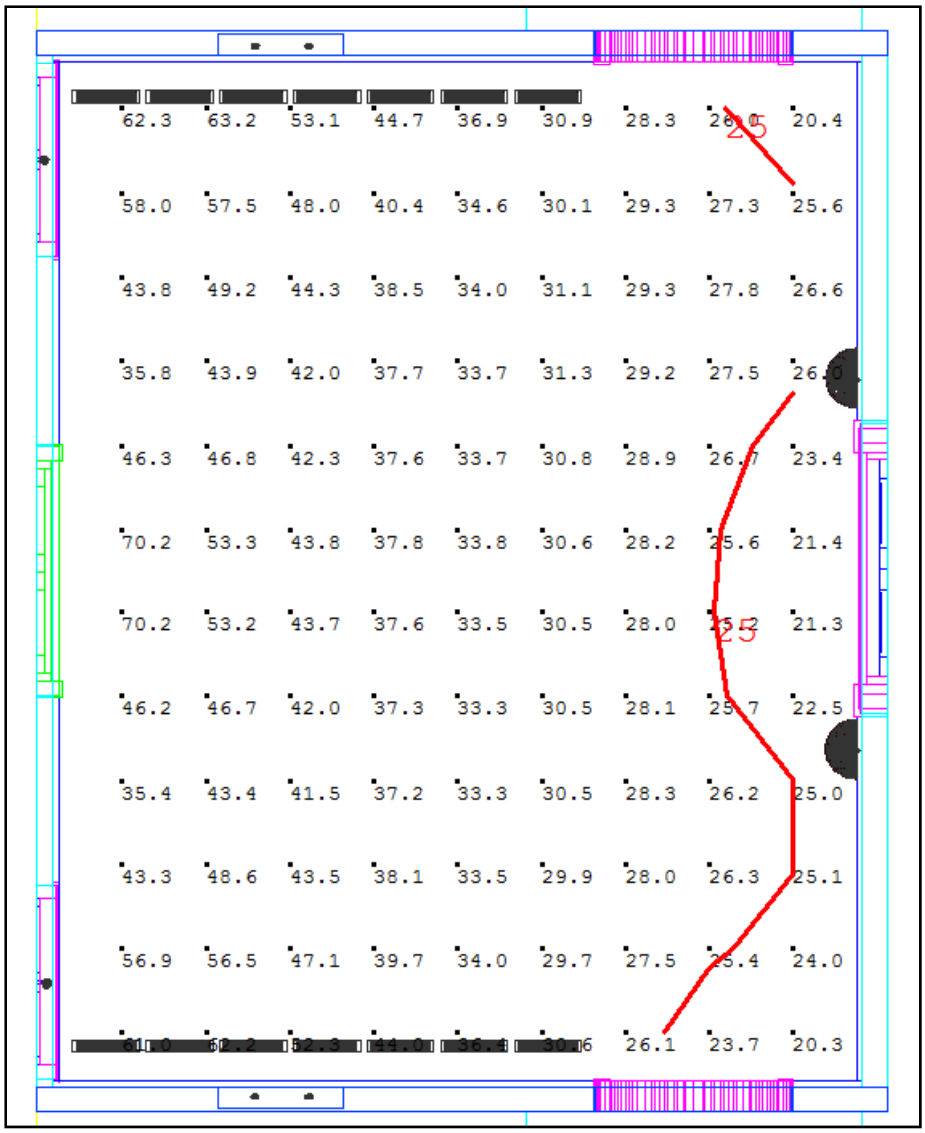
VIEW OF SOUTH WALL

VIEW OF WEST WALL

LIGHTING

CLOSE UP OF RECESS FOR PICTURE

LIGHTING



FOYER WITH DAYLIGHT ILLUMINANCE CALCULATION GRID

SCALE: NONE

CALC GRID	FOYER HORIZONTAL
AVERAGE	36.9 FC
MAXIMUM	70.2 FC
MINIMUM	20.3 FC
MAX:MIN RATIO	1.82
AVG: MIN RATIO	3.46

LIGHTING

VIEW TOWARD SOUTHEAST HALL WITH DAYLIGHTING

VIEW TOWARD INNER COURTYARD WITH DAYLIGHTING

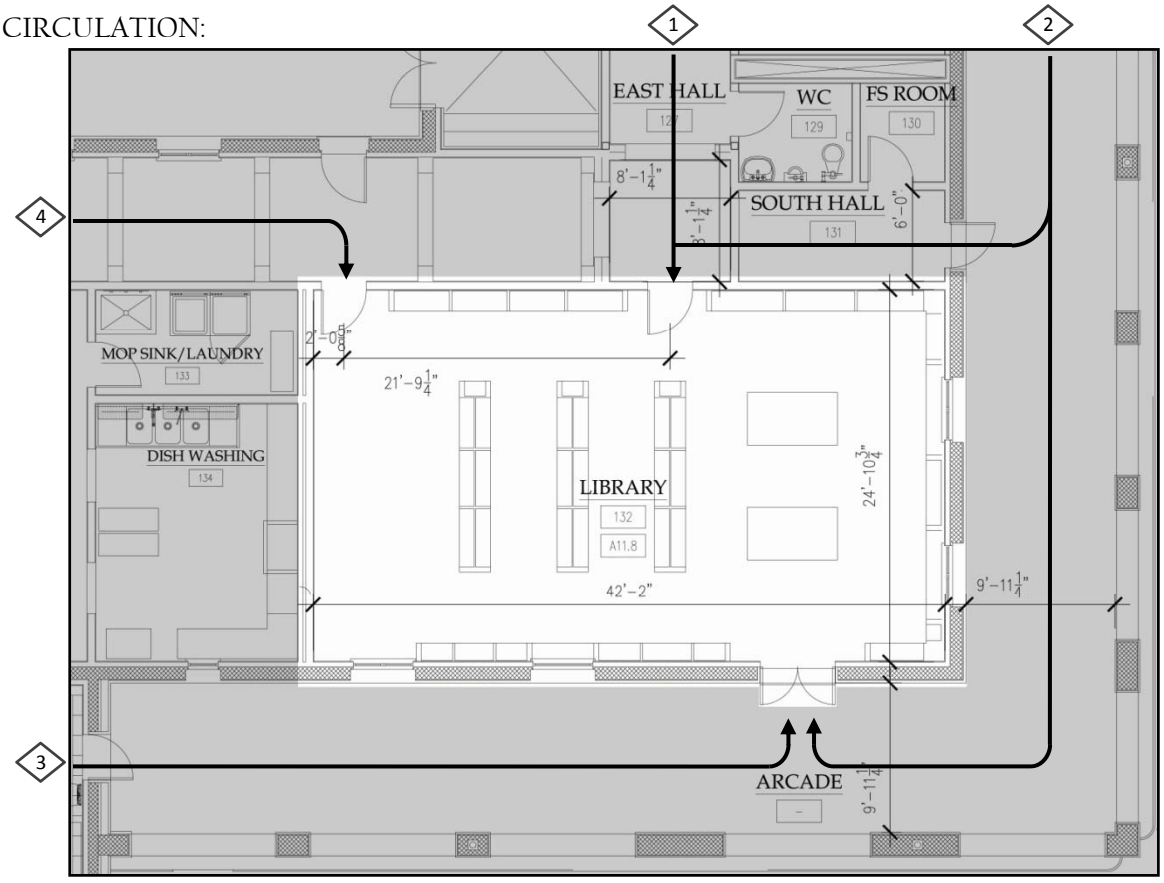
VIEW TOWARD MAIN FOYER WITH DAYLIGHTING

LIGHTING

DESCRIPTION:

The library is a rectangular space located in the southeast corner on the 1st floor of the friary. Used for quiet and personal activities such as reading, writing, and studying, the library is tucked away from the more active areas. To prevent disturbance from the dish washing station, sound attenuating material is used for the walls between the library and dishroom. The majority of the traffic to the library will be coming from the chapel and second floor cells by means of the east hall. Upon entering from this route, the first focal point that is apparent will be the stand alone bookshelves and tables in the center of the room. The cauffered natural finished mahogany ceiling will also be one of the main focal points. In addition to the bookshelves in the center of the room, the library has natural finished birch veneer built in shelves that span the north, east and south walls. The following discusses the circulation, dimensions, focal points and materials of the library.

CIRCULATION:



LIBRARY FLOOR PLAN

SCALE: NONE

1. Chapel, Offices, Stairs to 2nd Floor Cells
2. Chapel
3. Refectory
4. Recreation

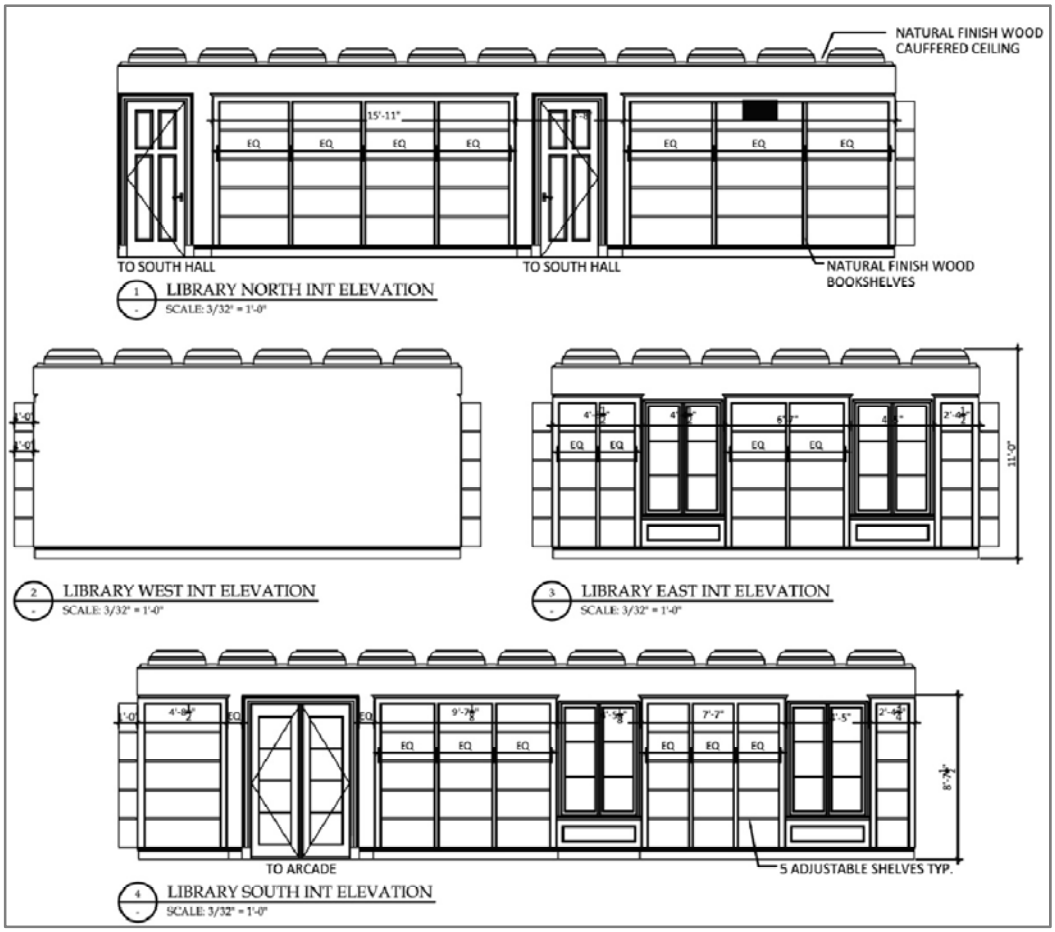
LIGHTING

DIMENSIONS:

	LIBRARY	ARCADE	EAST HALL
North-South	24’ 11”	-	-
West-East	42’ 2”	9’ 11 ¼”	8’ 1 ¼”
Ceiling Height	11’ 0”	11’ 0”	10’ 0”
Floor Area	1051 ft²	-	-

FOCAL POINTS:

North Elevation	Built in bookshelves, entrances from the south and east hall
West Elevation	Painted wall breaks up the shelving
East Elevation	Built in bookshelves, view to chapel courtyard
South Elevation	Built in bookshelves, view to south, solar gain blocked by arcade
Ceiling	Natural wood cauffered ceiling
Furniture	Stand alone bookshelves provided in center of room Two(2) tables provided on the east side of the space



LIBRARY INTERIOR ELEVATIONS

SCALE: 3/32”=1’—0”

LIGHTING

MATERIAL/REFLECTANCES:

	Surface	Material	Reflectance
	Ceiling	Benjamin Moore Paint: Wood Ash	0.05
	Wall	Benjamin Moore Paint: Stone House	0.73
	Shelving	Birch Plywood Natural Finish	0.55
	Flooring	Carpet	0.24

DESIGN CRITERIA/CONSIDERATIONS

READING

(Very Important)

APPEARANCE OF SPACE AND LUMINAIRES:

The architecture in the library is well designed and efficiently fulfills its purpose. The bookshelves, though built into the walls, are a focal point and a decorative aspect of the space. In addition, the natural finished cauffered ceiling provides visual interest. The simple and elegant nature of the space requires a lighting plan that will compliment the architecture and not detract from the beauty of the woodwork.

DIRECT GLARE:

One of the major concerns in the library is direct glare caused by both the electric and daylighting. In order to minimize distractions and discomfort that will result in lower satisfaction and productivity, solutions such as the use of indirect fixtures and the use of the Arcade's overhang to block excessive sunlight will be developed.

IESNA ILLUMINANCE RECOMMENDATIONS:

Horizontal:	Category D	Performance of visual task of high contrast	300 lx (30 fc)
Vertical:		Not Critical	

REFLECTED GLARE:

Though the majority of the reading material in the library will be matte surfaces, there will be several glossy reading materials available. To avoid the distraction and discomfort caused by reflected glare, consideration will be put into the placement and type of luminaires chosen for the space.

POWER ALLOWANCE:

According to ASHRAE 90.1- 2004 Energy Standard for Building's Space-by-Space method, the allowable power density for a library is 1.7 W/ft^2.

LIGHTING

SOURCE/TASKS/EYE GEOMETRY:

Desks, available on the east side of the library, are provided for reading and writing on various materials. These materials will include glossy magazines, photocopies, or material that is handwritten with a #2 or softer lead pencil or a ballpoint pen. The geometry between the task and the light source will be considered in order to develop a design that produces minimal veiling reflections.

(Important)

COLOR APPEARANCE(AND CONTRAST)

Wood is the most prevalent interior finish in this space used on the bookshelves, the ceiling and the table. In order to draw out the contrast in the grains of the wood, high color rendering index is important.

LIGHT DISTRIBUTION ON SURFACE

The light should be uniformly distributed on the task plane. This is important for both the bookstacks as well as the tables for reading.

LUMINANCE RATIOS:

The luminance ratio from task to background should not be below 1:5 and the task to wall ratio should be not be greater than 3:1.

BOOKSTACKS: ACTIVE

(Very Important)

DEGRADATION FACTORS:

Radiant energy absorbed from the electric and daylighting can cause books to dry out, fade, the binding to lose strength, and the covers to fray. The design for the lighting of the shelves should minimize the book's exposure to radiant energy in order that they maintain their value.

DIRECT GLARE:

The titles on the spine of the book may be faded and the contrast decreased from wear and tear. To be able to easily browse through the books while keeping the illuminance level at a minimum to prevent degradation, direct glare should be avoided.

IESNA ILLUMINANCE RECOMMENDATIONS:

Horizontal:		Not Critical	
Vertical:	Category D	Performance of visual task of high contrast	300 lx (30 fc)

LIGHT DISTRIBUTION ON SURFACE

The light should be uniformly distributed across the books on the shelves.

LIGHTING

SHADOWS:

Linear or area sources 30 degrees from the vertical will be used to illuminate the bookshelves so that shadows are not formed on the books from the friars.

LIBRARY DESIGN INTENT

The library is located in the southeast corner of the building. It is distanced from the main spaces of the building so it can function in the quiet and secluded atmosphere desired for this type of space. To enter the library, one must traverse the east or south hallway. Both hallway's current designs use a continuous line of pendant fixtures. Upon entering the library from the east hallway, the first impression of the space will be the vast array of books. The main view will be the bookshelves located in the center of the room.

The main architectural elements of the space are the wood cauffered ceiling and the built-in book shelf. In large part, the goal of the lighting design is to draw appreciation to and honor the design of the cauffered ceiling. The lighting elements are planned with the intention of not puncturing or diminishing the value of this feature.

According to IES recommendations, bookshelves require a high illuminance value of 30 fc from top to bottom. This criterion is hard to meet with a small and unobtrusive fixture. In order to comply with the recommendation, keep the ceiling untouched and pure in design, and avoid compromising the look of the space, a fixture was chosen that most fits the architectural appeal. This fixture is designed for library lighting and will be cantilever mounted from the top of the bookshelves. It continues around three of the four perimeter walls. The final wall, the only wall absent of bookshelves, will have candle sconces used to illuminate the last aisle of shelving.

LIGHTING

LUMINAIRE SCHEDULE: LIBRARY

TYPE	IMAGE	DESCRIPTION	LAMPS	VOLTS	MOUNTING	MANUFACTURER	CATALOG NO.
F4		LIBRARY - COVE ABOVE BOOKSHELVES	T5HO	120	COVE	LEDALITE/CUSTOM	IN-COVE II 3808H01EN
F5		LIBRARY - STACK LIGHTING	T5HO	120	WALLWASH	ELLIPTIPAR/CUSTOM	F140-T124-Y-02-T (VXC-02-12)
F6		LIBRARY - WALL SCONCE	13TT	120	SUSPENDED/ WALL MOUNTED	LIGHTOLIER	FW01-PW13SA-SG02-13TT-120
F7		LIBRARY - TABLE LAMPS	N/A	120	TABLE	USER DEFINED	N/A

LAMP SCHEDULE: LIBRARY

TYPE	FIXTURE	BALLAST	DESCRIPTION	WATTAGE	CRI	CCT	OUTPUT	RATED LIFE	MANUFACTURER	CATALOG NO.
L4	F4	B4	(1) T5HO LINEAR FLUORESCENT	39W	85	3500	3500 LMNS	20000 HRS	PHILIPS	F39T5/835/HO/ALTO
L5	F5	B5	(1) T5HO LINEAR FLUORESCENT	24W	85	3500	2000 LMNS	20000 HRS	PHILIPS	F24T5/835/HO/ALTO
L6	F6	B6	4-PIN ELEC TWIN TUBE	13W	82	3500	900 LMNS	12000 HRS	PHILIPS	PL-C 13W/835/4P/ALTO
L7	F7	B7	EL/T MED BASE	34W	82		2100 LMNS	7000 HRS	PHILIPS	37082-5

BALLAST SCHEDULE: LIBRARY

TYPE	FIXTURE	LAMP	NO. LAMPS	VOLTAGE	START METHOD	INPUT (W)	BALLAST FACTOR	POWER FACTOR	THD(%)	MANUFACTURER	CATALOG NO.
B4	F4	L5	1	120	PROGRAM RAPID START	40W	1.02	0.98	10	ADVANCE TRANSFORMER	ICN-2S39@120V
B5	F5	L6	1	120	PROGRAM RAPID START	27W	1.02	0.98	10	ADVANCE TRANSFORMER	ICN-2S24@120V
B6	F6	L7	1	120	PRE-HEAT	16W	0.89	1.01	25	ADVANCE TRANSFORMER	H-1B1-13-TP-BLS
B7	F8	L8	1	120	PROGRAM RAPID START	33W	1.04	0.98	10	ADVANCE TRANSFORMER	ICN-2S28@120V

LIGHT LOSS FACTORS: LIBRARY

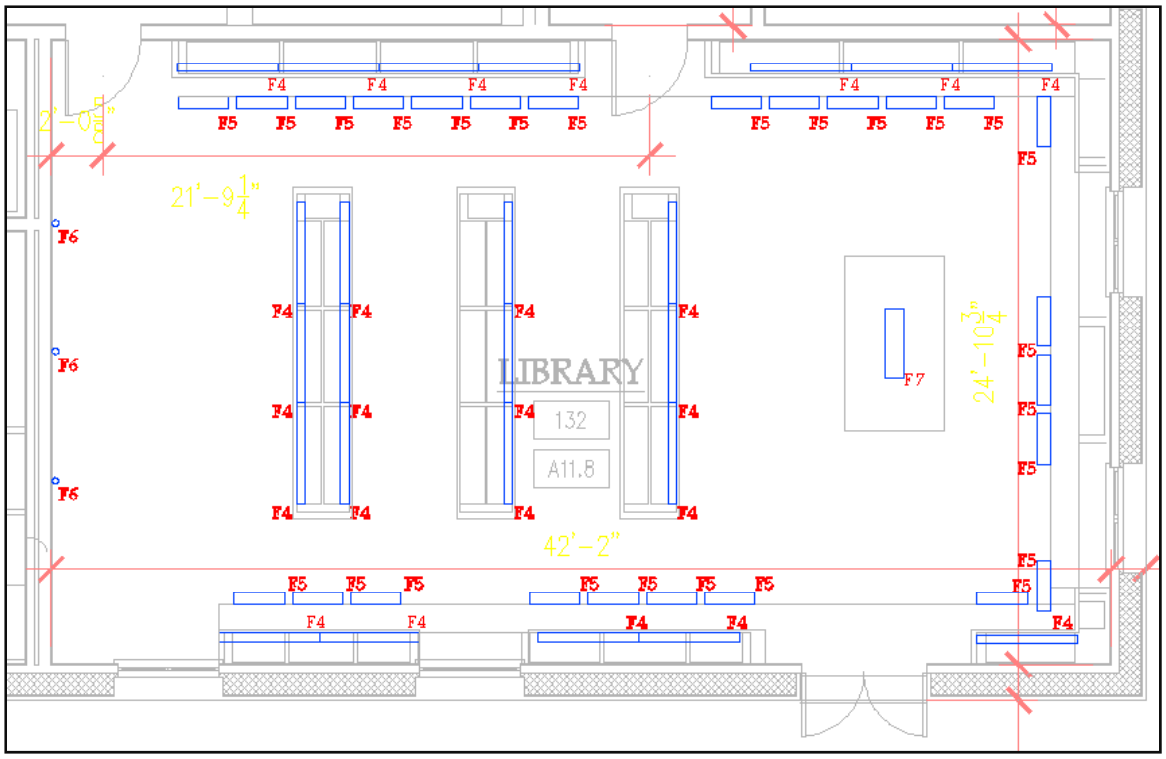
FIXTURE	MAINTENANCE CATEGORY	DISTRIBUTION	DIRT CONDITION	CLEANING CYCLE	LLD	LDD	RSDD	BF	TOTAL LLF
F4	II	INDIRECT	CLEAN	6 MONTHS	0.93	0.97	0.9	1.02	0.83
F5	IV	DIRECT	CLEAN	6 MONTHS	0.93	0.94	0.98	1.02	0.87
F6	V	GENERAL DIFFUSE	CLEAN	6 MONTHS	0.86	0.92	0.97	0.89	0.68

POWER DENSITY: LIBRARY

FIXTURE DESIGNATION	LAMPS PER FIXTURE	NO OF FIXTURES	INPUT WATTS	TOTAL INPUT WATTS
F4	1	24	40	960
F5	1	24	27	648
F6	1	3	16	48
				1656

AREA OF ROOM	POWER DENSITY	ASHRAE STANDARD	OK?
1051	1.6	1.7	OK

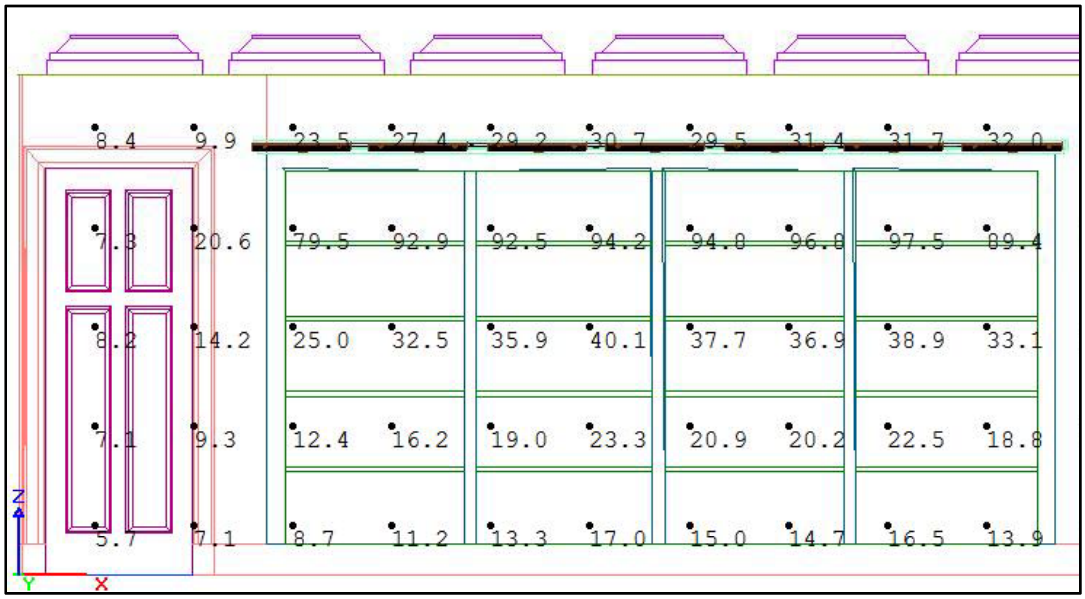
LIGHTING

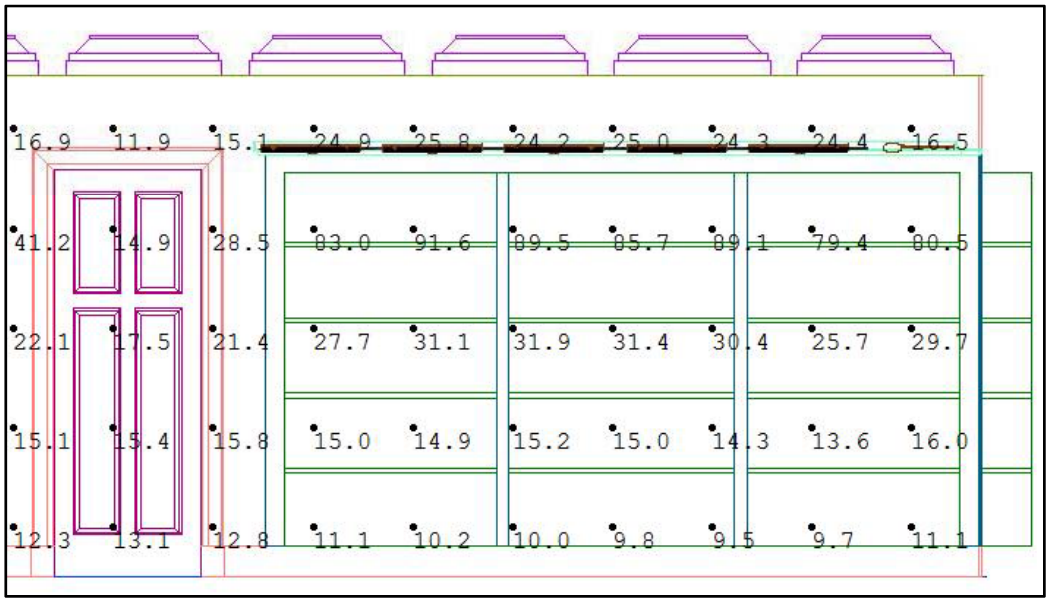


FOYER LIGHTING LAYOUT
SCALE: 1/8”=1’-0”

LIGHTING

ILLUMINANCE LEVELS: BOOKSHELVES





LIBRARY ILLUMINANCE CALCULATION GRID

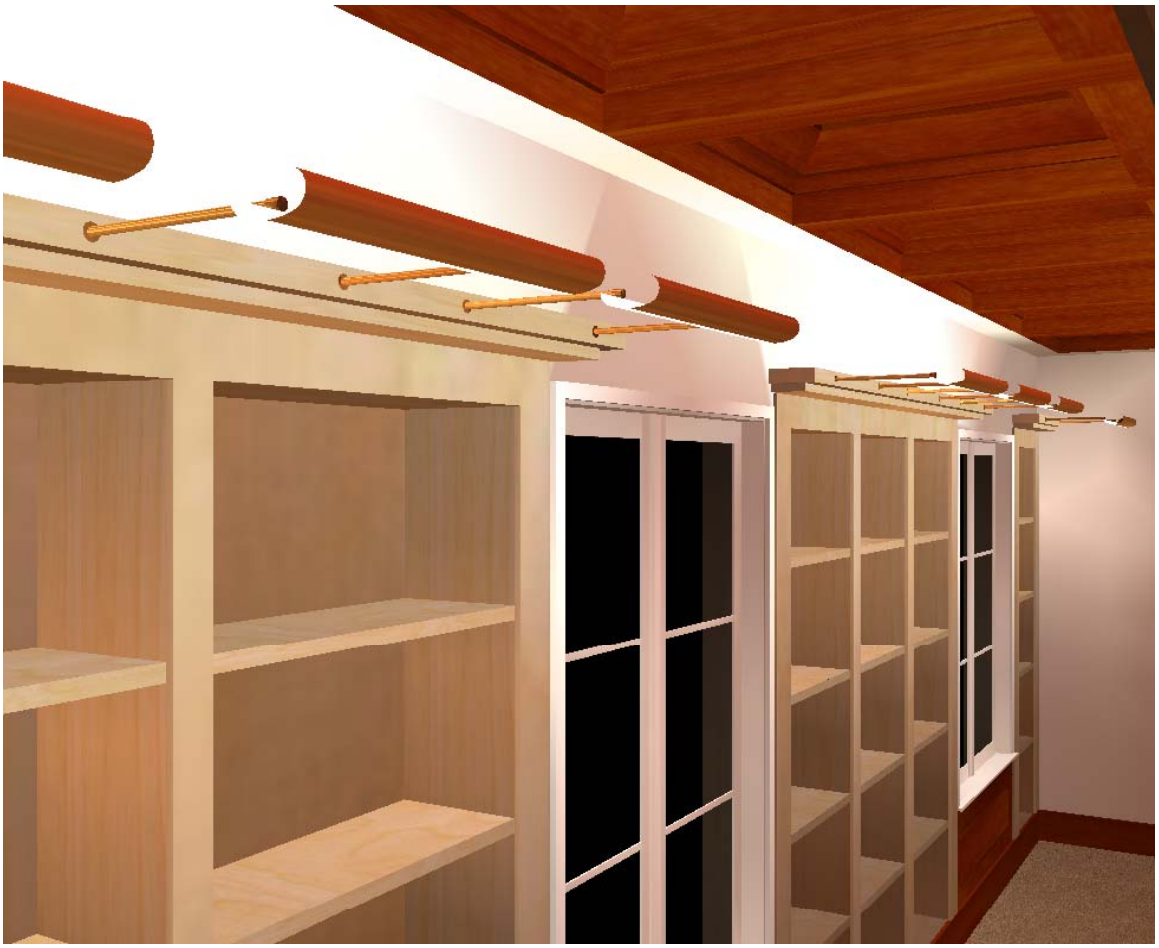
SCALE: NONE

CALC GRID	VERTICAL
AVERAGE	30.4 FC
MAXIMUM	97.5 FC
MINIMUM	5.7 FC
MAX:MIN RATIO	17.1
AVG: MIN RATIO	5.3

LIGHTING

LIBRARY: ENTRANCE FROM EAST HALLWAY

LIBRARY: BUILT-IN BOOKSHELVES



LIGHTING

LIBRARY: FREE STANDING BOOKSHELVES

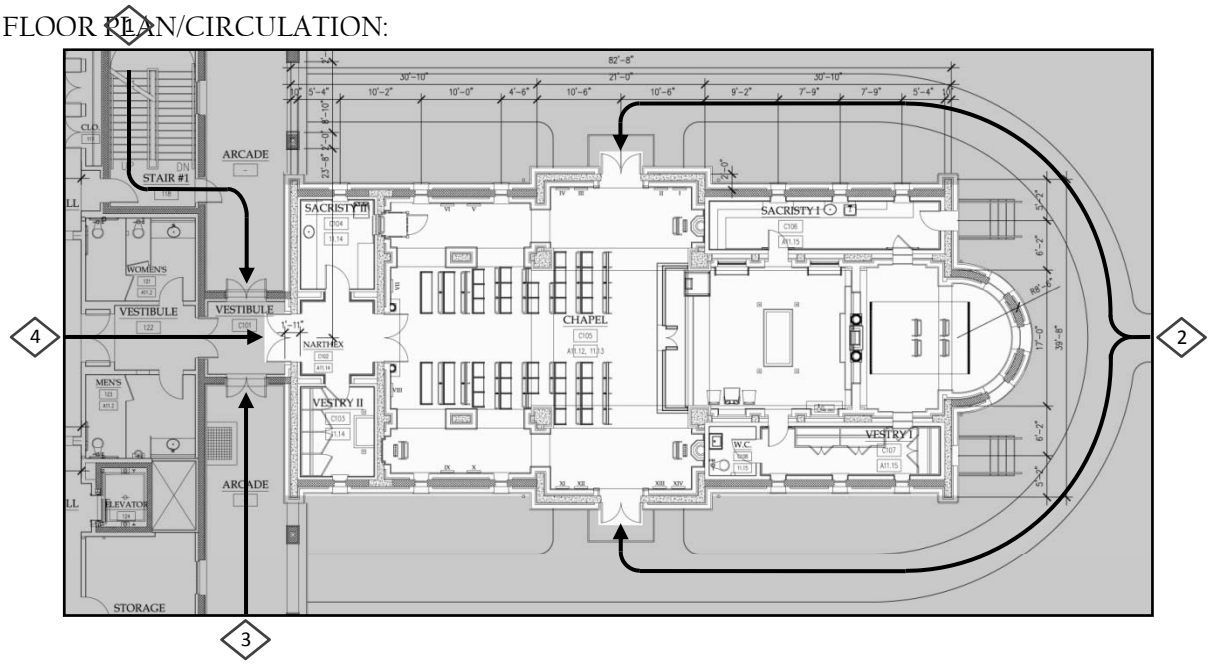
LIBRARY: VIEW TO CHAPEL COURTYARD

LIGHTING

DESCRIPTION:

The chapel has a more complex design and holds the highest importance of all the spaces in the friary. There is one interior entrance marked by a grand mahogany doorway in the foyer. This entrance enters the vestibule leading to two other interim spaces before entering the chapel. The other main traffic routes to the chapel are exterior routes and can be found on the flow diagram below. The chapel is a holy place set aside as an area of worship. The space itself is two stories of stone with stained glass displays on both levels of the North, East and South walls. The travertine flooring continues the design of using natural materials. The ceiling height, design, and material vary throughout the chapel. There are low, high, and domed ceilings made of stone, stucco, or exposed wood trusses. Stone archways are placed throughout the chapel as the ceiling or use of the spaces change. The following discusses more in depth the circulation, dimensions, focal points and materials of the chapel.

FLOOR PLAN/CIRCULATION:



CHAPEL FLOOR PLAN

SCALE: NONE

1. Stairs to 2nd Floor Cells
2. Courtyard
3. Library, Refectory
4. Foyer

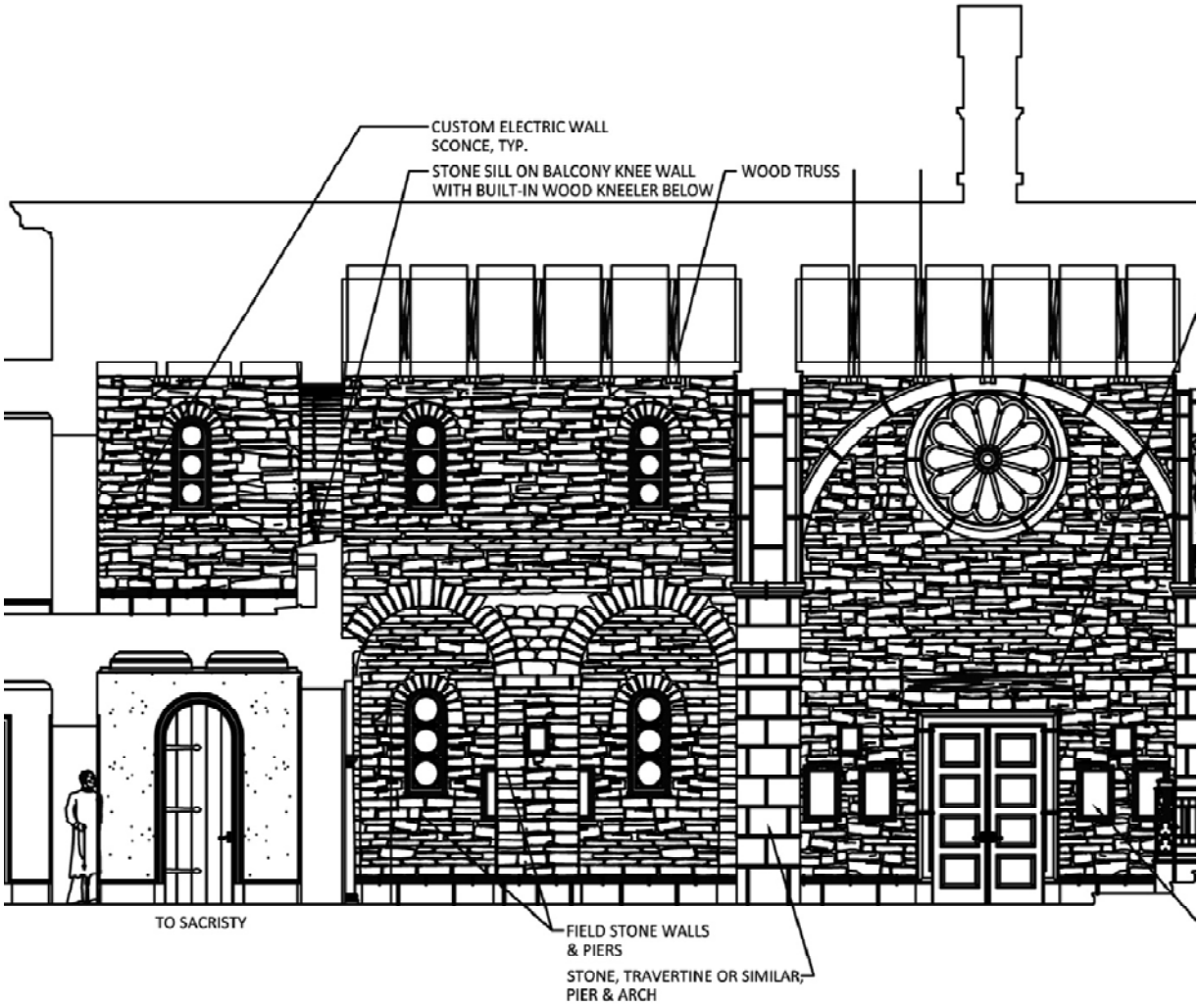
LIGHTING
SUMMARY OF SPACE

FOYER

LIBRARY

CHAPEL

COURTYARD



CHAPEL INTERIOR ELEVATION (TYPICAL NORTH AND SOUTH)
SCALE: 3/32”=1’-0”

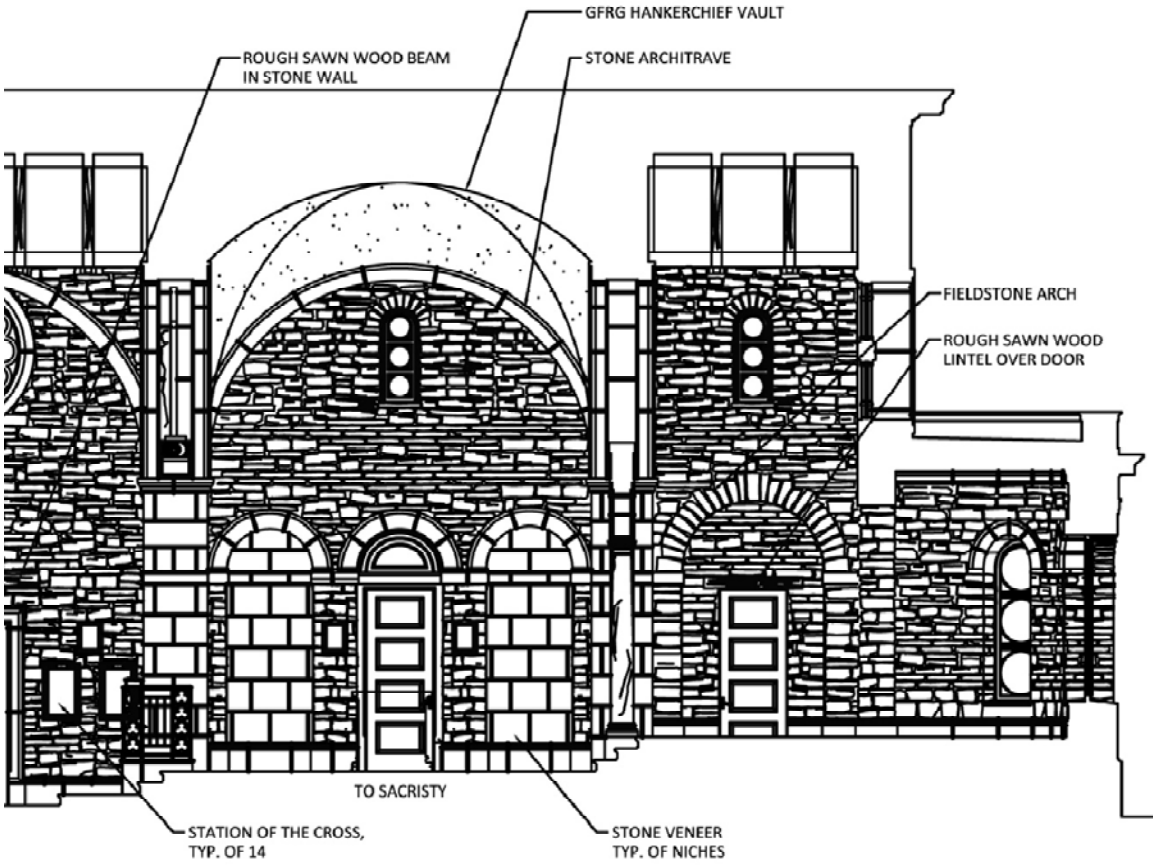
LIGHTING
SUMMARY OF SPACE

FOYER

LIBRARY

CHAPEL

COURTYARD



CHAPEL INTERIOR ELEVATION (TYPICAL NORTH AND SOUTH)
SCALE: 3/32”=1’-0”

LIGHTING

SUMMARY OF SPACE

DIMENSIONS:

	CHAPEL	NARTHEX	VESTIBULE
North-South	39’ 8”	9’ 4”	8’ 1 ¼”
West-East	91’ 2”	9’4”	-
Ceiling Height	VARIES	11’ 4”	10’ 0”
Floor Area	1990 ft^2	-	-

FOCAL POINTS:

West Elevation	Entrance from Foyer, 2nd Floor Balcony
North Elevation	Grand archways
East Elevation	Pulpit, Christ on the Cross, Tabernacle
South Elevation	Grand archways
Ceiling	Exposed wood trusses
Furniture	Pews located in center of chapel

MATERIALS:

	Surface	Material	Reflectance
	Capitals	Travertine: Brushed Ivory	0.61
	Walls	Alabama Brown Fieldstone	0.26
	Recess	Stone Veneer: Alabama Yellow	0.26
	Floor	Travertine: Noce Finish	0.33
	Door/Trusses	Honduras Mahogany	0.12

DESIGN CRITERIA/CONSIDERATIONS

CONGREGATIONAL AREA

(Very Important)

APPEARANCE OF SPACE AND LUMINAIRES:

The chapel is a holy space set aside for worship. The luminaires chosen should match and blend with the appearance of the space without distracting from the main focus.

COLOR APPEARANCES:

Various finishes are used throughout the chapel including fieldstone, travertine, and mahogany. The source type and color rendering index should be considered in design to enhance the characteristics of these rich materials.

LIGHTING

DIRECT GLARE:

The light sources should be placed at a height and location where they are not in direct view. Adequate glazing should be provided on windows to avoid discomfort glare. This is a minor concern since the majority of the windows in the chapel are stained glass.

FLICKER:

As a large space, the chapel has potential for noticeable flicker. This should be considered when choosing sources and ballasts.

MODELING OF FACES OR OBJECTS:

This area, as portrayed in the name, will be used for congregating, therefore, facial modeling is important.

SURFACE CHARACTERISTICS:

As discussed in the color rendering criteria, high quality materials were used for this space. The fieldstone used for the walls in particular will have a three dimensional quality that should be enhanced by the lighting design.

(Important)

IESNA ILLUMINANCE RECOMMENDATIONS:

Horizontal:	Category C	Working space, simple tasks performed	100 lux (10 fc)
Vertical:	Category A	Public space	30 lux (3 fc)

LIGHT DISTRIBUTION ON TASK PLANE:

One of the tasks that will occur in this space is reading of the Bible. The distribution on the task plane will need to be uniform to alleviate strain.

POWER ALLOWANCE:

According to ASHRAE 90.1- 2004 Energy Standard for Building's Space-by-Space method, the allowable power density for this space is 1.1 W/ft^2.

POINTS OF INTEREST:

The points of interest in the chapel include Christ on the cross, the tabernacle, and the paintings on display.

CONGREGATIONAL AREA

SHADOWS:

The elaborate architectural design of the chapel incorporates archways as a division between the different areas of the chapel. The luminaires should be placed at a height, angle, and frequency that minimizes the shadows created by this physical division.

LIGHTING

LEADERSHIP AREA

(Very Important)

DIRECT GLARE:

The leadership area requires higher illuminance levels than the congregational space. However, care should be taken when placing luminaires to avoid disabling or discomfort glare on the speaker.

IESNA ILLUMINANCE RECOMMENDATIONS:

Horizontal:	Category D	Performance of visual tasks of high contrast	300 lux (30 fc)
Vertical:	Category D	Performance of visual tasks of high contrast	300 lux (30 fc)

MODELING OF FACES AND OBJECTS:

Modeling of the leadership area is important so that facial features, expressions, and movement can be easily read.

POWER ALLOWANCE:

According to ASHRAE 90.1- 2004 Energy Standard for Building's Space-by-Space method, the allowable power density for this space is 1.1 W/ft^2.

(Important)

LIGHT DISTRIBUTION ON TASK PLANE:

As a reading area, the light distribution should be uniformly distributed across the task plane. This will allow for the speaker to quickly glance down at notes or the bible without having to shift the reading material to receive better lighting conditions.

REFLECTED GLARE:

The source/task/eye geometry should be determined for the lighting of the pulpit area to ensure that there is minimal reflected glare.

HIGHLIGHTED ITEMS

IESNA ILLUMINANCE RECOMMENDATIONS:

Horizontal:		Not critical	
Vertical:	Category D	Performance of visual tasks of high contrast	300 lux (30 fc)

LIGHTING

CHAPEL DESIGN INTENT

The definition of a friary states that it is a dwelling place reserved for prayer. As such, the chapel will be the most important of the spaces. Determining a lighting design to honor the holiness and architecture of the space was difficult. The goal was to enhance the features of the space and the holiness of the atmosphere without drawing attention to the lighting design itself. To accomplish this task, sources were used to illuminate areas of need while the fixtures remained hidden from view. The only visible fixture is the pendant lamps lined down the center of the chapel. These pendants will be simple in order to not draw attention to themselves.

The most important features of the chapel are Christ on the cross, the paintings and statues located in the side of the crossing, the altar, the pulpit, the tabernacle, the grand arches and the exposed trusses. The lighting was designed to enhance these features and to allow the space to "shine" based upon its architecture while leaving the focus on the task of worship and not the elements of the space.

A hierarchy of importance was developed in order to determine the proper lighting necessary for the space. As a result, three layers of light were introduced; ambient, accent and task lighting. The ambient lighting is provided in the space by uplighting the grand arches and by providing an ambient glow from the pendant fixtures. Indirect flood lights were mounted on the top surface of the capitals of the columns to illuminate the underside of the grand arches and give height to the space. The pendant fixtures illuminate the exposed trusses but leave the ceiling above the trusses unlit so the true height of the space is not revealed. The pendant fixtures should provide the light levels necessary to accomplish the tasks of reading and writing. The task lighting for the pulpit is a pendant light mounted on the beam overhead.

Two spotlights were placed on either side of the mantle and used to uplight the cross. A fill light will be created from the ambient light in the chapel itself. This will allow the statue to be accented without creating strong shadows that mask its intricate details. The same spotlights will be used to accent the altar and tabernacle behind.

LIGHTING

LUMINAIRE SCHEDULE: CHAPEL

TYPE	IMAGE	DESCRIPTION	LAMPS	VOLTS	MOUNTING	MANUFACTURER	CATALOG NO.
F8		CHAPEL - RECESSED DOWNLIGHTS	26W TT	120	RECESSED	KURT VERSEN	CFT626HEB
F9		CHAPEL - DISPLAY SPOTLIGHTS 10, 25, 40 DEGREE SPREAD	39W T6	120	SURFACE MOUNTED	PRESCOLITE	AKTMHT639 WH AKTSP1 WH
F10		CHAPEL - SMALL ARCHWAY SPOTLIGHT	35W MH	120	WALL MOUNTED	ERCO LIGHT SCOUT	33511
F11		CHAPEL - MAIN PENDANT FIXTURE SPOTLIGHT	(8)35W HAL	120	PENDANT	CUSTOM FIXTURE	N/A
F12		CHAPEL - PENDANT ABOVE PULPIT	20W HAL	120	PENDANT	LIGHTOLIER	8684
F13		CHAPEL - MEDITATION SPACE PENDANT	20W HAL	120	PENDANT	LIGHTOLIER	8684

LAMP SCHEDULE: CHAPEL

TYPE	FIXTURE	BALLAST	DESCRIPTION	WATTAGE	CRI	CCT	OUTPUT	RATED LIFE	MANUFACTURER	CATALOG NO.
L8	F8	B8	COMPACT FLUORESCENT GX24Q-3 BASE	26W	82	3000	1200 LMS	12000 HRS	PHILLIPS	PL-T 26W/830/RP/ALTO
L9	F9	B9	METAL HALIDE T-6 WITH G12 BASE	39W	81	4000	3300 LMS	9000 HRS	PHILLIPS	CDM35/T6/840
L10	F10	B10	METAL HALIDE T-4 WITH G8.5 BASE	39W	81	3000	3300 LMS	9000 HRS	PHILLIPS	CDM35/TC/830
L11	F11	-	(8)HALOGEN MRC-16 GU5.3 BASE	35W	-	3000	870 LMS	5000 HRS	PHILLIPS	35MRC16/IRC/WFL60
L12	F12	-	HALOGEN MRC-16 GU5.3 BASE	20W	-	3000	400 LMNS	5000 HRS	PHILLIPS	20MRC16IRC/FL26
L13	F13	-	HALOGEN MRC-16 GU5.3 BASE	20W	-	3000	400 LMS	5000 HRS	PHILLIPS	20MRC16IRC/FL26

BALLAST SCHEDULE: CHAPEL

TYPE	FIXTURE	LAMP	NO. LAMPS	VOLTAGE	START METHOD	INPUT (W)	BALLAST FACTOR	POWER FACTOR	THD(%)	MANUFACTURER	CATALOG NO.
B8	F8	L8	1	120	RAPID START	29W	1.00	0.98	10	ADVANCE TRANSFORMER	RCF-2S26-H1-LD-QS
B9	F9	L9	1	120	ELECTRONIC	45W	1.00	0.9	15	ADVANCE TRANSFORMER	IMH-39-A-M110
B10	F10	L10	1	120	ELECTRONIC	45W	1.00	0.9	15	ADVANCE TRANSFORMER	IMH-39-A-M110

LIGHT LOSS FACTORS: CHAPEL

FIXTURE	MAINTENANCE CATEGORY	DISTRIBUTION	DIRT CONDITION	CLEANING CYCLE	LLD	LDD	RSDD	BF	TOTAL LLF
F8	IV	DIRECT	CLEAN	6 MONTHS	0.85	0.96	0.97	1.00	0.79
F9	IV	DIRECT	CLEAN	6 MONTHS	0.83	0.96	0.97	1.00	0.77
F10	II	INDIRECT	CLEAN	6 MONTHS	0.83	0.92	0.89	1.00	0.68
F11	IV	DIRECT	CLEAN	6 MONTHS	0.93	0.96	0.97	1.00	0.87
F12	IV	DIRECT	CLEAN	6 MONTHS	0.93	0.96	0.97	1.00	0.87
F13	IV	DIRECT	CLEAN	6 MONTHS	0.93	0.96	0.97	1.00	0.87

POWER DENSITY: CHAPEL

FIXTURE DESIGNATION	LAMPS PER FIXTURE	NO OF FIXTURES	INPUT WATTS	TOTAL INPUT WATTS
F8	1	5	29	145
F9	1	4	45	180
F10	1	12	45	540
F11	8	5	35	1400
F12	1	1	20	20
F13	1	6	20	120

AREA OF ROOM	POWER DENSITY	ASHRAE STANDARD	OK?
2405	1900	1.3	2.4	OK

LIGHTING

CHAPEL INTERIOR

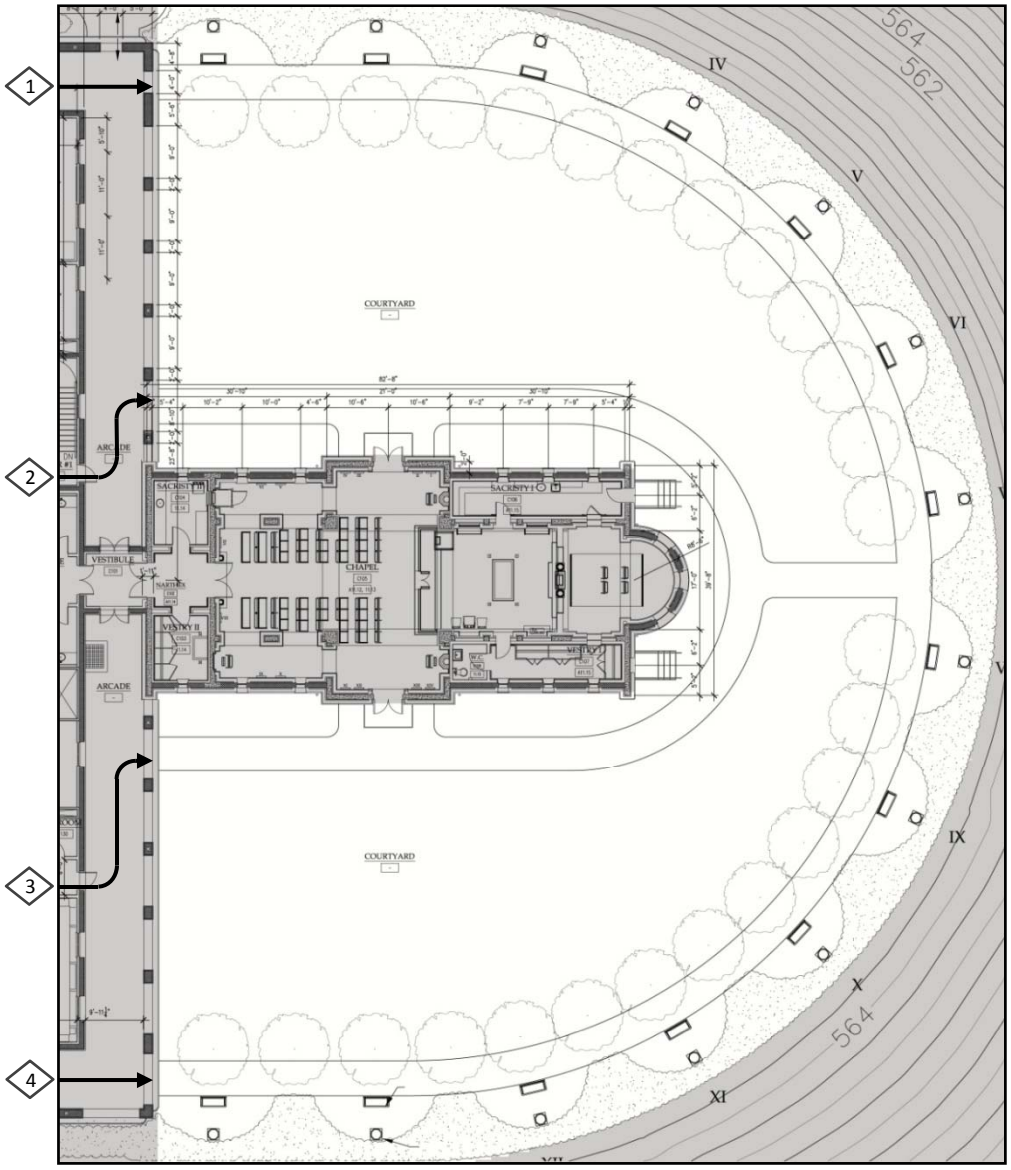
CHAPEL INTERIOR

LIGHTING

DESCRIPTION:

The courtyard, located on the east side of the friary surrounds the chapel. It can be accessed by means of the chapel or the arcade that lies along the perimeter of the friary. The courtyard is an arched space, a radius the length of the entire east side of the building, with twelve stations of the cross equally spaced along the outer edge. The following discusses more in depth the circulation, dimensions, focal points and materials of the courtyard.

FLOOR PLAN/CIRCULATION:



COURTYARD FLOOR PLAN
SCALE: NONE

1. Offices, Main Foyer
2. Stairs to 2nd Floor Cells
3. South Hall
4. Library, Refectory

LIGHTING

DIMENSIONS:

	COURTYARD	CHAPEL	ARCADE
North-South	200’ 0”	39’ 8”	185’ 4”
West-East	144’ 6”	91’ 2”	9’ 11 ¼”
Ceiling Height	-	VARIES	11’ 0”
Floor Area	21150 ft^2	-	-

FOCAL POINTS:

West Elevation	Chapel Façade and Arcade
Remaining Elevations	Trees and path leading to stations of the cross
Statues	Stations of the cross are placed along the perimeter

MATERIALS:

	Surface	Material	Reflectance
	Façade	Alabama Brown Fieldstone	0.26
	Pathways	Clay Paver: English Edge Cocoa	0.17
	Sculpture base	Travertine: Brushed Ivory	0.61
	Sculpture	Bronze Metal	0.14

DESIGN CRITERIA/CONSIDERATIONS

GARDEN: PATHS

(Very Important)

APPEARANCE OF LUMINAIRES:

The courtyard is a natural space and should maintain that appearance. It is the least marred by human hands and the closest to God’s original artwork. Thus, the luminaires chosen should blend in with the surroundings.

COLOR APPEARANCE:

As an exterior space at night, mesopic vision will be used. Thus, color rendition will be lessened especially in peripherals. Lighting should account for this by having a high CRI and an appropriate CCT.

CONTROLS:

Controls will be designed to evaluate daylight levels and turn the courtyard lighting on and off accordingly.

LIGHTING

DIRECT GLARE:

To avoid direct glare, luminaire placement is important. Bright sources cause discomfort when placed in an exterior space against a dark background. To prevent this, the visibility of the sources should yield to the higher importance of the object or area being illuminated. Light entering the windows on the second floor of the east wall should be minimal.

IESNA ILLUMINANCE RECOMMENDATIONS:

Horizontal:	10 lx (1 fc)
Vertical:	3 lx (0.3 fc)

LIGHT DISTRIBUTION ON SURFACES:

The illuminance along the pathway should be relatively uniform. This will give the impression that the lighting is purposefully placed and offer a sense of security. This will provide a safe path, where changes in elevation can be seen well in advance.

LIGHT POLLUTION/TRESPASS:

Because of the high respect for nature in this space, light pollution will be a major concern. The lighting should be designed for least interference with the access to a clear view of the stars. When lighting the façade, light trespass will also need to be considered for the 2nd floor cells along the east wall.

MAINTENANCE:

Fixtures chosen should be durable and weather resistant. The fixtures should be easily accessible and easy to maintain so that no lamps are burnt out, compromising the safety of the friars.

MODELING OF FACES AND OBJECTS:

Facial modeling is extremely important in an exterior space to allow recognition of other pedestrians and provide a sense of safety and security. To achieve facial modeling, vertical illuminance is required along the path. Modeling of objects is discussed in the sculpture section that follows.

POWER ALLOWANCE:

According to ASHRAE 90.1- 2004 Energy Standard for Building's Space-by-Space method, the allowable power density for this space is 0.2 W/ft^2 for the Building Façade.

LIGHTING

SAFETY AND SECURITY:

The courtyard is a very open and vast space with a pathway that lines the outer edge of the property. Trees line the inner edge of the path while sculptures are evenly spaced along the outer edge. In order to focus on the beauty of the courtyard and enjoy the sculptures, the viewer should not have any doubts about security. To provide a comfortable atmosphere, high light levels will be placed on hazardous areas, destinations, architectural features, and landscape features.

SHADOWS:

To ensure a feeling of safety, there should be no shadows along the path. Area and local sources should be used so that as the friars walk along the pathway their bodies do not create shadows along the path.

SCULPTURES

(Very Important)

APPEARANCE OF SPACE AND LUMINAIRES:

As discussed previously in the path section, the appearance of luminaires should respect the surroundings.

IESNA ILLUMINANCE RECOMMENDATIONS:

Horizontal:	Category A	Public Space	30 lx (3 fc)
Vertical:	Category B	Simple orientation for short visits	50 lx (5 fc)

LIGHT DISTRIBUTION ON SURFACE:

To introduce the depth and surface characteristics, the light should not be evenly distributed across the sculpture. Shadows will be necessary to create this depth and will be made by using a key and fill light and administering light from several different angles.

POINTS OF INTEREST:

The points of interest in the courtyard include the façade, the landscaping, and twelve sculptures of the stations of the cross.

REFLECTED GLARE:

The sculptures of the stations of the cross are bronze. Because of the reflective nature of this material, the reflections of the sources should be considered in luminaire placement.

SHADOWS:

Shadows should be used to provide depth, however, special care should be taken to ensure that the shadows do not fall over any ornate details of the sculpture.

LIGHTING

SURFACE CHARACTERISTICS:

The characteristics of the material will need to be taken into account when designing the lighting. The reflective qualities will determine the reflected glare as well as the perceived color of the sculpture.

COURTYARD DESIGN INTENT

The sculptures located along the perimeter of the courtyard are 8' tall and made of bronze. In order to bring out the quality of the sculpture's material and highlight the design of the sculpting an in-ground floodlight was used to illuminate the features of the sculpture from below. The metal halide source allows a large range of color temperature to choose from thus the best option for the material can be chosen. To provide both fill light for the sculpture as well as ambient light for safety and security of the friars, a pole lamp is located across the pathway. The light from this fixture will dance off the trees limbs creating decorative shadows along the path.

A pathway leads from the entrance of the chapel to the twelve stations of the cross that line the edge of the property. In an attempt to represent tea candles, colored LEDs will be placed along the outer edge of the pathway. Since the color of true flames is not consistent, as well as to compensate for the fact that red LEDs depreciate faster than other colors, a slight variation of color will be used for the lamps. These candle-like fixtures will illuminate the pathway, giving a comfortable feel to the atmosphere while displaying the changes in elevation and direction of the path. To continue the feeling of security, sconces will be places next to the entrances to the chapel to provide a clear indication of the destination.

When viewing the exterior of the chapel, the main focal point is the bell tower. This should be most prevalent of the architectural features. LED wall washers will be mounted on the interior of the tower and used to create a glowing 2' x 4' box that contains in it the bells for the chapel.

LIGHTING

LUMINAIRE SCHEDULE: COURTYARD

TYPE	IMAGE	DESCRIPTION	LAMPS	VOLTS	MOUNTING	MANUFACTURER	CATALOG NO.
F14		IN-GROUND FIXTURE: BRONZE COVERING, WET LOCATIONS	70W MH	120	IN-GROUND	BEGA	8615-MH
F15		COURTYARD - WALLWASH IN CHAPEL BELL TOWER	30W LED	120	SURFACE MOUNTED	COLOR KINETICS	501-00002-00
F16		COURTYARD - POLE LAMP PATHWAY	39 MH	120	POLE	ARCHITECTURAL AREA LIGHTING	PROS-DIRS-39MHT6EB
F17		COURTYARD EXTERIER FLOOD FAÇADE LIGHTING	70W MH	120	SURFACE MOUNTED	ALLSCAPE	FL-02-K-70MH-T6-120-R3
F18		COURTYARD - LED PATHWAY LIGHTS	0.9W LED	120	IN-GROUND	ERCO	
F19		COURTYARD - WALL SCONCE	MH	120	WALL MOUNTED	DESIGN PLAN	PEA-9-F1

LAMP SCHEDULE: COURTYARD

TYPE	FIXTURE	BALLAST	DESCRIPTION	WATTAGE	CRI	CCT	OUTPUT	RATED LIFE	MANUFACTURER	CATALOG NO.
L14	F14	B14	METAL HALIDE TD-6 WITH RX7 BASE	70W	80	4200	5700 LMS	9000 HRS	PHILLIPS	MHN70/TD/840
L15	F15	-	LED	30W	-	4000	-	-	COLOR KINETICS	-
L16	F16	B16	METAL HALIDE T-6 WITH G12 BASE	39W	81	3000	3300 LMS	9000 HRS	PHILLIPS	CDM35/T6/830
L17	F17	B17	METAL HALIDE TD-6 WITH RX7 BASE	70W	80	4200	5700 LMS	9000 HRS	PHILLIPS	MHN70/TD/840
L18	F18	B18	LED	0.9	-	-	-	-	COLOR KINETICS	-
L19	F19	B19	METAL HALIDE T-6 WITH G12 BASE	39W	81	3000	3300 LMS	9000 HRS	PHILLIPS	CDM35/T6/830

BALLAST SCHEDULE: COURTYARD

TYPE	FIXTURE	LAMP	NO. LAMPS	VOLTAGE	START METHOD	INPUT (W)	BALLAST FACTOR	POWER FACTOR	THD(%)	MANUFACTURER	CATALOG NO.
B14	F14	L14	1	120	ELECTRONIC	86W	1.00	0.98	18	ADVANCE TRANSFORMER	IMH-70-A-BLS-ID
B16	F16	L16	1	120	ELECTRONIC	45W	1.00	0.9	15	ADVANCE TRANSFORMER	IMH-39-A-M110
B17	F17	L17	1	120	ELECTRONIC	86W	1.00	0.98	18	ADVANCE TRANSFORMER	IMH-70-A-BLS-ID
B19	F19	L19	1	120	ELECTRONIC	45W	1.00	0.9	15	ADVANCE TRANSFORMER	IMH-39-A-M110

LIGHT LOSS FACTORS: COURTYARD

FIXTURE	MAINTENANCE CATEGORY	DISTRIBUTION	DIRT CONDITION	CLEANING CYCLE	LLD	LDD	BF	TOTAL LLF
F14	VI	INDIRECT	DIRTY	6 MONTHS	0.83	0.9	0.9	0.67
F15	VI	INDIRECT	DIRTY	6 MONTHS	1.00	0.9	1.0	0.90
F16	IV	SEMI-DIRECT	DIRTY	6 MONTHS	0.83	0.92	1.0	0.76
F17	VI	INDIRECT	DIRTY	6 MONTHS	0.83	0.9	1.0	0.75
F18	VI	INDIRECT	DIRTY	6 MONTHS	1.00	0.9	1.0	0.90
F19	IV	SEMI-DIRECT	DIRTY	6 MONTHS	0.83	0.92	1.0	0.76

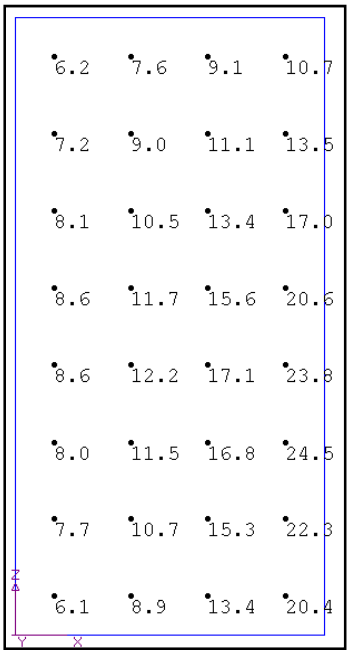
LIGHTING

POWER DENSITY: COURTYARD FAÇADE

FIXTURE DESIGNATION	LAMPS PER FIXTURE	NO OF FIXTURES	INPUT WATTS	TOTAL INPUT WATTS				
F17	1	21	86	1806				
F19	1	8	45	360	FAÇADE AREA	POWER DENSITY	ASHRAE STANDARD	OK?
				2166	8042	0.3	0.2	OK

The chapel façade power density is slightly above the standard at 0.3 W/ft^2, however, the chapel makes up for the façade using space by space method by being well below the power density standard.

STATUE LIGHTING CALC GRID



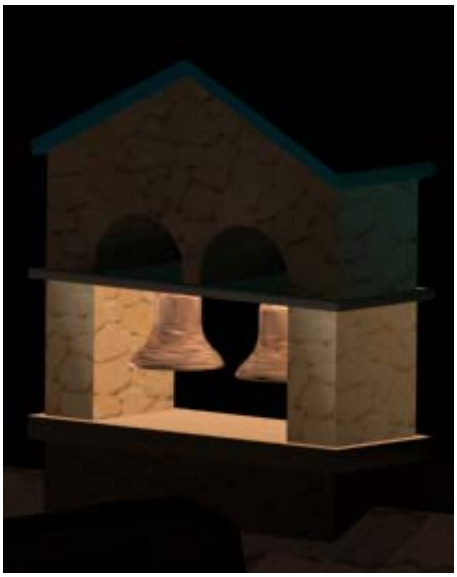
SCULPTURE ILLUMINANCE CALCULATION GRID

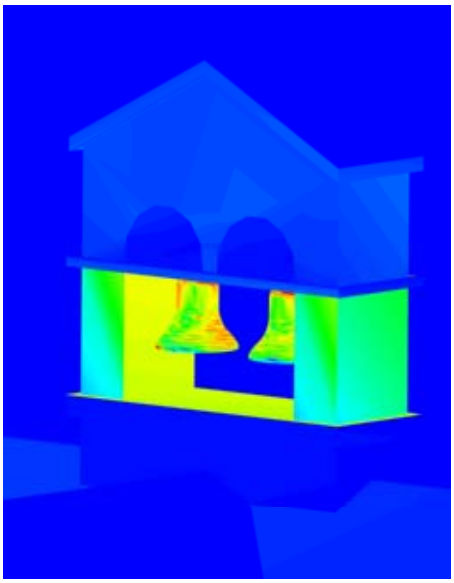
SCALE: NONE

CALC GRID	VERTICAL
AVERAGE	12.73 FC
MAXIMUM	24.5 FC
MINIMUM	6.1 FC
MAX:MIN RATIO	2.09
AVG: MIN RATIO	4.02

LIGHTING

BELL TOWER





PATHWAY WITH STATIONS OF THE CROSS

LIGHTING

CHAPEL FAÇADE AND ARCADE

CHAPEL FAÇADE

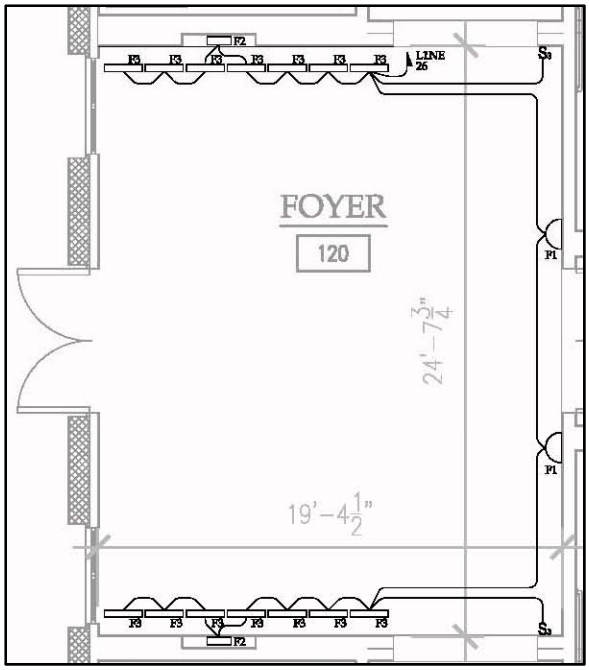
ELECTRICAL

FOYER:

The foyer is located in the center of the East side of the Friary. It circulates the traffic from the remainder of the building into the Chapel. The new lighting design proposed in this thesis uses two sconces on either side of the main door to the vestibule to create a break in the line of pendants in the adjacent hallway and to indicate the direction to the chapel. Floor mounted fluorescent wall washers wash the North and South walls while metal halide sources accent the pictures in the recesses. Two electric candles complete the design in the foyer as well as continue the design of the inner courtyard which has candles evenly placed in the windows along the perimeter. A three way switching system will be used with switches located in each of the entrances to the foyer from the East Hall. These switches will control the sconces, wall washers, and accent lights collectively. The candles will be battery powered to avoid the use of unsightly chords.

FLOOR PLAN:

The floor plan below shows the circuiting for the foyer. All of the lighting will be served from one circuit. Load calculations are provided to prove this to be feasible.



FOYER LIGHTING PLAN
SCALE: 1/8"=1'-0"

LOAD CALCULATIONS:

The load calculations provided determine the change in electrical lighting loads for the foyer. The lighting loads of the surrounding areas are still remaining on the circuit as well. The loads for the space lessened due to the use of fluorescent and metal halide sources.

ELECTRICAL

ORIGINAL DESIGN LIGHTING LOAD (L1NE(1) CKT 26)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
C	1	3	75 W	1.00	225 VA
D	2	3	75 W	1.00	450 VA
				Total:	675 VA

NEW DESIGN LIGHTING LOAD

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F1	2	1	60 W	1.00	120 VA
F2	2	1	35 W	1.00	70 VA
F3	14	1	11 W	0.97	149 VA
				Total:	339 VA

Original Circuit Load: 1146 VA

Remaining Loads: 1146 VA – 675 VA = 471 VA

New Circuit Load: 471 VA + 339 VA = *810 VA*

PANELBOARD SCHEDULE:

The panelboard below, L1NE, is located in the basement mechanical room of the Friary. The highlighted circuit serves the lighting in the foyer as well as the mail and storage room. The load shown is the calculated load for the existing mail and storage room design and the new foyer lighting design.

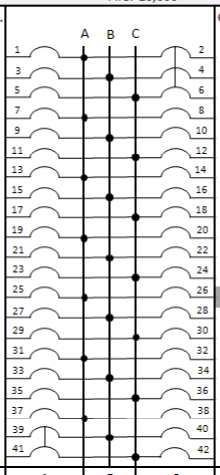
REDESIGN OF FOYER: REVISED LIGHTING LOADS ON L1NE

PANEL DESCRIPTION: L1NE(1) | LOCATION: BASEMENT MECH RM | MOUNTING: SURFACE | ENTRY: TOP | SECTION: 1 OF 2

BUS: 200A | VOLTAGE: 208 /120 | PHASE: 3 | WIRE: 4 | POLES: 84

MAIN: MLO | NEUTRAL: | AIC: 10,000 | IG BUS: NO | NOTES:

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	R-OFFICE	20	2#12+#12G 3/4"C	1440	474	4#12+#12G 3/4"C	15	FCU	2
3	R-OFFICE	20	2#12+#12G 3/4"C	1440	473			-	4
5	R-RECREATION	20	2#12+#12G 3/4"C	1440	473			-	6
7	R-OFFICE	20	2#12+#12G 3/4"C	1440	720	2#12+#12G 3/4"C	20	R-WORKROOM	8
9	R-CORRIDORS	20	2#12+#12G 3/4"C	1440	1200	2#12+#12G 3/4"C	20	R-KITCHENETTE	10
11	R-OFFICE	20	2#12+#12G 3/4"C	1440	1200	2#12+#12G 3/4"C	20	R-KITCHENETTE	12
13	R-PARLOR	20	2#12+#12G 3/4"C	1440			20	SPARE	14
15	R-WORK RM	20	2#12+#12G 3/4"C	1060			20	SPARE	16
17	R-CONF	20	2#12+#12G 3/4"C	1260	1426	2#12+#12G 3/4"C	20	L-OFFICES, RECREATION	18
19	WATER COOLERS	20	2#12+#12G 3/4"C	1020	1647	2#12+#12G 3/4"C	20	L-FOYER, PARLOR	20
21	SPARE	20			998	2#12+#12G 3/4"C	20	L-WORK ROOM, OFFICES	22
23	SPARE	20			1300	2#12+#12G 3/4"C	20	L-1ST FLOOR, CORRIDOR	24
25	SPARE	20			810	2#12+#12G 3/4"C	20	L-FOYER, MAIL, STORAGE	26
27	R-CORRIDORS	20	2#12+#12G 3/4"C	1440	1100	2#12+#12G 3/4"C	20	L-ARCADE	28
29	R-FOYER, CORRIDOR	20	2#12+#12G 3/4"C	1260	700	2#12+#12G 3/4"C	20	L-ARCADE	30
31	R-MAIL OFFICE	20	2#12+#12G 3/4"C	1260	600	2#12+#12G 3/4"C	20	L-ARCADE	32
33	R-OFFICE	20	2#12+#12G 3/4"C	720	200	2#12+#12G 3/4"C	20	L-PORTICO FLOOD LIGHT	34
35	R-PRINTER	20	2#12+#12G 3/4"C	300			20	SPARE	36
37	R-COPIER	20	2#12+#12G 3/4"C	1000			20	SPARE	38
39	-						20	SPARE	40
41	R-SHREDDER	20		300			20	SPARE	42



TOTAL CONNECTED KVA =	34	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES =	93.7
			11.9	10.1	11.8		

ELECTRICAL

PANEL DESCRIPTION	LOCATION: BASEMENT MECH RM	MOUNTING: SURFACE	ENTRY: TOP	SECTION: 2 OF 2
L1NE(2)	BUS: 200A VOLTAGE:208 /120 PHASE: 3		WIRE: 4	POLES: 84
	MAIN: MLO NEUTRAL:YES	AIC: 10,000	IG BUS:NO	NOTES:

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	A B C	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	L-DRIVEWAY	20	2#8+#12G 3/4"C	800	1 2	600	2#10+#10G 3/4"C	20	ACCESSIBLE DOOR	2
3	-			800	3 4			20	SPARE	4
5	L-PARKING	20	2#8+#20G 3/4"C	500	5 6	360	2#12+#12G 3/4"C	20	FCU-28	6
7	-			500	7 8			20	SPARE	8
9	L-LANDSCAPE	20	2#10+#10G 3/4"C	900	9 10			20	SPARE	10
11	R-BASEMENT	20	2#10+#10G 3/4"C	1260	11 12			20	SPARE	12
13	R-BASEMENT	20	2#10+#10G 3/4"C	1260	13 14			20	SPARE	14
15	SPARE				15 16				SPACE	16
17	SPARE				17 18				SPACE	18
19	SPARE				19 20				SPACE	20
21	SPARE				21 22				SPACE	22
23	SPACE				23 24				SPACE	24
25	SPACE				25 26				SPACE	26
27	SPACE				27 28				SPACE	28
29	SPACE				29 30				SPACE	30
31	SPACE				31 32				SPACE	32
33	SPACE				33 34				SPACE	34
35	SPACE				35 36				SPACE	36
37	SPACE				37 38				SPACE	38
39	SPACE				39 40				SPACE	40
41	SPACE				41 42				SPACE	42

TOTAL CONNECTED KVA =	7	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES =	19.4
			3.2	1.7	2.1		

Panel L1NE(1)	=	93.7 A
Panel L1NE(2)	=	19.4 A
Total L1NE	=	113.1 A
Fuse size:		
131.1A*1.25	=	141A (Resize the fuse to 150A)
Feeder size:		(4)3/O+#4G – 2”C*

*Based on the use of aluminum feeders

FEEDER SIZE:

L1NE is sized at 200A though the load on the panelboard will allow for a smaller overcurrent protection device. The new fuse will be 150A. The feeder size based upon NEC 2005 Table 310.16, will be (3)3/O phase wires (1)3/O neutral and a #4 ground conductor in a 2” EMT conduit.

LIBRARY:

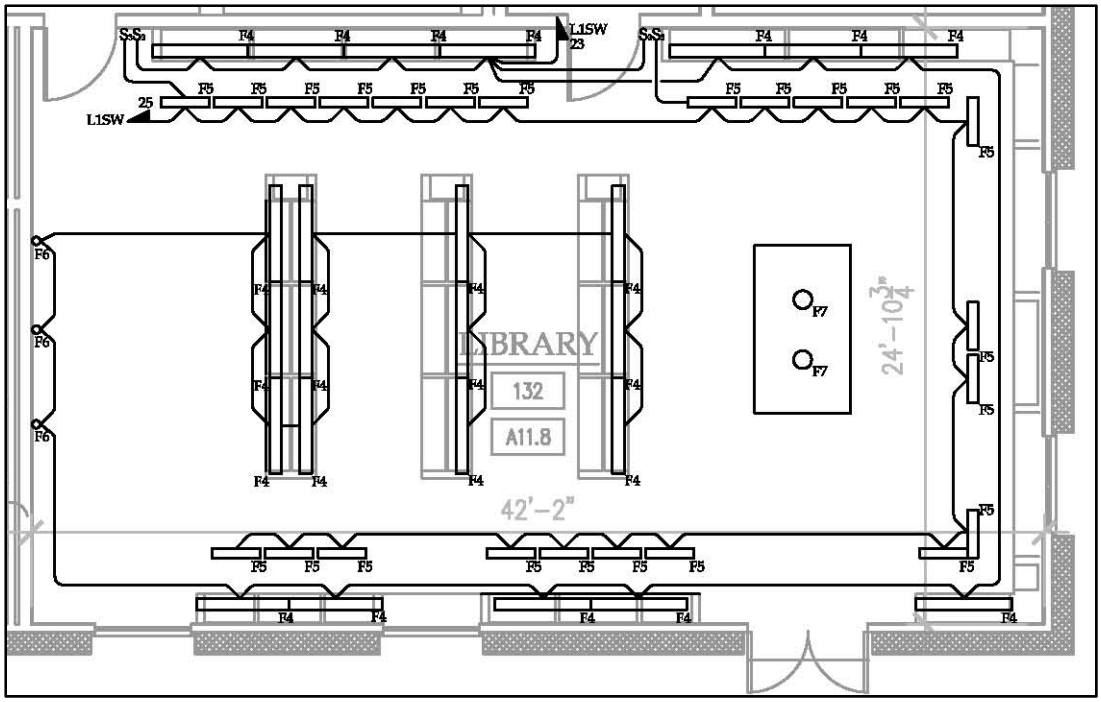
The library is located in the southeast corner of the Friary. Built-in bookshelves line three of the four walls and stand alone bookshelves are placed in the center of the west side of the room. A table is located in the center of the room on the east side. The new lighting design uses fluorescent wall washers to illuminate the walls of books. Cove lighting is tucked above the bookshelves and used to uplight the coffered wood ceiling. Table lamps are provided as task light on the table. These lamps will use receptacles and be manually switched. Battery powered candles will be placed in the windows as in the foyer.

The booklights will be served by their own 3-way switch with a switch at each of the hallway entrances. This will allow the booklights to be turned off when they are unnecessary thus lowering the book’s exposure to harmful rays. The coves and sconces will all be placed on a second 3-way switch.

ELECTRICAL

FLOOR PLAN:

The lighting in the library will need two circuits. The coves which operate on their own switch will be on one circuit while the remainder of the lighting loads will be served by another circuit.



LIBRARY LIGHTING PLAN
SCALE: 1/8"=1'-0"

LOAD CALCULATIONS:

ORIGINAL DESIGN LIGHTING LOAD (L1SW(2) CKTS 23,25)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
C	10	3	75 W	1.00	2250 VA
				Total:	2250 VA

NEW DESIGN LIGHTING LOAD

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F5	24	1	39 W	1.02	955 VA
F6	40	1	24 W	1.02	979 VA
F7	3	1	13 W	0.97	38 VA
				Total:	1972 VA

Original Circuit Load: 1125 VA/circuit (2 circuits)

New Circuit Load: 955 VA (bookshelf lights)
1017 VA (cove/sconce lights)

ELECTRICAL

PANELBOARD SCHEDULE:

The panelboard below, L1SW, is located on the southwest of the first floor of the Friary. The highlighted circuits serve the lighting in the library. The load shown is the calculated load for the new lighting design. Calculations can be found on the previous page.

REDESIGN OF LIBRARY: REVISED LIGHTING LOADS ON L1SW

PANEL DESCRIPTION	LOCATION: 1ST FLOOR SW		MOUNTING: SURFACE	ENTRY: TOP		SECTION: 1 OF 2
L1SW(1)	BUS: 225A	VOLTAGE:208 /120	PHASE: 3	WIRE: 4	POLES: 84	
	MAIN: 225A	NEUTRAL: YES	AIC: 10,000	IG BUS: NO	NOTE:	

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA		CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	R-REFECTORY	20	2#12+#12G 3/4"C	1080	1	560	3#12+#12G 1/2"C	20	FCU-	2
3	R-LIB COMPUTERS	20	2#12+#12G 3/4"C	1200	3	560		20	-	4
5	R-LIBRARY	20	2#12+#12G 3/4"C	900	5			20	SPACE	6
7	SPARE	20			7	363	4#12+#12G 3/4"C	20	FCU-10	8
9	SPARE	20			9	363		20	-	10
11	WASHER, DRYER	20	2#12+#12G 3/4"C	1800	11	363		20	-	12
13	R-RECREATION	20	2#12+#12G 3/4"C	1440	13			20	SPARE	14
15	R-CORRIDOR	20	2#12+#12G 3/4"C	1440	15			20	-	16
17	R-CORRIDOR	20	2#12+#12G 3/4"C	1260	17			20	-	18
19	R-HOBBY RM	20	2#12+#12G 3/4"C	360	19			20	SPARE	20
21	R-HOBBY RM	20	2#12+#12G 3/4"C	1200	21			20	-	22
23	R-HOBBY RM	20	2#12+#12G 3/4"C	1200	23			20	-	24
25	R-EXERCISE	20	2#12+#12G 3/4"C	1000	25	474	4#12+#12G 3/4"C	20	FCU-23	26
27	R-EXERCISE	20	2#12+#12G 3/4"C	1250	27	473		20	-	28
29	R-EXERCISE	20	2#12+#12G 3/4"C	1000	29	473		20	-	30
31	R-TREADMILL	20	2#12+#12G 3/4"C	1000	31			20	SPARE	32
33	R-TREADMILL	20	2#12+#12G 3/4"C	1000	33			20	-	34
35	R-TREADMILL	20	2#12+#12G 3/4"C	1000	35			20	-	36
37	L-COURTYARD	20	2#12+#12G 3/4"C	140	37	474	4#12+#12G 3/4"C	20	FCU-22,16	38
39	R-CORRIDOR,STORAGE	20		1080	39	473		20	-	40
41	SPARE	20			41	473		20	-	42

TOTAL CONNECTED KVA =	24	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES = 67.8
			6.9	9.0	8.5	

PANEL DESCRIPTION	LOCATION: 1ST FLOOR SW		MOUNTING: SURFACE	ENTRY:		SECTION: 2 OF 2
L1SW(2)	BUS: 225A	VOLTAGE: 208 /120	PHASE: 3	WIRE: 4	POLES: 84	
	MAIN: MLO	NEUTRAL: YES	AIC: 10,000	IG BUS: NO	NOTE:	

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA		CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	R-CELLS	20	2#12+#12G 3/4"C	1080	1	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	2
3	R-CELLS	20	2#12+#12G 3/4"C	1080	3	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	4
5	R-CELLS	20	2#12+#12G 3/4"C	1440	5	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	6
7	SPARE	20	2#12+#12G 3/4"C		7	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	8
9	SPARE	20	2#12+#12G 3/4"C		9	360	2#12+#12G 3/4"C	20	R-CELL BRS SW	10
11	SPARE	20	2#12+#12G 3/4"C		11	720	2#12+#12G 3/4"C	20	R-2ND FL CORR	12
13	R-STUDY (EF)	20	2#12+#12G 3/4"C	720	13	720	2#12+#12G 3/4"C	20	R-STUDY 277	14
15	R-MUSIC RM	20	2#12+#12G 3/4"C	1080	15	1080	2#12+#12G 3/4"C	20	R-CORR	16
17	R-PORCH,HALL	20	2#12+#12G 3/4"C	720	17	720	2#12+#12G 3/4"C	20	R-CELL	18
19	FF-3	20	2#12+#12G 3/4"C	720	19	540	2#12+#12G 3/4"C	20	R-CELL BRS, CLO	20
21	L-1ST FL CORR-S	20	2#12+#12G 3/4"C	1200	21	360	2#12+#12G 3/4"C	20	R-CELL BRS	22
23	L-1ST FL LIB	20	2#12+#12G 3/4"C	955	23	1080	2#12+#12G 3/4"C	20	R-CELL	24
25	L-1ST FL LIB	20	2#12+#12G 3/4"C	1017	25	600	2#12+#12G 3/4"C	20	L-ATTIC	26
27	L-RECREATION	20	2#12+#12G 3/4"C	1086	27	1268	2#12+#12G 3/4"C	20	L-LAUNDRY	28
29	L-EXERCISE	20	2#12+#12G 3/4"C	1503	29	1319	2#12+#12G 3/4"C	20	L-MUSIC, STUDY	30
31	L-ARCADE	20	2#12+#12G 3/4"C	600	31	1500	2#12+#12G 3/4"C	20	L-CELLS	32
33	L-ARCADE	20	2#12+#12G 3/4"C	600	33	1275	2#12+#12G 3/4"C	20	L-CELLS	34
35	L-ARCADE	20	2#12+#12G 3/4"C	800	35	1275	2#12+#12G 3/4"C	20	L-CELLS	36
37	L-LANDSCAPE	20	2#8+#10G 3/4"C	1300	37	1275	2#12+#12G 3/4"C	20	L-CELLS	38
39	FCU-26	20	2#12+#12G 3/4"C	360	39	1480	2#10+#10G 3/4"C	20	L-DRIVEWAY	40
41	SPARE	20			41	1480			-	42

TOTAL CONNECTED KVA =	35	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES = 96.6
			10.8	11.6	12.4	

Panel L1SW(1)	=	67.8A
Panel L1SW(2)	=	96.6 A
Total L1SW	=	177.4 A
Fuse Size:		
177.4A*1.25(growth)	=	221.75A

FEEDER SIZE:

The fuse for L1SW was originally sized for 225A. The new lighting load will not impact this calculation and the fuse and feeder should remain the same.

ELECTRICAL

CHAPEL:

The chapel is located to the far east of the footprint. Three sides of the chapel open to the outdoors and the fourth side of the chapel is where the main entrance to the chapel, accessed by a central foyer, lies. The proposed lighting design consists of 6 pendant fixtures that provide the main ambient light, indirect fixtures that uplight the archways, and spotlights that highlight some of the key elements. All circuits will have a main switch at the main entrance through the foyer. The pendant fixtures will have a fourway switch allowing for them to be turned on or off at every main entrance. The spot lights will have their switch located at the front of the chapel next to the pulpit allowing for the circuit to be turned on and off locally.

ORIGINAL DESIGN LIGHTING LOAD (LCHAP CKT 1)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
AA	2	14	40 W	1.00	1120 VA
				Total:	1120 VA

ORIGINAL DESIGN LIGHTING LOAD (LCHAP CKT 3)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
BB	5	1	60 W	1.00	300 VA
HH	2	1	100 W	1.00	200 VA
K1	2	1	50 W	1.00	100 VA
				Total:	600 VA

ORIGINAL DESIGN LIGHTING LOAD (LCHAP CKT 5)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
BB	5	1	60 W	1.00	300 VA
HH	2	1	100 W	1.00	200 VA
K1	2	1	50 W	1.00	100 VA
				Total:	600 VA

NEW DESIGN LIGHTING LOAD (LCHAP CKT 1)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F10	12	1	35 W	1.00	420 VA
F13	6	1	20 W	1.00	120 VA
				Total:	540 VA

NEW DESIGN LIGHTING LOAD (LCHAP CKT 3)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F9	5	1	35 W	1.00	175 VA
F12	1	1	20 W	1.00	20 VA
				Total:	195 VA

NEW DESIGN LIGHTING LOAD (LCHAP CKT 5)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F11	6	8	35 W	1.00	1680 VA
F8	4	1	26 W	1.00	104 VA
				Total:	1784 VA

ELECTRICAL

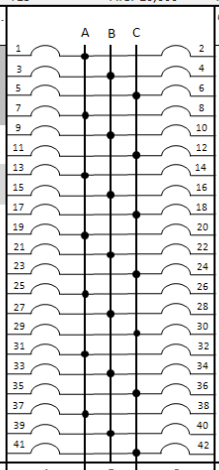
PANELBOARDS:

The LCHAP panelboard is designated to serve the chapel. It is the only panelboard that will be affected by the redesign. The panelboard below displays the new calculated loads.

REDESIGN OF CHAPEL: REVISED LIGHTING LOADS ON LCHAP

PANEL DESCRIPTION: LCHAP	LOCATION: SACRISTY I		MOUNTING: FLUSH	ENTRY: TOP		SECTION: 1 OF 1
	BUS: 200 A	VOLTAGE: 208 /120	PHASE: 3	WIRE: 4	POLES: 30	
	MAIN: 200A	NEUTRAL: YES	AIC: 10,000	IG BUS: NO	NOTE:	

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	PENDANT LTG	20	2#10+#10 1/2"C	540	720	2#12+#12G 1/2"C	20	RECEPTACLES	2
3	CHAPEL SCONCES	20	2#10+#10 1/2"C	195	720	2#12+#12G 1/2"C	20	RECEPTACLES	4
5	CHAPEL SCONCES	20	2#10+#10 1/2"C	1784	500	2#12+#12G 1/2"C	20	RECEPTACLES	6
7	ALTER LIGHTING	20	2#10+#10 1/2"C	0	580	2#12+#12G 1/2"C	20	L-BALCONY	8
9	L-SACRISTY/VESTRY	20	2#10+#10 1/2"C	1425	900	2#10+#10G 3/4"C	20	R-ALTER	10
11	L-SACRISTY/VESTRY	20	2#10+#10 1/2"C	675	1500	2#10+#10G 3/4"C	20	INSTAHOT	12
13	L-FLOOD	20	2#10+#10 1/2"C	1750	1500	2#10+#10G 3/4"C	20	INSTAHOT	14
15	L-BELL TOWER	20	2#10+#10 1/2"C	60	300	2#12+#12G 3/4"C	20	UC FRIDGE	16
17	L-FLOOD LIGHTS	20	2#10+#10 1/2"C	600	300	2#12+#12G 3/4"C	20	UC FRIDGE	18
19	L-FLOOD LIGHTS	20	2#10+#10 1/2"C	300			20	SPARE	20
21	INSTAHOT	20	2#10+#10 1/2"C	1500			20	SPARE	22
23	SPARE	20						SPACE	24
25	SPACE							SPACE	26
27	SPACE							SPACE	28
29	SPACE							SPACE	30
31									32
33									34
35									36
37									38
39									40
41									42



TOTAL CONNECTED KVA =	16	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES = 44.0
			5.4	5.1	5.4	

Panel LCHAP	=	44.9 A
Fuse Size:		
44.9A*1.25(growth)	=	56.1 A(Resize the fuse to 100A)
Feeder size:		(4)#1+#6G – 1 ½”C*

*Based on the use of aluminum feeders

FEEDER SIZE:

The LCHAP panelboard is sized at 200A though the load on the panelboard will allow for a smaller overcurrent protection device. The new fuse will be 100A. The feeder size based upon NEC 2005 Table 310.16, will be (3)#1 phase wires (1)#1 neutral and a #6 ground conductor in a 1 ½ ” EMT conduit.

COURTYARD:

The exterior courtyard lighting design is comprised of mainly two parts. The first part of the design is the façade. The façade is washed with flood lights and sconces are located at the entrances. The lighting design was based upon providing the friars with a sense of security. The second part is the statues that line the outer edge of the property. These statues will be lit with a flood light from the ground. As well a pole lamp across the sidewalk will provide some general lighting. All lighting will be switched on by an automatic time switch. The floorplans can be found in the electrical appendix.

ELECTRICAL

LOAD CALCULATIONS:

ORIGINAL DESIGN LIGHTING LOAD (LINE(2) CKT 9)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
S-4	8	1	20 W	1.00	160 VA
S-5	10	1	35 W	1.00	350 VA
				Total:	510 VA

ORIGINAL DESIGN LIGHTING LOAD (LISW(2) CKT 37)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
S-4	20	1	20 W	1.00	400 VA
S-5	20	1	35 W	1.00	700 VA
				Total:	1100 VA

ORIGINAL DESIGN LIGHTING LOAD (LCHAP CKT 13)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
S-6	10	1	75 W	1.00	750 VA
				Total:	750 VA

NEW DESIGN LIGHTING LOAD (LINE(2) CKT 9)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F16	12	1	35 W	1.00	420 VA
				Total:	420 VA

NEW DESIGN LIGHTING LOAD (LISW(2) CKT 37)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F14	12	1	70 W	1.00	840 VA
				Total:	840 VA

NEW DESIGN LIGHTING LOAD (LCHAP CKT 13)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F18	2	1	30 W	1.00	60 VA
				Total:	60 VA

NEW DESIGN LIGHTING LOAD (LCHAP CKT 15)

FIXTURE	QUANTITY	LAMPS/FIXTURE	LAMP WATTAGE	BALLAST FACTOR	LOAD
F17	21	1	70 W	1.00	1470 VA
F19	8	1	35 W	1.00	280 VA
				Total:	1750 VA

ELECTRICAL

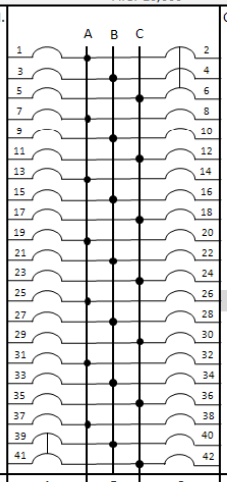
PANELBOARDS:

The panelboard below, L1SW, is located on the southwest of the first floor of the Friary. Panelboard LCHAP is located in the chapel, and panelboard L1NE is located in the northeast of the basement. All three panelboards serve the courtyard lighting. Panelboard L1SW serves the statue spotlights. Panel L1NE serves the statue pole fixtures. Panelboard LCHAP serves the façade lighting. The highlighted circuits show the calculated loads for the new design. Calculations can be found on the previous page.

REDESIGN OF COURTYARD: REVISED LIGHTING LOADS ON L1NE

PANEL DESCRIPTION: L1NE(1) | LOCATION: BASEMENT MECH RM | BUS: 200A | MAIN: MLO | VOLTAGE: 208 /120 | NEUTRAL: | MOUNTING: SURFACE | PHASE: 3 | AIC: 10,000 | ENTRY: TOP | WIRE: 4 | IG BUS: NO | POLES: 84 | NOTES: | SECTION: 1 OF 2

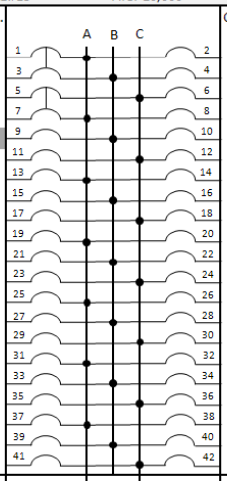
CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	R-OFFICE	20	2#12+#12G 3/4"C	1440	474	4#12+#12G 3/4"C	15	FCU	2
3	R-OFFICE	20	2#12+#12G 3/4"C	1440	473			-	4
5	R-RECREATION	20	2#12+#12G 3/4"C	1440	473			-	6
7	R-OFFICE	20	2#12+#12G 3/4"C	1440	720	2#12+#12G 3/4"C	20	R-WORKROOM	8
9	R-CORRIDORS	20	2#12+#12G 3/4"C	1440	1200	2#12+#12G 3/4"C	20	R-KITCHENETTE	10
11	R-OFFICE	20	2#12+#12G 3/4"C	1440	1200	2#12+#12G 3/4"C	20	R-KITCHENETTE	12
13	R-PARLOR	20	2#12+#12G 3/4"C	1440			20	SPARE	14
15	R-WORK RM	20	2#12+#12G 3/4"C	1060			20	SPARE	16
17	R-CONF	20	2#12+#12G 3/4"C	1260	1426	2#12+#12G 3/4"C	20	L-OFFICES, RECREATION	18
19	WATER COOLERS	20	2#12+#12G 3/4"C	1020	1647	2#12+#12G 3/4"C	20	L-FOYER, PARLOR	20
21	SPARE	20			998	2#12+#12G 3/4"C	20	L-WORK ROOM, OFFICES	22
23	SPARE	20			1300	2#12+#12G 3/4"C	20	L-1ST FLOOR, CORRIDOR	24
25	SPARE	20			810	2#12+#12G 3/4"C	20	L-FOYER, MAIL, STORAGE	26
27	R-CORRIDORS	20	2#12+#12G 3/4"C	1440	1100	2#12+#12G 3/4"C	20	L-ARCADE	28
29	R-FOYER, CORRIDOR	20	2#12+#12G 3/4"C	1260	700	2#12+#12G 3/4"C	20	L-ARCADE	30
31	R-MAIL OFFICE	20	2#12+#12G 3/4"C	1260	600	2#12+#12G 3/4"C	20	L-ARCADE	32
33	R-OFFICE	20	2#12+#12G 3/4"C	720	200	2#12+#12G 3/4"C	20	L-PORTICO FLOOD LIGHT	34
35	R-PRINTER	20	2#12+#12G 3/4"C	300			20	SPARE	36
37	R-COPIER	20	2#12+#12G 3/4"C	1000			20	SPARE	38
39	-						20	SPARE	40
41	R-SHREDDER	20		300			20	SPARE	42



TOTAL CONNECTED KVA =	34	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES =	93.7
			11.9	10.1	11.8		

PANEL DESCRIPTION: L1NE(2) | LOCATION: BASEMENT MECH RM | BUS: 200A | MAIN: MLO | VOLTAGE: 208 /120 | NEUTRAL: YES | MOUNTING: SURFACE | PHASE: 3 | AIC: 10,000 | ENTRY: TOP | WIRE: 4 | IG BUS: NO | POLES: 84 | NOTES: | SECTION: 2 OF 2

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	L-DRIVEWAY	20	2#8+#12G 3/4"C	800	600	2#10+#10G 3/4"C	20	ACCESSIBLE DOOR	2
3	-			800			20	SPARE	4
5	L-PARKING	20	2#8+#20G 3/4"C	500	360	2#12+#12G 3/4"C	20	FCU-28	6
7	-			500			20	SPARE	8
9	L-LANDSCAPE	20	2#10+#10G 3/4"C	420			20	SPARE	10
11	R-BASEMENT	20	2#10+#10G 3/4"C	1260			20	SPARE	12
13	R-BASEMENT	20	2#10+#10G 3/4"C	1260			20	SPARE	14
15	SPARE							SPACE	16
17	SPARE							SPACE	18
19	SPARE							SPACE	20
21	SPARE							SPACE	22
23	SPACE							SPACE	24
25	SPACE							SPACE	26
27	SPACE							SPACE	28
29	SPACE							SPACE	30
31	SPACE							SPACE	32
33	SPACE							SPACE	34
35	SPACE							SPACE	36
37	SPACE							SPACE	38
39	SPACE							SPACE	40
41	SPACE							SPACE	42



TOTAL CONNECTED KVA =	7	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES =	18.1
			3.2	1.2	2.1		

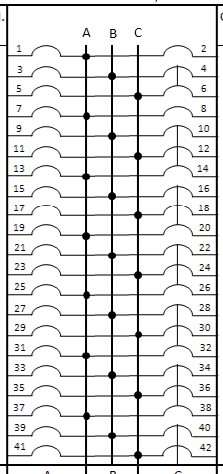
Panel L1NE(1)	=	93.7A
Panel L1NE(2)	=	18.1 A
Total L1NE	=	111.8 A(Resize to 150A)

ELECTRICAL

REDESIGN OF COURTYARD: REVISED LIGHTING LOADS ON L1SW

PANEL DESCRIPTION	LOCATION: 1ST FLOOR SW			MOUNTING: SURFACE	ENTRY: TOP		SECTION: 1 OF 2
L1SW(1)	BUS: 225A	VOLTAGE: 208	/120	PHASE: 3	WIRE: 4	POLES: 84	
	MAIN: 225A	NEUTRAL: YES		AIC: 10,000	IG BUS: NO	NOTE:	

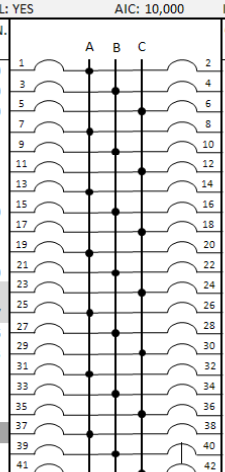
CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA		CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	R-REFECTORY	20	2#12+#12G 3/4"C	1080		560	3#12+#12G 1/2"C	20	FCU-	2
3	R-LIB COMPUTERS	20	2#12+#12G 3/4"C	1200		560		20	-	4
5	R-LIBRARY	20	2#12+#12G 3/4"C	900				20	SPACE	6
7	SPARE	20				363	4#12+#12G 3/4"C	20	FCU-10	8
9	SPARE	20				363		20	-	10
11	WASHER, DRYER	20	2#12+#12G 3/4"C	1800		363		20	-	12
13	R-RECREATION	20	2#12+#12G 3/4"C	1440				20	SPARE	14
15	R-CORRIDOR	20	2#12+#12G 3/4"C	1440				20	-	16
17	R-CORRIDOR	20	2#12+#12G 3/4"C	1260				20	-	18
19	R-HOBBY RM	20	2#12+#12G 3/4"C	360				20	SPARE	20
21	R-HOBBY RM	20	2#12+#12G 3/4"C	1200				20	-	22
23	R-HOBBY RM	20	2#12+#12G 3/4"C	1200				20	-	24
25	R-EXERCISE	20	2#12+#12G 3/4"C	1000		474	4#12+#12G 3/4"C	20	FCU-23	26
27	R-EXERCISE	20	2#12+#12G 3/4"C	1250		473		20	-	28
29	R-EXERCISE	20	2#12+#12G 3/4"C	1000		473		20	-	30
31	R-TREADMILL	20	2#12+#12G 3/4"C	1000				20	SPARE	32
33	R-TREADMILL	20	2#12+#12G 3/4"C	1000				20	-	34
35	R-TREADMILL	20	2#12+#12G 3/4"C	1000				20	-	36
37	L-COURTYARD	20	2#12+#12G 3/4"C	140		474	4#12+#12G 3/4"C	20	FCU-22,16	38
39	R-CORRIDOR,STORAGE	20		1080		473		20	-	40
41	SPARE	20				473		20	-	42



TOTAL CONNECTED KVA =	24	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES = 67.8
			6.9	9.0	8.5	

PANEL DESCRIPTION	LOCATION: 1ST FLOOR SW			MOUNTING: SURFACE	ENTRY:		SECTION: 2 OF 2
L1SW(2)	BUS: 225A	VOLTAGE: 208	/120	PHASE: 3	WIRE: 4	POLES: 84	
	MAIN: MLO	NEUTRAL: YES		AIC: 10,000	IG BUS: NO	NOTE:	

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA		CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	R-CELLS	20	2#12+#12G 3/4"C	1080		360	2#12+#12G 3/4"C	20	R-CELL BRS SW	2
3	R-CELLS	20	2#12+#12G 3/4"C	1080		360	2#12+#12G 3/4"C	20	R-CELL BRS SW	4
5	R-CELLS	20	2#12+#12G 3/4"C	1440		360	2#12+#12G 3/4"C	20	R-CELL BRS SW	6
7	SPARE	20	2#12+#12G 3/4"C			360	2#12+#12G 3/4"C	20	R-CELL BRS SW	8
9	SPARE	20	2#12+#12G 3/4"C			360	2#12+#12G 3/4"C	20	R-CELL BRS SW	10
11	SPARE	20	2#12+#12G 3/4"C			720	2#12+#12G 3/4"C	20	R-2ND FL CORR	12
13	R-STUDY (EF)	20	2#12+#12G 3/4"C	720		720	2#12+#12G 3/4"C	20	R-STUDY 277	14
15	R-MUSIC RM	20	2#12+#12G 3/4"C	1080		1080	2#12+#12G 3/4"C	20	R-CORR	16
17	R-PORCH,HALL	20	2#12+#12G 3/4"C	720		720	2#12+#12G 3/4"C	20	R-CELL	18
19	EF-3	20	2#12+#12G 3/4"C	720		540	2#12+#12G 3/4"C	20	R-CELL BRS, CLO	20
21	L-1ST FL CORR-S	20	2#12+#12G 3/4"C	1200		360	2#12+#12G 3/4"C	20	R-CELL BRS	22
23	L-1ST FL LIB	20	2#12+#12G 3/4"C	955		1080	2#12+#12G 3/4"C	20	R-CELL	24
25	L-1ST FL LIB	20	2#12+#12G 3/4"C	1017		600	2#12+#12G 3/4"C	20	L-ATTIC	26
27	L-RECREATION	20	2#12+#12G 3/4"C	1086		1268	2#12+#12G 3/4"C	20	L-LAUNDRY	28
29	L-EXERCISE	20	2#12+#12G 3/4"C	1503		1319	2#12+#12G 3/4"C	20	L-MUSIC, STUDY	30
31	L-ARCADE	20	2#12+#12G 3/4"C	600		1500	2#12+#12G 3/4"C	20	L-CELLS	32
33	L-ARCADE	20	2#12+#12G 3/4"C	600		1275	2#12+#12G 3/4"C	20	L-CELLS	34
35	L-ARCADE	20	2#12+#12G 3/4"C	800		1275	2#12+#12G 3/4"C	20	L-CELLS	36
37	L-LANDSCAPE	20	2#8+#10G 3/4"C	840		1275	2#12+#12G 3/4"C	20	L-CELLS	38
39	FCU-26	20	2#12+#12G 3/4"C	360		1480	2#10+#10G 3/4"C	20	L-DRIVEWAY	40
41	SPARE	20				1480			-	42



TOTAL CONNECTED KVA =	34	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES = 95.3
			10.3	11.6	12.4	

Panel L1SW(1)	=	67.8A
Panel L1SW(2)	=	95.3 A
Total L1SW	=	163.1 A
Fuse size:		
163.1A * 1.25(growth)	=	204.4A

ELECTRICAL

REDESIGN OF COURTYARD: REVISED LIGHTING LOADS ON LCHAP

PANEL DESCRIPTION	LOCATION: SACRISTY I			MOUNTING: FLUSH	ENTRY: TOP			SECTION: 1 OF 1
LCHAP	BUS: 200 A	VOLTAGE: 208	/120	PHASE: 3	WIRE: 4		POLES: 30	
	MAIN: 200A	NEUTRAL: YES		AIC: 10,000	IG BUS: NO		NOTE:	

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA		CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	PENDANT LTG	20	2#10+#10 1/2"C	350		720	2#12+#12G 1/2"C	20	RECEPTACLES	2
3	CHAPEL SCONCES	20	2#10+#10 1/2"C	350		720	2#12+#12G 1/2"C	20	RECEPTACLES	4
5	CHAPEL SCONCES	20	2#10+#10 1/2"C	440		500	2#12+#12G 1/2"C	20	RECEPTACLES	6
7	ALTER LIGHTING	20	2#10+#10 1/2"C	312		580	2#12+#12G 1/2"C	20	L-BALCONY	8
9	L-SACRISTY/VESTRY	20	2#10+#10 1/2"C	1425		900	2#10+#10G 3/4"C	20	R-ALTER	10
11	L-SACRISTY/VESTRY	20	2#10+#10 1/2"C	675		1500	2#10+#10G 3/4"C	20	INSTAHOT	12
13	L-FLOOD	20	2#10+#10 1/2"C	1750		1500	2#10+#10G 3/4"C	20	INSTAHOT	14
15	L-BELL TOWER	20	2#10+#10 1/2"C	60		300	2#12+#12G 3/4"C	20	UC FRIDGE	16
17	L-FLOOD LIGHTS	20	2#10+#10 1/2"C	600		300	2#12+#12G 3/4"C	20	UC FRIDGE	18
19	L-FLOOD LIGHTS	20	2#10+#10 1/2"C	300				20	SPARE	20
21	INSTAHOT	20	2#10+#10 1/2"C	1500				20	SPARE	22
23	SPARE	20							SPACE	24
25	SPACE								SPACE	26
27	SPACE								SPACE	28
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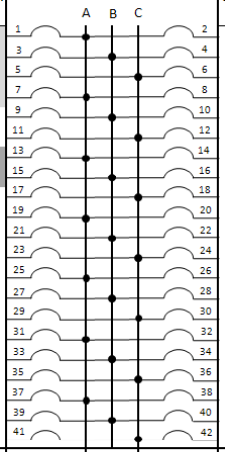
39										40
41										42



TOTAL CONNECTED KVA =	15	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES = 41.1
			5.5	5.3	4.0	

Panel LCHAP = 41.1A

Fuse size:

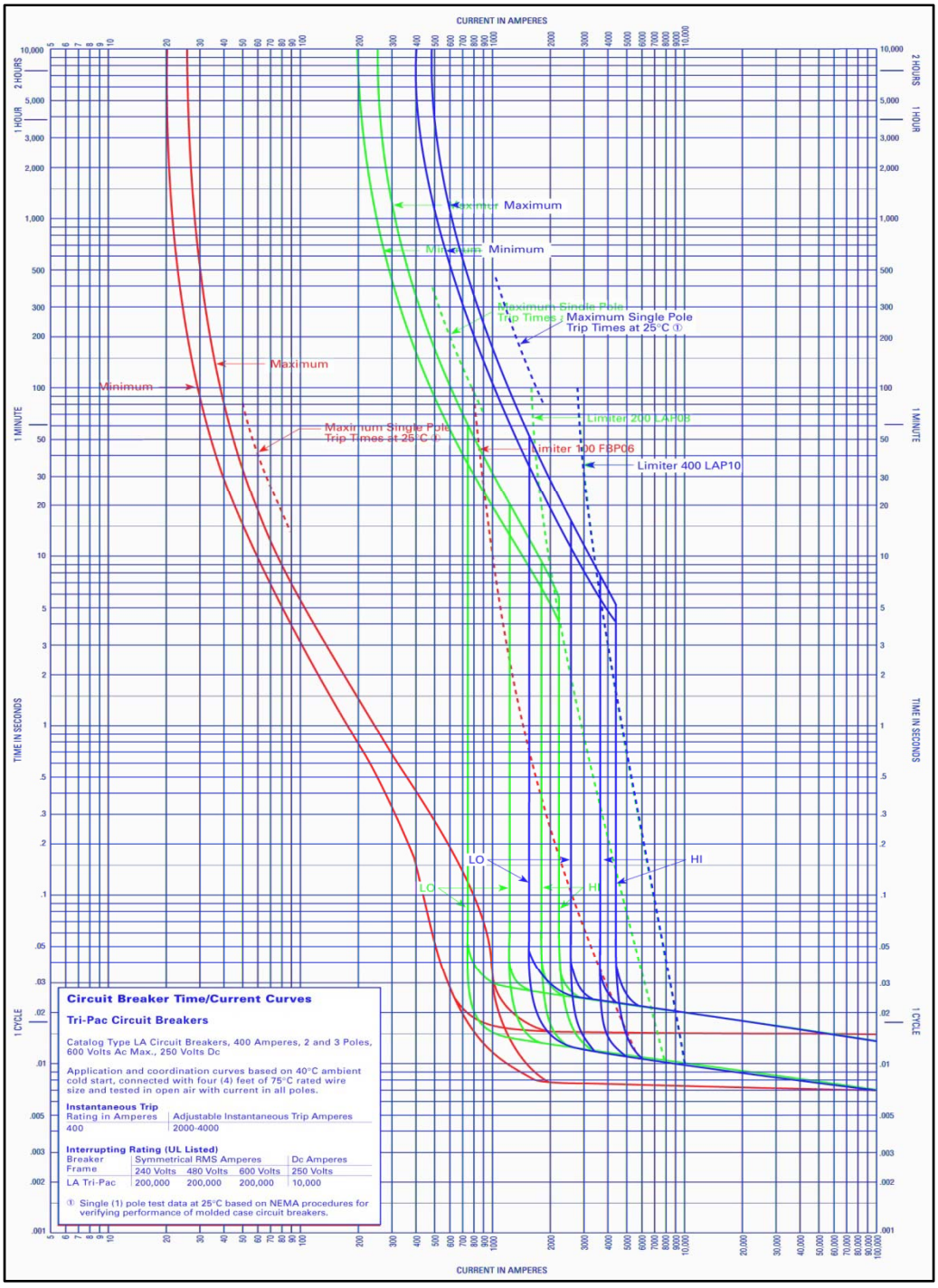
41.1A * 1.25(growth) = 51.3A(Resize to 100A)

FEEDER SIZING:

The feeders for the courtyard can be modified with the new lighting loads. The L1NE panelboard as discussed in previous sections can be resized to 150A. The L1SW panelboard can remain the same. Panel LCHAP can be downsized to 100A. All these modifications have been made in the calculations of the other three spaces.

ELECTRICAL

TIME/CURRENT CURVES:



*CUTLER-HAMMER OCTOBER 1997 CATALOG: AB DE-ION TRI PAC CIRCUIT BREAKERS

Type FB, 20 Amps, 3 poles	(Branch protection for lighting circuit on L-CHAP)
Type LA, 200 Amps, 3 poles	(Feeder Protection for L-CHAP)
Type LA, 400 Amps, 3 poles	(Feeder Protection for Emergency Distribution Panel)

ELECTRICAL

OVER-CURRENT DEVICE COORDINATION STUDY:

Over-current devices are specified and installed for 3 main reasons: 1)To prevent injuries, 2)To prevent fires, 3) to protect equipment. Over-currents can cause overloads, short circuits and ground faults to occur. An overload takes place when the load on a piece of equipment goes above the rating of the over-current device provided to protect the equipment. Short circuits are broken into two different categories; arc or bolted faults. They can occur either line to line or line to neutral. In the NEC 2005 Section 110.9,110.10, it states that the equipment chosen should be sufficient to handle high fault currents. Equipment selections should be based upon line to line bolted faults because these represent the maximum short circuit currents.

The time it takes to trip an over-current device under overload conditions is on a forced delay system to prevent devices from tripping due to minor load inflections. With short circuits, however, where the change in current is severe and sudden, the over-current device must have an immediate response time with no built-in delay.

An inverse time curve, provided by the manufacturer of the equipment, is used to determine the time it takes for the over-current device to respond to the additional current. In order for a distribution path to be most efficient and protected, the smallest breaker should be the first to trip in the event of an over-current. The path chosen to study the St. Francis Friary starts from the emergency distribution panelboard and travels through the LCHAP panel to a lighting circuit. As can be seen on the graph on the previous page, the lighting circuit with a 20 amp breaker will trip first, the LCHAP panelboard with a 200 amp rating will trip second, and the emergency distribution panelboard will trip last under overload conditions. However, if a fault were to occur at or above 800 amps in under 0.02 seconds, the 200 amp breaker on the LCHAP panel would trip before the panelboard. Likewise, if a fault were to occur at or above 2000 amps in under 0.015 seconds, the 400 amp breaker on the EDP panel would trip before the LCHAP and the lighting circuit. However, these both represent extreme condition that are unlikely to occur, thus the circuit breakers will be sufficient for the project.

SHORT CIRCUIT CURRENT:

Short circuit currents put both mechanical and thermal stress on the electrical equipment. Mechanical stress is caused by the force that the fault applies to the conductors. If not properly braced, the conductors make break. Thermal stress is caused by the heat generated by the over-current. 75 degree rated conductors are generally used in order to withstand the extra heat. As discussed above, short circuits are placed under two main categories: 1) arcing fault and 2) bolted fault.

An arcing fault occurs when insulation on a conductor is worn and an arc is able to jump from one conductor to the next. The resistance between the conductors is very high and therefore the change in current is lower, and not as easy to detect. That combined with the fact that the over-current is confined to a small portion of the system causes arcing faults to be more dangerous and harmful than bolted faults.

ELECTRICAL

Bolted faults are less common since they should be able to avoided. Bolted faults occur when two conductors come into contact with each other or another piece of metal. Standard precaution should prevent this from happening. However, when bolted faults do occur, it is such a quick and apparent change in current, that the over-current protection should be quick to recognize and terminate the problem.

SHORT CIRCUIT CURRENT CALCULATIONS:

UTILITY

Base KVA	10000
Utility SC KVA	1000000
Z(utility)	0.01
%R(utility	0
%X(utility)	100

$R_{p.u.}$ (utility)	0 p.u.
$X_{p.u.}$(utility)	0.01 p.u.

TRANSFORMER

kV	0.208
kVA	1000
(Table 4)	
X/R(transformer)	2.38
%Z(transformer)	5.8
%R(transformer)	2.25
%X(transformer)	5.35

$R_{p.u.}$(transformer)	0.22 p.u.
$X_{p.u.}$(transformer)	0.53 p.u.
$Z_{p.u.}$(transformer)	0.59 p.u.
I_{SC}	47163 A

AIC RATING	85000 A

PANEL EDP

kV	0.208
kVA	100
Conductor Size	500kcmil
Length (ft)	150
# of sets	1
(Table 7)	
R	0.0294
X_L	0.0466
R(EDP)	0.00441
X(EDP)	0.00699

$R_{p.u.}$(EDP)	1.02 p.u.
$X_{p.u.}$(EDP)	1.62 p.u.
$Z_{p.u.}$(EDP)	2.49 p.u.
I_{SC}	11148 A

AIC RATING	22000 A

PANEL LCHAP

kV	0.208
kVA	25
Conductor Size	3/O
Length (ft)	110
# of sets	1
(Table 7)	
R	0.0805
X_L	0.0519

R(LCHAP)	0.01
X(LCHAP)	0.01
$R_{p.u.}$(LCHAP)	2.05 p.u.
$X_{p.u.}$(LCHAP)	0.00 p.u.
$Z_{p.u.}$(LCHAP)	3.47 p.u.
I_{SC}	8018 A

AIC RATING	10000 A

ELECTRICAL

CONCLUSION:

The AIC ratings listed after the calculations above are that of the equipment in the building. As determined in these calculations, the interrupting capacity rating of each piece of equipment analyzed is rated above the short circuit current and, in the event of a such, will interrupt. This concludes that the equipment and ratings chosen are adequate and will not need to be redesigned.

ELECTRICAL

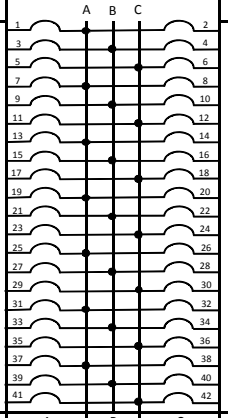
INTRODUCTION:

When changing the mechanical system from a constant volume 4-pipe system with a centralized chiller and boiler to a geothermal system, the centralized chiller and boiler were eliminated. Though heat pumps were added to the scope, the electrical load went down significantly due to the new system. The 600A load from the chiller was removed from the main distribution panel leaving an available spare for future growth. The heat pumps were added to panelboards that previously served the associated air handling units. Both panelboards affected by this additional load will require larger capacity busses as well as higher rated overcurrent protection devices. Another alternative would be to add a new panelboard served by the main distribution panel.

REDESIGN OF MECHANICAL SYSTEM: NEW LOADS ON LB2

PANEL DESCRIPTION: LB2(1) | LOCATION: MAIN ELECTRICAL ROOM | MOUNTING: SURFACE | ENTRY: TOP | SECTION: 1 OF 1
BUS: 400 | VOLTAGE: 208 /120 | PHASE: 3 | WIRE: 4 | POLES: 84
MAIN: MLO | NEUTRAL: YES | AIC: 10,000 | IG BUS: NO | NOTE:

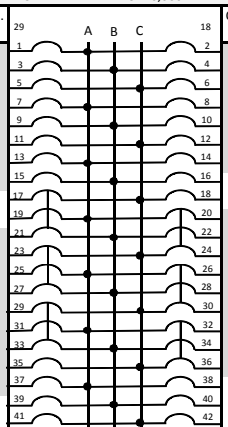
CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	HWP-2	30	3#10+#10G 3/4"C		1800	2#10+#10G 3/4"C	25	B-1	2
3	(STANDBY)				300	2#10+#10G 3/4"C	20	WATER HEATER WH-2	4
5	-				300	2#10+#10G 3/4"C	20	WATER HEATER WH-1	6
7	HWP-1	30	3#10+#10G 3/4"C	2020	1270	3#12+#12G 1/2"C	25	AIR COMPRESSOR	8
9	-			2020	1270			-	10
11	-			2020	1270			-	12
13	AHU-7	15	3#12+#12G 1/2"C	947	1130	2#12+#12G 3/4"C	20	CV-1	14
15	-			947	510	2#12+#12G 3/4"C	20	CV-2	16
17	-			946			20	SPARE	18
19	AHU-8	20	2#12+#12G 1/2"C	1130			20	SPARE	20
21	AHU-15	20	2#12+#12G 1/2"C	830			20	SPARE	22
23	AHU-14	20	3#12+#12G 1/2"C	473			20	SPARE	24
25	-	20		474				SPACE	26
27	-	20		474				SPACE	28
29	SPARE	20						SPACE	30
31	SPARE	20						SPACE	32
33	SPARE	20						SPACE	34
35	SPARE	20						SPACE	36
37	SPARE	20						SPACE	38
39	SPARE	20						SPACE	40
41	SPARE	20						SPACE	42



TOTAL CONNECTED KVA = 20 | VA / PHASE = | A: 8.8 | B: 6.4 | C: 5.0 | TOTAL CONNECTED AMPERES = 55.9

PANEL DESCRIPTION: LB2(2) | LOCATION: MAIN ELECTRICAL ROOM | MOUNTING: SURFACE | ENTRY: TOP | SECTION: 1 OF 1
BUS: 400 | VOLTAGE: 208 /120 | PHASE: 3 | WIRE: 4 | POLES: 84
MAIN: MLO | NEUTRAL: YES | AIC: 10,000 | IG BUS: NO | NOTE:

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	HP-7	20	2#12+#12G 3/4"C	1200	1200	2#12+#12G 3/4"C	20	HP-14	2
3	HP-8	20	2#12+#12G 3/4"C	1200	732	2#12+#12G 3/4"C	20	HP-10	4
5	HP-15	15	2#12+#12G 3/4"C	732	732	2#12+#12G 3/4"C	20	HP-12	6
7	HP-11	30	2#12+#12G 3/4"C	2052	1200	2#12+#12G 3/4"C	20	HP-13	8
9	HP-9	20	2#12+#12G 3/4"C	1200	732	2#12+#12G 3/4"C	20	HP-20	10
11	HP-12	15	2#12+#12G 3/4"C	732	732	2#12+#12G 3/4"C	15	HP-18	12
13	HP-13	20	2#12+#12G 3/4"C	1200	732	2#12+#12G 3/4"C	15	HP-25	14
15	HP-19	30	2#12+#12G 3/4"C	2052			20	SPARE	16
17	SPARE	20					20	SPARE	18
19	SPARE	20			2880	3#10+#8G 1" C	30	HP-24	20
21	HP-6	50	3#6+#8G 1" C	4210	2880			-	22
23	-			4210	2880			-	24
25	-			4210	4210	3#6+#8G 1" C	50	HP-6	26
27	HP-6	50	3#6+#8G 1" C	4210	4210			-	28
29	-			4210	4210			-	30
31	-			4210	4210	3#6+#8G 1" C	50	HP-6	32
33	HP-6	50	3#6+#8G 1" C	4210	4210			-	34
35	-			4210	4210			-	36
37	-			4210				SPACE	38
39	SPACE							SPACE	40
41	SPACE							SPACE	42



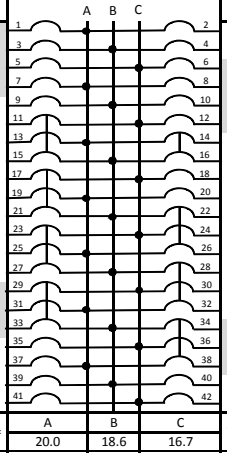
TOTAL CONNECTED KVA = 88 | VA / PHASE = | A: 31.5 | B: 29.8 | C: 26.9 | TOTAL CONNECTED AMPERES = 245.2

ELECTRICAL

REDESIGN OF MECHANICAL SYSTEM: NEW LOADS ON LB1

PANEL DESCRIPTION: LB1	LOCATION: MAIN ELECTRICAL RO	MOUNTING: SURFACE	ENTRY: TOP	SECTION: 1 OF 1
	BUS: 225 VOLTAGE: 208 /120	PHASE: 3	WIRE: 4	POLES: 42
	MAIN: MLO NEUTRAL: YES	AIC: 10,000	IG BUS: NO	NOTE:

CKT NO.	DESCRIPTION	BKR TRIP	WIRE AND CONDUIT	CONN. VA	CONN. VA	WIRE AND CONDUIT	BKR TRIP	DESCRIPTION	CKT NO.
1	HP-2	15	2#12+#12G 1/2"C	900	600	2#12+#12G 1/2"C	20	ELEVATOR LIGHTING	2
3	HP-3	20	2#12+#12G 1/2"C	1200	300	2#12+#12G 1/2"C	20	R-CHILLER PAD, GENERATOR	4
5	HP-4	20	2#12+#12G 1/2"C	1200	1200	2#12+#12G 1/2"C	20	HP-13	6
7	HP-17	20	2#12+#12G 1/2"C	732	2052	2#10+#8G 1"C	30	HP-16	8
9	SUMP PUMP	20	2#12+#12G 1/2"C	1130	2052	2#10+#8G 1"C	30	HP-23	10
11	CHWP	60	3#6+#8G 1"C	2920	1200	2#12+#12G 1/2"C	20	HP-21	12
13	-			2920	1000	3#8+#10G 1"C	30	GENERATOR BATTERY	14
15	-			2920	1000			-	16
17	CHWP	60	3#6+#8G 1"C		100	2#12+#12G 1/2"C	20	TIME CLOCK	18
19	(STANDBY)				1800	2#10+#10G 1"C	20	HEAT TAPE	20
21	-				947	3#12+#12G 3/4"C	15	AHU 1	22
23	AHU-2	30	3#10+#10G 3/4"C	2020	947			-	24
25	-			2020	946			-	26
27	-			2020	947	3#12+#12G 3/4"C	15	AHU 3,4	28
29	HP-22	30	3#10+#10G 3/4"C	1919	946			-	30
31	-			1919	947			-	32
33	-			1919	4210	3#12+#12G 3/4"C	50	HP-1	34
35	SPARE	20			4210			-	36
37	SPARE	20			4210			-	38
39	SPARE	20					20	SPARE	40
41	SPARE	20					20	SPARE	42



TOTAL CONNECTED KVA =	55	VA / PHASE =	A	B	C	TOTAL CONNECTED AMPERES =	153.8
			20.0	18.6	16.7		

REDESIGN OF MECHANICAL SYSTEM: NEW LOADS ON MDP

PANELBOARD: SWBD-1	BUS RATING:	2000A	MAIN DEVICE TYPE: DRAW-OUT CB
MIN AIC: 85,000	VOLTS:	208/120V	PHASE: 3 WIRE: 4
ENCLOSURE NEMA: 1	MOUNTING:	FLOOR	LOCATION: MAIN ELEC RM
GROUND BUS: FULL	ISOLATED GROUND BUS:	NO	BRANCH CIRCUIT DEVICE TYPE: BOLT-ON CB
REMARKS			

CKT #	DESCRIPTION	BREAKER FRAME	TRIP	POLE	NOTE	VOLT-AMPERES A	B	C	FEEDER CONDUIT & WIRE
1	ELEVATOR	400	350	3		17320	17320	17320	2 SETS 4-#3/Okcmil + #4G 3"C
2	L1NE	225	200	3		15100	11800	13900	4-250kcmil + #4G 3"C
3	LB1	225	225	3		20000	18600	16700	4-300kcmil + #2G 3"C
4	LB2	400	400	3		40300	36200	31900	2 SETS 4-250kcmil + #4G 3"C
5	EDP	400	400	3		29900	28300	22600	2 SETS 4-250kcmil + #4G 3"C
6	WIRE TROUGH(KL1, L1SW)	400	400	3		42000	48000	43700	2 SETS 4-250kcmil + #4G 3"C
7	L2NE	225	150	3		12700	9920	9920	4#3/O + #4G 2 1/2" C
8	SPARE	600	600	3					
9	SPARE	400		3					
10	SPARE	400		3					
11	SPARE	225		3					
12	SPARE	225		3					
						CONNECTED LOAD		503.5 KVA	

*The over-current protection devices and the feeder ratings were based upon the MCA and the MOPD specified on the heat pump cutsheets. These cutsheets can be found in the Mechanical Appendix.

**Feeder sizing was based on NEC Table 310.16 in accordance with the aluminum feeder redesign in the following section.

CONCLUSION:

The mechanical redesign has a great impact on the electrical loads. Due to the elimination of the chiller, the building load decreased 5% . This decrease in load allows for the main switchboard, if desired, to be downsized to a 1600A frame. The benefits of the higher efficiency of the new mechanical equipment, as seen in the electrical load decrease, are significant.

ELECTRICAL

INTRODUCTION:

The original design for the St. Francis Friary utilizes copper conductors to carry electricity throughout the building. Copper is the most common choice for conductor material. Aluminum, the alternative material to copper, will be researched in this study to determine whether the use of aluminum conductors is a more cost efficient and practical proposal for the St Francis Friary.

COPPER FEEDERS:

The current system uses copper feeders for the design. Copper feeders are most frequently specified in buildings because of their many advantages over aluminum at a relatively competitive price. The advantages and disadvantages are as follows:

Advantages:

- Higher conductivity
- High tensile strength(can withstand more stress without breaking)
- Reliable (more easily and frequently installed)

Disadvantages:

- More expensive
- Heavier

ALUMINUM FEEDERS:

Aluminum feeders, though less conductive than copper, are more affordable. The cost benefit is one of the main advantages that aluminum has over copper. Some other advantages and disadvantages are mapped out below.

Advantages:

- More cost efficient
- Light weight
- Better for longer runs

Disadvantages:

- Larger wire sizes necessary to have the same ampacity rating as copper
- Requires larger conduit
- Around 60% of the conductivity as copper
- Poor connections

SCHEDULE:

A feeder schedule and single line diagram can be found in the electrical appendix of this report. This schedule and diagram show the comparison of the original feeder design and the redesign.

ELECTRICAL

COST DIFFERENCE:

Copper Feeders:	$94,684.42
Aluminum Feeders:	$78,447.09
Dollar Savings:	$16.237.33
Percent Savings:	17% savings

*Cost based upon RSMeans Version 2007.

CONCLUSION:

Aluminum was studied as an alternative to copper for conductor material. The savings alone are phenomenal, however, there are a few draw backs to using aluminum as discussed above. If installed, the aluminum will need to be cleaned immediately before installation to maximize the efficiency of the system. In addition, aluminum is more prone to breaking than copper wire, thus requiring the installer to be knowledgeable and experienced in order to account for the heightened risk involved during installation. If installed properly, however, aluminum should perform to a similar standard as the copper. This is purely an economic decision and as the price of copper continues to fluctuate this may want to be considered as a bid alternate.

MECHANICAL

INTRODUCTION:

The following study will compare the current design for St. Francis Friary with a new design that results in reduced energy consumption and consequently reduced green house gas emissions. Stewardship is a fundamental principal of the client and thus reviewing this option provides an opportunity to build more of their principles into the design of the building. The location of St. Francis Friary is Hanceville, Alabama. Due to the location and climate, the cooling system was identified as being the most significant piece of mechanical equipment that contributes to the overall energy use. The proposed system design which maximizes the use of geothermal heat will be reviewed for comparison against the current central chilled and hot water design. Geothermal heat pumps use the constant temperature of the earth to minimize the energy needed for heat transfer. A redesign that incorporates the use of geothermal heat pumps would benefit the environment by lowering the energy consumption and emissions associated with the heating and cooling system of St. Francis Friary.

CURRENT SYSTEM:

The current mechanical system design is a constant volume four pipe system using a combination of fan coil units and air handling units for zone control. Each temperature control zone has multiple similar use spaces served by a single thermostat. The air systems were very successfully designed to not disrupt the open architecture in some of the more ornate spaces. In the chapel and refectory, the ductwork is installed in the crawl space and floor diffusers are used to eliminate the need for mechanical ductwork within the open ceiling space. The chilled water system consists of a central 125KW air cooled chiller which generates chilled water that is in turn distributed via chilled water pumps throughout the building to each of the fan coils and air handlers. The heating hot water system consists of a central 1,500 mbh gas fired boiler which generates hot water that is distributed via hot water pumps throughout the building to each of the fan coils and air handlers.

RESEARCH ON GEOTHERMAL HEAT PUMPS:

Geothermal heat pumps or geo exchange systems utilize the earth's ability to maintain a constant temperature throughout all the seasons. In contrast to systems that rely on outdoor air which has a variable temperature, by using heat from the ground in the winter and rejecting heat to the ground in the summer, the temperature difference required to meet the design conditions is lessened. Thus, the mechanical equipment will need to do less work to bring the refrigerant to the proper temperature to heat or cool the air. This allows geothermal heat pumps to provide more comfortable and energy efficient heating and cooling year round.

MODIFIED SYSTEM:

The modified system will consist of geothermal heat pump system with high density polyethylene vertical piping and a Puron refrigerant. The piping will be spaced 10 feet apart and will be fed in and out of wells that go 250 ft below the earth's surface. The "loop field", as shown in the construction management report will be located in the southeast quadrant of the site where it will have the least interference with site

landscaping. As well, should maintenance be required, the southeast corner is out of range of the main views from the site. The new system will require 1(8)ton, (7)5 ton, (1)4 ton,(5)3 ton, (8)2 ton, (7)1 ton heat pumps. This will need to be accounted for when determining the electric savings.

SYSTEM MODELING:

The Trace computer program was used to analyze the current system verses the modified system. The output of the program determines the size of the heat pumps as well as the potential savings in energy consumption when using the heat pump system. From the data received, the energy savings and lowered emissions were calculated.

ASSUMPTIONS:

Weather Data: based on Birmingham, Alabama.

Lighting Load: Incandescent, Hung Below Ceiling, 60% Load to Space

OCCUPANCY (NEC 2005 TABLE 220.12)	
CHURCH	3 VA/ft
DWELLING UNIT	1VA/ft

Activities:

ACTIVITY	
GENERAL OFFICE	143 ft^2/person
LIBRARY	50 ft^2/person

Ventilation:

APPLICATION (TABLE 4-2 OUTDOOR AIR REQUIREMENTS FOR VENTILATION)	
BEDROOM	30 cfm/room
LOBBY	15 cfm/room
OFFICE	20 cfm/room
AUDITORIUM	15 cfm/room

Design Conditions:

COOLING (T_{db})	78 ^{O}F
HEATING (T_{db})	65^{O}F
HUMIDITY RATIO	50%

TRACE OUTPUT

	COOLING	HEATING	AUXILIARY	TOTAL
ORIGINAL	247252.2 KWH/YR	3880 KWH/YR	39208.3 KWH/YR	290340.5 KWH/YR
REDESIGN	164843.7 KWH/YR	9605.7 KWH/YR	0 KWH/YR	174449.4 KWH/YR
			ENERGY SAVINGS	40 PERCENT

Based upon the output from the program, the energy consumption of the system is decreased by 40 percent each year.

MECHANICAL

EMISSIONS:

The emissions of the original design and the redesign were calculated using the National Renewable Energy Laboratory, Source Energy and Emission Factor for Buildings. Calculations are based on a yearly output.

Table 3 Total Emission Factors for Delivered Electricity
(lb of pollutant per kWh of electricity)

Pollutant (lb)	National	Eastern	Western	ERCOT	Alaska	Hawaii
CO_{2e}	1.67E+00	1.74E+00	1.31E+00	1.84E+00	1.71E+00	1.91E+00
CO_2	1.57E+00	1.64E+00	1.22E+00	1.71E+00	1.55E+00	1.83E+00
CH_4	3.71E-03	3.59E-03	3.51E-03	5.30E-03	6.28E-03	2.96E-03
N_2O	3.73E-05	3.87E-05	2.97E-05	4.02E-05	3.05E-05	2.00E-05
NO_X	2.76E-03	3.00E-03	1.95E-03	2.20E-03	1.95E-03	4.32E-03
SO_X	8.36E-03	8.57E-03	6.82E-03	9.70E-03	1.12E-02	8.36E-03
CO	8.05E-04	8.54E-04	5.46E-04	9.07E-04	2.05E-03	7.43E-03
TNMOC	7.13E-05	7.26E-05	6.45E-05	7.44E-05	8.40E-05	1.15E-04
Lead	1.31E-07	1.39E-07	8.95E-08	1.42E-07	6.30E-08	1.32E-07
Mercury	3.05E-08	3.36E-08	1.86E-08	2.79E-08	3.80E-08	1.72E-07
PM10	9.16E-05	9.26E-05	6.99E-05	1.30E-04	1.09E-04	1.79E-04
Solid Waste	1.90E-01	2.05E-01	1.39E-01	1.66E-01	7.89E-02	7.44E-02

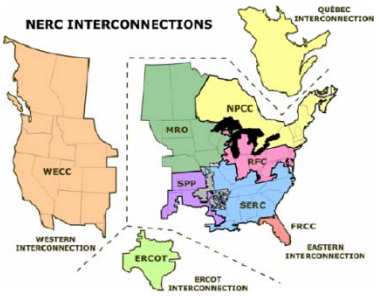


Table 8 Emission Factors for On-Site Combustion in a Commercial Boiler
(lb of pollutant per unit of fuel)

Pollutant (lb)	Commercial Boiler					
	Bituminous Coal *	Lignite Coal **	Natural Gas	Residual Fuel Oil	Distillate Fuel Oil	LPG
	1000 lb	1000 lb	1000 ft³ ***	1000 gal	1000 gal	1000 gal
CO_{2e}	2.74E+03	2.30E+03	1.23E+02	2.56E+04	2.28E+04	1.35E+04
CO_2	2.63E+03	2.30E+03	1.22E+02	2.55E+04	2.28E+04	1.32E+04
CH_4	1.15E-01	2.00E-02	2.50E-03	2.31E-01	2.32E-01	2.17E-01
N_2O	3.68E-01	ND †	2.50E-03	1.18E-01	1.19E-01	9.77E-01
NO_X	5.75E+00	5.97E+00	1.11E-01	6.41E+00	2.15E+01	1.57E+01
SO_X	1.66E+00	1.29E+01	6.32E-04	4.00E+01	3.41E+01	0.00E+00
CO	2.89E+00	4.05E-03	9.33E-02	5.34E+00	5.41E+00	2.17E+00
VOC	ND †	ND †	6.13E-03	3.63E-01	2.17E-01	3.80E-01
Lead	1.79E-03	6.86E-02	5.00E-07	1.51E-06	ND †	ND †
Mercury	6.54E-04	6.54E-04	2.60E-07	1.13E-07	ND †	ND †
PM10	2.00E+00	ND †	8.40E-03	4.64E+00	1.88E+00	4.89E-01

* from the U.S. LCI data module: Bituminous Coal Combustion in an Industrial Boiler (NREL 2005)
** from the U.S. LCI data module: Lignite Coal Combustion in an Industrial Boiler (NREL 2005)
*** Gas volume at 60°F and 14.70 psia.
† no data available

EMISSIONS COMPARISON FOR MECHANICAL SYSTEM CURRENT AND REDESIGN

ORIGINAL	290340.5 kWh
REDESIGN	174449.4 kWh

ORIGINAL	1413 ft^3
REDESIGN	0 ft^3

	ELECTRICTICY DELIVERED		FUEL COMBUSTION		TOTAL		CHANGE
POLLUTANT(LB)	ORIGINAL	REDESIGN	ORIGINAL	REDESIGN	ORIGINAL	REDESIGN	%
CO_{2e}	505192.47	303541.956	17.3799	0	505209.8499	303541.956	-60.082351
CO_2	476158.42	286097.016	3.2499	0	476161.6699	286097.016	-60.084008
CH_4	1042.322395	626.273346	3.5325	0	1045.854895	626.273346	-59.881476
N_2O	11.23617735	6.75119178	3.5325	0	14.76867735	6.75119178	-45.712907
N_{ox}	871.0215	523.3482	156.843	0	1027.8645	523.3482	-50.916069
S_{ox}	2488.218085	1495.031358	0.893016	0	2489.111101	1495.031358	-60.062862
CO	245.3377225	147.409743	0	0	245.3377225	147.409743	-60.084418
VOC	0	0	131.8329	0	131.8329	0	0
TNMOC	18.72696225	11.2519863	0	0	18.72696225	11.2519863	-60.084418
Lead	0.009813509	0.00589639	0.0007065	0	0.010520009	0.00589639	-56.049285
Mercury	0.008855385	0.005320707	0.00036738	0	0.009222765	0.005320707	-57.691013
PM10	26.9435984	16.18890432	11.8692	0	38.8127984	16.18890432	-41.710222
Solid Waste	59519.8025	35762.127	0	0	59519.8025	35762.127	-60.084418

MECHANICAL

COST SAVINGS

	ENERGY CONSUMPTION	UTILITY RATE	TOTAL COST/YR
Current System	290340.5 KWh/yr	$0.08921/KWh	$25,901.27
Redesign	174449.4KWh/yr	$0.08921/KWh	$15,562.63
		SAVINGS	$10,338.64

CONCLUSION:

The current system designed for the St. Francis Friary is a good design. It serves different zones and because it is a four pipe system, it allows for variable heating and cooling control throughout the building. The proposed system, as shown above may have some advantages above the designed system. Geothermal systems utilize the earth's pure resources in order to serve the building with its heating and cooling needs. Because of the use of the natural steady temperature below the earth's surface, mechanical equipment can be downsized and some pieces taken out completely. This allows for a more energy efficient design and as a result savings on energy bills. The most important impact of the new design, however, is the minimization of the impact on the environment. Because the energy use is being reduced, the emissions from the power plant are lower. As well, this can be seen locally because of the elimination of the gas fired boiler from the project scope, reducing the emissions from equipment on the site itself.

CONSTRUCTION MANAGEMENT

INTRODUCTION:

This study continues the research of heat pumps to determine the feasibility of changing from a constant volume four pipe system served by a central chiller and boiler to a geothermal system in construction. This study will compare the current system with both vertical and horizontal geothermal heat pump systems to determine the site implications and the difference in project cost and overall project schedule.

PROPOSED SYSTEM REVISIONS:

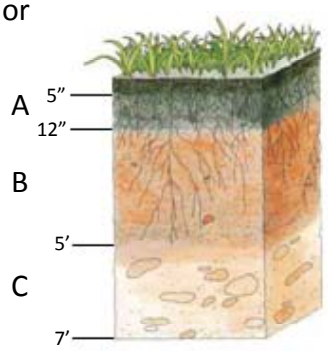
As previously described in the Mechanical section of this report, the proposed system revisions consist of changing from a four pipe hot water heating and chilled water cooling system to a two pipe water to water heat pump system. The alternate system replaces the existing fan coils with water source heat pumps and eliminates the need for an air cooled chiller and hot water boiler along with one set of pipes.

RESEARCH ON GEOTHERMAL HEAT PUMPS:

Geothermal heat pumps or geo exchange systems utilize the earth's ability to maintain a constant temperature throughout all the seasons. There are two main configurations of closed loop geothermal heat pump systems; horizontal and vertical. The two options will be reviewed for application on this project.

SITE IMPLICATIONS:

Preliminary research shows that the site is located in the Warrior Basin District and based upon the geological region has a Pottsville Formation. This Pottsville Formation consists of beds of sandstone and shale. Upon exploration of the site, The subsurface report shows that the soil conditions found at St. Francis Friary are as follows:



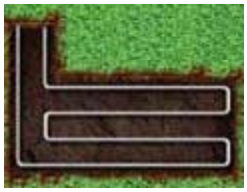
A. 5-12 inches of topsoil
B. Residual sandy clay soils
C. Weathered rock

The weathered rock found below the residual soils was tested And results conclude that the weathered rock will not prohibit the auger from boring beyond this point.

HORIZONTAL PIPING

Horizontal systems are installed in a trench 4-6 feet deep. Horizontal piping configurations require a field large enough to accommodate the length of piping necessary which as a rule of thumb and as suggested by a contractor in the Cullman county are is 400-600 feet of piping per ton of heating and cooling. Based upon the 84 ton system in the St. Francis Friary, the area necessary for a horizontal system would need to be adequate for 42,000 feet of piping spaced 10 feet apart.

CONSTRUCTION MANAGEMENT



Advantages of a Horizontal System:

-Lower installation cost

-Easy to access for maintenance purposes

Disadvantages of a Horizontal System:

-Maintenance is needed more frequently due to damage from sharp rocks below the surface

-Temperature varies due to close proximity to surface

VERTICAL PIPING

Vertical systems require deep holes to be bored to allow for piping to be configured in a vertical pattern. Bore holes are generally 150 to 450 feet deep depending on the geographic location. As suggested by contractors in the Cullman county area, 250 feet is necessary per hole, each hole serving one ton of heating and cooling. The holes must be spaced at a minimum of 10 feet apart. Based upon the 84 ton heating and cooling system of the St. Francis Friary, the area necessary for a vertical system would need to be adequate to hold 84 holes spaced at 10 feet apart.

Advantages of a Vertical System

Less piping required

Temperature more stable

More efficient

*Recommended by contractors in Cullman district

Disadvantages of a Vertical System

Higher installation cost

FINAL PIPING ARRANGEMENT SELECTION

While both options are valid for this site, the decision was made to use vertical piping because it requires less piping, is more appropriate for the existing soil conditions and disrupts less of the site allowing for potential future expansion.

SITE

The position of the vertical boring well field on the site can be found in the Construction Management Appendix.

CONSTRUCTION MANAGEMENT

PROJECT COST

Multiple prices were received for the entire project. Based on a cost estimate from one contractor, the premium for the heat pump system is estimated to be approximately 10%. This yields a cost increase between $70,000 and $110,000. For the purposes of this analysis, an average of the two will be used ($90,000).

Based on the initial cost increase and the projected annual energy savings of 116,000 kwh/yr the simple payback for this additional investment is approximately nine years.

PROJECT SCHEDULE

A review of the proposed construction schedule indicates that the mechanical systems are not on the critical path. The proposed system is actually less complicated to install because it utilizes less equipment and dramatically reduced piping throughout the building. A complete set of piping runs, two pumps, a chiller and a boiler are no longer required. While the costs are slightly higher, the overall installation is less time consuming. The wells associated with the heat pumps can be drilled simultaneously with the general building construction. Though they will take approximately 3 months to complete, they have no impact on the critical path and the remaining installation can follow the previously defined schedule for interior piping, electrical and mechanical system installation. An argument could be made that this system could reduce the overall construction period and therefore also reduce the cost of general conditions associated with the construction period; however, it is not significant enough to use in justifying the use of this system.

CONCLUSION

The analysis of the overall construction management yielded the following recommendations:

- Incorporate the following changes into the construction documents
  - Geothermal heat pumps
  - Revised lighting layout
- Utilize horizontal piping to minimize site disturbance and maintain a maximum amount of the site for future expansion.
- Because the overall project cost is currently over budget and the documents are essentially complete, continue to utilize the design bid build approach to provide a known price and allow time to seek additional funding to support a more energy efficient option
- Incorporate a bid alternative in the bid documents to consider the use of aluminum conductors as a potential cost cutting measure

While the change to a heat pump system has an increased first cost, it has a very short payback, a lower net present value and does not impact the critical path for construction.

ACKNOWLEDGMENTS

The people I would like to acknowledge my appreciation for on this project are as follows:

PROFESSIONALS

META ENGINEERS:

for an awesome opportunity to work for them as well as for offering me this project and supplying me with the prints.

ART LOHSEN:

for being so kind as to allow me to use this project and for answering any questions I have had.

FRANK PENO:

for providing me with construction cost estimates and scheduling for geothermal systems and for being such a pleasure to speak with on the phone.

TOM REGISTER:

for explaining the important things to know about geothermal systems in Alabama, providing a cost estimate, and helping me size the equipment necessary. Also, for being super nice and having a southern accent.

PROFESSORS

DR. MISTRICK:

for being our faithful lighting teacher for the past 3 years, and for not making me use Radiance for my thesis project. ☺

DR. HOUSER:

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PROFESSOR DANNERTH:

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for helping me understand the construction of geothermal systems and the importance of this project.

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for helping with understanding the things necessary to succeed in thesis and for being available for help.

DR. HOLLAND:

for helping with thesis class and helping us to be prepared to succeed.

COREY WILKENSON:

for being the man behind the scenes all the time and helping everyone with all their computer problems. You are very much appreciated Corey!

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FAMILY

MOM AND DAD:

for proofreading my writing and for putting up with my irrational phone calls after not sleeping.

GRANDMA PAT:

for sending me encouraging texts?

MY SISTER:

for successfully calling me every time at the exact moment that my computer would crash just to give me an updated countdown and stressing me out… I love you Ann!

APPENDIX

FOYER: F1

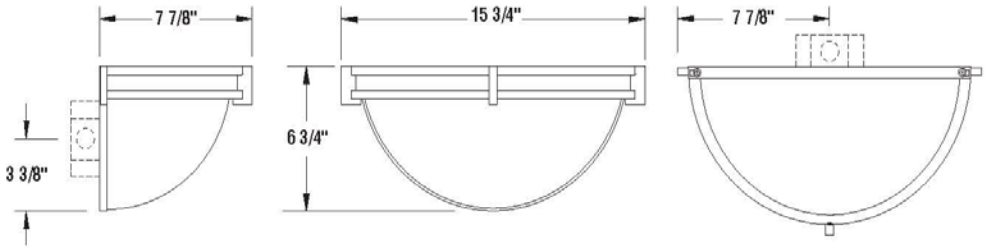
FOYER: F1

"Skill to do comes of doing." (Ralph Waldo Emerson)

WALL BRACKETS

Technical Data:

3202



Product Specifications:

Catalog #: 3202

Lamping: 3202
- I - (2) 60W A-19/Med.
- F - (2) CFQ13W/GX23

Voltage: 120V or 277V, Incandescent 120 Volt Only

Lens Options:
- OA: Opal Acrylic (Etched)
- FAH: Hand Painted Faux Alabaster
  - FAH4: White Vein
  - FAH5: Antique Alabaster (Beige)
  - FAH6: Gray Vein
  - FAH7: Beige Vein
- FGH: Faux Glass

Finishes: Standard
- BAL: Brushed Aluminum with Painted Black Neoteel Accents
- PB: Polished Brass with Painted Black Neoteel Accents

Custom
- CPF: Custom Paint Finish (Consult Factory)
- CMF: Custom Metal Finish (Consult Factory)

Special:
- STD: Standard
- MOD: Modified Standard

Weight: 3202
- I: 6 lbs.
- F: 8 lbs.

How to Specify:

EXAMPLE: 3202 - F - 120V - OA - BAL - STD

- Catalog Number
- Lamping Option
- Voltage
- Lens Option
- Finish
- Special (STD or MOD)

NOTES:
- UL LISTED AND CUL APPROVED.
- ALL WINONA LIGHTING PRODUCTS ARE UNION MADE.
- CUSTOM SIZES AND FINISHES AVAILABLE UPON REQUEST.
- ALL FLUORESCENT FIXTURES AVAILABLE IN 120 VOLT OR 277 VOLT. INCANDESCENT IN 120 VOLT ONLY.
- WINONA LIGHTING RESERVES THE RIGHT TO MAKE DESIGN CHANGES WITHOUT PRIOR NOTICE.
- LAMPS NOT INCLUDED.
- COMPACT FLUORESCENT LAMP BASE INFORMATION: CFQ13W (GX23-2). SEE PAGE 337 OF TECHNICAL SECTION FOR MORE INFORMATION.
- BALLAST INFORMATION: MAGNETIC

TO USE AS YOUR SUBMITTAL FORM, SIMPLY PHOTOCOPY THIS PAGE, FILL IN YOUR SPECIFICATIONS, AND FAX SUBMITTAL TO (507) 452-8528. A WINONA LIGHTING SALES REP WILL RESPOND TO YOUR REQUEST.

PRODUCT SPECIFICATIONS: 3202 - ____ - ____ - ____ - ____ - ____ TYPE: _____

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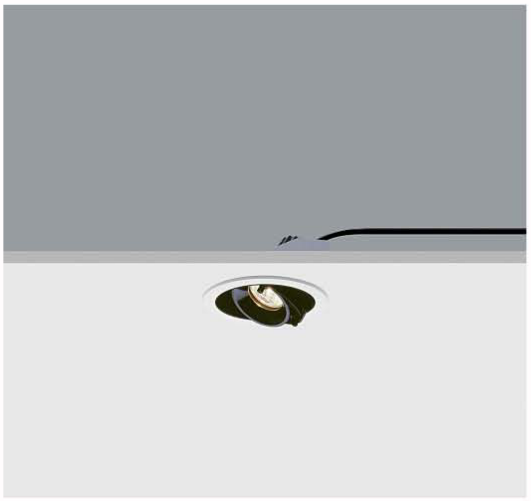
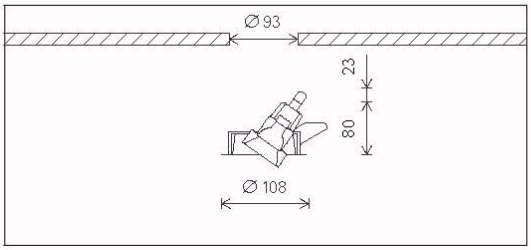
(FOR MORE INFORMATION ABOUT OUR WEBSITE SEE PAGES 346-349 FOR ALL THE DETAILS.)

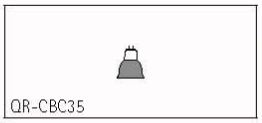
ERCO

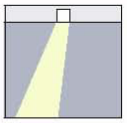
Gimbal Recessed spotlight

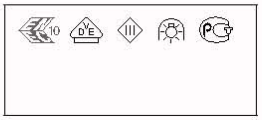
for low-voltage halogen lamps





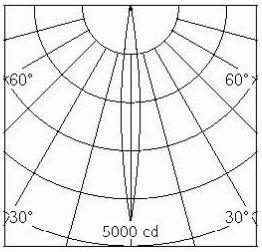






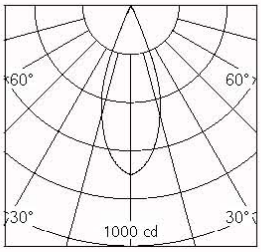
88100.000
QR-CBC35 20W 12V GU4 10°
QR-CBC35 20W 12V GU4 38°

Product description
Size 3
Luminaire: cast aluminium, black powder-coated. Heat sink: black. Mounting ring: plastic, white (RAL9002), with multigroove baffle, cast aluminium, black powder-coated. Fixing springs for ceiling thickness max. 25mm. Cardanic suspension of the luminaire in the mounting ring. 0°-40° tilt. Pivots are to be locked.
Cable, L 500mm.
Anti-dazzle ring as lamp retainer: plastic, black.
Transformer according to EN 61558 or EN 61347 to be ordered separately.
Weight 0.25kg



QR-CBC35 20W 12V GU4 10°

h(m)	E(lx)	D(m) 10°
1	4500	0.17
2	1125	0.35
3	500	0.52
4	281	0.70
5	180	0.87



QR-CBC35 20W 12V GU4 38°

h(m)	E(lx)	D(m) 39°
1	700	0.71
2	175	1.42
3	78	2.12
4	44	2.83
5	28	3.54

ERCO Leuchten GmbH
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Germany
Tel.: +49 2351 551 0
Fax: +49 2351 551 300
info@erco.com

Technical Region: 230V/50Hz
We reserve the right to make technical and design changes.
Edition: 13.11.2007
Please download the current version from
www.erco.com/88100.000

APPENDIX

FOYER: F2

ERCO

Gimbal Recessed spotlight

Planning data

Cleaning (a)	1				2				3			
Ambient conditions	P	C	N	D	P	C	N	D	P	C	N	D
LMF	0.96	0.94	0.90	0.86	0.93	0.91	0.86	0.81	0.92	0.90	0.84	0.79
RSMF	0.96	0.92	0.87	0.81	0.96	0.92	0.87	0.81	0.96	0.92	0.87	0.81

Hours of operation (h)	1000	2000
LLMF	0.96	0.84
LSF	1	1

MF	LMFxRSMFxLLMFxLSF
MF	Maintainance Factor
LMF	Lumiaire Maintenance Factor
RSMF	Room Surface Maintenance Factor
LLMF	Lamp Lumens Maintenance Factor
LSF	Lamp Survival Factor
P	Room pure
C	Room clean
N	Room normal
D	Room dirty

APPENDIX

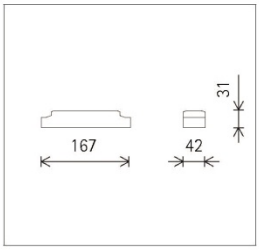
FOYER: F2

ERCO

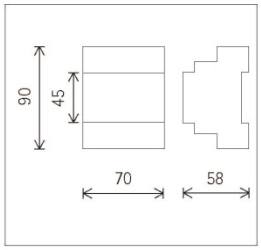
Gimbal Recessed spotlight

Accessories

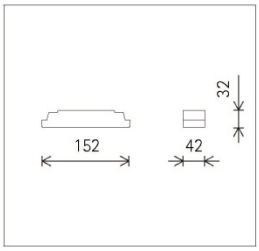
83817.000
DALI transformer EN 61347
230/240/12V, 50-60Hz. 20-105W
at max 60°C ambient temperature.
Secondary voltage 11.8V.
Installation in ceiling voids, show-
cases, furniture.
Plastic housing. Primary and sec-
ondary cable clamps and terminal
blocks.
Short-circuit protection: electronic
cut-out, reconnect once short-
circuit is cleared.
Overload and overheat protection:
automatic load-sensing.
For interference suppression
to VDE 0875, part 2, secondary
conductor length 2m max.
For ceiling aperture ø 80mm,
recessed depth 90mm
Weight 0.18kg
SELV
TS-115



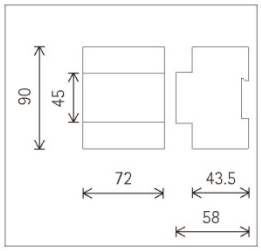
83829.000
DALI dimmer 1000W
for ohmic loads, conventional and
electronic transformers.
Mounting on DIN rail.
Weight 0.18kg

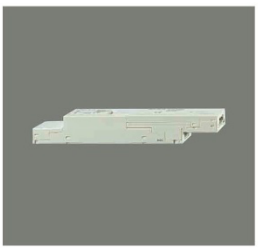


83831.000
Electronic transformer EN 61347
230/12V, 50-60Hz. 20-105W at
max 50°C ambient temperature.
Secondary voltage 11.8V.
Installation in ceiling voids, show-
cases, furniture.
Plastic housing. Primary and sec-
ondary cable clamps and terminal
blocks.
Short-circuit protection: electronic
cut-out, reconnect once short-
circuit is cleared.
Overload and overheat protection:
automatic load-sensing.
Use dimmers for electronic trans-
formers (trailing edge).
For interference suppression
to VDE 0875, part 2, secondary
conductor length 2m max.
For ceiling aperture ø 80mm,
recessed depth 70mm
Weight 0.19kg
SELV
TS-115

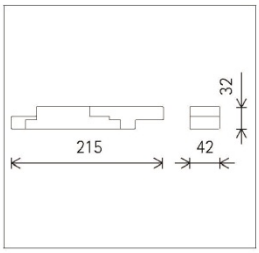


83816.000
DALI switch actuator, double, 16A
Two voltage-free contacts for
switching ohmic, inductive and
capacitive loads max 16A.
DALI interface with two independ-
ent addresses.
Mounting on DIN rail.
Weight 0.21kg





83833.000
Electronic transformer EN 61347
230/12V, 50Hz. 20-105W at max.
50°C ambient temperature, 1V-10V
controllable.
Secondary voltage 11.7V.
Installation in ceiling voids, show-
cases, furniture.
Plastic housing. Primary and sec-
ondary cable clamps and terminal
blocks.
Short-circuit protection: electronic
cut-out, reconnect once short-
circuit is cleared.
Overload and overheat protection:
automatic load-sensing.
For interference suppression
to VDE 0875, part 2, secondary
conductor length 2m max.
For ceiling aperture ø 80mm,
recessed depth 125mm
Weight 0.20kg
SELV
TS-115



83819.000
Overvoltage protection device
for max. 10 electronic transformers.
L 45mm, B 25mm, H 22mm.
2x1,5mm², L 80mm.
Weight 0.05kg
Only in conjunction with:
83831.000
83833.000

APPENDIX

FOYER: F3

Extérieur Vert

RECESSED PROJECTOR
Fixed reflector :
narrow spot, flood or asymetrical
Fluorescent lamp T2
11W / 120 /277V

M2 SERIES

MERCURE

IP 67 | W 4,3 | 11W | T2

Projector body

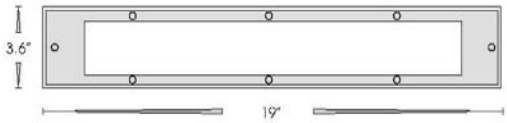
- Drive over rated
- Waterproof IP67
- Available in anodized black cast aluminum.
- Integral electronic ballast.
- 3.5 Metric tons / 7600 Lbs.

Lamp / Optics

- Fluorescent lamp T2 11W /120/277V
- Lamp holder W4,3 .
- Choice of 3 fixed reflectors:
- Symetrical Spot reflector
- Symetrical Flood reflector
- Asymetrical reflector

Trim

- Black anodised cast aluminium.
- Heat treated glass.
- 8 stainless steel securing screws.

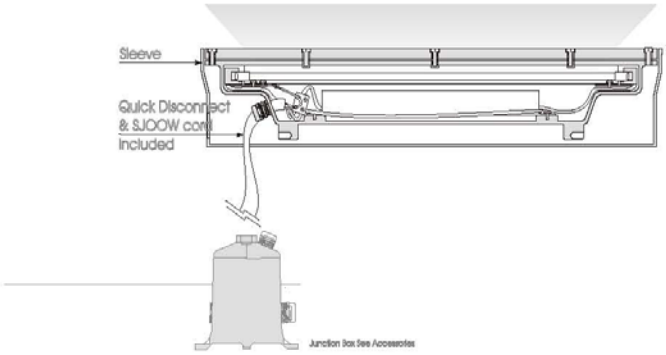


Rough-In Components

- Fixture is pre-wired with 2ft of SJOOW cord and quick disconnect anti-wicking barrier
- Sleeve is ordered separately (see accessories).

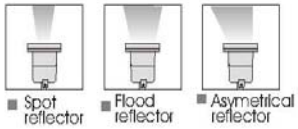
Installation Recomendations

- In all potentially wet/damp locations, a waterproof junction box must be used.
- Provisions for effective drainage are



Applications

- Public spaces
- Walkways
- Commercial facilities



EXTERIEUR VERT a division of TARGETTI NORTH AMERICA
www.exterieurvert.com

1513 E. Saint Gertrude Place Tel 714 957-4960
Santa Ana, Ca 92705 Fax 714 957-4965

MercureM2 05.23.07

APPENDIX

FOYER: F3

Extérieur Vert

M2 SERIES

MERCURE

■ Part # Logic

M2	RMP	1	QD
Base Part #	Reflector	Voltage	Quick Disconnect
T2 Fluoresent Projector	RMP—Symetrical Spot Reflector RMS—Symetrical Flood Reflector RMA—Asymetric Reflector	1=120V 7=277V	QD=Quick Disconnect Included

■ Select Rough In Kit

Sleeve (Required)

Part #	Description
ME-M2QD	Aluminum sleeve with quick disconnect

Accessories

■ Filters

Color	Part #
Blue	B387
Green	G387
Red	R387
Yellow	Y387
Frosted	F387

*387mm

■ Louvers

Transversal

Longitudinal

Part #	Description
MER-LOL	Longitudinal Louver/Black
MER-LOT	Transversal Louver/Black
LFL0000T2011020	Lamp 3000° K
LFL0000T2011040	Lamp 4100° K

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MercureM2 05.23.07

APPENDIX

LIBRARY: F4

In-Cove II

LEDALITE

Project Name

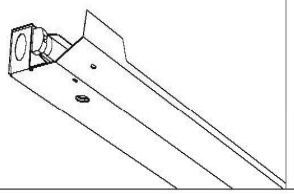
Spec Type

Notes

Cove

Indirect

1 T5HO



Order Guide

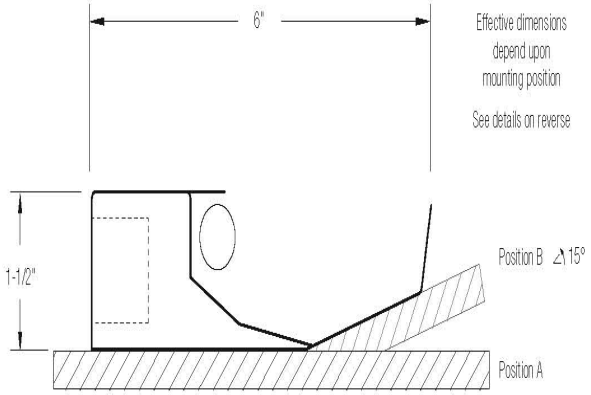
Some combinations of product options may not be available. Consult factory for assistance with your specification.

3808	H01	E	N	-		-		-		-		-	
Product Series & Type	Lamping	Lower Optics	Upper Optics		Run Length		Wiring		Voltage		Ballast		Color & Finish
In-Cove II Indirect	1 T5HO	E Solid Housing	N None		*Enter the total run length in feet*		1 1 cct 3 1 cct w/ Emergency cct 5 1 cct w/ Battery Pack 7 1 cct Dimming		1 120V 2 277V 3 347V		E Standard Ballast		W High Reflective White
					See details on reverse		Consult website for complete list of standard wiring options				Consult website for ballast manufacturer information		

Upgrades & Accessories

Please indicate with check mark.

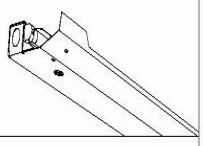
☐ Lamps Included ☐ Lamps Included and Installed



 Phone: 604.888.6811 Fax: 800.665.5332 Web: www.ledalite.com Email: info@ledalite.com Filename 3808H01EN.pdf Rev 1

In-Cove II

Cove
Indirect
1 T5HO



Photometry Optics EN

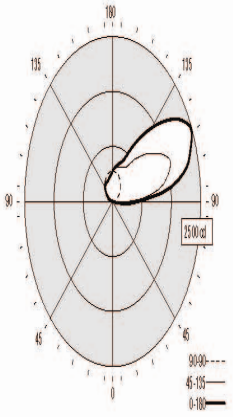
Report Summary

Report # 9901075
Filename 3808H01EN.ies
Efficiency 87.1%

Peak Candela Value* 2480 @ 115°
Peak to Zenith Ratio* 5.4 : 1
* Between 90-180° vertical angle

Candela Distribution

Vertical Angle	Horizontal Angle 0	22.5	45	67.5	90	Zonal Lumens
0	0	0	0	0	0	
5	0	0	0	0	0	0
15	0	0	0	0	4	0
25	0	0	0	0	4	0
35	0	0	0	4	4	0
45	0	0	0	5	5	0
55	0	0	0	5	7	0
65	0	0	0	7	7	1
75	0	0	0	6	8	5
85	425	172	0	7	7	71
90	744	470	9	9	5	
95	1372	1047	31	15	9	369
105	2221	1637	100	104	86	737
115	2480	1645	177	171	153	822
125	2182	1265	257	259	229	710
135	1586	912	318	294	314	527
145	1044	628	376	312	335	357
155	673	567	416	340	336	236
165	575	534	442	385	365	151
175	503	492	456	434	422	69
180	462	462	462	462	462	



Coefficients of Utilization (%)

Ceiling:	80				70			50			0
Wall:	70	50	30	10	70	50	30	50	30	10	0
0 RCR	84	84	84	84	72	72	72	50	50	50	2
1	75	71	68	65	64	61	58	42	40	38	0
2	68	62	57	52	58	53	49	36	34	31	0
3	62	54	48	43	53	46	42	32	29	26	0
4	57	48	41	36	48	41	36	28	25	22	0
5	52	42	36	31	44	36	31	25	21	19	0
6	47	37	31	26	40	32	27	22	19	16	0
7	44	34	27	22	37	29	23	20	16	14	0
8	40	30	24	19	34	26	21	18	14	12	0
9	37	27	21	17	32	23	18	16	13	10	0
10	34	25	19	15	29	21	16	15	11	9	0

Based on a floor reflectance of 0.2

Avg. Luminance (cd/m²)

Vertical Angle	Horizontal Angle 0	45	90
55	0	0	97
65	0	0	132
75	0	0	247
85	38938	0	641

IES files for this and other photometric options can be downloaded online at www.ledalite.com

Additional Information

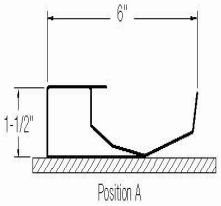
Modules

Nominal module length shown on right.

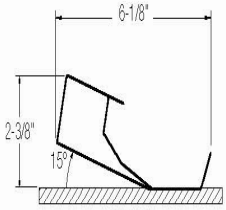
Module	Nominal Length
2ft	1'11
3ft	2'11"
4ft	3'11"
6ft	5'9"
8ft	7'9"

Mounting Positions

Fixtures can be mounted in multiple positions to adjust for specific site and lighting requirements.



Position A



Position B

Specifications

Due to continuing product improvements, Ledalite reserves the right to change specifications without notice.

Housing
Die-formed 20 gauge cold-rolled steel painted white.

Weight
3.0 lb/ft.

Optical System
Constructed of highly specular Miro M® aluminum* and highly reflective 20 gauge steel to produce an asymmetric distribution.

* Note: 2T8 constructed of highly specular aluminum.

Mounting
Fixtures can be screwed down in multiple positions and orientations to enable precise coordination of optical distributions.

Electrical
Factory pre-wired to section ends with quick wire connectors.

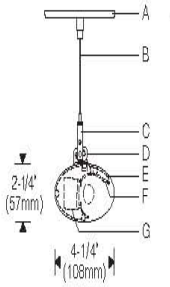
Ballast
Electronic.

Approvals
Certified to UL & CSA standards.

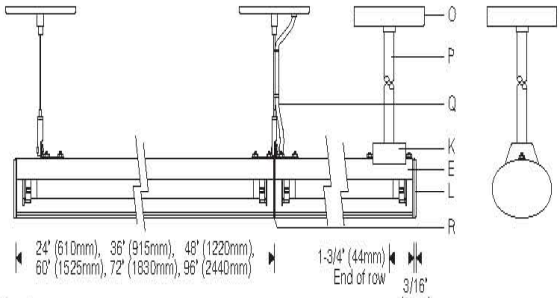
 Phone: 604.888.6811 Fax: 800.665.5332 Web: www.ledalite.com Email: info@ledalite.com Filename 3808H01EN.pdf Rev 1

Lighting the Wall Xtra small enclosed oval, integral — T5 Fluorescent — Ovalinear xs — Style 140

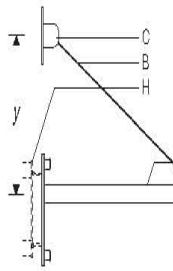
Cable 1:8 Scale

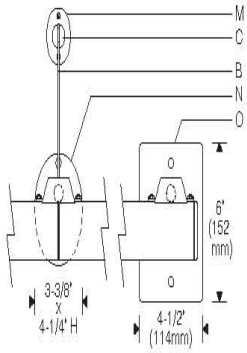


Pendant Stem

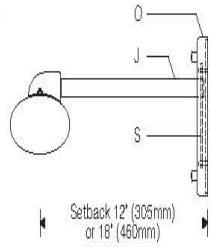


Cantilever with Tie-Back





Cantilever with Canopy



Specifications

- **A** 1/4" aluminum canopy
- **B** 1/16" dia. 7x7 cable
- **C** Adjustable cable glider
- **D** Leveling bracket (cable)
- **E** Extruded aluminum housing
- **F** Specular extruded aluminum reflector
- **G** Electronic ballast
- **H** Recessed outlet box w/ plaster ring (by others)
- **J** Tubular steel arm
- **K** Formed aluminum fitting
- **L** Aluminum decorative end plates (order separately)
- **M** Aluminum anchor plate
- **N** Aluminum cover plate
- **O** Aluminum canopy
- **P** Tubular aluminum stem
- **Q** 18/3 cord with clips
- **R** Aluminum joiner/ reveal plates (black)
- **S** Steel wall and leveling plates (under canopy)

Finish:
Semi-gloss white housing. Black joiner/reveal plates.

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:
Cables, pendants or cantilevers hangers **ordered separately**.

For single unit, specify starter/individual module (**X** mount). For continuous row, add intermediate/end modules (**Y** mount). Joiner/reveal plates align and bolt together.

Pendant stem - 11/16" O.D. aluminum, internally threaded. 5" dia. aluminum canopy. For swivel - consult factory.

Cable - 1/16" dia. 7x7 aircraft cable, field adjustable length. Crossbar w/ 1/4-20 stud, coupling with slipring, 5" dia. canopy.

Cantilever - 11/16" O.D. steel arm ; suitable support structure required. Choice of: **Rectangular canopy** with adjustable interface plate allows leveling of arms +/- 5°, or
Oval wall plates with adjustable cable tieback.

Electrical:
Prewired with modular through wiring with quick connectors.

X mount - starter/individual module furnished with 18/3 cord for connection to supply at recessed outlet box (by others). Cord is clipped alongside cable or managed through cantilever arm or pendant stem. Note: cantilever with tieback requires recessed plaster ring (Raco #727 or equal by others).

Y mount - intermediate/end module plugs into adjacent unit.

Integral electronic HPF thermally protected class P ballast with end-of-life protection. Remove reflector to service ballast.

Optional electronic dimming ballast; compatible dimmer switch required (by others). Consult sales representative for compatibility and specifications.

Optional integral emergency battery operates one lamp. Separate unswitched supply is required. Note: first battery pack in row must be located in starter module (**X** mount).

Standard:
UL listed or CSA certified.

8/07 **U.S. Patent 6,860,618 and other patents pending**

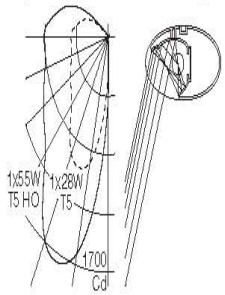
Features

- *Small classic form - full oval end plates; articulated reveals*
- *Powerful T5/T5HO fluorescent wall lighting - low energy*
- *Unequaled uniformity from minimal setbacks - ideal for conference rooms, markerboards, art walls, displays, signs*
- *Versatile - cable, pendant or two styles of cantilevers*
- *Integral electronic ballast - modular quick connect wiring*

W 19.0

Performance

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



For complete photometrics, see www.elliptipar.com.

elliptipar

To Order

Ovalinear xs **Style 140**

To form a Catalog Number

F 1,4,0 - T [ ] - [ ] - [ ] - [ ] [ ] [ ]
1 2 3 4 5 6 7 8

Project: [ ]

Type: [ ]

1 Source

F = Linear fluorescent

2 Style

140 = Xtra small enclosed oval, **integral** ballast

3 Lamp

T [ ] [ ] = **T5 Fluorescent Lamp Code**

Lamp Wattage (see chart below)

Number of Lamps in Length, specify **1** or **2**

Example: **T155** = 4' (1.2m) housing with one 54W T5HO lamp

*Length**	*T5*		*T5HO*	
	Code	*Lamp(s)*	*Code*	*Lamp(s)*
T5 Fluorescent				
24" (610mm)	**T114**	1 x F14T5	**T124**	1 x F24T5/HO
36" (915mm)	**T121**	1 x F21T5	**T139**	1 x F39T5/HO
48" (1220mm)	**T128**	1 x F28T5	**T155**	1 x F54T5/HO
60" (1525mm)	**T135**	1 x F35T5	**T180**	1 x F80T5/HO
72" (1830mm)	**T221**	2 x F21T5	**T239**	2 x F39T5/HO
96" (2440mm)	**T228**	2 x F28T5	**T255**	2 x F54T5/HO

For complete lamp and ballast information, see Accessories Section.
Standard T5 lamp color is 3000K / 80+ CRI.

* Add 3/8" (10mm) to row or single unit for **ADE** Decorative End Plates

W 19.1

4 Mounting

X = Starter/individual module with electrical feed (18/3 cord)
Note: units with dimming or battery will be provided with 18/4 or two (2) 18/3 cords as required.

Y = Intermediate/end module with modular through wiring with quick connectors

Note: Order cable, pendant, or cantilever hangers separately.

5 Finish

02 = Semi-gloss white

99 = Custom RAL or computer matched color to be specified, consult sales representative

6 Voltage/Ballast

Electronic	*Dimming**
1 = 120V	**T** = 120V
2 = 277V	**V** = 277V
3 = 347V (Canada)	

Note: Not available for use with cable hangers.

* Consult sales representative for dimming 5' lamps (lamp codes **T135**, **T180**). Availability for wattages and voltages varies with ballast manufacturer and control type - see **www.elliptipar.com** for additional dimming specifications and limitations.

Consult factory when dimming units with cable supports.
The quantity of electrical feed cable hangers to accommodate the control circuit varies with ballast manufacturer and control type.

7 Option (See Accessories Section for specifications)

00 = No option

0E = Integral emergency battery pack with indicator lamp and test button. Operates one lamp. Available in 4', 5', 6' and 8' lengths (lamp codes **T128**, **T135**, **T221**, **T228**, **T155**, **T239** and **T255**).
Note: For **rows**, 0E option must be specified for the starter/individual module (**X** mount). Additional battery packs may be specified on intermediate/end modules.

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

F140 - T155 - X - 02 - 2 - 000

Xtra small enclosed oval series for use with one 4' F54T5HO lamp, 48" long housing (not including decorative end plates). For use with cable, pendant or cantilever hangers (order separately). Semi-gloss white. Integral 277V ballast. UL. Order decorative end plates and hangers separately.

Accessories

Order separately. See Accessories Section for specifications.

ADE40 [ ] **0** = **Decorative end plates**, pair, white, or custom color to match housing
5
Note: adds 3/8" (10mm) to length

Hangers

Order separately. See Accessories Section for specifications.

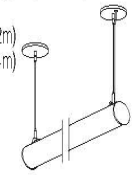
Cable supports
Order one non-electrical and one electrical feed cable support for each starter/individual module (**X** mount). Order one non-electrical cable support for each additional intermediate/end module (**Y** mount) in a row.

Note: For dimming (voltage/ballast code **T** or **V**), an additional electrical feed cable support may be required depending on ballast manufacturer and control type - consult factory.

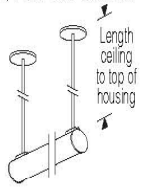
Pendant and Cantilevers
Order one hanger for each module (**X** or **Y** mount) plus one hanger for the end of each row. At location with outlet box, prewired cord on starter/individual module (**X** mount) is managed through stem or arm.

Electrical feed can be located at ends or intermediate joints.

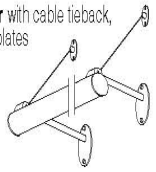
VX [ ] [ ] [ ] **0** = **Cable support**, field adjustable
48 = up to 48" (1.2m)
96 = up to 96" (2.4m)
5 Finish
Note: canopy is white unless specified other
R = Non-electrical
S = Electrical feed, white or black 18/3 cord



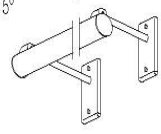
VXF [ ] [ ] **0** = **Pendant stem**, 11/16" O.D. aluminum
Length in inches, up to 60" (1.5m), 6" minimum
5 Finish



VXV [ ] [ ] **0** = **Cantilever** with cable tieback, oval wall plates
Setback in inches, 12" (305mm) min. 36" (915mm) max.
5 Finish



VXC [ ] [ ] **0** = **Cantilever** with rectangular canopy, levels +/- 5°
Setback in inches,
12 = 12" (305mm)
18 = 18" (460mm)
5 Finish

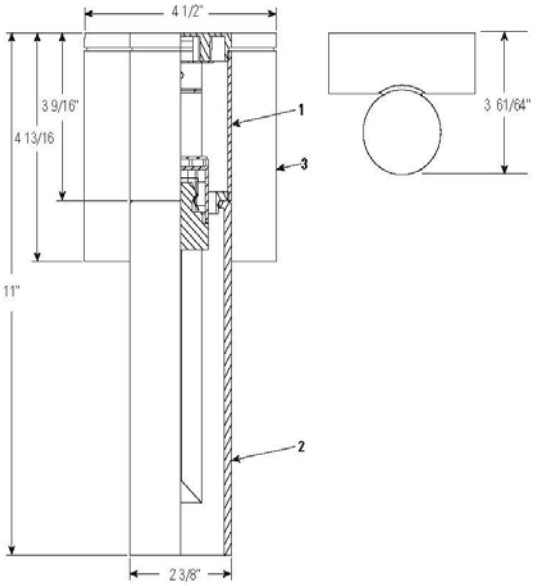


8/07 **elliptipar**

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

Vetro Architectural Decorative **FW01**

Wall Mount



Complete Fixture Minus Suspension Kit:

Spec ID	Powerhead	Inner Glass	Outer Glass	Lamp	Volts
FW01	**PW13SA**	SG02	NA	4-Pin Elect. Twin Tube 13W	120V
FW201	**PW132SA**	SG02	NA	4-Pin Elect. Twin Tube 13W	277V
FW01Q	**PW13QSA**	SG02	NA	4-Pin Quad Tube 13W	120V
FW201Q	**PW132QSA**	SG02	NA	4-Pin Twin Tube 13W	277V
IW01	**PW50SA**	SG02	NA	T-4 Mini-Can 50W	120V

***All suspension kits can be shortened to length in field with the execption of SMK and CTC.**

Features

1. **Power Compartment:** Die Cast and Machined Aluminum Components. Brushed and Clear Lacquer Finish.
2. **Primary Glass:** Triplex Hand Blown Glass.
3. **Backplate:** Die Cast Aluminum, Brushed and Clear Lacquer Finish.

Lamping (by others)

Incandescent: 50W Max. T-4 Mini Candelabra

Compact Fluorescent:

General Electric	Osram/Sylvania	Philips
(1) 13W Twin Tube 4-Pin Compact Fluorescent Lamp		
N/A	CF13DS/E/*	N/A
(1) 13W Quad Tube 4-Pin Compact Fluorescent Lamp		
F13DBX/SPX*/4P	CF13DD/E/*	PL-CL3W/*/4P/ALTO

*Manufacturers Color Temperature Designation

Electrical

Lampholders

Incandescent: E11 Base, Porcelain, Plated Copper Alloy Screw Shell

Compact Fluorescent: 13W Twin: 2GX7 Base, High Impact Thermoset Polymer with Brass Contacts.

13W Quad: GX24Q-1 Base, High Impact Thermoset Polymer with Brass Contacts.

Ballasts: Fluorescent: Electronic	**13 Watts**	
Voltage	120	277
Total Imput Watts	35	28
Max. Line Current (Amps)	.33	.18

Labels

cULus Listed. Suitable for Damp Locations.

Job Information **Type:**

Job Name:

Cat. No.:

Lamp(s):

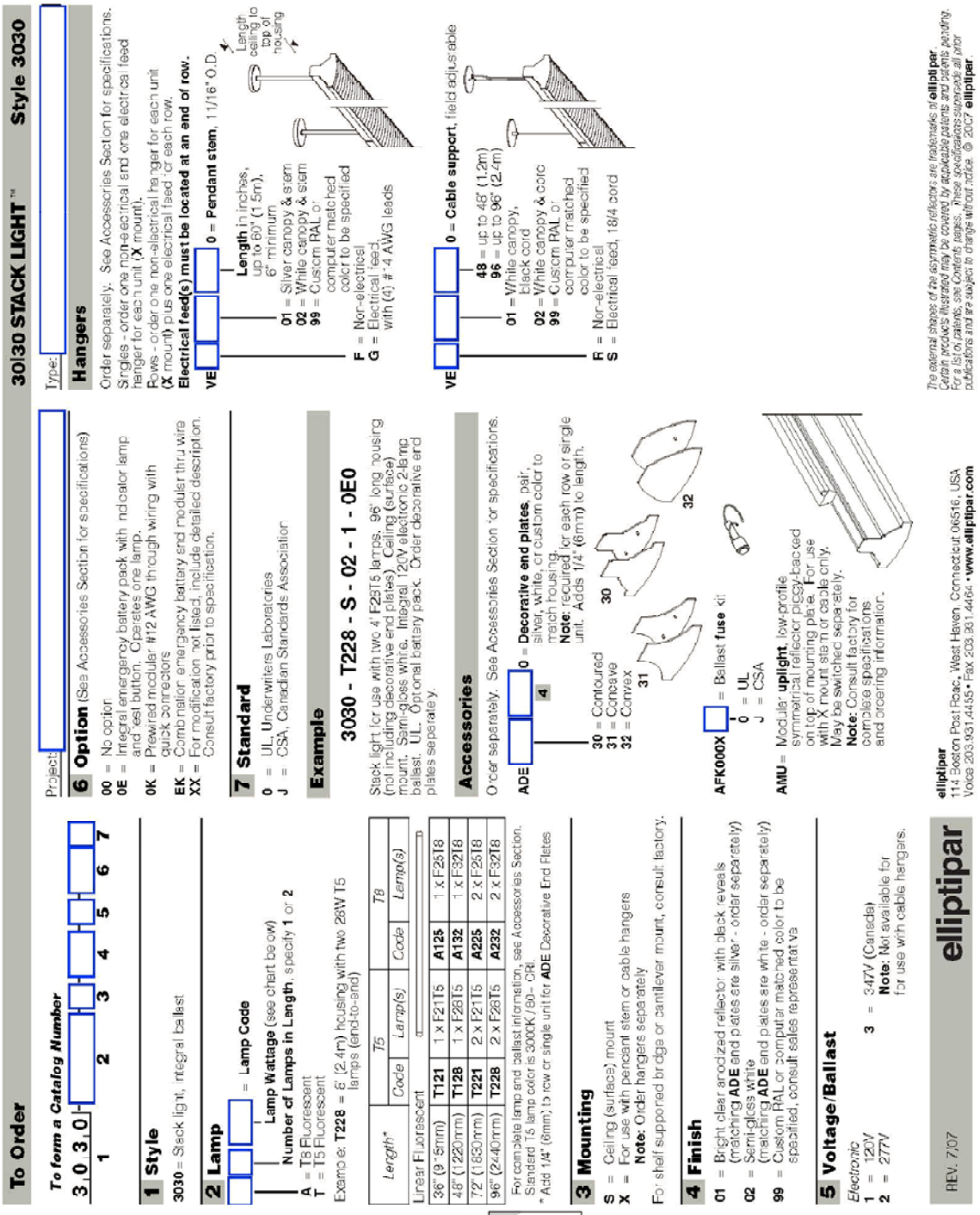
Notes:

Lightolier a Genlyte company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

APPENDIX

LIBRARY: F8



To Order — **30|30 STACK LIGHT™** — **Style 3030**

To form a Catalog Number

3 0 3 0 - _ _ _ _ _ _ _
1 2 3 4 5 6 7

Project: Type:

1 Style

3030 = Stack light, integral ballast

2 Lamp

_ _ _ = **Lamp Code**

Lamp Wattage (see chart below)

Number of Lamps in Length, specify **1** or **2**

A = T8 Fluorescent
T = T5 Fluorescent

Example: **T228** = 8' (2.4m) housing with two 28W T5 lamps (end-to-end)

*Length**	T5		T8	
	Code	*Lamp(s)*	*Code*	*Lamp(s)*
Linear Fluorescent				
36" (915mm)	**T121**	1 x F21T5	**A125**	1 x F25T8
48" (1220mm)	**T128**	1 x F28T5	**A132**	1 x F32T8
72" (1830mm)	**T221**	2 x F21T5	**A225**	2 x F25T8
96" (2440mm)	**T228**	2 x F28T5	**A232**	2 x F32T8

For complete lamp and ballast information, see Accessories Section.
Standard T5 lamp color is 3000K / 80+ CRI.
* Add 1/4" (6mm) to row or single unit for **ADE** Decorative End Plates

3 Mounting

S = Ceiling (surface) mount
X = For use with pendant stem or cable hangers
Note: Order hangers separately

For shelf supported bridge or cantilever mount, consult factory.

4 Finish

01 = Bright clear anodized reflector with black reveals (matching **ADE** end plates are silver - order separately)
02 = Semi-gloss white (matching **ADE** end plates are white - order separately)
99 = Custom RAL or computer matched color to be specified, consult sales representative

5 Voltage/Ballast

Electronic
1 = 120V
2 = 277V
3 = 347V (Canada)
Note: Not available for use with cable hangers.

REV: 7/07

elliptipar

6 Option (See Accessories Section for specifications)

00 = No option
0E = Integral emergency battery pack with indicator lamp and test button. Operates one lamp.
0K = Prewired modular #12 AWG through wiring with quick connectors
EK = Combination emergency battery and modular thru wire
XX = For modification not listed, include detailed description. Consult factory prior to specification.

7 Standard

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

Example

3030 - T228 - S - 02 - 1 - 0E0

Stack light for use with two 4' F28T5 lamps, 96" long housing (not including decorative end plates). Ceiling (surface) mount. Semi-gloss white. Integral 120V electronic 2-lamp ballast. UL. Optional battery pack. Order decorative end plates separately.

Accessories

Order separately. See Accessories Section for specifications.

ADE _ **4** = **0** = **Decorative end plates**, pair, silver, white, or custom color to match housing
Note: required for each row or single unit. Adds 1/4" (6mm) to length.
30 = Contoured
31 = Concave
32 = Convex

AFK000X _ = Ballast **fuse** kit
0 = UL
J = CSA

AMU = Modular **uplight**, low-profile symmetrical reflector piggybacked on top of mounting plate. For use with X mount stem or cable only. May be switched separately.
Note: Consult factory for complete specifications and ordering information.

VE _ _ = **0** = **Pendant stem**, 11/16" O.D.
Electrical feed(s) must be located at an end of row.

VE _ _ = **0** = **Cable support**, field adjustable
48 = up to 48" (1.2m)
96 = up to 96" (2.4m)
01 = White canopy, black cord
02 = White canopy & cord
99 = Custom RAL or computer matched color to be specified
F = Non-electrical
S = Electrical feed, 18/4 cord

The external shapes of the asymmetric reflectors are trademarks of **elliptipar**.
Certain products illustrated may be covered by applicable patents and patents pending. For a list of patents, see Contents pages. These specifications supersede all prior publications and are subject to change without notice. © 2007 **elliptipar**.

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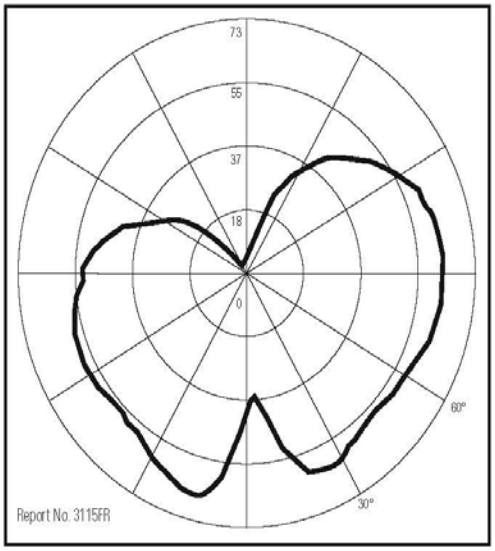
Vetro Architectural Decorative **FW01**

Wall Mount

Catalog No. FW01, 13W 4 Pin Twin Tube, 800 Lumens.



CANDLEPOWER SUMMARY

Angle	0°	45°	90°
0	42	42	42
5	35	37	50
10	43	47	62
15	53	60	68
20	60	65	69
25	61	66	67
30	61	64	65
35	59	62	63
40	58	61	61
45	57	60	60
50	57	60	60
55	58	60	61
60	59	61	61
65	60	62	62
70	61	63	63
75	62	64	63
80	63	65	64
85	63	65	62
90	63	65	63
95	63	65	62
100	63	65	62
105	62	64	60
110	61	63	59
115	60	62	56
120	57	59	53
125	55	56	50
130	51	53	46
135	47	49	41
140	43	45	36
145	39	40	30
150	33	34	22
155	27	26	14
160	19	17	8
165	10	8	3
170	3	3	1
175	1	1	1
180	1	1	1

ZONAL LUMENS AND PERCENTAGES

Zone	Lumens	%Lamp	%Fixt
0-30	53.06	6.6	8.2
0-40	97.48	11.4	14.1
0-60	190.3	23.8	29.4
0-90	381.35	47.7	58.9
90-120	174.62	21.8	27
90-130	214.22	26.8	33.1
90-150	257.49	32.2	33.1
90-180	265.77	33.2	41.1
0-180	647.03	80.9	100

** Efficiency = 80.9% **

COEFFICIENTS OF UTILIZATION

Ceiling		80%				70%		50%		30%		
Wall		70	50	30	10	50	10	50	10	50	10	0
RCR		Zonal Cavity Method - Effective Floor Reflectance = 20%										
Room Cavity Ratio	0	88	88	88	88	82	82	71	71	61	61	48
	1	77	71	67	62	66	58	57	50	48	43	32
	2	68	60	54	48	56	45	48	39	40	33	24
	3	62	52	44	38	48	36	41	31	34	26	19
	4	56	45	37	32	42	30	36	26	30	22	15
	5	51	40	32	26	37	25	31	21	26	18	12
	6	47	36	28	23	33	21	28	18	24	16	11
	7	43	32	25	19	30	18	25	16	21	14	9
	8	40	29	22	17	27	16	23	14	19	12	8
	9	37	26	19	15	24	14	21	12	18	11	7
	10	35	24	18	13	22	13	19	11	16	9	6

Determined In Accordance With Current IES Published Procedures
Luminaire Imput Watts = 18

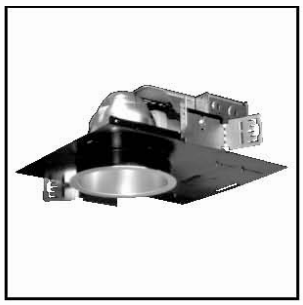
Job Information **Type:**

Lightolier a Genlyte company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

APPENDIX

CHAPEL: F8



Featuring VirtualSource® Reflectors

6" Horizontal Triple Open & Wall Wash Downlight

CFT632HEB

One 26W, 32W, or
42W Triple Tube 4-Pin Lamp
Non-IC Rated
120V, 208V, 240V, 277V, or 347V

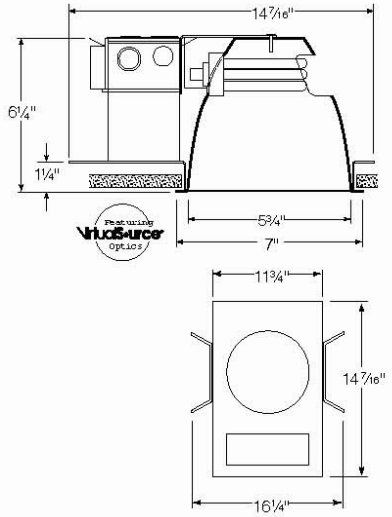
DATE: TYPE:

FIRM NAME:

PROJECT:

Architektūr

Ceiling Cutout: 6 1/4"
Maximum Ceiling Thickness: 1 1/4"
For conversion to millimeters, multiply inches by 25.4
Not to Scale



APPLICATIONS:
The CFT632HEB offers a horizontally lamped compact fluorescent downlight and wall wash fixture that provides superior brightness and glare control. The multi-watt multi-volt ballast provides the ability to change wattages by simply replacing the lamp. This luminaire is ideal for a wide variety of low to medium height ceiling applications including commercial, retail, and hospitality. The CFT632HEB is compatible with the Signos6 family of architectural elements.

HOUSING:
One-piece painted 18-gauge cold rolled steel platform. Prewired J-box with snap-on cover for easy access. Vented at lamp tip and socket for maximum light output. Same housing accommodates downlight and wall wash downlight reflectors.

REFLECTOR:
High purity aluminum Alzak Virtual Source® iridescence suppressed reflector. Self-trim standard. Painted white self-trim available. Baffled units standard with painted white self-trim.

BALLAST:
One (1) compact fluorescent Class 'P' electronic multi-volt (120V through 277V) ballast suitable for operating 26W, 32W, and 42W triple tube lamps. HPF and EOL protection standard. Accessible from below ceiling. 347V available (specify wattage when ordering).

LAMP:
One (1) 26W (GX24q-3 base), 32W (GX24q-3 base), or 42W (GX24q-4 base) 4-pin triple tube compact fluorescent lamp. Lamps furnished by others.

SOCKET:
One (1) injection molded socket suitable for 26W, 32W, and 42W triple tube lamps (vented).

INSTALLATION:
Universal adjustable mounting brackets accommodate 1 1/2" or 3/4" lathing channel or 1/2" EMT (by others), or Prescolite 24" bar hangers (B24 or B6).

LABELS:
UL, CSA listed for damp locations
Approved for through wiring
Non-type I.C.

CATALOG NUMBER: EXAMPLE: CFT632HEBDMEM-STF602HCG-B24

HOUSING

- ☐ **CFT632HEB** 6" 26W 32W/42W triple tube, multi-volt electronic ballast

HOUSING OPTIONS

- **347V** [1] (Specify wattage)
- ☐ **CP** [5] Chicago Plenum. Fixture construction and/or specifications may vary. Refer to Chicago Plenum specification sheets on www.prescolite.com for details.
- ☐ **DM** Electronic Analog Dimming Ballast to 3%, 4-wire (120V or 277V)
- ☐ **SDM** [3] Lutron Compact SE Dimming Ballast to 5%, 3-wire line voltage (specify supply voltage/wattage)

HOUSING OPTIONS

- ☐ **HDM** [2,3] Lutron Hi-Lume Dimming Ballast to 1%, 3-wire line voltage (specify supply voltage/wattage)
- ☐ **2DM** [2,3] Lutron Tu-Wire Dimming Ballast to 5%, 2-wire line voltage (120V only)
- ☐ **7DM** Advance Mark 7 Dimming Ballast to 5%, 4-wire, 0-10V, analog (120V or 277V)
- ☐ **XDM** Advance Mark 10 Dimming Ballast to 5%, 2-wire, line voltage (specify voltage/wattage)
- ☐ **B24** Set of two (2) 24" bar hangers for T-bar ceilings
- ☐ **B6** Set of two (2) bar hangers for ceiling joists up to 24" centers

HOUSING OPTIONS

- ☐ **EM** Emergency battery pack with remote test switch and indicator light
- ☐ **FSDFA** Fuse kit installed at factory
- ☐ **RIF1** Radio interference filter (single circuit)
- ☐ **MW26** Max Wattage label, 26W
- ☐ **MW32** Max Wattage label, 32W

REFLECTOR

- ☐ **STF602H** ® 6" Alzak reflector

REFLECTOR COLOR

- ☐ **Blank** Clear Alzak
- ☐ **CG** Champagne Gold Alzak
- ☐ **BL** Black Alzak
- ☐ **WE** Wheat Alzak
- ☐ **LW** Light Wheat Alzak
- ☐ **PW** Pewter Alzak

REFLECTOR FINISH

- ☐ **Blank** Specular
- ☐ **SS** Semi-Specular
- ☐ **MFC** American Matte

REFLECTOR OPTIONS

- ☐ **WT** Painted white self-flange
- ☐ **BC** [4] Painted black cone
- ☐ **WC** [4] Painted white cone
- ☐ **BB** [4] Painted black baffle
- ☐ **WB** [4] Painted white baffle
- ☐ **WW** Wall wash reflector
- ☐ **TRG** Trim Ring Gasket (factory installed)

ACCESSORIES

- ☐ **FSDFI** Fuse kit for field installation
- ☐ **SCA6D_** Sloped ceiling adapter (see note on back page)
- ☐ **Signos6** Architectural glass elements
  Refer to specification sheets ARCH-SIG-001 through -004

[1] Dimming options not available in 347V.
[2] Not available with 42W lamps.
[3] For 26W, 32W, or 42W CFL lamps specify CFT626HEB, CFT632HEB, or CFT642HEB housing and add desired dimming option suffix.
[4] Not available with MFC, haze or semi-specular finishes.
[5] Top access required to service ballast for Chicago Plenum.

prescolite
A Division of Hubbell Lighting, Inc.

In a continuing effort to offer the best product possible we reserve the right to change, without notice, specifications or materials that in our opinion will not alter the function of the product.
Web: **www.prescolite.com** • Tech Support: **(888) 777-4832**

ARCH-CFL-001

PHOTOMETRIC DATA

Architektūr - 6" Horizontal Triple Open & Wall Wash Downlights - CFT632HEB

BALLAST DATA	26W Triple			32W Triple			42W Triple		
	120V	277V	347V	120V	277V	347V	120V	277V	347V
Total System Watts	28W	28W	38W	35W	35W	42W	44W	47W	48W
Input Current (Amps)	0.23	0.1	0.11	0.29	0.13	0.12	0.36	0.17	0.14
Input Frequency in Hz	50/60	50/60	50/60	50/60	50/60	50/60	50/60	50/60	50/60
Power Factor	>97%	>97%	>97%	>97%	>97%	>97%	>97%	>97%	>97%
Ballast Factor	>98%	>98%	>98%	>98%	>98%	>98%	>98%	>98%	>98%
Total Harmonic Distortion	<10%	<10%	<10%	<10%	<10%	<10%	<10%	<10%	<10%
Total Harmonic Distortion	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)	-18°C (0°F)

LAMP DATA (One per fixture)

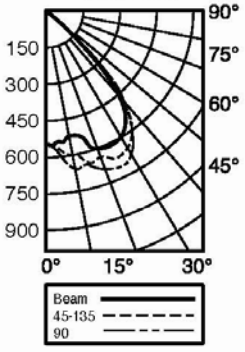
	26W Triple	32W Triple	42W Triple
Rated Watts			
Rates Lumens	1800	2400	3200
Efficacy (LPW)	69	75	76
Rated Life	10,000 hours	10,000 hours	10,000 hours
CRI	82	82	82
Min. Starting Temp.	0° F	0° F	0° F

LUMINANCE DATA IN CANDELA/SQ. METER

Angle in Vertical	Average 0°	Average 45°	Average 90°
45°	21019	21096	14312
55°	0	0	0
65°	0	0	0
75°	0	0	0
85°	0	0	0

CFT632HEB-STF602H
with Specular Clear Alzak Reflector
Lamp: One 32W Triple
Spacing Criteria:
0° = 1.5
90° = 1.6
Efficiency: 45.1%

CANDLEPOWER DISTRIBUTION



Test No. PL5221

CANDLEPOWER SUMMARY

Angle	0°	45°	90°
0	540	540	540
5	598	572	535
15	649	638	528
25	700	663	601
35	605	601	557
45	249	249	227
55	0	0	0
65	0	0	0
75	0	0	0
85	0	0	0

AVERAGE INITIAL FOOTCANDLES
Multiple Units (Square Array)
Ceiling 80% Wall 50% Floor 20%

32W Triple

SPACING	RCR1	RCR3	RCR7
7.0	20	17	12
8.0	15	13	9
9.0	12	10	7
10.0	10	8	6
11.0	8	7	5

COEFFICIENTS OF UTILIZATION Zonal Cavity Method

Room Cavity Ratio	% Effective Floor Cavity Reflectance: 80%				70%				50%			30%			10%		
	20% Effective Floor Cavity Reflectance																
	% Wall Reflectance: 70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10
1	.51	.50	.49	.48	.50	.49	.48	.47	.47	.46	.46	.45	.45	.44	.44	.43	.43
2	.49	.47	.45	.43	.48	.46	.44	.43	.44	.43	.42	.43	.42	.41	.42	.41	.40
3	.46	.43	.41	.39	.45	.42	.40	.39	.41	.40	.38	.40	.39	.38	.39	.38	.37
4	.44	.40	.38	.36	.43	.40	.37	.36	.39	.37	.35	.38	.36	.35	.37	.36	.34
5	.41	.37	.35	.33	.40	.37	.34	.32	.36	.34	.32	.35	.33	.32	.35	.33	.32
6	.39	.35	.32	.30	.38	.34	.32	.30	.34	.31	.30	.33	.31	.29	.32	.30	.29
7	.36	.32	.29	.27	.36	.32	.29	.27	.31	.29	.27	.30	.28	.27	.30	.28	.27
8	.34	.29	.27	.25	.34	.29	.26	.24	.29	.26	.24	.28	.26	.24	.28	.26	.24
9	.32	.27	.24	.22	.31	.27	.24	.22	.26	.24	.22	.26	.23	.22	.25	.23	.22
10	.30	.25	.22	.20	.29	.25	.22	.20	.24	.22	.20	.24	.21	.20	.23	.21	.20

CFT632HEB-STF602H Test No. PL5221

NOTES

Denotes a Virtual Source reflector.

Refer to www.prescolite.com for additional photometric tests (IES Files).

When ordering a sloped ceiling adapter, specify the degree of slope in 5° increments, max. of 35°. For a more precise degree or wet ceiling applications, please contact factory. Sloped ceiling adapter and housing must be installed at the same time.

Note: Use of horizontally-lamped open downlights with amalgam-based CFL lamps in air-handling plenums is not recommended because cool air flow over the lamps will result in reduced light output. Prescolite recommends vertical lamp downlights or use of the regressed lensed trim option for horizontal downlights in these applications to reduce this effect. Refer to Prescolite White Paper WP0003 at www.prescolite.com for more information.

prescolite

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HUBBELL
Hubbell Lighting, Inc.

APPENDIX

CHAPEL: F9

SignosM

Architectural Elements

AKTMHT

One 39W or 70W T4 or T6 Metal Halide Lamp

DATE: TYPE

FIRM NAME:

PROJECT:

ArchiTrak

For conversion to millimeters, multiply inches by 25.4
Not to Scale

APPLICATIONS:
Prescolite's SignosM T4 and T6 metal halide foundations provide the perfect starting point to create your own unique style. Contemporary, and highly shielded, the final design is up to you. Specify with one of three finishes to compliment your interior space.

TRACK FOUNDATION:
Diecast aluminum foundation with electronic ballast. Lamp assembly rotates 180° both horizontally and vertically. Tool-less aiming connector has solid copper contact bars, fixed for one or two circuit connection without modification. Baked enamel finish available in black (BL), white (WH), or Zet (Z) metallic silver.

LAMP:
Use one (1) GE T4.5 or Philips T6 metal halide lamp only. Use of any other manufacturers lamps may jeopardize optical performance. Lamp furnished by others.

SOCKET:
T6: Ceramic bi-pin G12 base with 200°C wire in silicone insulator sleeve.

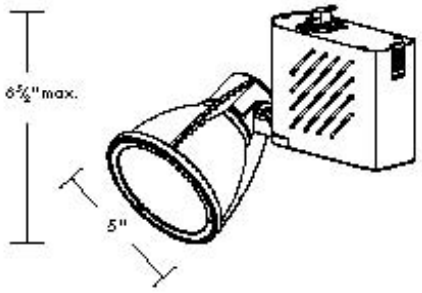
T4: Ceramic bi-pin G6.5 base with 200°C wire in silicone insulator sleeve.

LENS:
All reflector assemblies include diecast lens cam ring with tool-less access and clear tempered glass lens.

REFLECTOR:
Specify spot (10°), medium (25°) or flood (40°) distribution reflector assembly (required), which features a clear specular or matte finish anodized reflector and an outer solid shade in your choice of black (BL), white (WH) or zet (Z) metallic silver painted finishes.

INSTALLATION:
Easy installation onto ArchiTrak one/two circuit track.

LABELS:
CSA NRTL/C Listed



CATALOG NUMBER: EXAMPLE: AKTMHT670 WH AKTRL1 WH

TRACK FOUNDATION	TRACK FOUNDATION	REFLECTOR/LENS ASSEMBLY (REQUIRED)	
☐ AKTMHT439 Z	☐ AKTMHT639 Z	T4/T6 SPOT (10°)* SPECULAR REFLECTOR	T6 MEDIUM (25°)* MATTE REFLECTOR
☐ AKTMHT439 BL	☐ AKTMHT639 BL	☐ AKTSP1 Z	☐ AKTME2 Z
☐ AKTMHT439 WH T4.5, 39W GE	☐ AKTMHT639 WH T6, 39W Philips	☐ AKTSP1 BL	☐ AKTME2 BL
☐ AKTMHT470 Z	☐ AKTMHT670 Z	☐ AKTSP1 WH	☐ AKTME2 WH
☐ AKTMHT470 BL	☐ AKTMHT670 BL	T4 MEDIUM (25°)* SPECULAR REFLECTOR	T4/T6 FLOOD (40°)* MATTE REFLECTOR
☐ AKTMHT470 WH T4.5, 70W GE	☐ AKTMHT670 WH T6, 70W Philips	☐ AKTME1 Z	☐ AKTFL1 Z
		☐ AKTME1 BL	☐ AKTFL1 BL
		☐ AKTME1 WH	☐ AKTFL1 WH

*Note: Finish indicates exterior finish. Interior reflector finish is clear specular or matte.

prescolite
A Division of Hubbell Lighting, Inc.

In a continuing effort to offer the best product possible we reserve the right to change, without notice, specifications or materials that in our opinion will not alter the function of the product.
Web: www.prescolite.com • Tech Support: (888) 777-4832

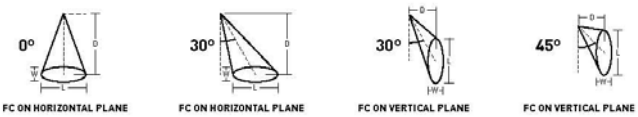
ATRK-032

APPENDIX

CHAPEL: F9

PHOTOMETRIC DATA

ArchiTrak - Architectural Elements
Signos M - AKTMHT



FC ON HORIZONTAL PLANE | FC ON HORIZONTAL PLANE | FC ON VERTICAL PLANE | FC ON VERTICAL PLANE

AKTMHT639
AKTSP1
PHILIPS 39W T6
Rated Hrs.: 12,000
CBCP: 16,434
Test No.: 914

BEAM ANGLE 11°

D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W
6'	457	1.2'	1.2'	6'	297	1.6'	1.4'	5'	82	4.2'	2.1'	5'	232	2.0'	1.5'
8'	257	1.5'	1.5'	8'	167	2.2'	1.9'	6'	57	5.0'	2.5'	6'	161	2.5'	1.8'
10'	164	1.9'	1.9'	10'	107	2.7'	2.4'	7'	42	5.9'	2.9'	7'	119	2.9'	2.0'
12'	114	2.3'	2.3'	12'	74	3.3'	2.9'	8'	32	6.7'	3.3'	8'	91	3.3'	2.3'
14'	84	2.7'	2.7'	14'	54	3.8'	3.3'	9'	25	7.5'	3.7'	9'	72	3.7'	2.6'
16'	64	3.1'	3.1'	16'	42	4.4'	3.8'	10'	21	8.4'	4.1'	10'	58	4.1'	2.9'
18'	51	3.5'	3.5'	18'	33	4.9'	4.3'	12.5'	13	10.5'	5.2'	12.5'	37	5.1'	3.7'

AKTMHT670
AKTSP1
PHILIPS 70W T6
Rated Hrs.: 12,000
CBCP: 31,352
Test No.: 917D

BEAM ANGLE 11°

D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W
6'	871	1.1'	1.1'	6'	566	1.5'	1.3'	5'	157	4.1'	1.9'	5'	443	2.0'	1.3'
8'	490	1.5'	1.5'	8'	318	2.1'	1.7'	6'	109	5.0'	2.3'	6'	308	2.4'	1.6'
10'	314	1.9'	1.9'	10'	204	2.6'	2.2"	7'	80	5.8'	2.6'	7'	226	2.8'	1.9'
12'	218	2.3'	2.3'	12'	141	3.1'	2.6'	8'	61	6.6'	3.0'	8'	173	3.2'	2.1'
14'	160	2.6'	2.6'	14'	104	3.6'	3.1'	9'	48	7.4'	3.4'	9'	137	3.6'	2.4'
16'	122	3.0'	3.0'	16'	80	4.1'	3.5'	10'	39	8.3'	3.8'	10'	111	4.0'	2.7'
18'	97	3.4'	3.4'	18'	63	4.6'	3.9'	12.5'	25	10.3'	4.7'	12.5'	71	4.9'	3.3'

AKTMHT639
AKTME2
PHILIPS 39W T6
Rated Hrs.: 12,000
CBCP: 2,343
Test No.: 1361

BEAM ANGLE 32°

D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W
5'	86	2.8'	2.8'	5'	56	3.8'	3.5'	3'	30	6.0'	3.6'	3'	84	3.2'	2.5'
6'	59	3.3'	3.3'	6'	39	4.6'	4.2'	4'	17	7.9'	4.8'	4'	47	4.4'	3.4'
7'	44	3.9'	3.9'	7'	28	5.3'	4.8'	5'	11	9.9'	6.0'	5'	30	5.5'	4.2'
8'	33	4.4'	4.4'	8'	22	6.1'	5.5'	6'	7	11.9'	7.2'	6'	21	6.6'	5.1'
9'	26	5.0'	5.0'	9'	17	6.9'	6.2'	7'	5	13.9'	8.4'	7'	15	7.7'	5.9'
10'	21	5.5'	5.5'	10'	14	7.6'	6.9'	8'	4	15.9'	9.6'	8'	12	8.8'	6.8'
12.5'	14	6.9'	6.9'	12.5'	9	9.5'	8.7'	10'	3	19.9'	12.0'	10'	8	11.0'	8.5'

AKTMHT670
AKTME2
PHILIPS 70W T6
Rated Hrs.: 12,000
CBCP: 4,852
Test No.: 1546

BEAM ANGLE 28°

D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W
5'	194	2.4'	2.4'	5'	126	3.4'	3.0'	3'	67	5.8'	3.1'	3'	191	3.0'	2.2'
6'	135	2.9'	2.9'	6'	88	4.1'	3.6'	4'	38	7.7'	4.2'	4'	107	4.1'	2.9'
7'	99	3.4'	3.4'	7'	64	4.8'	4.2'	5'	24	9.6'	5.2'	5'	69	5.1'	3.7'
8'	76	3.9'	3.9'	8'	49	5.5'	4.8'	6'	17	11.5'	6.3'	6'	48	6.1'	4.4'
9'	60	4.4'	4.4'	9'	39	6.2'	5.4'	7'	12	13.4'	7.3'	7'	35	7.1'	5.2'
10'	49	4.9'	4.9'	10'	32	6.9'	6.0'	8'	9	15.4'	8.3'	8'	27	8.1'	5.9'
12.5'	31	6.1'	6.1'	12.5'	20	8.6'	7.5'	10'	6	19.2'	10.4'	10'	17	10.2'	7.4'

AKTMHT639
AKTFL1
PHILIPS 39W T6
Rated Hrs.: 12,000
CBCP: 1,355
Test No.: 1362

BEAM ANGLE 56°

D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W
5'	54	4.7'	4.7'	5'	35	4.8'	4.8'	3'	19	6.8'	5.0'	3'	53	4.2'	3.5'
6'	38	5.6'	5.6'	6'	18	6.7'	6.7'	4'	11	9.1'	6.6'	4'	30	5.6'	4.7'
7'	28	6.6'	6.6'	7'	11	8.6'	8.6'	5'	7	11.3'	8.3'	5'	19	7.0'	5.9'
8'	21	7.5'	7.5'	8'	7	10.5'	10.6'	6'	5	13.6'	9.9'	6'	13	8.4'	7.0'
9'	17	8.5'	8.5'	9'	5	12.4'	12.5'	7'	3	15.9'	11.6'	7'	10	9.8'	8.2'
10'	14	9.4'	9.4'	10'	4	14.3'	14.4'	8'	3	18.1'	13.3'	8'	7	11.2'	9.4'
12.5'	9	11.7'	11.7'	12.5'	3	16.2'	16.3'	10'	2	22.7'	16.6'	10'	5	14.0'	11.7'

AKTMHT670
PHILIPS AKTFL1
70W T6
Rated Hrs.: 12,000
CBCP: 3,013
Test No.: 1547

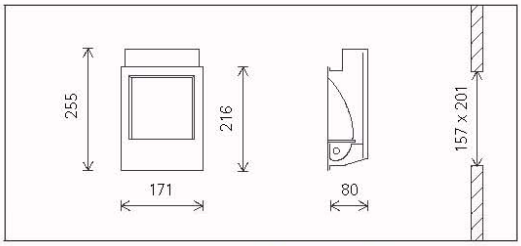
BEAM ANGLE 51°

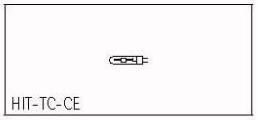
D	FC	L	W	D	FC	L	W	D	FC	L	W	D	FC	L	W
5'	121	4.3'	4.3'	5'	78	4.8'	6.1'	3'	42	6.6'	6.3'	3'	118	4.2'	4.5'
6'	84	5.2'	5.2'	6'	54	5.8'	7.3'	4'	24	8.8'	8.4'	4'	67	5.6'	6.0'
7'	61	6.0'	6.0'	7'	40	6.8'	8.5'	5'	15	11.0'	10.5'	5'	43	7.1'	7.5'
8'	47	6.9'	6.9'	8'	31	7.7'	9.7'	6'	10	13.2'	12.7'	6'	30	8.5'	8.9'
9'	37	7.8'	7.8'	9'	24	8.7'	11.0'	7'	8	15.4'	14.8'	7'	22	9.9'	10.4'
10'	30	8.6'	8.6'	10'	20	9.7'	12.2'	8'	6	17.7'	16.9'	8'	17	11.3'	11.9'
12.5'	19	10.8'	10.8'	12.5'	13	12.1'	15.2'	10'	4	22.1'	21.1'	10'	11	14.1'	14.9'

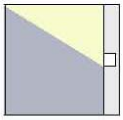
ERCO

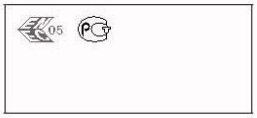
Atrium Uplight

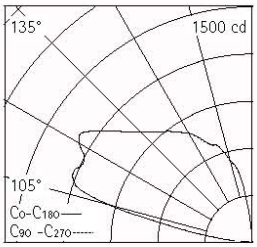
for metal halide lamps











HIT-TC-CE 35W G8.5 3300lm

33511.000 Reflector silver
HIT-TC-CE 35W G8.5 3300lm
ECG

Product description
Size 5
Housing for mounting in dry-wall partitions: metal, black powder-coated. Mounting bracket with screw fixing. Clamp extension 10-25mm.
Electronic control gear. 2 cable entries, through-wiring possible. 5-pole terminal block.
Front cover: cast aluminium, white (RAL9002) powder-coated.
Darklight reflector: aluminium, anodised. Horizontal diffuser as safety glass.
Weight 1.90kg

ERCO Leuchten GmbH
Postfach 2460
58505 Lüdenscheid
Germany
Tel.: +49 2351 551 0
Fax: +49 2351 551 300
info@erco.com

Technical Region: 230V/50Hz
We reserve the right to make technical and design changes.
Edition: 13.11.2007
Please download the current version from
www.erco.com/33511.000

APPENDIX

CHAPEL: F10

ERCO

Atrium Uplight

Planning data

Cleaning (a)	1				2				3			
Ambient conditions	P	C	N	D	P	C	N	D	P	C	N	D
LMF	0.93	0.86	0.81	0.74	0.88	0.77	0.66	0.57	0.85	0.70	0.55	0.45
RSMF	0.91	0.83	0.68	0.51	0.90	0.81	0.67	0.50	0.90	0.81	0.67	0.50

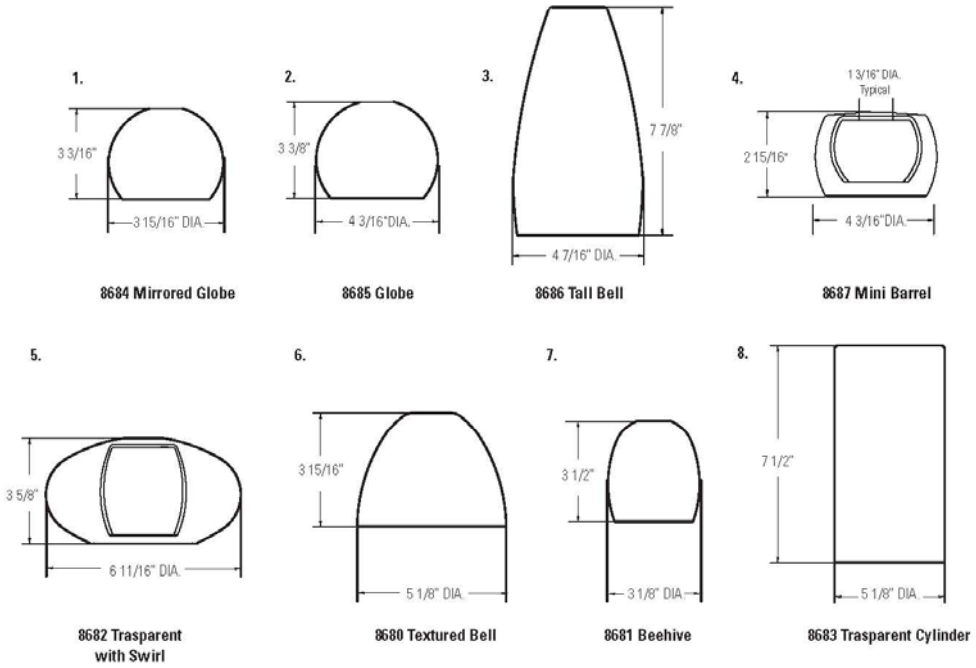
Hours of operation (h)	1000	2000	4000	6000	8000	9000
LLMF	0.94	0.86	0.82	0.75	0.69	0.66
LSF	1	1	1	1	1	1

MF	LMFxRSMFxLLMFxLSF
MF	Maintainance Factor
LMF	Lumiaire Maintenance Factor
RSMF	Room Surface Maintenance Factor
LLMF	Lamp Lumens Maintenance Factor
LSF	Lamp Survival Factor
P	Room pure
C	Room clean
N	Room normal
D	Room dirty

Lytespan® Accent Lighting System 8680

Page 1 of 1

Lytejacks Style Jack Shades



8684 Mirrored Globe | 8685 Globe | 8686 Tall Bell | 8687 Mini Barrel

8682 Trasparent with Swirl | 8680 Textured Bell | 8681 Beehive | 8683 Trasparent Cylinder

Catalog No.	Finish	Description
8684MR	Mirror	Mirrored Globe: Semi transparent mirror elegantly fades to clear mouth blown glass providing a soft glow.
8685LC	Light Caramel	Globe: Provides a soft warm glow while promoting downward light.
8686LC	Light Caramel	Tall Bell: Creates a warm focal glow and delivers a soft downward pool of light.
8687CL	Clear	Mini Barrel: Double barrel concept creates an array of soft translucent light.
8687CB	Champagne Beige	Mini Barrel: Double barrel concept creates an array of soft translucent light.
8687BL	Blue	Mini Barrel: Double barrel concept creates an array of soft translucent light.
8682WH	Clear Swirl	Transparent with Swirl: Translucent white opal glass, glows warmly through the rich white glass thread decor.
8680WH	White	Textured Bell: Soft textured white opal glass delivers a soft glow and directs downward light.
8681WH	White	Beehive: Concentrated light gently glows through the textured mouth blown glass.
8683WH	White	Transparent Cylinder: White opal glass creates a translucent glow. Clear glass radiates beautifully.

Features

1. Mouth blown clear glass with semi transparent mirror
2. Mouth blown cased glass, matte surface
3. Mouth blown cased glass, matte surface
4. Mouth blown transparent glass, with glossy finish
   a. Inside piece: Mouth blown translucent opal glass. Matte surface
5. Mouth blown clear glass thread decor. Glossy surface
   a. Inside piece: Mouth blown translucent opal glass. Matte surface
6. Mouth blown textured glass bell, with linen structure. Matte surface.
7. Mouth blown textured glass with linen structure. Matte surface.
8. Mouth blown, upper part translucent opal, lower part clear with glossy surface.

Features

Mouth blown glass.

Labels

UL

Job Information **Type:**

Job Name:

Cat. No.:

Lamp(s):

Notes:

Lightolier a Genlyte company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

APPENDIX

COURTYARD: F14

Drive over in ground flood lights for ceramic metal halide sources

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 my 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.

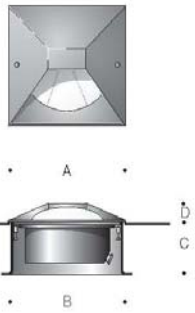
Electrical: Lampholders: H.I.D. single ended G8.5 bi-pin with nickel plated contacts supplied with 180°C leads, rated 600V pulse rated 5 KV. Ballast is electronic 120V or 277 - specify. Inner housing pre-wired with three (3) feet of 18/3 waterproof cable, cable clamp, and waterproof cable gland entry into housing. A separate waterproof wiring box for power supply must be provided (by contractor).

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

U.L. Listed, suitable for wet locations and vehicle drive over.
Protection class: IP 67.

Luminaires are designed to withstand loads of 6660 lbs at speeds of 30 MPH of vehicles with pneumatic tires when installed on a proper foundation. The luminaire may not be used for traffic lanes where they are subjected to horizontal pressure from vehicle braking. Proper drainage must be provided. For installation in poured concrete only.

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



Cast bronze uplights utilizing H.I.D. light sources. Light distribution from an anodized matte reflector. Convex tempered glass ¼" think. U.L. listed, suitable for wet locations. IP 67.
Finish: Natural bronze casting.
The column "T" indicates the temperature in degrees C.

	Lamp		Lumen	A	B	C	D	T
8615MH	1	70W T4 G8.5 MH	6600	13¾	14	6⅜	2½	100°

BEGA/US 1000 BEGA Way, Carpinteria, CA 93013 [P] 805·684·0533 [F] 805·684·6682

APPENDIX

COURTYARD: F15

COLOR KINETICS

PHILIPS

iW CAST 14 POWERCORE

IntelliWhite™ iW Cast 14 Powercore is a first-of-its kind LED white light fixture. It is a high-performance union of linear fixture design with maximized light intensity for wall washing, highlighting architectural detail, designs, and lit surfaces to complement ambient scenes and moods. iW Cast Powercore provides flexible color temperature and brightness control through Chromacore®, the proven technology that underlies Color Kinetics' existing intelligent solid-state lighting systems. When applied to IntelliWhite products, Chromacore controls channels of warm white and cool white LEDs to produce output of color temperatures within the range of 3000 - 6500 kelvin from within a single fixture. iW Cast 14 Powercore allows the adjustment of intensity while providing the option to either maintain constant color temperature or vary the color temperature.

iW Cast 14 Powercore, designed to meet the rugged requirements of outdoor applications, is completely sealed and meets specifications for wet locations. iW Cast 14 Powercore is available with either a narrow or wide beam angle. The attached, two-point mounting plate simplifies installation and minimizes required tools. The over-molded, end-to-end locking connectors, capable of making 180° turns, make iW Cast 14 Powercore extremely versatile and easily adaptable for even the most challenging mounting environments.

iW Cast 14 Powercore incorporates patent-pending Powercore® digital power processing technology to drive LED systems, integrating power and data management directly into the fixture and eliminating the need for an external power supply. Powercore surpasses traditional power supply technology by streamlining multiple conversion and regulation stages into a single, flexible, microprocessor-controlled power stage that controls power output to LED systems directly from line voltage and significantly increases overall system efficiency. Built-in active power factor correction (PFC) yields higher system efficiencies and minimizes stress on building wiring making the installation and system more cost effective.

iW Cast 14 Powercore receives data via Color Kinetics iW Data Enabler—a data formatting device specifically designed for use with Color Kinetics IntelliWhite Powercore based fixtures and Color Kinetics line of iW controllers. Each iW Data Enabler will support up to 36 (110VAC) or 61 (240VAC) iW Cast 14 Powercore fixtures, using a 50-foot, field-cuttable leader cable. The Data Enabler supports a slightly greater or fewer number of fixtures depending on customized installation parameters, including line voltage, leader and jumper cable lengths. One-foot (30 cm) and five-foot (152 cm) jumper cables are available for installations that require spacing between fixtures.

iW CAST 14 SPECIFICATIONS

TEMPERATURE RANGE	3000K to 6500K
SOURCE	High intensity, power LEDs
BEAM ANGLE	18°
HOUSING	Black or white powder coated, die cast aluminum 13.5" x 2.7" x 2.7" (34.3 cm) x (6.9 cm) x (6.9 cm)
LENS	Polycarbonate with UV and scratch resistant silicone hard coat
CONNECTORS	Over-molded, integral male/female connectors
LISTINGS	UL/cUL, CE

CHROMACORE® BY COLOR KINETICS

POWERCORE® BY COLOR KINETICS

OPTIBIN® BY COLOR KINETICS

DRY

DAMP

WET

CE c UL us LISTED 13PE

COMMUNICATION SPECIFICATIONS

DATA INTERFACE	Color Kinetics iW Data Enabler
CONTROL	Color Kinetics line of iW Controllers including iW Scene Controller

ELECTRICAL SPECIFICATIONS

POWER REQUIREMENT	100-240VAC, 50-60 Hz
POWER CONSUMPTION	30W at full output
POWER FACTOR	0.95 or greater at 120VAC

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE RANGE	-40°F to 122°F (-40°C to 50°C) operating temperature -4°F to 122°F (-20°C to 50°C) starting temperature
PROTECTION RATING	IP66

LED SOURCE LIFE

In traditional lamp sources, lifetime is defined as the point at which 50% of the lamps fail. This is also termed Mean Time Between Failure (MTBF). LEDs are semiconductor devices and have a much longer MTBF than conventional sources. However, MTBF is not the only consideration in determining useful life. Color Kinetics uses the concept of useful light output for rating source lifetimes. Like traditional sources, LED output degrades over time (lumen depreciation) and this is the metric for SSL lifetime.

LED lumen depreciation is affected by numerous environmental conditions such as ambient temperature, humidity, and ventilation. Lumen depreciation is also affected by means of control, thermal management, current levels, and a host of other electrical design considerations. Color Kinetics systems are expertly engineered to optimize LED life when used under normal operating conditions. Lumen depreciation information is based on LED manufacturers' source life data as well as other third party testing. Low temperatures and controlled effects have a beneficial effect on lumen depreciation. Overall system lifetime could vary substantially based on usage and the environment in which the system is installed.

Temperature and effects will affect lifetime. Color Kinetics rates product lifetime using lumen depreciation to 70% of original light output. When the fixture is running on warm or cool, at room temperature, the LED lifetime is in the range 50,000 – 70,000 hours. This is LED manufacturers' test data. High output is defined as any LED device that is 1/2 watt or above. For more detailed information on source life, please see www.colorkinetics.com/lifetime.

ITEM# 501-000002-00 (White)
501-000002-01 (Black)
501-000003-00 (White, Conduit)
501-000003-01 (Black, Conduit)

BRO144 Rev 04

Specifications subject to change without notice. Refer to www.colorkinetics.com for the most recent data sheet versions.

PHILIPS SOLID-STATE LIGHTING SOLUTIONS • 3 BURLINGTON WOODS DRIVE • BURLINGTON, MA 01803 • USA
TEL 888 FULL RGB • TEL 617 423 9999 • FAX 617 423 9998 • INFO@COLORKINETICS.COM • WWW.COLORKINETICS.COM

APPENDIX

COURTYARD: F15

iW CAST 14 POWERCORE

PHOTOMETRIC PERFORMANCE

Photometric data is based on test results from an independent testing lab.

SOURCE SPECIFICATIONS

Optics:	Metalized polycarbonate reflectors
Lens:	UV resistant soft focus polycarbonate lens
Source:	18 LEDs (12 warm white, 6 cool white)
Beam Angle:	18° (at 50% of peak illuminance)
Distribution:	Symmetric direct illumination
CCT:	Adjustable 3,000–6,500K
CRI:	82 All, 74 Warm, 87 Cool

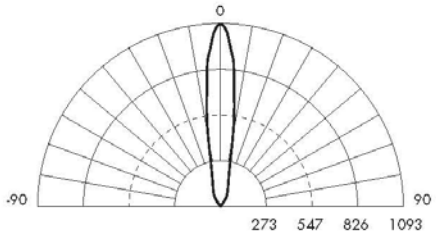
ILLUMINANCE DISTRIBUTION

1.4 / 15.1	4.4 / 47.4	7.6 / 81.8	6.5 / 70.0	3.0 / 32.3	0.9 / 9.7	1.0′/0.3m
1.8 / 19.4	6.5 / 70.0	12.3 / 132.4	11.0 / 118.4	5.3 / 57.0	1.8 / 19.4	2.0′/0.6m
1.7 / 18.3	6.2 / 66.7	13.2 / 142.1	13.2 / 142.1	6.4 / 68.9	2.0 / 21.5	3.0′/1.0m
1.4 / 15.1	3.8 / 40.9	8.8 / 94.7	10.6 / 114.1	5.6 / 60.3	1.7 / 18.3	4.0′/1.2m
1.1 / 11.8	2.1 / 22.6	4.3 / 46.3	5.3 / 57.0	3.2 / 34.4	1.3 / 14.0	5.0′/1.5m
0.9 / 9.7	1.3 / 14.0	2.0 / 21.5	2.3 / 24.8	1.7 / 18.3	1.0 / 10.8	6.0′/2.0m

3.0′/1.0m 0′/0m 3.0′/1.0m

Units: Footcandles (top)/Lux (bottom)
Location: Ceiling mount. 2′/0.6m from wall with light at a 60° angle off horizontal.
Measured all on, reflectance model: 80 ceiling, 50 wall, 20 floor

CANDLE POWER DISTRIBUTION



Measured on: All
Beam center: 1093 cd
Thin dashed lined: Indicates 50% of peak

ILLUMINANCE

	3′ / 1m	6′ / 2m	9′ / 3m	15′ / 5m
ALL	110.0 / 1184.0	28.9 / 311.1	13.1 / 141.0	4.8 / 51.7

Measured in Footcandles (top)/Lux (bottom) on axis.
Measured on all, reflectance 0.

LIGHT OUTPUT

	TOTAL OUTPUT (lumens)	POWER (Watts)	EFFICACY (lm/W)
ALL	208	37.3	5.6
WARM	135	28.5	4.7
COOL	80	19.8	4.0

Note: Efficacy figures are for a complete tested fixture not simply a lamp source.

CRI

It is common practice in the lighting industry to use color rendering index (CRI) to compare the properties of various light sources. There are known deficiencies and limitations associated with CRI and as a result, it is not always an accurate indicator of good object color appearance. This is especially true for LED-based sources. Until a better method for measuring color rendering in LEDs is accepted, Color Kinetics measures CRI in accordance with the current CIE 13.3-1995 standard using the Ra calculation. The reference illuminants employed are the Planckian locus below 5000K and CIE Daylight reference above 5000K. All measurements for Color Kinetics products are performed by third party laboratories using NIST-traceable instruments.

PHILIPS SOLID-STATE LIGHTING SOLUTIONS • 3 BURLINGTON WOODS DRIVE • BURLINGTON, MA 01803 • USA
TEL 888 FULL RGB • TEL 617 423 9999 • FAX 617 423 9998 • INFO@COLORKINETICS.COM • WWW.COLORKINETICS.COM

APPENDIX

COURTYARD: F16

Providence® PROS

page 2 of 4 DATE TYPE

PROS / / / /

FIXTURE	LAMP/BALLAST	COLOR	OPTIONS	DECORATIVE ARMS
1	2	3	4	5

1 Fixture

☐	PROS-DIRS	Symmetric direct, direct reflective optical system.
☐	PROS-INDA	Asymmetric indirect, indirect reflective optical system, Mini Mastercolor lamps only.
☐	PROS-INDS	Symmetric indirect, indirect reflective optical system, Mini Mastercolor lamps only.

2 Lamps/Ballasts

☐	20MMC	20 watt electronic metal halide ballast. 120/277 volt. Uses a PGJ5 base, Mini Mastercolor lamp.
☐	39MMC	39 watt electronic metal halide ballast. 120/277 volt. Uses a PGJ5 base, Mini Mastercolor lamp.
☐	39MHT6EB	39 watt electronic metal halide ballast, 120/277 volt. Uses a G12 base, clear T-6 ceramic lamp.
☐	70MHT6EB	70 watt electronic metal halide ballast, 120/277 volt. Uses a G12 base, clear T-6 ceramic lamp.
☐	CF	Compact Fluorescent, electronic ballast 120/277 volt. Use a GX24q base, 26,32 or 42 watt lamp (direct only). 0°F/-18°C minimum starting temp.

3 Color

☐	AWT	Arctic White
☐	LGY	Light Grey
☐	MAL	Matte Aluminum
☐	MDG	Medium Grey
☐	ATG	Antique Green
☐	VBL	Verde Blue
☐	WRZ	Weathered Bronze
☐	DGN	Dark Green
☐	CRT	Corten
☐	BRM	Metallic Bronze
☐	DBZ	Dark Bronze
☐	BLK	Black
☐	MTB	Matte Black
☐	RAL #	
☐	CUSTOM	

4 Options

☐ SPK

Decorative cast aluminum spikes on the top and bottom of the four vertical struts.

☐ PFN

Cast aluminum finial painted a brass color.

☐ BPS

Cast Aluminum Struts painted a brass color-spikes also painted brass if option SPK chosen

☐ LDL

LIGHTLY DIFFUSED LENS Frosted, flat tempered glass lens has a lightly diffused finish to minimize the lamp and reflector brightness. For horizontal reflector models.

☐ HSS

HOUSE SIDE SHIELD. For direct optical system only. House side shield to cut off light behind the pole and shield the lamp from view. *Factory installed.*

SOLD TO | PO # | JOB NAME | Approvals

Architectural Area Lighting
14249 Artesia Blvd / La Mirada, CA 90639
714.994.2700 / fax 714.994.0522 / www.aal.net

APPENDIX

COURTYARD: F16

Providence® PROS

page 3 of 4 DATE TYPE

5 Decorative Arms

☐ TRA59D

Cast Scroll Arm - 4"/100 mm O.D. Side Mount Down

☐ TRA59U

Cast Scroll Arm - 4"/100 mm O.D. Side Mount Up

☐ WMA59D

Cast Scroll Arm - Wall Mount Down

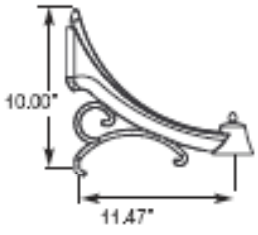
☐ WMA59U

Cast Scroll Arm - Wall Mount Up

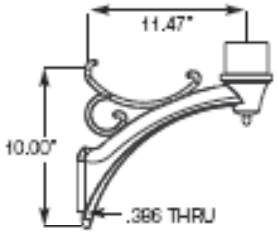
Decorative Arms

These one piece cast aluminum arms are prewired with quick disconnects. Wall mounted arms do not include wall mounting hardware. Pole mounted arms use 3/8-16 hex head bolts for attaching to the pole.

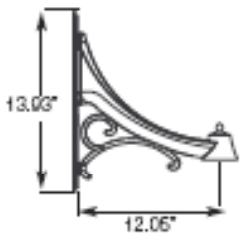
NOTE: For use with other AAL wall and post top arm models, consult the factory.



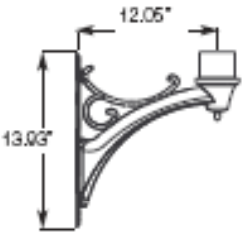
☐ TRA59D



☐ TRA59U



☐ WMA59D



☐ WMA59U

Architectural Area Lighting
14240 Artesia Blvd / La Mirada, CA 90638
714.994.2700 / fax 714.994.0522 / www.aal.net

APPENDIX

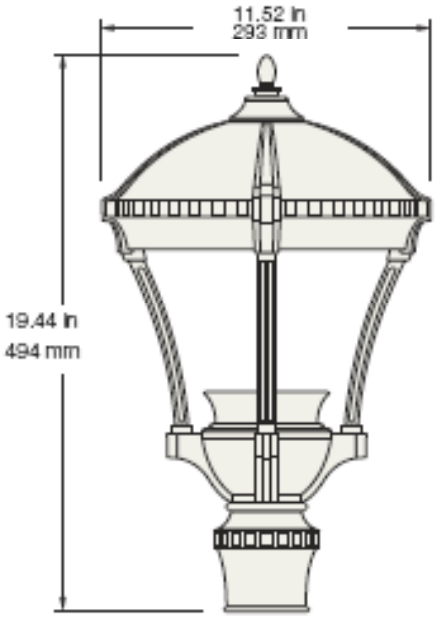
COURTYARD: F16

Providence® PROS

page 4 of 4 DATE TYPE

Specifications

WEIGHT: 9 lbs EPA: 0.46



REFLECTOR MODELS - REFLECTOR/LAMP

The upper lamp housing shall be die cast aluminum. The internal reflector module is sealed from the outer housing with a one piece, memory retentive, molded silicone gasket. The tempered glass lens shall be sealed to the housing with a silicone gasket. One stainless steel latch shall release the door to allow access to the lamp.

The reflector module shall be composed of a spun, specular aluminum panel rigidly attached in a die cast aluminum housing. The horizontal lamp reflectors shall meet ANSI-IES standards for full cutoff reflector systems.

REFLECTOR MODELS - BALLAST

The lower ballast housing shall be cast aluminum. The tool-less ballast access for servicing is accomplished by a quarter turn motion of the top cover. The ballast shall be mounted on a prewired tray with a quick disconnect plug attached to the underside of the cover. HID ballasts are high power factor, rated for -30°F starting. Electronic ballasts for metal halide lamps are sound rated A. Sockets are medium base, G12 for use with T6 lamps. All sockets are pulse rated porcelain. Ballasts are multi tap, wired at the factory for 277 volts. Compact fluorescent transformers shall accept 120 to 277 volt input and rated for 0°F starting.

INDIRECT MODELS - LOWER LAMP MODULE

The lower housing shall contain the lamp module. The cover shall be die cast aluminum with a tempered glass lens. The lamp shall be accessed by turning the lamp housing cover a quarter turn. The reflector shall be polished, anodized aluminum with an extremely narrow beam for directing the light to the upper reflector. Sockets are PGJ5 for use with BT-5 lamps. All sockets are pulse rated porcelain.

INDIRECT MODELS - UPPER REFLECTOR/BALLAST

The die cast aluminum upper housing shall contain the ballast assembly and the indirect reflector. The tool-less ballast access for servicing is accomplished with a single stainless steel latch and hinged top cover. The ballast shall be mounted on a prewired tray with a quick disconnect plug. The HID ballasts are high power factor, rated for -30°F starting. Ballasts are multi-tap, wired at the factory for 277 volts. The indirect reflector is mounted to the underside of the upper housing. The reflector shall be die cast aluminum, finished in a high reflectance white. The indirect reflector models shall be IES classified as cutoff with less than 1% lumen output above 90 degrees.

INSTALLATION & MOUNTING

The PROS shall be factory supplied as a complete, prewired assembly. The fixture shall slip over a 3"/ 75mm open top pole or 4"/100mm pole mounted arm and secured and leveled with 3 stainless steel set screws.

FINISH

Fixture finish consists of a five stage pretreatment regimen with a polymer primer sealer, oven dry off and top coated with a thermoset super TGIC polyester powder coat finish. The finish shall meet the AAMA 605.2 performance specification which includes passing a 3000 hour salt spray test for corrosion resistance.

CERTIFICATION

The fixture shall be listed with ETL for outdoor, wet location use, UL1598 and Canadian CSA Std. C22.2 no.250. IP55.

WARRANTY

Fixture shall be warranted for three years. Ballast components carry the ballast manufacturer's limited warranty.

Architectural Area Lighting
14240 Artesia Blvd / La Mirada, CA 90638
714.994.2700 / fax 714.994.0522 / www.aal.net

APPENDIX

COURTYARD: F17

ALLSCAPE®

2930 South Fairview Street
Santa Ana, CA 92704
Phone: 714 668 3660
Fax: 714 668 1107
sales@allscape.net
http://www.alllighting.com

FL-02

Specification Grade
Sign Accent
Building Entrances
Doorways
Pedestrian Areas
Landscape Areas
Building Accent
Wall Wash

FL-02-YM

FL-02-VO

FL-02

Specifications

Certifications ETL and CETL listed for wet location and meets IP65 standard, dust-tight and water-jet proof.

Fixture Housing/Knuckle The housing and knuckle is constructed of heavy wall die cast aluminum castings with a minimum 1/8" thickness.

Lens Clear tempered 3/16" thick, high temperature silicone gasket sealed to fixture housing.

Lens Frame Die cast aluminum minimum thickness of 1/8", attached to fixture housing with one center pinned latch and four rear mounted stainless steel cap screws.

Reflectors Spun aluminum highly specular Alzak™ finish for either type R2 spot (1H1V), R3 flood (3H3V) or R4 flood (4H4V) distributions. One segmented asymmetric reflector is available, type R5 (distribution varies with lamp).

Lamp Holder Porcelain 4kv pulse rated medium base for HID and Incandescent lamp sources.

Options Color Filter (CF), Polycarbonate Lens Shield (PL), Barndoors (BD), Grid Louver (GL), Long Visor (LV), Short Visor (SV), Full Visor (FV), Fusing (F), Double Fusing (FF), Quartz Standby (QS), Photo Control Button (PCB). The Vertical Orientation (VO) allows the FL-02 to be configured in the vertical position. Note: when in the VO orientation the asymmetric optics are rotated 90°.

Mounting Detail The FL-02 Knuckle is field adjustable up to 136° tilt and 360° horizontal rotation and slips over a 2-3/8" tenon. The FL-02-K or FL-02-VO may be horizontal surface mounted using either the Pier Mount (PM) or Stanchion Mount (SM) options. The FL-02-K or FL-02-VO may be wall mounted using the Designer Wall Bracket (DWB), or Standard Wall Bracket (WBT). The FL-02-Y is field adjustable up to 300° tilt and 90° horizontal rotation and can be secured to any surface with two screws using a cast adaptor. Mounting hardware and junction box by others. Call factory for custom mounting arrangements.

Finish BK-BZ-WH-GR-GY-NA baked enamel paint standard. Powder coat and custom colors available on request.

APPENDIX

COURTYARD: F17

PROJECT
FIXTURE TYPE
CATALOG#

2930 South Fairview Street
Santa Ana, CA 92704
Phone: 714 668 3660
Fax: 714 668 1107
sales@allscape.net
http://www.alllighting.com

FL-02

Product Order Guide

Series	Mounting Type	Max Watts	Lamp Type	Voltage[1]	Reflector Type	Finish[2]	Options
FL-02	K Knuckle	13 CF	CF	120	R2 1H1V Spot	BK[3] Black	CF Color Filter
	Y Yoke	26 CFQ	CFQ	208	R3 3H3V Flood	BZ[3] Bronze	PL Polycarbonate Lens Shield
		42 CFT	CFT	240	R4[5] 7H7V Flood	WH[3] White	BD Barn Doors
		70 HPS	E17	277	R5[5] Asymmetric	GR[3] Green	GL Grid Louver
		70 MH	E17			NA[3] Natl Aluminum	LV Long Visor
		70 MH	T6			GY[3] Gray	SV Short Visor
						CC[3] Custom Color	FV Full Visor
		150 HAL	T4[4]	120			DWB Designer Wall Bracket
							PM Pier Mount
							SM Stanchion Mount
							WBT Wall Bracket with Tenon
							JBA Junction Box 1/2" NPT Adaptor
							F Fusing
							FF Double Fusing
							QS Quartz Standby
							PCB Photo Control Button
							VO Vertical Orientation

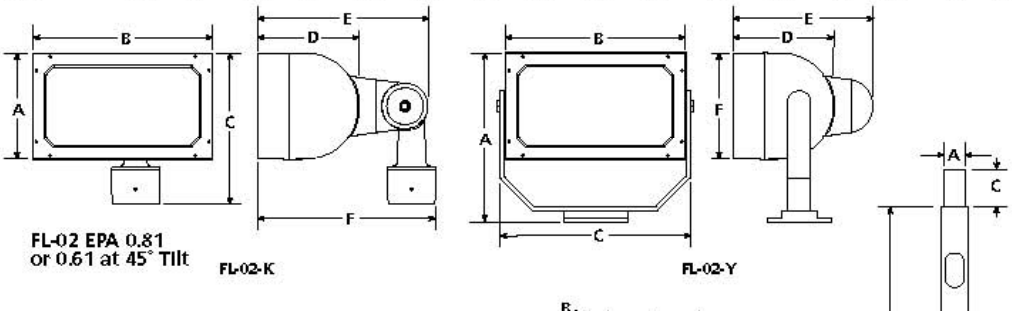
[1] Consult factory for other voltages.
[2] Consult factory for other finishes.
[3] Baked enamel paint is standard, powder coat is optional.
[4] T4, Clear lamp and Mini-Can Base
[5] Compact fluorescent limited to R4 and R5 reflector types. R4 only compact fluorescent.

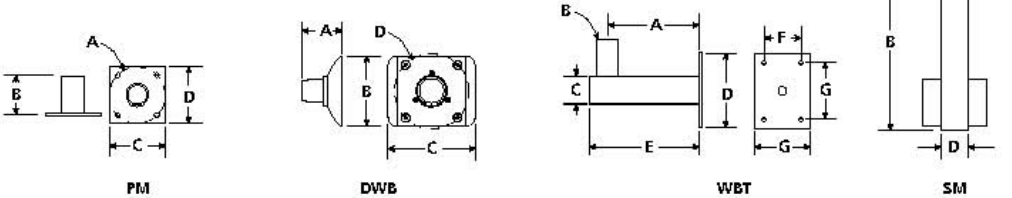
Note: E-17 Lamps 175W and below are medium base
CF=single biax, CFQ=double biax, CFT=triple biax

Example: FL-02-K-70MH-E17-277-R3-BK-DWB

Luminaire Dimensions

Luminaire	A		B		C		D		E		F		G		Weight	
	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	lbs.	kg
FL-02-K	7.00	178	11.88	302	10.00	254	6.59	167	11.19	284	11.73	298	n/a	n/a	25	11.3
FL-02-Y	11.16	283	11.88	302	12.52	318	6.59	167	9.18	233	7.00	178	n/a	n/a	20	9.1
PM	6.00	152	4.00	102	6.00	152	6.00	152	n/a	n/a	n/a	n/a	n/a	n/a	3	1.4
SM	2.375	60	24.00	610	4.09	104	3.00	76	n/a	n/a	n/a	n/a	n/a	n/a	4	1.8
WBT	10.00	254	2.375	60	3.00	76	8.00	203	12.00	305	4.00	102	6.00	152	7	3.2
DWB	4.31	109	7.50	191	9.50	241	8.00	203	n/a	n/a	n/a	n/a	n/a	n/a	5	2.3



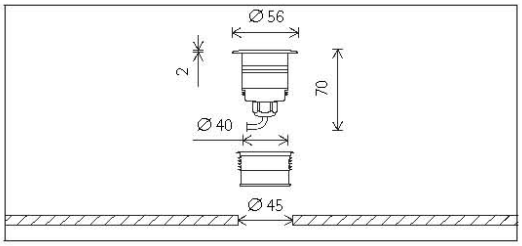


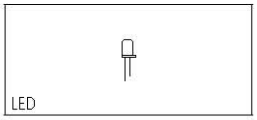
natural aluminum
bronze
gray
green
white
black

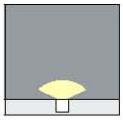
APPENDIX

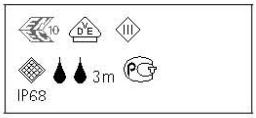
COURTYARD: F18

ERCO LED orientation luminaire









33766.000 LED amber
LED 0.9W 30V DC 21m

Product description
Housing with gasket: stainless steel.
Installation bush with ribs: plastic.
Cable 4x0.75mm², L 500mm.
Clear prismatic diffuser with circular light aperture.
Cover ring: corrosion resistant stainless steel, with 6mm safety glass. Load 5kN.
Control gear to be ordered separately.
Protection mode IP68 3m: protection against dust ingress, and continuous immersion up to 3m deep.
Weight 0.16kg

ERCO Leuchten GmbH
Postfach 2460
58505 Lüdenscheid
Germany
Tel.: +49 2351 551 0
Fax: +49 2351 551 300
info@erco.com

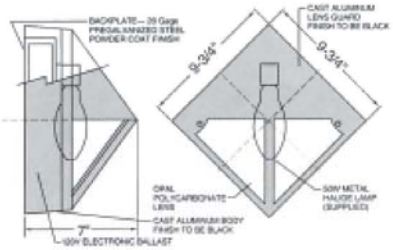
Technical Region: 230V/50Hz
We reserve the right to make technical and design changes.
Edition: 13.11.2007
Please download the current version from
www.erco.com/33766.000

APPENDIX

COURTYARD: F19

peaquad

- Cast Aluminum body
- UV stabilized opal polycarbonate lens
- Fluorescent or HID lamps
- Cast Aluminum shroud
- Fluorescent fixtures supplied with -25°F cold weather electronic ballast
- UL, cUL listed, wet label IP55
- Metal Halide units supplied with open fixture lamps
- 70 watt HID units supplied with remote F can ballast. Remote ballast to be installed in appropriate wet label enclosure by contractor.



ORDERING CHART

SERIES	Prod. ID XXX	Lamp X	Wattage XX	Body X	Finish XX	Grill X	Ballast X	Lens X	Options XX
Peaquad	PEA	8- Fluorescent 9- HID	H3-1X32W TRIPLE 3500K H5-1X42W TRIPLE 3500K F1-35W MH A7-50W MH A8-50W HPS B4-70W MH B6-70W HPS B7-35W HPS	1-Surface Mount No Conduit Entries	00-Semi Gloss Black 01-Semi Gloss White 02-Black Suede 03-Grey 04-Bronze 05-Hammered Bronze 07-Hammered Copper 10-Matte Silver 17-Granite 47-Weathered Bronze 48-Weathered Moss 49-Good Earth 80-Weathered Copper 81-Weathered Iron 82-Hammered Gunmetal 83-Metallic Silver 84-Aluminum Painted 85-Terracotta 86-Metallic Gold 87-Chrome 88-Quick Silver 89-Zinc Gray HB-Hand Painted Weathered Bronze HC-Hand Painted Weathered Cooper 99-Custom	1-Standard	C- 120-277V Elect. 2- 347V Elect. 9- 120V MAG. HPF A- 277V MAG. HPF R- 120-277V REM MAG.	X-Opal	0-None 4-One Circuit Fusing 7-Photocontrol (stationary) 8-Special Screws A-DG Bayonet Socket F-Quartz Restrike (HID Only) G-Remote Emerg. Fluor. Only

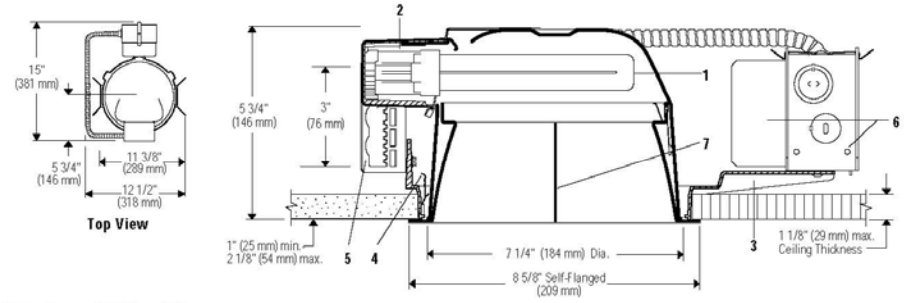
To order choose one number from each column and two numbers from options column. Use 00 for options to signify none required.

NOTE:
Fluorescent is always C or 2.
HID is always 9 or A.

designplan
79 Trenton Avenue
Frenchtown, NJ 08825
Tel: (908) 996-7710
Fax: (908) 996-7042

Calculite® Compact Fluorescent Open Downlight **8096CB**

7 3/8" Aperture (2) Quad Tube Cross Blade Louver



Ceiling Cutout: 8" (203 mm) Dia.

Reflector Trim		Frame-In Kit			Lamp
8096CBW	White Cone, White Flange	**7218HU**	Electronic 4-pin	120V-277V	**2) 18W Quad Tube**
8096CBA	Aluminum Cone, White Flange	**7218HDU3**	PowerSpec® Dimming 4-pin	120V-277V	
		7218HM120	Magnetic 2-pin	120V	
		7218HM277	Magnetic 2-pin	277V	
		Note: Add **S** for Steel frame: ex. **S7226HU** - Steel Frame Without **S**- Die Cast: ex. **7226HU** - Die Cast			
		S7226HU	Electronic 4-pin	120V-277V	**(2) 26W Quad Tube**
		S7226HDU3	PowerSpec® Dimming 4-pin	120V-277V	
		7226HM120	Magnetic 2-pin	120V	
		7226HM277	Magnetic 2-pin	277V	
		S7226HUEM	Electronic Emergency 4-pin	120V-277V	

Features

1. **Reflector:** 16 ga. Die-formed aluminium, Anobrite® finish.
2. **Socket Cup:** Die-cast zinc cup effectively dissipates heat and positions lamp holder. Snaps onto reflector neck to assure consistently correct optical alignment without tools.
3. **Mounting Frame:** Die-cast aluminum for dry or plaster ceilings. Accepts other 7" quad tube reflectors.
4. **Retaining Springs:** Precision-tooled steel friction springs secure reflector to mounting frame for quick, tool-less installation.
5. **Mounting Brackets:** 16 ga. steel. Adjust from inside of fixture. Use 3/4" or 1 1/2" lathing channel, 1/2" EMT, or optional mounting bars.
6. **Ballast/J-Box:** Outboard mounted to reduce heat transfer and maintain lamp efficacy and life. Service from below without tools.
7. **Cross Blade Louver:** Die-formed, 16 ga. Aluminum, matte white or painted aluminum finish. Accepts lens (consult factory). 50° cut-off to lamp, medium beam. Keyed for orientation.

Electrical

Note: For ballast electrical data and latest lamp/ballast compatibility refer to **"Ballast"** specification sheet for complete electrical data.

UL listed for through branch circuit wiring with max of (8) No. 12 AWG, 90°C supply conductors.

Options and Accessories

Other Louver Finishes
Consult Factory

Emergency	Add suffix **EM***
Chicago Plenum	Add suffix **LC**
Existing/Thk. Ceiling	**FA EC7***

Options and Accessories (continued)

Emergency Ltg. Kit	**FA EM3E*(4 pin)**
	FA EM4E*(4 pin)
	FA EM2T*(2 pin)
Fuse (Slow Blow)	Add suffix **F**

*See Spec. Sheets: FAEC, FAEM

Mounting Bars & Accessories; see Specification Sheet MBA.
Sloped Ceiling Adapters; see Specification Sheet SCA.

Labels

UL listed for damp locations.

Alzak® is a registered trademark of ALCOA.
US Patent Pending.

Job Information	**Type:**
Job Name:	
Cat. No.:	
Lamp(s):	
Notes:	

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

LIGHTOLIER®

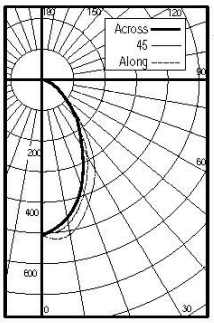
Calculite® Compact Fluorescent Open Downlight **8096CB**

7 3/8" Aperture (2) Quad Tube Cross Blade Louver

18W

Spacing Ratio = 0.8

CERTIFIED TEST REPORT NO. LSI 12561
CALCULITE COMPACT FLUORESCENT
DIFFUSE REFLECTOR WITH WHITE PAINTED 4 CELL LOUVER
2-18W SYLVANIA DULUX D/E FLUORESCENT LAMPS, LUMEN RATING = 1250 LMS.



CANDLEPOWER

ANGLE	ALONG	22.5	45	67.5	ACROSS	LUMENS
0	513	513	513	513	513	
5	525	511	504	495	495	48
10	513	495	481	466	461	
15	477	453	439	422	415	122
20	430	406	390	364	358	
25	375	354	329	305	303	151
30	325	296	271	247	247	
35	253	233	183	193	198	133
40	188	169	155	148	148	
45	128	118	109	109	103	88
50	82	95	76	78	74	
55	53	61	58	57	58	54
60	50	48	46	45	46	
65	39	37	36	35	35	36
70	29	28	27	26	26	
75	20	19	19	18	18	20
80	12	12	12	11	11	
85	6	6	5	5	5	
90	0	0	0	0	0	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	321	12.88	48.92
0-40	454	18.18	69.08
0-60	595	23.82	90.52
0-90	657	26.32	100.00
40-90	203	8.14	30.92
60-90	62	2.49	9.48
90-180	0	.00	.00
0-180	657	26.32	100.00

**** EFFICIENCY =26.3% ****
DATE: JUL 13, 1996

Coefficients of Utilization

	% EFFECTIVE CEILING CAVITY REFLECTANCE															
	80			70			50			30			10			0
	% WALL REFLECTANCE															
	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.29	.28	.27	.28	.27	.27	.27	.26	.26	.26	.25	.25	.25	.25	.24	
2	.26	.25	.24	.26	.25	.24	.25	.24	.23	.24	.23	.23	.23	.23	.22	
3	.24	.23	.21	.24	.22	.21	.23	.22	.21	.22	.21	.22	.21	.20	.22	
4	.22	.21	.19	.22	.20	.19	.21	.20	.19	.21	.20	.19	.20	.19	.19	
5	.21	.19	.18	.20	.19	.17	.20	.18	.17	.19	.18	.17	.19	.18	.17	
6	.19	.17	.16	.19	.17	.16	.18	.17	.16	.18	.17	.16	.18	.17	.16	
7	.18	.15	.15	.17	.16	.15	.17	.16	.15	.17	.15	.14	.16	.15	.14	
8	.16	.15	.13	.16	.15	.16	.16	.14	.13	.16	.14	.13	.15	.14	.13	
9	.15	.14	.12	.15	.14	.12	.15	.13	.12	.15	.13	.12	.14	.13	.12	
10	.14	.13	.11	.14	.13	.11	.14	.12	.11	.14	.12	.11	.14	.12	.11	

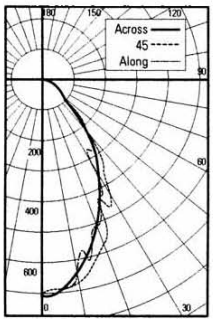
ROOM CAVITY RATIO

20% FLOOR CAVITY REFLECTANCE
Conversion Factors: Aluminum Cross Blade, C.U. x 0.7.

26W

Spacing Ratio = 0.9

CERTIFIED TEST REPORT NO. LSI
CALCULITE COMPACT FLUORESCENT
DIFFUSE REFLECTOR WITH WHITE PAINTED 4 CELL LOUVER
2-26W SLVANIA DULUX D/E FLUORESCENT LAMPS, LUMEN RATING = 1800 LMS.



CANDLEPOWER

ANGLE	ALONG	22.5	45	67.5	ACROSS	LUMENS
0	705	705	705	705	705	
5	688	697	698	709	697	67
10	679	682	667	664	648	
15	531	584	612	597	582	167
20	574	564	507	521	506	
25	431	483	420	441	434	208
30	434	407	335	360	365	
35	338	321	284	293	293	183
40	213	215	205	219	220	
45	170	161	152	162	158	123
50	109	110	106	113	109	
55	84	83	82	84	83	75
60	66	65	66	66	65	
65	52	51	51	51	51	51
70	39	38	39	38	38	
75	27	27	27	27	27	28
80	16	16	16	16	16	
85	7	7	7	7	7	8
90	0	0	0	0	0	

ZONAL LUMENS AND PERCENTAGES

ZONE	LUMENS	% LAMP	%LUMINAIRE
0-30	441	12.27	48.51
0-40	624	17.36	68.63
0-60	823	22.88	90.43
0-90	910	25.30	100.00
40-90	285	7.94	31.37
60-90	287	2.42	9.57
90-180	0	.00	.00
0-180	910	25.30	100.00

**** EFFICIENCY =25.3% ****
DATE: JUL 30, 1996

Coefficients of Utilization

	% EFFECTIVE CEILING CAVITY REFLECTANCE															
	80			70			50			30			10			0
	% WALL REFLECTANCE															
	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.27	.27	.26	.27	.26	.26	.25	.25	.25	.25	.24	.24	.24	.24	.23	.23
2	.25	.24	.23	.25	.24	.23	.24	.23	.22	.23	.22	.22	.22	.22	.21	.21
3	.23	.22	.20	.23	.21	.20	.22	.21	.20	.21	.20	.20	.21	.20	.19	.19
4	.21	.20	.19	.21	.20	.18	.21	.19	.18	.20	.19	.18	.19	.19	.18	.19
5	.20	.18	.17	.19	.18	.17	.19	.18	.17	.19	.17	.16	.18	.17	.16	
6	.18	.17	.15	.18	.16	.15	.18	.16	.15	.17	.16	.15	.17	.16	.15	
7	.17	.15	.14	.17	.15	.14	.15	.15	.14	.16	.15	.14	.16	.15	.14	
8	.16	.14	.13	.16	.14	.13	.15	.14	.13	.15	.14	.13	.15	.14	.13	
9	.15	.13	.12	.15	.13	.12	.14	.13	.12	.14	.13	.12	.14	.13	.12	
10	.14	.13	.11	.14	.12	.11	.13	.12	.11	.13	.12	.11	.13	.12	.11	

ROOM CAVITY RATIO

20% FLOOR CAVITY REFLECTANCE
Conversion Factors: Aluminum Cross Blade, C.U. x 0.7

Job Information | **Type:**

Lightolier a Genlyte company www.lightolier.com
631 Airport Road, Fall River, MA 02720 • (508) 679-8131 • Fax (508) 674-4710

LIGHTOLIER®

APPENDIX

BALLAST: B3

T2

- Programmed Rapid Starting Options
- 1-2 Lamp Applications

TRIAD® ELECTRONIC BALLASTS
FOR F6T2, F8T2, F11T2 AND F13T2 LAMPS

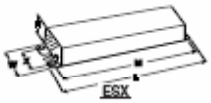
Fluorescent-Electronic

Lamp Qty.	Lamp Starting Method	Line Volts	Catalog Number	Certification			Line Current (Amps)	Input Power (Watts)	Power Factor (PF)	Ballast Factor (BF)	Ballast Efficacy Factor (BEF)	THD %	Min. F/C Start Temp	Wiring Diag.	Dim.
F6T2 - One And Two Lamp Applications															
2	SER-PRS	120 277	ES1786X	•	•		0.12 0.07	14 15	> .97	1.00	7.14 6.67	< 10	0/-18	37	ESX
1	PRS	120 277	ES1786X	•	•		0.07 0.05	8 9	> .97	1.00	12.50 11.11	< 10	0/-18	37	ESX
F8T2 - One And Two Lamp Applications															
2	SER-PRS	120 277	ES1786X	•	•		0.17 0.08	20 21	> .97	1.00	5.00 4.76	< 10	0/-18	37	ESX
1	PRS	120 277	ES1786X	•	•		0.10 0.06	11	> .97	1.00	9.09	< 10	0/-18	37	ESX
F11T2 - One And Two Lamp Applications															
2	SER-PRS	120 277	ES1786X	•	•		0.20 0.09	26	> .97	1.00	3.85	< 10	0/-18	37	ESX
1	PRS	120 277	ES1786X	•	•		0.12 0.07	15	> .97	1.00	6.67	< 10	0/-18	37	ESX
F13T2 - One And Two Lamp Applications															
2	SER-PRS	120 277	ES1786X	•	•		0.27 0.13	31 32	> .97	1.00	3.23 3.13	< 10	0/-18	37	ESX
1	PRS	120 277	ES1786X	•	•		0.15 0.08	16 17	> .97	1.00	6.25 5.88	< 10	0/-18	37	ESX

STARTING METHOD LEGEND

IS = Instant Start
PRS = Programmed Rapid Start
RS = Rapid Start
PAR-IS = Parallel Instant Start
PAR-PRS = Parallel Programmed Rapid Start
PAR-RS = Parallel Rapid Start
SER-RS = Series Rapid Start

Overall Dimensions			Mounting Dimensions		
Draw #	L	W	H	M	X
ESX	14.13"	1.24"	0.73"	13.78"	—



WIRING DIAGRAMS

FOR ONE LAMP OPERATION, CAP YELLOW LEADS INDIVIDUALLY

DIAGRAM 37

APPENDIX

BALLAST: B4

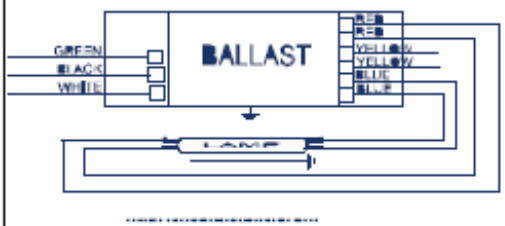
ADVANCE

ICN-2S24@120V	
Brand Name	CENTIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F24T5/HO	1	24	0/-18	0.23	27	1.02	10	0.98	1.7	3.78
F24T5/HO	2	24	0/-18	0.44	52	1.00	10	0.98	1.7	1.92
* F39T5/HO	1	39	0/-18	0.34	40	0.90	10	0.98	1.7	2.25
FC12T5	1	40	0/-18	0.34	40	0.84	10	0.98	1.7	2.10
FC9T5	1	22	0/-18	0.23	27	1.02	10	0.98	1.7	3.78
FC9T5	2	22	0/-18	0.44	52	1.00	10	0.98	1.7	1.92
FT24W/2G11	1	24	0/-18	0.23	27	1.02	10	0.98	1.7	3.78
FT24W/2G11	2	24	0/-18	0.44	52	1.00	10	0.98	1.7	1.92
FT36W/2G11	1	36	0/-18	0.29	34	0.90	10	0.98	1.7	2.65
FT40W/2G11/RS	1	40	0/-18	0.40	47	1.00	10	0.98	1.7	2.13

Wiring Diagram



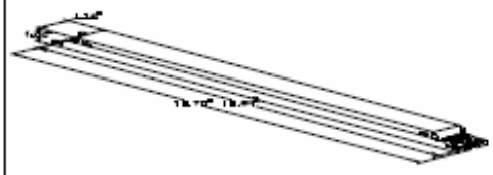
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

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

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

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
16.70 "	1.18 "	1.00 "	16.34 "
16 7/10	1 9/50	1	16 17/50
42.4 cm	3 cm	2.5 cm	41.5 cm

Revised 09/01/2004

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

ADVANCE
O'HARE INTERNATIONAL CENTER · 10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Customer Support/Technical Service: Phone: 800-372-3331 · Fax: 630-307-3071
Corporate Offices: Phone: 800-322-2086

APPENDIX

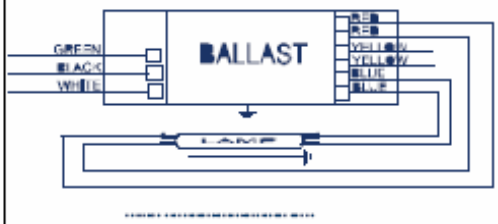
BALLAST: B5

ICN-2S24@120V	
Brand Name	CENTIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
* F24T5/HO	1	24	0/-18	0.23	27	1.02	10	0.98	1.7	3.78
F24T5/HO	2	24	0/-18	0.44	52	1.00	10	0.98	1.7	1.92
F39T5/HO	1	39	0/-18	0.34	40	0.90	10	0.98	1.7	2.25
FC12T5	1	40	0/-18	0.34	40	0.84	10	0.98	1.7	2.10
FC9T5	1	22	0/-18	0.23	27	1.02	10	0.98	1.7	3.78
FC9T5	2	22	0/-18	0.44	52	1.00	10	0.98	1.7	1.92
FT24W/2G11	1	24	0/-18	0.23	27	1.02	10	0.98	1.7	3.78
FT24W/2G11	2	24	0/-18	0.44	52	1.00	10	0.98	1.7	1.92
FT36W/2G11	1	36	0/-18	0.29	34	0.90	10	0.98	1.7	2.65
FT40W/2G11/RS	1	40	0/-18	0.40	47	1.00	10	0.98	1.7	2.13

Wiring Diagram



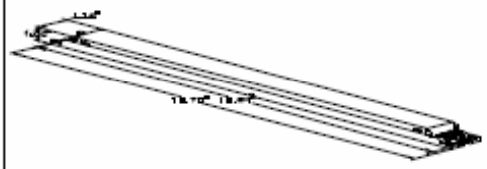
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

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

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

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
16.70 "	1.18 "	1.00 "	16.34 "
16 7/10	1 9/50	1	16 17/50
42.4 cm	3 cm	2.5 cm	41.5 cm

Revised 09/01/2004

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ADVANCE
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Corporate Offices: Phone: 800-322-2086

APPENDIX

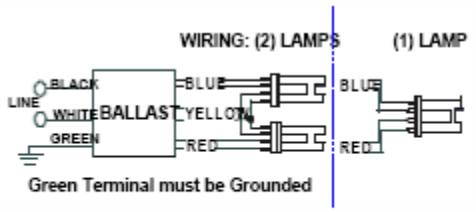
BALLAST: B6

RCF-2S13-H1-LD-QS	
Brand Name	AMBISTAR - HPF
Ballast Type	Electronic
Starting Method	Rapid Start
Lamp Connection	Series
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.
CFQ13W/G24Q	1	13	0/-18	0.13	16	1.00	10	0.98	1.7	6.25
CFQ13W/G24Q	2	13	0/-18	0.25	29	1.00	10	0.98	1.7	3.45
* CFTR13W/GX24Q	1	13	0/-18	0.13	16	1.00	10	0.98	1.7	6.25
CFTR13W/GX24Q	2	13	0/-18	0.25	29	1.00	10	0.98	1.7	3.45

Wiring Diagram



Green Terminal must be Grounded

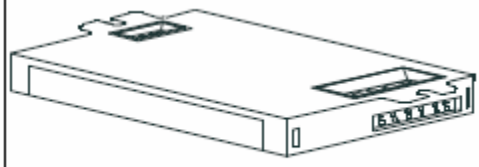
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow	0	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)
4.98 "	2.4 "	1.0 "	4.6 "
4 49/50	2 2/5	1	4 3/5
12.6 cm	6.1 cm	2.5 cm	11.7 cm

Revised 09/10/2007

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ADVANCE
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Customer Support/Technical Service: Phone: 800-372-3331 · Fax: 630-307-3071
Corporate Offices: Phone: 800-322-2086

APPENDIX

BALLAST: B7

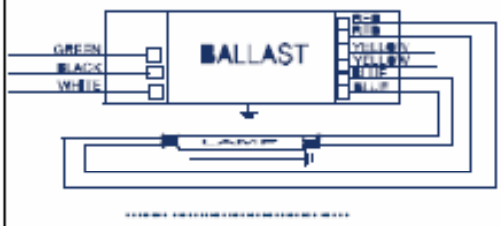
ADVANCE

ICN-2S28@120	
Brand Name	CENTIUM T5
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F14T5	1	14	0/-18	0.16	19	1.07	20	0.98	1.7	5.63
F14T5	2	14	0/-18	0.29	34	1.06	10	0.98	1.7	3.12
F21T5	1	21	0/-18	0.21	26	1.03	15	0.99	1.7	3.96
F21T5	2	21	0/-18	0.40	48	1.02	10	0.98	1.7	2.13
* F28T5	1	28	0/-18	0.28	33	1.04	10	0.98	1.7	3.15
F28T5	2	28	0/-18	0.55	64	1.03	10	0.99	1.7	1.61
F35T5	1	35	0/-18	0.34	41	1.01	10	0.98	1.7	2.46
F35T5	2	35	0/-18	0.67	80	1.00	10	0.99	1.7	1.25

Wiring Diagram



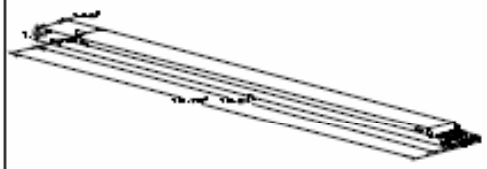
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	In.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow	0	0
Gray	0	0
Violet	0	0

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

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
16.70 "	1.18 "	1.00 "	16.34 "
16 7/10	1 9/50	1	16 17/50
42.4 cm	3 cm	2.5 cm	41.5 cm

Revised 08/21/2006

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

ADVANCE
O'HARE INTERNATIONAL CENTER · 10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Customer Support/Technical Service: Phone: 800-372-3331 · Fax: 630-307-3071
Corporate Offices: Phone: 800-322-2086

APPENDIX

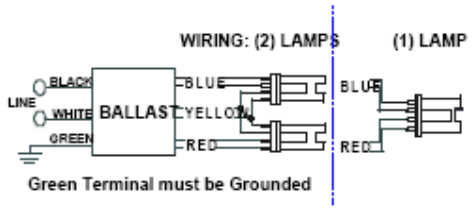
BALLAST: B8

RCF-2S26-H1-LD-QS	
Brand Name	AMBISTAR - HPF
Ballast Type	Electronic
Starting Method	Rapid Start
Lamp Connection	Series
Input Voltage	120
Input Frequency	60
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.
CFQ26W/G24Q	1	26	0/-18	0.23	27	1.00	10	0.98	1.7	3.70
CFQ26W/G24Q	2	26	0/-18	0.43	51	1.00	10	0.98	1.7	1.96
* CFTR26W/GX24Q	1	26	0/-18	0.24	29	1.10	10	0.98	1.7	3.79
CFTR26W/GX24Q	2	26	0/-18	0.45	54	1.00	10	0.98	1.7	1.85
CFTR32W/GX24Q	1	32	0/-18	0.31	36	0.98	10	0.98	1.7	2.72
CFTR42W/GX24Q	1	42	0/-18	0.38	46	0.98	10	0.98	1.7	2.13

Wiring Diagram



Green Terminal must be Grounded

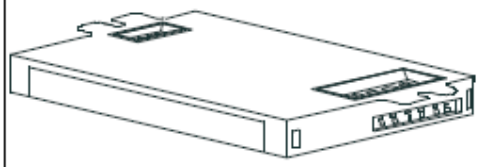
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0	0
White	0	0
Blue	0	0
Red	0	0
Yellow	0	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)
4.98 "	2.4 "	1.0 "	4.6 "
4 49/50	2 2/5	1	4 3/5
12.6 cm	6.1 cm	2.5 cm	11.7 cm

Revised 09/10/2007

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Corporate Offices: Phone: 800-322-2086

APPENDIX

BALLAST: B9,B10,B16,B19

ADVANCE

e-Vision® Electronic Ballast for Metal Halide Lamps

Catalog Number IMH-50-A
For (1) 39W ANSI M130 or
(1) 50W ANSI M110 Metal Halide Lamp
120-277V 50/60Hz Electronic
Status: Active

DIMENSIONS AND DATA

Lamp Data Number	Lamp Data Watts	Input Volts	Catalog Number*	Line Current (Amps)	Input Power (W)	Ballast Factor	Max THD (%)	Min Power Factor	Wiring Dia	Figure	Weight (lb)	Max Distance to Lamp (ft)
39 Watt Lamp, ANSI Code M130 Minimum Starting Temp -30°C/-20°F												
1	39	120	IMH-50-A-xxx	0.38	45	1.0	15	0.9	1	A	1.4	5
		277		0.16	44							
50 Watt Lamp, ANSI Code M110 Minimum Starting Temp -30°C/-20°F												
1	50	120	IMH-50-A-xxx	0.47	56	1.0	15	0.9	2	A	1.4	5
		277		0.20	55							

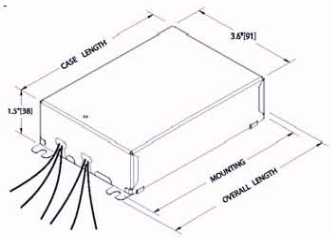
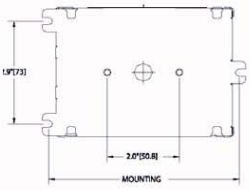
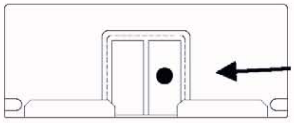


Figure A

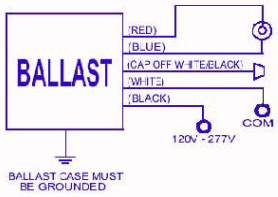
CASE LENGTH = 4.72" [120mm]□□
MOUNTING LENGTH = 5.20" [132mm]□□
MOUNTING WIDTH = 2.87" [73mm]□□
OVERALL LENGTH = 5.51" [140mm]□□
CASE WIDTH = 3.62" [92mm]□□
HEIGHT = 1.50" [38mm]□□



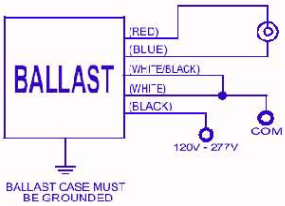


MEASURE CASE TEMPERATURE ON RIGHT HEAT SINK CLIP AT BALAST END

Case Temperature Measurement Location



Wiring Diagram 1



Wiring Diagram 2

INSTALLATION & APPLICATION NOTES:

1. Maximum allowable case temperature is 85°C. See figure above for measurement location
2. Ignition pulse is 4 kV max
3. All leads are 12 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp

***Ordering Information**

Order Suffix	Description
-LF	Ballast with side exit leads and mounting feet
-BLS	Ballast with bottom exit leads and mounting studs

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Advance • 10275 West Higgins Road • Rosemont, Illinois 60018-5603 • (847) 390-5000 • fax: 847-390-5109 • www.advancetransformer.com

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10/11//05

APPENDIX

BALLAST: B14,B17

ADVANCE™

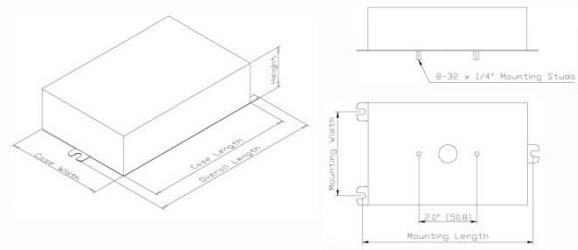
e-Vision® Electronic Ballast for Metal Halide Lamps

Catalog Number IMH-70-A-BLS-ID
For 70W Metal Halide Lamps
ANSI M98, M143 or M139
120-277V 50/60Hz Electronic
Status: Released

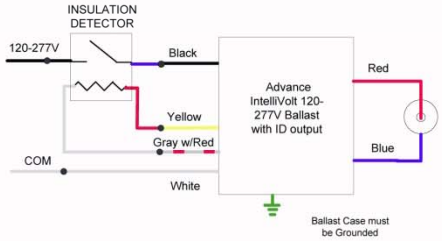
DIMENSIONS AND DATA

Lamp Data		Input Volts	Catalog Number*	Line Current (Amps)	Input Power (W)	Ballast Factor	Max THD (%)	Min Power Factor	Wiring Dia	Figure	Weight (lb)	Max Distance to Lamp (ft)
Number	Watts											
70W Watt Lamp, ANSI Code M98, M143 or M139 Minimum Starting Temp -30°C/-20°F												
1	70	120	IMH-70-A-xxx-ID	0.72	86	1.0	18%	0.9	8	A	1.5	5
		277		0.31	84							

Figure A

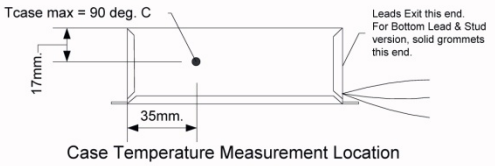


CASE LENGTH = 4.72" [120mm]
MOUNTING LENGTH = 5.20" [132mm]
MOUNTING WIDTH = 2.87" [73mm]
OVERALL LENGTH = 5.51" [140mm]
CASE WIDTH = 3.62" [92mm]
HEIGHT = 1.50" [38mm]



Wiring Diagram 8

Ballast will not operate if Insulation Detector is Absent, Shorted or Failed Open



Case Temperature Measurement Location

INSTALLATION & APPLICATION NOTES:

1. Use with any Thermal Protector having equivalent resistive value 5k to 25k ohm (4 wire versions only)
2. Open Circuit voltage across ID output approx 270VDC
3. Maximum allowable case temperature is 90°C. See figure above for measurement location
4. Ignition pulse is 4 kV max
5. All leads are 12 inches long
6. Ballast output will shutdown after 20 minutes if lamp fails to ignite
7. Power must be cycled off – then on, after replacing lamp

***Ordering Information**

Order Suffix	Description
-BLS	Ballast with bottom exit leads and mounting studs

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

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9/29/06

APPENDIX

50RVR AQUAZONE™

Indoor, Water-Cooled
High Eficiency Water Source Heat Pumps

50RHR - Horizontal - ½ to 5 Nominal Tons
50RVR - Vertical - ¾ to 5

The 50RHR,RVR indoor, water-cooled heat pump units are designed for vertical and horizontal installation with a variety of airflow configurations. These units provide a practical and economical approach for comfort conditioning requirements in both traditional and geothermal replacement, renovation, and new construction applications.

Additional Information
Physical data
Documents/DownLoads

Controls
WSHP Control Panel
PremierLink™

Other Horizontal WSHPs
50RHC - Std Eff
50RHS - Premium Eff
50HQL - Large Cap

Other Vertical WSHPs
50RVC - Std Eff
50RVS - Premium Eff

Performance Features

- Capacities of ½, ¾, 1, 1-1/3, 1 ½, 2, 2 ½, 3, 3 ½, 4, and 5 tons
- EERs up to 18.6
- Three-speed, direct drive PSC (permanent split capacitor) blower
- Compressors mounted on computer selected vibration isolator springs
- Water loop (boiler/tower and ground loop/water) application use with operating temperature range of 20 to 110 F
- Extended range package for open loop and geothermal applications (factory-installed option)
- Blower upgrades for high-static applications (size 048; factory-installed option)
- Fully insulated unit with acoustic type insulation
- Equipped with performance monitor to ensure efficient heat pump operation
- TXV (thermostatic expansion valve) controlled
- Copper or cupronickel heat exchanger (factory-installed option)
- Mute package for applications requiring especially low noise levels (factory-installed option)
- Complete control system (standard) or deluxe microprocessor control, PremierLink™, and LON (Local Operating Network) control systems (factory-installed options)
- Exceeds ASHRAE 90.1 performance requirements
- ARI/ISO 13256-1 certified
- Energy Star certified

Reliability Features

- Galvanized steel construction
- Coated and insulated condensate pan
- E-coated coils for corrosive environments (factory-installed option)
- Eight standard safeties include anti-short cycle, random start delay, high/low refrigerant pressure protection, condensate overflow sensor, high/low voltage protection, automatic intelligent reset, water coil freeze protection, and air coil freeze protection
- Shipped with "report card" validating factory test and proper operation
- Two-way motorized control valve (factory-installed option)
- Reversing valve (4-way), water-to-refrigerant coaxial coil, and enhanced aluminum fin/rifled copper tube refrigerant-to-air heat exchanger standard
- Microprocessor control with DDC (Direct Digital Controls) options
- UL, UL Canada, and ETL certified

Electrical data

50RHR,RVR ELECTRICAL DATA

50RHR,RVR UNIT	VOLTS-PHASE 60 Hz	VOLTAGE MIN/MAX	COMPRESSOR		FAN MOTOR FLA	TOTAL UNIT FLA	MIN CIRCUIT AMP	MAX FUSE/HACR
			RLA	LRA				
006*	208/230-1	197/254	2.9	17.7	0.40	3.3	4.0	15
	265-1	239/292	2.5	15.0	0.35	2.8	3.5	15
009	208/230-1	197/254	3.9	22.2	0.80	4.7	5.7	15
	265-1	239/292	3.3	18.8	0.90	4.2	5.0	15
012	208/230-1	197/254	5.3	27.9	0.80	6.1	7.5	15
	265-1	239/292	4.2	22.2	0.90	5.1	6.2	15
015	208/230-1	197/254	5.9	29.0	1.00	6.9	8.4	15
	265-1	239/292	5.4	27.0	0.86	6.3	7.7	15
019	208/230-1	197/254	7.9	48.3	1.10	9.0	11.0	15
	265-1	239/292	7.1	41.0	0.90	8.0	9.7	15
024	208/230-1	197/254	8.7	48.3	1.30	10.0	12.1	20
	265-1	239/292	8.3	47.0	1.58	9.9	12.0	20
	208/230-3	197/254	6.0	50.0	1.30	7.3	8.8	15
	460-3	414/506	3.2	25.0	0.85	4.1	4.9	15
030	208/230-1	197/254	11.2	60.0	1.90	13.1	15.9	25
	265-1	239/292	10.3	58.0	1.66	11.9	14.5	20
	208/230-3	197/254	6.4	50.0	1.90	8.3	9.9	15
	460-3	414/506	3.2	25.0	1.00	4.2	5.0	15
036	208/230-1	197/254	14.1	84.0	3.00	17.1	20.6	30
	265-1	239/292	13.5	83.0	2.70	16.2	19.5	30
	208/230-3	197/254	8.2	63.4	3.00	11.2	13.3	20
	460-3	414/506	4.1	36.0	1.70	5.8	6.8	15
042	208/230-1	197/254	16.2	96.0	3.00	19.2	23.2	35
	208/230-3	197/254	10.3	75.0	3.00	13.3	15.8	25
	460-3	414/506	4.3	40.0	1.70	6.0	7.1	15
	575-3	518/633	3.7	31.0	1.50	5.2	6.1	15
048	208/230-1	197/254	18.3	102.0	3.40	21.7	26.2	40
	208/230-3	197/254	12.6	91.0	3.40	16.0	19.2	30
	460-3	414/506	5.7	42.0	1.80	7.5	8.9	15
	575-3	518/633	4.7	39.0	1.60	6.3	7.5	15
060	208/230-1	197/254	25.6	170.0	4.30	29.9	36.4	60
	208/230-3	197/254	14.7	124.0	4.30	19.0	22.7	35
	460-3	414/506	7.4	59.6	2.50	9.9	11.8	15
	575-3	518/633	5.9	49.4	2.20	8.1	9.8	15

LEGEND

FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
LRA — Locked Rotor Amps
RLA — Rated Load Amps

*Size 006 is available in 50RHR units only.

50VQL AQUAZONE™

Indoor, Water-Cooled
Large Capacity Water Source Heat Pump

50HQL - Horizontal - 6 to 10 Nominal Tons
50VQL - Vertical - 6½ to 25 Nominal Tons

The 50HQL,VQL large capacity, indoor water-cooled heat pump units are designed for vertical and horizontal installation with a variety of airflow configurations. These units provide a practical and economical approach for comfort conditioning requirements in both traditional and geothermal replacement, renovation, and new construction applications.

Additional Information
Physical data
Documents/DownLoads

Controls
WSHP Control Panel
PremierLink™

Other Horizontal WSHPs
50RHC - Std Eff
50RHR - High Eff
50RHS - Premium Eff

Other Vertical WSHPs
50RVC - Std Eff
50RVR - High Eff
50RVS - Premium Eff

Performance Features

- Capacities of 6, 6 ½, 8, 8 ½, 10, 13, 17, 20, and 25 tons
- EERs up to 18.7
- Belt driven centrifugal blowers
- Scroll compressors mounted on computer selected vibration isolator springs
- Water loop (boiler/tower and ground loop/water) application use with operating temperature range of 20 to 110 F
- Extended range package for open loop and geothermal applications (factory-installed option)
- Blower upgrades for high-static applications (factory-installed option)
- Fully insulated unit with acoustic type insulation
- Dual refrigerant circuits
- Equipped with performance monitor to ensure efficient heat pump operation
- TXV (thermostatic expansion valve) controlled
- Copper or cupronickel heat exchanger (factory-installed option)
- Mute package for applications requiring especially low noise levels (factory-installed option)
- Complete control system (standard) or deluxe microprocessor, PremierLink™, and LON (Local Operating Network) control systems (factory-installed options)
- Exceeds ASHRAE 90.1 performance requirements
- ARI/ISO 13256-1 certified
- Energy Star certified

Reliability Features

- Galvanized steel construction
- Coated and insulated condensate pan
- E-coated coils for corrosive environments (factory-installed option)
- Eight standard safeties include anti-short cycle, random start delay, high/low refrigerant pressure protection, condensate overflow sensor, high/low voltage protection, automatic intelligent reset, water coil freeze protection, and air coil freeze protection
- Shipped with "report card" validating factory test and proper operation
- Two-way motorized control valve (field-installed accessory)
- Reversing valve (4-way), water-to-refrigerant coaxial coil, and enhanced aluminum fin/rifled copper tube refrigerant-to-air heat exchanger standard
- Microprocessor control with DDC (Direct Digital Controls) options
- UL, UL Canada, and ETL certified

APPENDIX

Electrical data

50HQL072,096,120

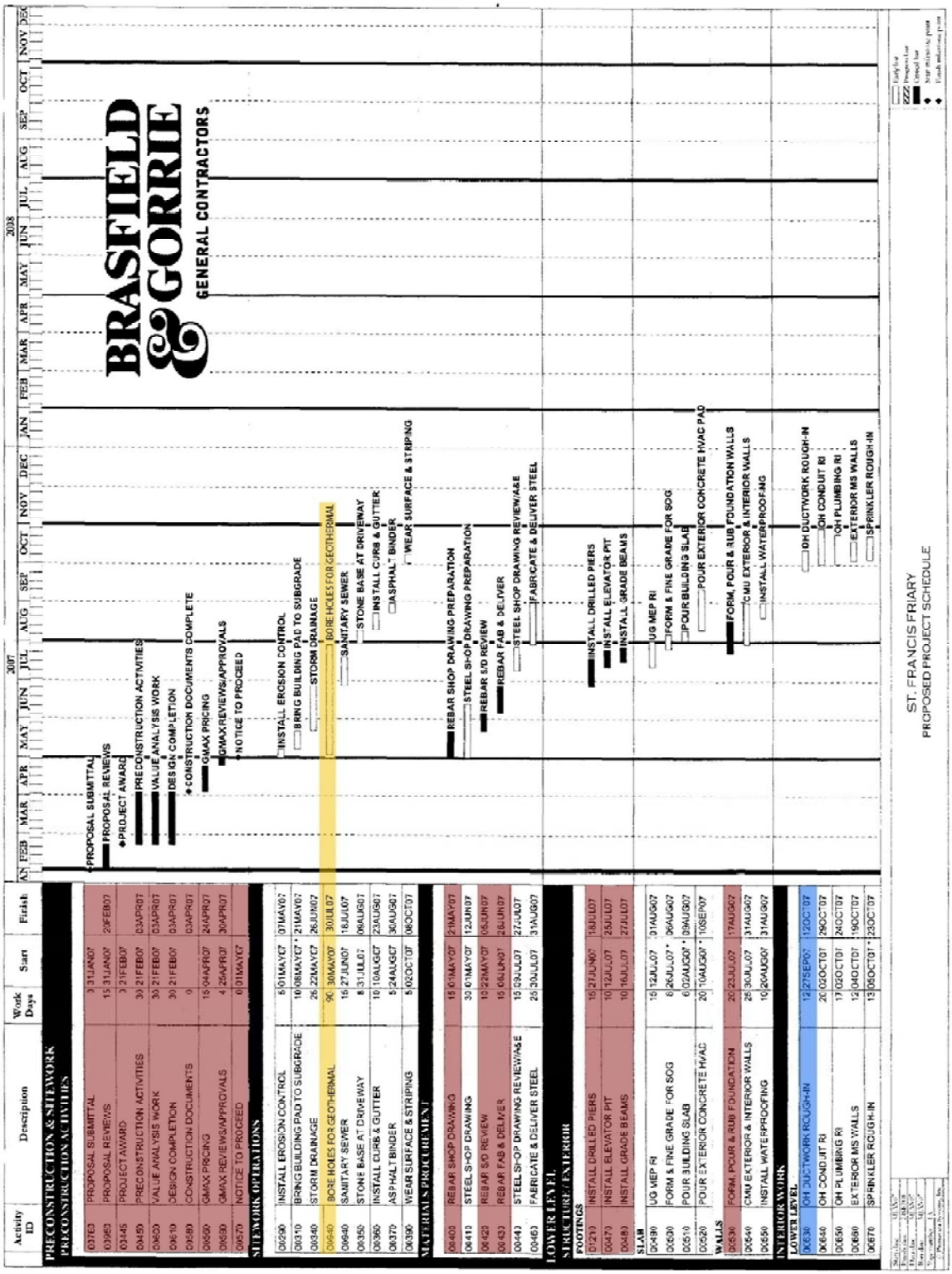
UNIT 50HQL	VOLTAGE (3 Ph — 60 Hz)	VOLTAGE RANGE		BLOWER MOTOR FACTORY-INSTALLED OPTION	COMPRESSOR			FAN MOTOR		TOTAL FLA	MCA	MOCP*
		Min	Max		Qty	RLA	LRA	HP	FLA			
072	208/230	187	253	Standard	2	10.4	65.5	1.5	5.0	25.8	28.4	35
				Large	2	10.4	65.5	2.0	6.2	27.0	29.6	40
	460	414	506	Standard	2	4.9	33.0	1.5	2.4	12.2	13.4	15
				Large	2	4.9	33.0	2.0	3.1	12.9	14.1	15
096	208/230	187	253	Standard	2	14.3	91.0	2.0	6.5	35.1	38.7	50
				Large	2	14.3	91.0	3.0	8.8	37.4	41.0	50
	460	414	506	Standard	2	7.2	46.0	2.0	3.1	17.5	19.3	25
				Large	2	7.2	46.0	3.0	4.2	18.6	20.4	25
	575	518	633	Standard	2	5.7	37.0	2.0	2.8	14.2	15.6	20
				Large	2	5.7	37.0	3.0	3.4	14.8	16.2	20
120	208/230	187	253	Standard	2	19.3	123.0	2.0	6.5	45.1	49.9	60
				Large	2	19.3	123.0	3.0	8.8	47.4	52.2	70
	460	414	506	Standard	2	7.5	49.5	2.0	3.1	18.1	20.0	25
				Large	2	7.5	49.5	3.0	4.2	19.2	21.1	25
	575	518	633	Standard	2	6.4	40.0	2.0	2.8	15.6	17.2	20
				Large	2	6.4	40.0	3.0	3.4	16.2	17.8	20

LEGEND

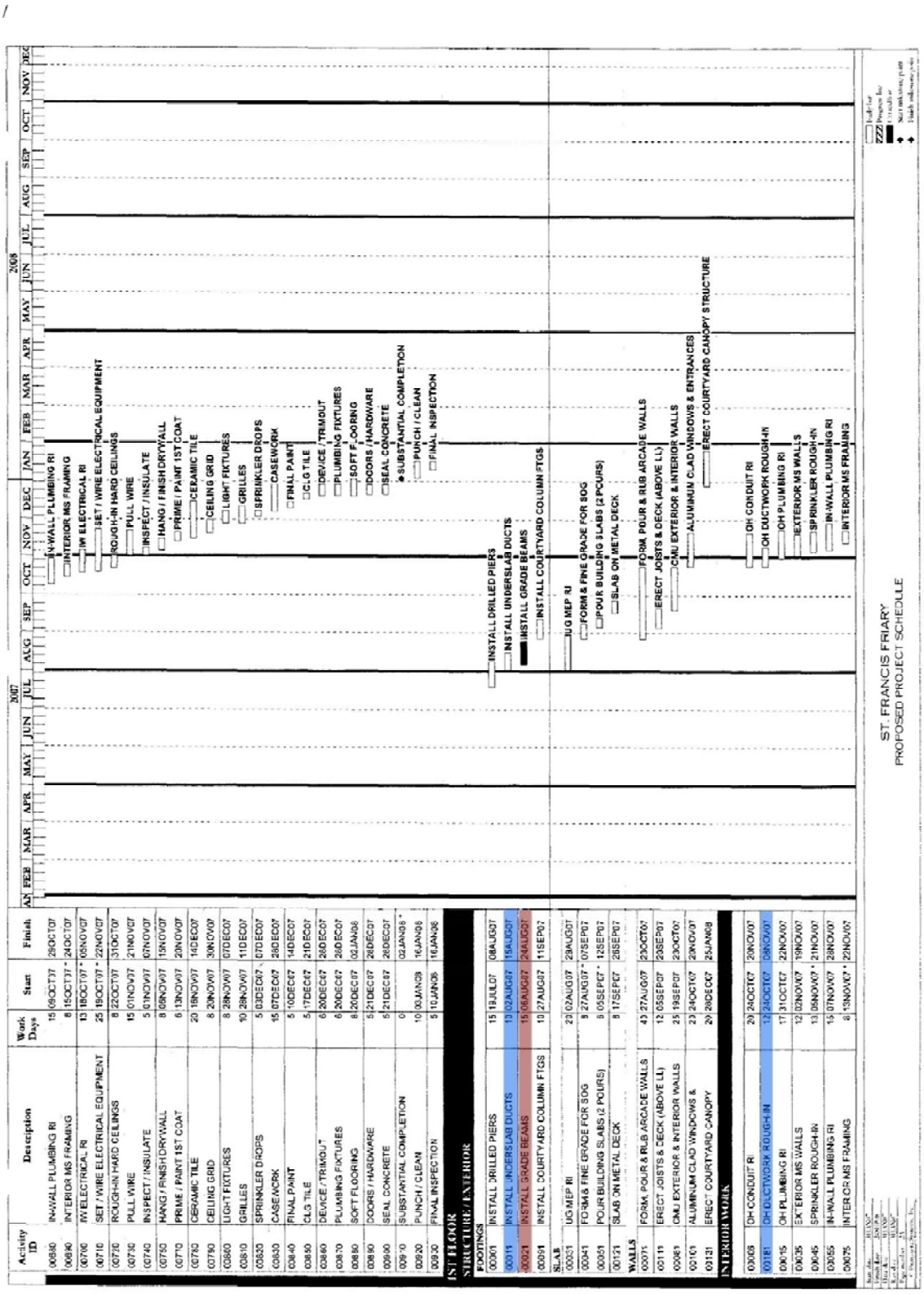
FLA — Full Load Amps
HACR — Heating, Air Conditioning, and Refrigeration
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Minimum Over Current Protection
RLA — Rated Load Amps

*Time-delay fuse or HACR circuit breaker.

APPENDIX

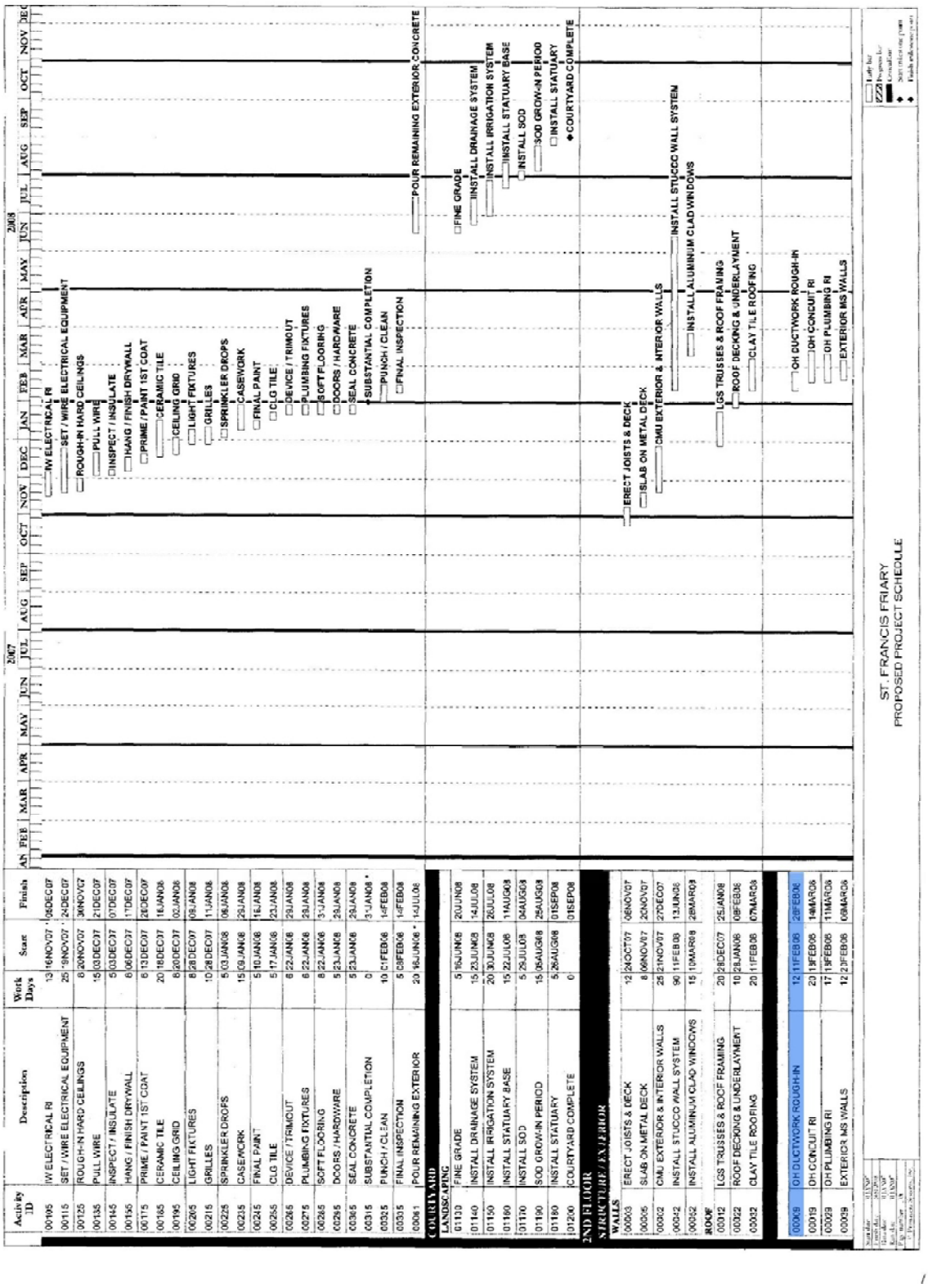

BRASFIELD & GORRIE
GENERAL CONTRACTORS
ST. FRANCIS FRIARY
PROPOSED PROJECT SCHEDULE

APPENDIX



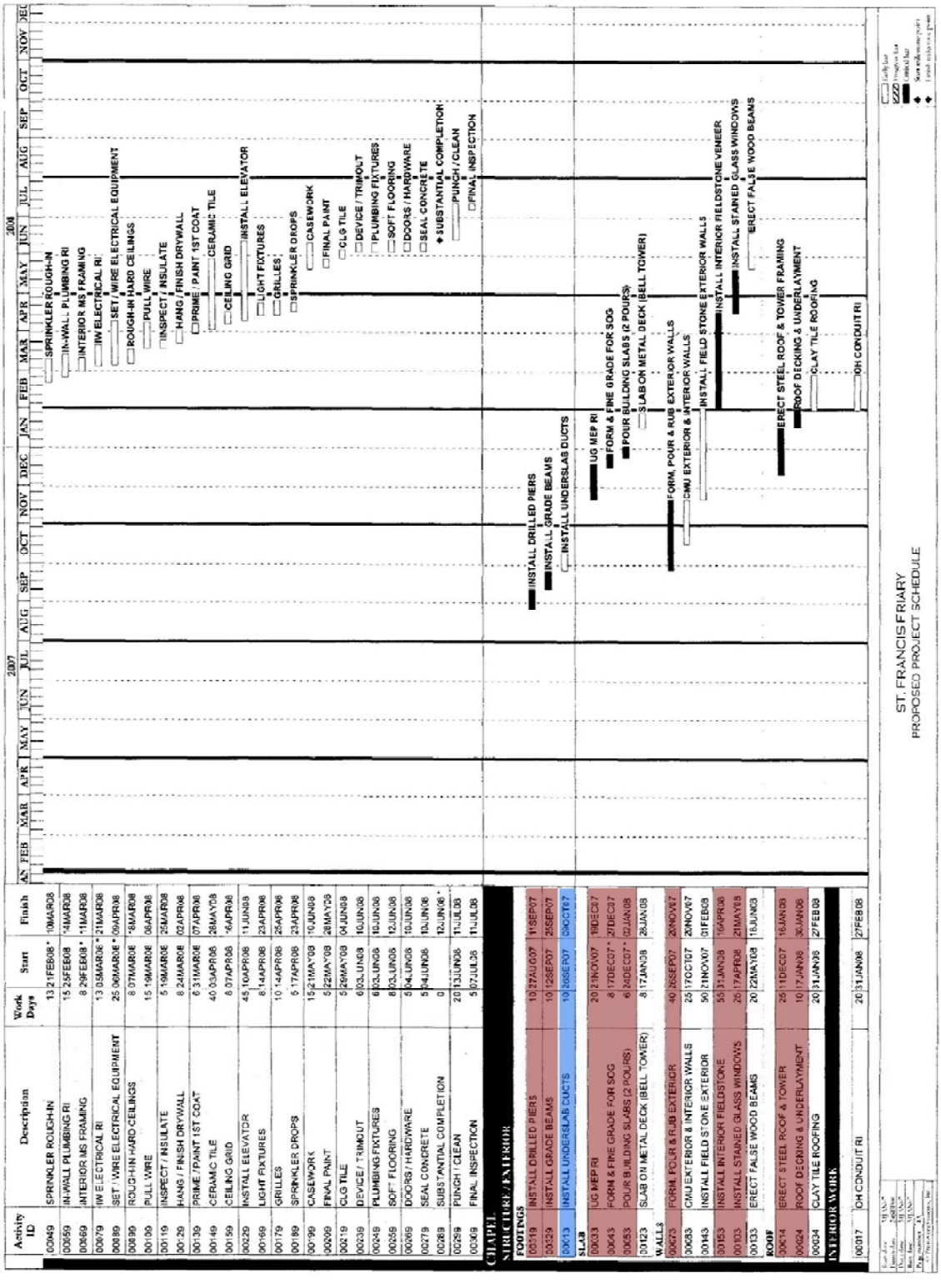
Activity ID	Description	Work Days	Start	Finish
00580	IN-WALL PLUMBING RI	15	09OCT07	29OCT07
00690	INTERIOR MS FRAMING	8	15OCT07 *	24OCT07
00700	IW ELECTRICAL RI	13	18OCT07 *	05NOV07
00710	SET / WIRE ELECTRICAL EQUIPMENT	25	19OCT07 *	22NOV07
00720	ROUGH-IN HARD CEILINGS	8	22OCT07	31OCT07
00730	PULL WIRE	15	01NOV07	21NOV07
00740	INSPECT / INSULATE	5	01NOV07	07NOV07
00750	HANG / FINISH DRYWALL	8	06NOV07	15NOV07
00770	PRIME / PAINT 1ST COAT	6	13NOV07	20NOV07
00780	CERAMIC TILE	20	19NOV07	14DEC07
00790	CEILING GRID	8	20NOV07	30NOV07
00800	LIGHT FIXTURES	8	28NOV07	07DEC07
00810	GRILLES	10	28NOV07	11DEC07
00820	SPRINKLER DROPS	5	03DEC07	07DEC07
00830	CASEWORK	15	07DEC07	28DEC07
00840	FINAL PAINT	5	10DEC07	14DEC07
00850	CLG TILE	5	17DEC07	21DEC07
00860	DEVICE / TRIMOUT	6	20DEC07	26DEC07
00870	PLUMBING FIXTURES	6	20DEC07	26DEC07
00880	SOFT FLOORING	8	20DEC07	02JAN08
00890	DOORS / HARDWARE	5	21DEC07	26DEC07
00900	SEAL CONCRETE	5	21DEC07	26DEC07
00910	SUBSTANTIAL COMPLETION	0		02JAN08 *
00920	PUNCH / CLEAN	10	03JAN08	16JAN08
00930	FINAL INSPECTION	5	10JAN08	16JAN08
1ST FLOOR				
STRUCTURE / EXTERIOR				
FOOTINGS				
00001	INSTALL DRILLED PIERS	15	19JUL07	08AUG07
00011	INSTALL UNDERSLAB DUCTS	10	02AUG07	15AUG07
00021	INSTALL GRADE BEAMS	15	06AUG07	24AUG07
00091	INSTALL COURTYARD COLUMN FTGS	10	27AUG07	11SEP07
SLAB				
00031	UG MEP RI	23	02AUG07	29AUG07
00041	FORM & FINE GRADE FOR SOG	9	27AUG07 *	07SEP07
00051	POUR BUILDING SLABS (2 POURS)	9	05SEP07 *	12SEP07
00121	SLAB ON METAL DECK	8	17SEP07	26SEP07
WALLS				
00071	FORM, POUR & RUB ARCADE WALLS	43	27AUG07	23OCT07
00111	ERECT JOISTS & DECK (ABOVE LL)	12	05SEP07	20SEP07
00081	CMU EXTERIOR & INTERIOR WALLS	25	19SEP07	23OCT07
00101	ALUMINUM CLAD WINDOWS &	23	24OCT07	20NOV07
03121	ERECT COURTYARD CANOPY	20	26DEC07	25JAN08
INTERIOR WORK				
03005	OH CONDUIT RI	20	24OCT07	20NOV07
03181	OH DUCTWORK ROUGH-IN	12	24OCT07	08NOV07
00015	OH PLUMBING RI	17	31OCT07	22NOV07
00035	EXTERIOR MS WALLS	12	02NOV07	19NOV07
00045	SPRINKLER ROUGH-IN	13	05NOV07 *	21NOV07
03055	IN-WALL PLUMBING RI	15	07NOV07	28NOV07
00675	INTERIOR MS FRAMING	8	13NOV07 *	22NOV07

APPENDIX



Activity ID	Description	Work Days	Start	Finish
00105	IW ELECTRICAL RI	13	16NOV07	08DEC07
00115	SET / WIRE ELECTRICAL EQUIPMENT	25	19NOV07	24DEC07
00125	ROUGH-IN HARD CEILINGS	8	20NOV07	30NOV07
00135	PULL WIRE	15	03DEC07	21DEC07
00145	INSPECT / INSULATE	5	03DEC07	07DEC07
00155	HANG / FINISH DRYWALL	6	06DEC07	17DEC07
00175	PRIME / PAINT 1ST COAT	6	13DEC07	20DEC07
00165	CERAMIC TILE	20	18DEC07	16JAN08
00195	CEILING GRID	8	20DEC07	02JAN08
00205	LIGHT FIXTURES	8	28DEC07	08JAN08
00215	GRILLES	10	28DEC07	11JAN08
00225	SPRINKLER DROPS	5	03JAN08	09JAN08
00235	CASEWORK	15	09JAN08	29JAN08
00245	FINAL PAINT	5	10JAN08	16JAN08
00255	CLG TILE	5	17JAN08	23JAN08
00265	DEVICE / TRIMOUT	8	22JAN08	29JAN08
00275	PLUMBING FIXTURES	8	22JAN08	29JAN08
00285	SOFT FLOORING	8	22JAN08	31JAN08
00295	DOORS / HARDWARE	5	23JAN08	29JAN08
00305	SEAL CONCRETE	5	23JAN08	29JAN08
00315	SUBSTANTIAL COMPLETION	0		31JAN08 *
00325	PUNCH / CLEAN	10	01FEB08	14FEB08
00335	FINAL INSPECTION	5	08FEB08	14FEB08
00061	POUR REMAINING EXTERIOR	20	16JUN08 *	14JUL08
COURTYARD				
LANDSCAPING				
01130	FINE GRADE	5	16JUN08	20JUN08
01140	INSTALL DRAINAGE SYSTEM	15	23JUN08	14JUL08
01150	INSTALL IRRIGATION SYSTEM	20	30JUN08	26JUL08
01160	INSTALL STATUARY BASE	15	22JUL08	11AUG08
01170	INSTALL SOD	5	29JUL08	04AUG08
01190	SOD GROWN PERIOD	15	05AUG08	25AUG08
01180	INSTALL STATUARY	5	26AUG08	01SEP08
01200	COURTYARD COMPLETE	0		01SEP08
2ND FLOOR				
STRUCTURE / EXTERIOR				
WALLS				
00003	ERECT JOISTS & DECK	12	24OCT07	06NOV07
00005	SLAB ON METAL DECK	8	06NOV07	20NOV07
00002	CMU EXTERIOR & INTERIOR WALLS	25	21NOV07	27DEC07
00042	INSTALL STUCCO WALL SYSTEM	90	11FEB08	13JUN08
00052	INSTALL ALUMINUM CLAD WINDOWS	15	10MAR08	28MAR08
ROOF				
00012	LGS TRUSSES & ROOF FRAMING	20	28DEC07	25JAN08
00022	ROOF DECKING & UNDERLAYMENT	10	28JAN08	08FEB08
00032	CLAY TILE ROOFING	20	11FEB08	07MAR08
00009	OH DUCTWORK ROUGH-IN	12	11FEB08	26FEB08
00019	OH CONDUIT RI	23	11FEB08	14MAR08
00029	OH PLUMBING RI	17	11FEB08	11MAR08
00039	EXTERIOR MS WALLS	12	23FEB08	09MAR08

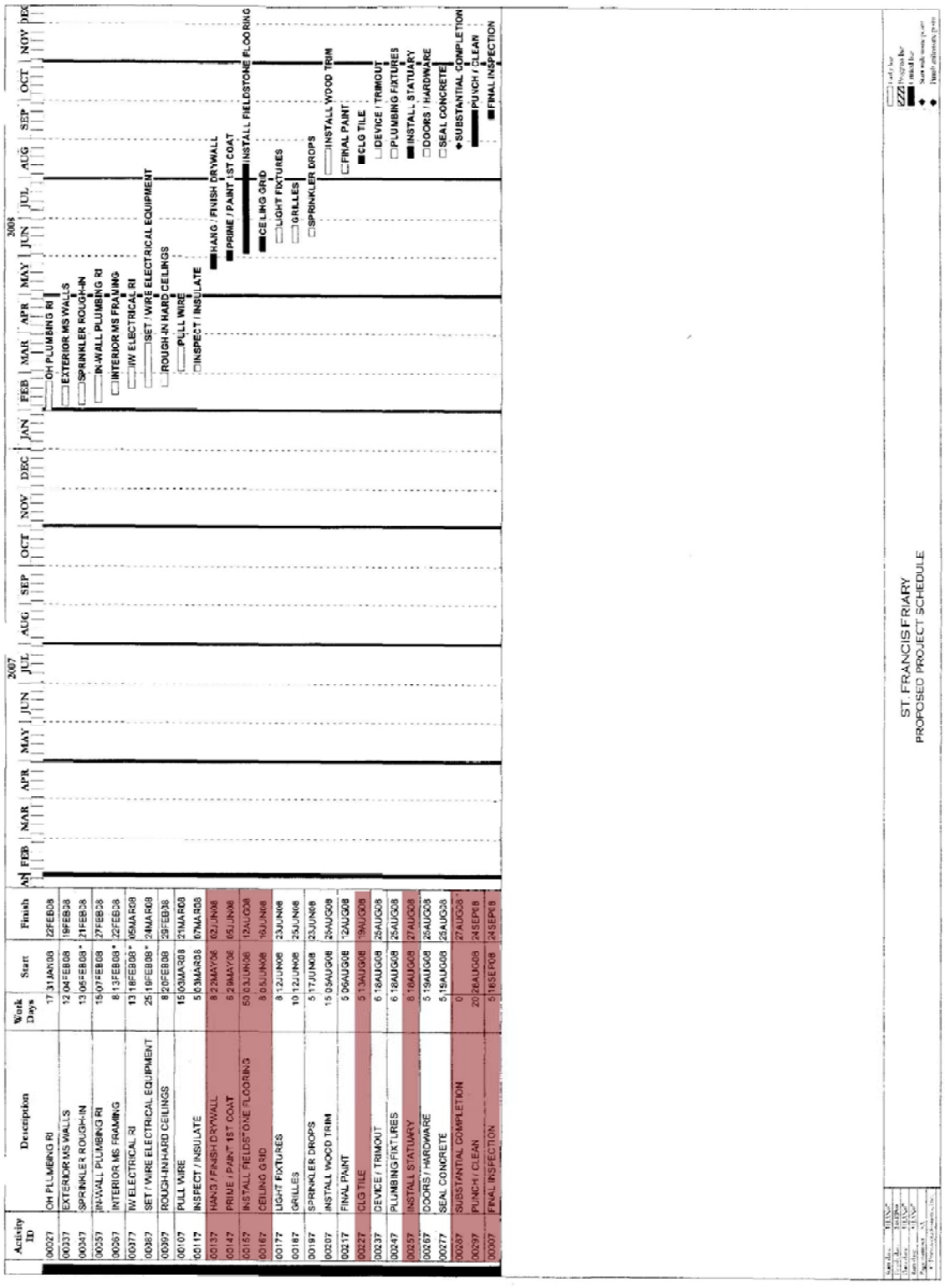
APPENDIX



Activity ID	Description	Work Days	Start	Finish
00049	SPRINKLER ROUGH-IN	13	21FEB08*	10MAR08
00059	IN-WALL PLUMBING RI	15	25FEB08	14MAR08
00069	INTERIOR MS FRAMING	8	29FEB08*	11MAR08
00079	HV ELECTRICAL RI	13	05MAR08*	21MAR08
00089	SET / WIRE ELECTRICAL EQUIPMENT	25	06MAR08*	09APR08
00099	ROUGH-IN HARD CEILINGS	8	07MAR08	18MAR08
00109	PULL WIRE	15	19MAR08	08APR08
00119	INSPECT / INSULATE	5	19MAR08	25MAR08
00129	HANG / FINISH DRYWALL	8	24MAR08	02APR08
00139	PRIME / PAINT 1ST COAT	6	31MAR08	07APR08
00149	CERAMIC TILE	40	03APR08	28MAY08
00159	CEILING GRID	8	07APR08	16APR08
00229	INSTALL ELEVATOR	45	10APR08	11JUN08
00169	LIGHT FIXTURES	8	14APR08	23APR08
00179	GRILLES	10	14APR08	25APR08
00189	SPRINKLER DROPS	5	17APR08	23APR08
00199	CASEWORK	15	21MAY08	10JUN08
00209	FINAL PAINT	5	22MAY08	28MAY08
00219	CLG TILE	5	29MAY08	04JUN08
00239	DEVICE / TRIMOUT	6	03JUN08	10JUN08
00249	PLUMBING FIXTURES	6	03JUN08	10JUN08
00259	SOFT FLOORING	8	03JUN08	12JUN08
00269	DOORS / HARDWARE	5	04JUN08	10JUN08
00279	SEAL CONCRETE	5	04JUN08	10JUN08
00283	SUBSTANTIAL COMPLETION	0		12JUN08*
00289	PUNCH / CLEAN	20	13JUN08	11JUL08
00309	FINAL INSPECTION	5	07JUL08	11JUL08
	CHAPEL			
	STRUCTURE / EXTERIOR			
	FOOTINGS			
00319	INSTALL DRILLED PIERS	10	27AUG07	11SEP07
00329	INSTALL GRADE BEAMS	10	12SEP07	25SEP07
00013	INSTALL UNDERSLAB DUCTS	10	26SEP07	09OCT07
	SLAB			
00033	UG MEP RI	20	21NOV07	19DEC07
00043	FORM & FINE GRADE FOR SOG	8	17DEC07*	27DEC07
00053	POUR BUILDING SLABS (2 POURS)	6	28DEC07*	02JAN08
00123	SLAB ON METAL DECK (BELL TOWER)	8	17JAN08	28JAN08
	WALLS			
00073	FORM, POUR & RUB EXTERIOR	40	26SEP07	20NOV07
00083	CMU EXTERIOR & INTERIOR WALLS	25	17OCT07	20NOV07
00143	INSTALL FIELD STONE EXTERIOR	50	21NOV07	01FEB08
00153	INSTALL INTERIOR FIELDSTONE	55	31JAN08	16APR08
00103	INSTALL STAINED GLASS WINDOWS	25	17APR08	21MAY08
00133	ERECT FALSE WOOD BEAMS	20	22MAY08	18JUN08
	ROOF			
00014	ERECT STEEL ROOF & TOWER	25	11DEC07	16JAN08
00024	ROOF DECKING & UNDERLAYMENT	10	17JAN08	30JAN08
00034	CLAY TILE ROOFING	20	31JAN08	27FEB08
	INTERIOR WORK			
00017	OH CONDUIT RI	20	31JAN08	27FEB08

ST. FRANCIS FRIARY
PROPOSED PROJECT SCHEDULE

APPENDIX

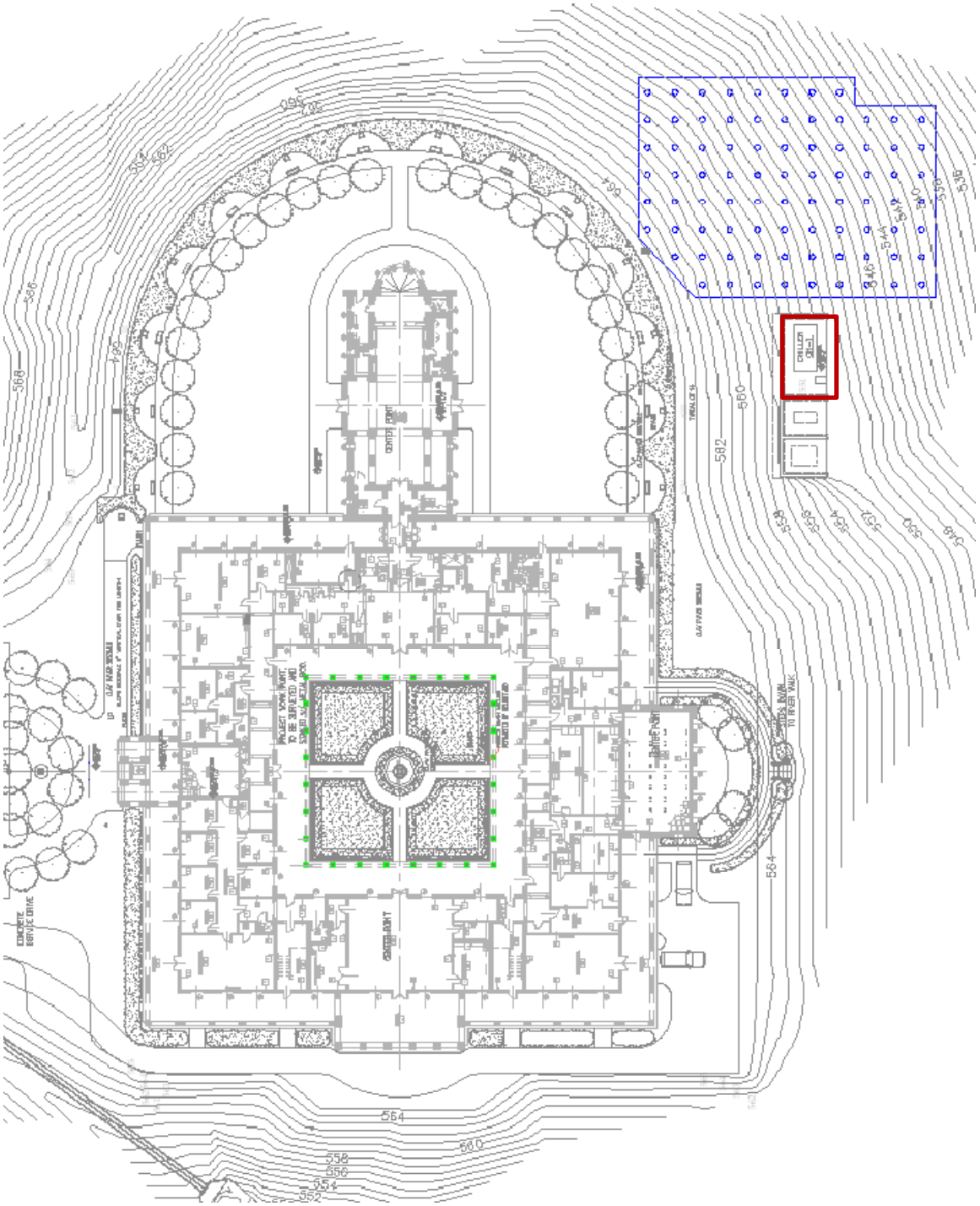


Activity ID	Description	Work Days	Start	Finish
00027	OH PLUMBING RI	17	31JAN08	22FEB08
00037	EXTERIOR MS WALLS	12	04FEB08	19FEB08
00047	SPRINKLER ROUGH-IN	13	05FEB08*	21FEB08
00057	IN-WALL PLUMBING RI	15	07FEB08	27FEB08
00067	INTERIOR MS FRAMING	8	13FEB08*	22FEB08
00077	IW ELECTRICAL RI	13	18FEB08*	06MAR08
00087	SET / WIRE ELECTRICAL EQUIPMENT	25	19FEB08*	24MAR08
00097	ROUGH-IN HARD CEILINGS	8	20FEB08	29FEB08
00107	PULL WIRE	15	03MAR08	21MAR08
00117	INSPECT / INSULATE	5	03MAR08	07MAR08
00137	HANG / FINISH DRYWALL	8	23MAY08	02JUN08
00147	PRIME / PAINT 1ST COAT	6	29MAY08	05JUN08
00157	INSTALL FIELDSTONE FLOORING	50	03JUN08	12AUG08
00167	CEILING GRID	8	05JUN08	16JUN08
00177	LIGHT FIXTURES	8	12JUN08	23JUN08
00187	GRILLES	10	12JUN08	25JUN08
00197	SPRINKLER DROPS	5	17JUN08	23JUN08
00207	INSTALL WOOD TRIM	15	05AUG08	26AUG08
00217	FINAL PAINT	5	06AUG08	12AUG08
00227	CLG TILE	5	13AUG08	19AUG08
00237	DEVICE / TRIMOUT	6	18AUG08	26AUG08
00247	PLUMBING FIXTURES	6	18AUG08	25AUG08
00257	INSTALL STATUARY	8	19AUG08	27AUG08
00267	DOORS / HARDWARE	5	19AUG08	25AUG08
00277	SEAL CONCRETE	5	15AUG08	29AUG08
00287	SUBSTANTIAL COMPLETION	0		27AUG08
00297	PUNCH / CLEAN	20	28AUG08	24SEP08
00307	FINAL INSPECTION	5	16SEP08	24SEP08

ST. FRANCIS FRIARY
PROPOSED PROJECT SCHEDULE

APPENDIX

SITE IMPLIFICATIONS OF GEOTHERMAL SYSTEM

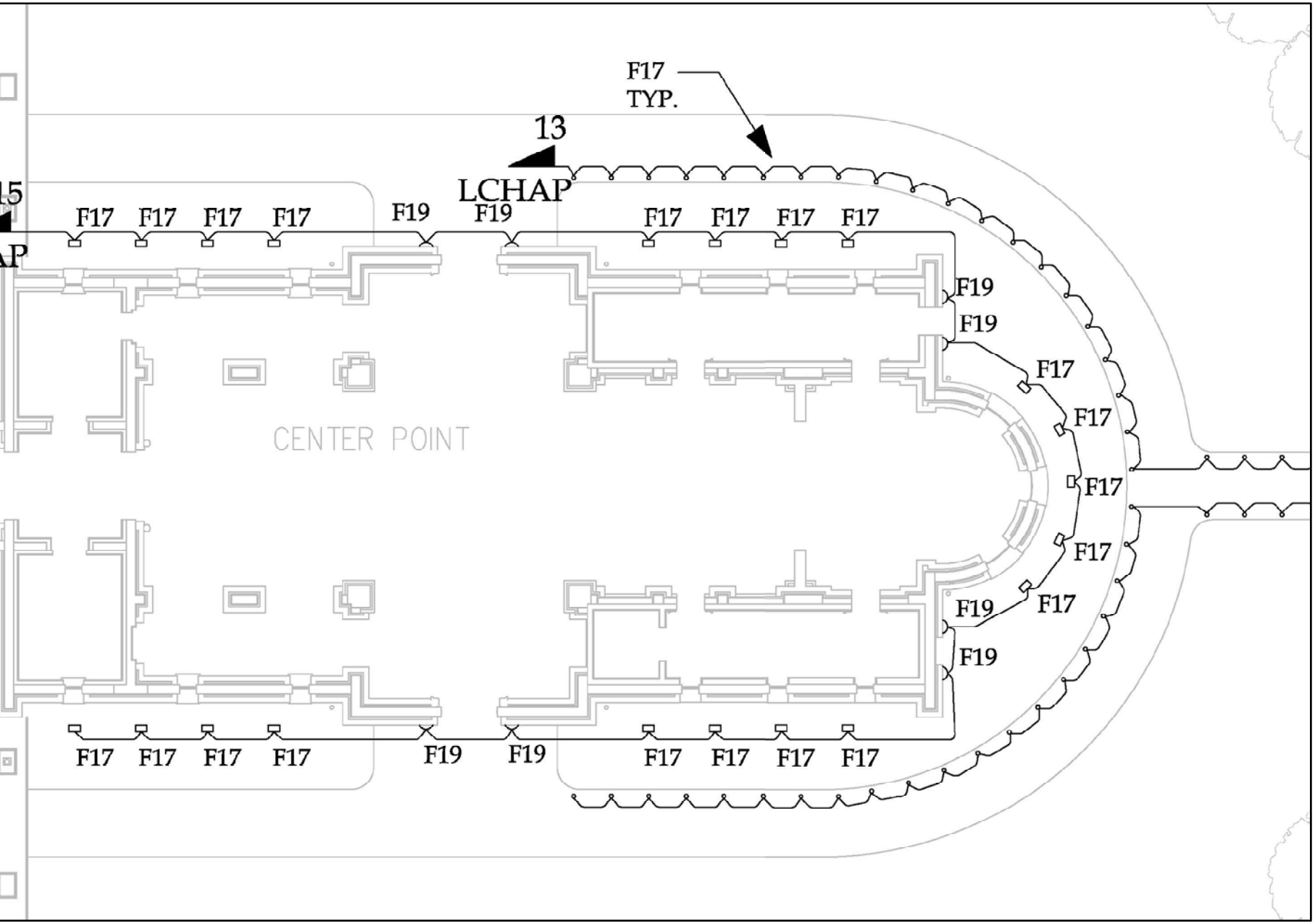


Current design site elements: Chiller location

Proposed Geothermal system site elements: (84) 250’ vertical holes

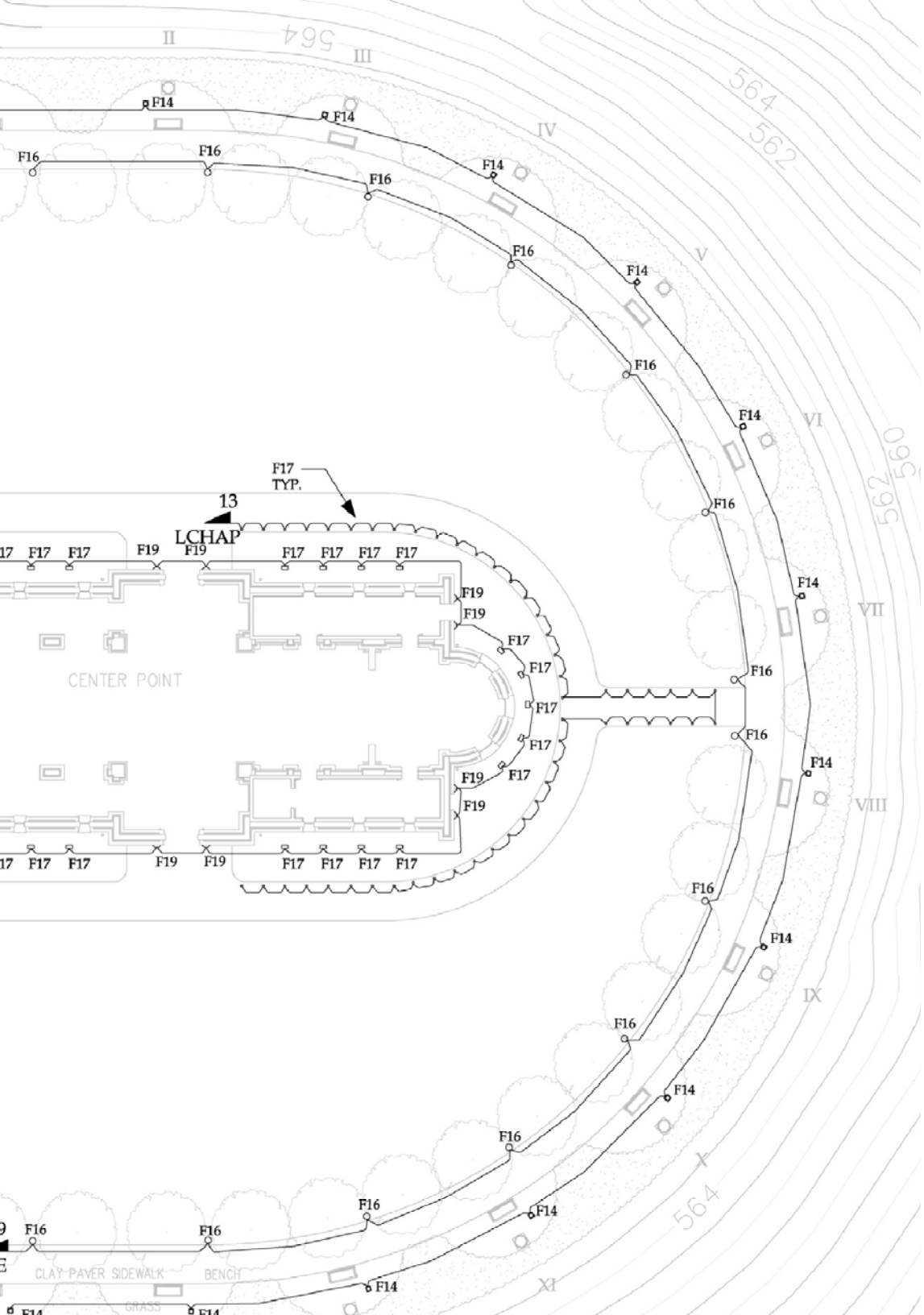
MPARISON: COPPER TO ALUMINUM

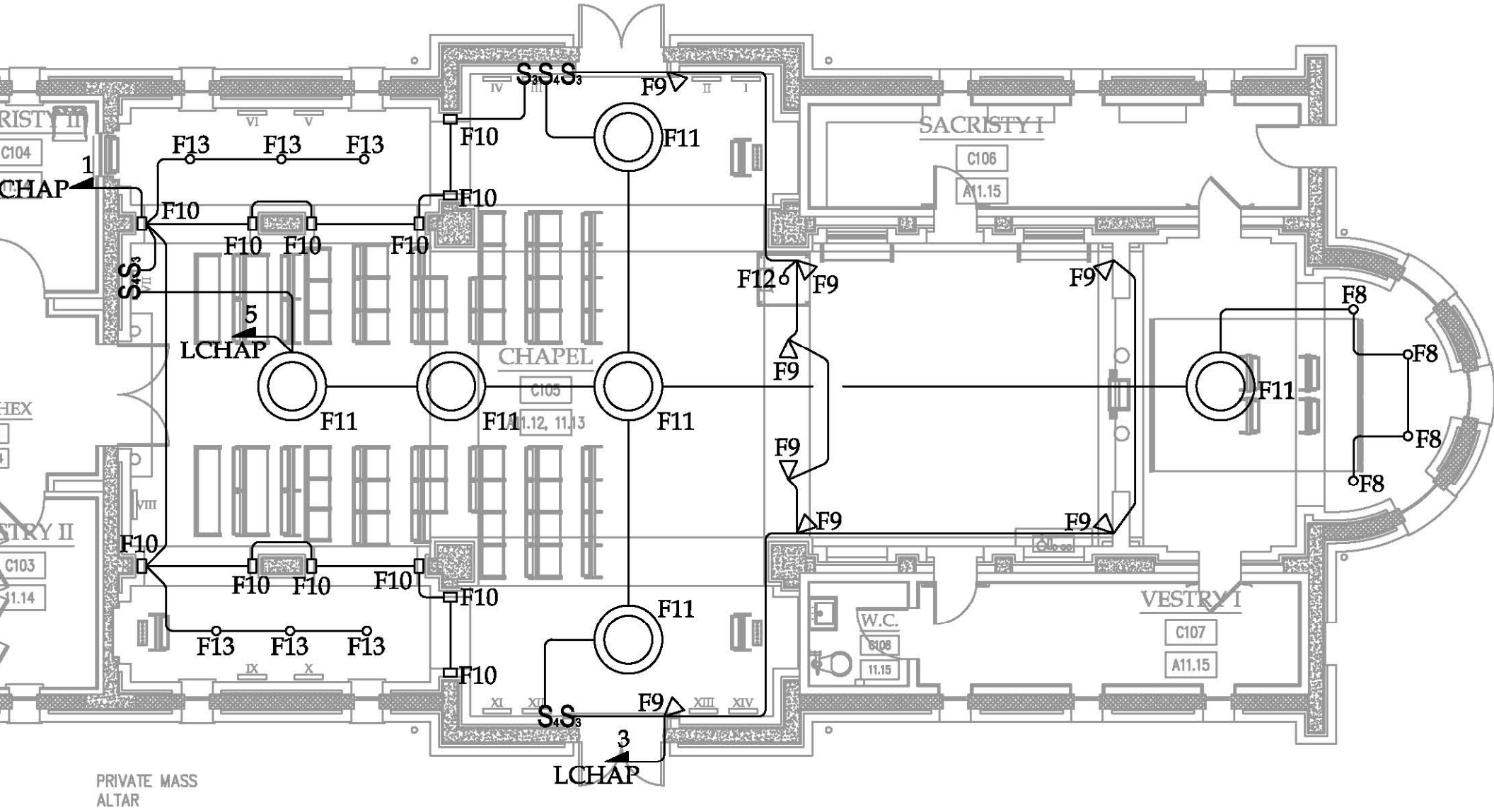
						COPPER								ALUMINUM					
						CONDUCTOR/NEUTRAL			GROUND		CONDUIT			CONDUCTOR/NEUTRAL			GROUND		
OM	TO	FRAME SIZE/ SWITCH SIZE	OVERCURRENT PROTECTION	LENGTH (FT)	NO OF SETS	SIZE	V_{drop}	CLF	SIZE	CLF	SIZE	CLF	NO OF SETS	SIZE	V_{drop}	CLF	SIZE	CLF	SIZE
NS	MDP	2000	2000	85	6	400kcmil	1.20	10.84	#3	1.96	3	26.5	7	500kcmil	1.151353	4.75	#2	1.155	3
DP	ELEV	400	350	60	1	500kcmil	0.79	13.03	#3	1.96	3	26.5	2	4/O	0.90825	2.51	#4	0.9	2
DP	TROUGH	400	400	10	2	3/O	0.15	5.16	#6	1.18	2	12.9	2	250kcmil	0.1530385	2.88	#4	0.9	2 1
DP	L1NE	225	200	125	1	3/O	1.91	5.16	#6	1.18	2	12.9	1	250kcmil	1.9129808	2.88	#4	0.9	2 1
DP	LB1	225	225	15	1	4/O	0.21	6.26	#4	1.665	2	12.9	1	300kcmil	0.2273744	3.59	#2	1.155	2 1
DP	LB2	400	400	126	2	3/O	1.93	5.16	#6	1.18	2	12.9	2	250kcmil	1.9282846	2.88	#4	0.9	2 1
DP	L2NE	225	150	160	1	3/O	1.84	5.16	#6	1.18	2	12.9	1	4/O	2.076	2.51	#4	0.9	2
DP	EDP	600	600	20	2	350kcmil	0.27	9.67	#4	1.665	3	26.5	2	500kcmil	0.2844519	4.75	#2	1.155	3
N	EDP	600	600	85	2	350kcmil	1.17	9.67	#4	1.665	3	26.5	2	500kcmil	1.2089207	4.75	#2	1.155	3
UGH	L1SW	225	225	130	1	4/O	1.82	6.26	#4	1.665	2	12.9	1	300kcmil	1.9705781	3.59	#2	1.155	2 1
UGH	KL-1	225	225	130	1	4/O	1.82	6.26	#4	1.665	2	12.9	1	300kcmil	1.9705781	3.59	#2	1.155	2 1
-1	L2W	100	100	90	1	#2	1.47	2.35	#8	0.86	1 1/4	9.32	1	2/O	1.16775	1.97	#6	0.73	2
P	ELNE	100	100	160	1	#1	2.16	2.86	#8	0.86	1 1/2	10.44	1	2/O	2.076	1.97	#6	0.73	2
P	LCHAP	200	200	100	1	3/O	1.53	5.16	#6	1.18	2	12.9	1	250kcmil	1.5303846	2.88	#4	0.9	2 1
P	ELSW	200	200	130	1	3/O	1.99	5.16	#6	1.18	2	12.9	1	250kcmil	1.9895	2.88	#4	0.9	2 1



D LIGHTING PLAN

"=1'-0"


F14
F16
F17
TYP.
13
LCHAP
F19
F17
CENTER POINT
CLAY PAVER SIDEWALK
BENCH
GRASS
II
III
IV
V
VI
VII
VIII
IX
XI
564
562
560



PEL LIGHTING PLAN

LE: 1/8”=1’-0”