spertus Institute of Jewish Studies

AE481/482 | Lighting/Electrical Option

Technical Report 2 | Electrical Systems Existing Conditions and Building Load Summary

11.04.08

Kanis Glaewketgarn
Consultant: Professor Ted Dannerth

Table of Contents:

Executive Summary

This report describes Electrical Systems Existing Conditions and Building Load Summary of Spertus, Institute of Jewish Studies. Special characteristic of Descriptions and electrical load analysis were developed based on an exploration of the design drawings and specifications provided by architects and engineers. After analyzing the building, it was found that the primary operating voltage throughout the building was 480Y/277V, with the exception of 208Y/120V for lighting and receptacle loads.

In addition, the report also includes single-line diagrams that describe the full extent of existing electrical systems distribution. Two single-line diagrams are provided in the report: one for 208Y/120V and the other for 480Y/277V distribution system. The emergency system and generator are connected to 480Y/277V distribution system. There is a high level of redundancy in design to ensure safety issues and allow for future expansion.

The service entrance sizing methods illustrate that all methods are producing similar loads. Although load per square foot method performed in conceptual/schematic design phase underestimates the actual demand load, it is a good place to start the design. Design development load calculation and actual electrical load from work drawings are comparable. They also show the service entrances are oversized which allow for future expansion.

General Building Statistics:

Building name: **Spertus**

Location and site: **610 South Michigan Ave Chicago, IL 60605**

Building occupant name: **Institute of Jewish Studies**

Occupancy / function types: Institutional facility that includes the following space types:

- **Museum**
- **College**
- **Library**

Size: **155,000 Sq.ft.**

Number of stories above grade: **10 (total levels: 11)**

Primary projects team:

- **Owner: Spertus Institute of Jewish Studies**
- **Architects: Krueck+Sexton Architects**
- **MEP/FP & Tel/Data: Environmental Systems Design**
- **Structural Engineer: Tylk Gustafson Reckers Wilson Andrews**
- **Lighting Design: SPI Design Inc. / Schuler Shook**
- **General Contractor: W.E. O'Neil Construction Co.**
- **Theater Consultant: Schuler Shook**

Dates of construction: **September 2007 – September 2009**

Actual cost information: **$59 million (actual construction cost)**

Project delivery method: **Design-bid-build – GPM**

Single-Line Diagram Drawing List

Electrical one line diagram is provided for each system in the building including 480/277V, 208/120V, and Emergency system. Electrical riser diagram is also provided for ground system, UPS power, and branch conduit. Refer to Appendix A for single-line diagrams.

Sheet Title	Sheet No.
Electrical One Line-Diagram-480/277V	E0.11
Electrical One Line-Diagram-208/120V	E0.12
Electrical One Line-Diagram-Emergency	E0.13
Electrical Riser Diagrams-Grounding	E0.21
Electrical Riser Diagrams	E0.22

FEEDER SCHEDULE

TAG	FROM	TO	# OF SET	CONDUIT (PER SET)		CONDUCTORS (PER SET)									SIZE OF OVER CURRENT PROTECTION	FRAME OR SWITCH SIZE	REMARKS
						PHASE CONDUCTORS			NEUTRAL CONDUCTORS			GROUND					
				SIZE	TYPE	No	SIZE	TYPE	No	SIZE	TYPE	No	SIZE	TYPE			
1	UTILITY	MSWB-1	6	3"	EMT	3	400KCMIL	CU THWN	1	400KCMIL	CU THWN						BY COMED
2	MSWB-1	0MDP-1	4	3"	EMT	3	350KCMIL	CU THWN	1	350KCMIL	CU THWN	1	3/0AWG	CU THWN	1200	1200A/3P	
3	0MDP-1	0M-1	1	3.5"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	3AWG	CU THWN	400	400A/3P	
4	0MDP-1	0M-2	1	3.5"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	3AWG	CU THWN	400	400A/3P	
5	0MDP-1	3M-1	1	3.5"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	3AWG	CU THWN	400	400A/3P	
6	0MDP-1	5M-1	1	3.5"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	3AWG	CU THWN	400	400A/3P	
7	0MDP-1	7M-1	1	3.5"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	3AWG	CU THWN	400	400A/3P	
8	0MDP-1	9M-1	1	3.5"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	3AWG	CU THWN	400	400A/3P	
9	0MDP-1	ATS-3	1	1"	EMT	3	8AWG	CU THWN	1	8AWG	CU THWN	1	10AWG	CU THWN	30	30A/3P	
10	0MDP-2	SP-1	1	.75"	EMT	3	10AWG	CU THWN	1	10AWG	CU THWN	1	10AWG	CU THWN	30	10A/3P	
11	0MDP-2	SE-1	1	.75"	EMT	3	10AWG	CU THWN	1	10AWG	CU THWN	1	10AWG	CU THWN	30	10A/3P	
12	0MDP-2	T-EM3	1	.75"	EMT	3	10AWG	CU THWN	1	10AWG	CU THWN	1	10AWG	CU THWN	30	10A/3P	
13	T-EM3	SP-2	1	.75"	EMT	3	10AWG	CU THWN	1	10AWG	CU THWN	1	10AWG	CU THWN	30	10A/3P	
14	UTILITY	ESWB-1	1	1.5"	EMT	3	1AWG	CU THWN	1	1AWG	CU THWN						BY COMED
15	ESWB-1	T-EM1	1	1.5"	EMT	3	1AWG	CU THWN	1	1AWG	CU THWN	1	6AWG	CU THWN	200	125A/3P	
16	T-EM1	ATS-1	1	2.5"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	3AWG	CU THWN			
17	ATS-2	OE-3	1	1.25"	EMT	3	3AWG	CU THWN	1	3AWG	CU THWN	1	8AWG	CU THWN			
18	ATS-2	OEDP-1	1	2.5"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	3AWG	CU THWN			
19	OEDP-1	OE-1	1	1.25"	EMT	3	3AWG	CU THWN	1	3AWG	CU THWN	1	8AWG	CU THWN	60	60A/3P	
20	OEDP-1	3E-1	1	1.25"	EMT	3	3AWG	CU THWN	1	3AWG	CU THWN	1	8AWG	CU THWN	60	60A/3P	
21	OEDP-1	5E-1	1	2.5"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	3AWG	CU THWN	200	200A/3P	
22	UTILITY	ESWB-2	1	3.5"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	3AWG	CU THWN			BY COMED
23	ESWB-2	ATS-6	1	3.0"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	3AWG	CU THWN	400	400A/3P	
24	GENERATOR	1EDP-1	2	3.5"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	1/0AWG	CU THWN			
25	1EDP-1	ATS-6	1	3.0"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	3AWG	CU THWN	400	400A/3P	
26	1EDP-1	T-EM2	1	1.5"	EMT	3	1AWG	CU THWN	1	1AWG	CU THWN	1	6AWG	CU THWN	200	125A/3P	
27	1EDP-1	ATS-4	1	2.0"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	3AWG	CU THWN	200	200A/3P	
28	1EDP-1	ATS-3	1	1"	EMT	3	8AWG	CU THWN	1	8AWG	CU THWN	1	10AWG	CU THWN	30	30A/3P	

TAG	FROM	TO	# OF SET	CONDUIT (PER SET)		CONDUCTORS (PER SET)									SIZE OF OVER CURRENT PROTECTION	FRAME OR SWITCH SIZE	REMARKS
						PHASE CONDUCTORS			NEUTRAL CONDUCTORS			GROUND					
				SIZE	TYPE	No	SIZE	TYPE	No	SIZE	TYPE	No	SIZE	TYPE			
29	1EDP-1	PORTABLE	2	3.5"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	1/0AWG	CU THWN	800	800A/3P	
30	T-EM2	ATS-2	1	2.5"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	3AWG	CU THWN			
31	10MDP-1	EHC-2	1	2.0"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	3AWG	CU THWN	250	250A/3P	
32	10MDP-1	CHILLER#1	1	2.5"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	1AWG	CU THWN	500	500A/3P	
33	10MDP-1	CHILLER#2	1	2.5"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	1AWG	CU THWN	500	500A/3P	
34	10MDP-1	ELEV-PE1	1	1.5"	EMT	3	1AWG	CU THWN	1	1AWG	CU THWN	1	6AWG	CU THWN	100	100A/3P	
35	10MDP-1	ELEV-PE2	1	1.5"	EMT	3	1AWG	CU THWN	1	1AWG	CU THWN	1	6AWG	CU THWN	100	100A/3P	
36	10MDP-1	ELEV-PE3	1	1.5"	EMT	3	1AWG	CU THWN	1	1AWG	CU THWN	1	6AWG	CU THWN	100	100A/3P	
37	10MDP-1	10M-1	1	3.5"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	3AWG	CU THWN	400	400A/3P	
38	10MDP-1	10M-2	1	3.5"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	3AWG	CU THWN	400	400A/3P	
39	10MDP-1	ATS-4	1	2.0"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	3AWG	CU THWN	200	200A/3P	
40	10EDP-1	ELEV-FE4	1	2.0"	EMT	3	2/0AWG	CU THWN	1	2/0AWG	CU THWN	1	6AWG	CU THWN	200	150A/3P	
41	10EDP-1	T-EM4	1	.75"	EMT	3	10AWG	CU THWN	1	10AWG	CU THWN	1	10AWG	CU THWN	30	30A/3P	
42	T-EM4	11E-1	1	1.0"	EMT	3	3AWG	CU THWN	1	3AWG	CU THWN	1	10AWG	CU THWN			
43	5MDP-1	AHU-1	1	2.0"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	3AWG	CU THWN	250	250A/3P	
44	5MDP-1	SF-1	1	1.0"	EMT	3	3AWG	CU THWN	1	3AWG	CU THWN	1	6AWG	CU THWN	100	100A/3P	
45	5MDP-1	SF-2	1	1.0"	EMT	3	3AWG	CU THWN	1	3AWG	CU THWN	1	6AWG	CU THWN	100	100A/3P	
46	5MDP-1	SF-3	1	1.0"	EMT	3	3AWG	CU THWN	1	3AWG	CU THWN	1	6AWG	CU THWN	100	100A/3P	
47	5MDP-1	SF-4	1	1.0"	EMT	3	3AWG	CU THWN	1	3AWG	CU THWN	1	6AWG	CU THWN	100	100A/3P	
48	5MDP-1	ER-1	1	.75"	EMT	3	8AWG	CU THWN	1	8AWG	CU THWN	1	10AWG	CU THWN	50	50A/3P	
49	5MDP-1	ER-2	1	.75"	EMT	3	8AWG	CU THWN	1	8AWG	CU THWN	1	10AWG	CU THWN	50	50A/3P	
50	5MDP-1	AC5.1	1	1.0"	EMT	3	6AWG	CU THWN	1	6AWG	CU THWN	1	10AWG	CU THWN	60	60A/3P	
51	5MDP-1	AC7.1	1	1.0"	EMT	3	6AWG	CU THWN	1	6AWG	CU THWN	1	10AWG	CU THWN	60	60A/3P	
52	5MDP-1	AC7.2	1	.75"	EMT	3	8AWG	CU THWN	1	8AWG	CU THWN	1	10AWG	CU THWN	40	40A/3P	
53	5MDP-1	EHC-3	1	1.25"	EMT	3	2AWG	CU THWN	1	2AWG	CU THWN	1	8AWG	CU THWN	90	90A/3P	
57	MSWB-2	10MDP-1	5	3"	EMT	3	400KCMIL	CU THWN	1	400KCMIL	CU THWN	1	4/0AWG	CU THWN	1600	1600A/3P	
58	MSWB-2	TVSS-A	1	1.25"	EMT	3	4AWG	CU THWN	1	4AWG	CU THWN	1	8AWG	CU THWN	60	60A/3P	
59	UTILITY	MSWB-2	5	3"	EMT	3	400KCMIL	CU THWN	1	400KCMIL	CU THWN						
60	MSWB-1	5MDP-1	2	3.5"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	1/0AWG	CU THWN	800	800A/3P	
61	MSWB-1	TVSS-A	1	1.25"	EMT	3	4AWG	CU THWN	1	4AWG	CU THWN	1	8AWG	CU THWN	60	60A/3P	

NOTES:
1. REFER TO RISER DIAGRAM FOR FEEDER TAGS
2. ADD PROJECT NOTES HERE

AL=ALUMINUM
CU=COPPER

Summery Description of Distribution System

The power distribution system consists of an electrical service provided by ComEd. Five feeders deliver power to Spertus from the utility company's transformer vault. There are two transformers; each serves 2,000A, 480/227V service entrance switchboard. Another 2,000A, 208/120V service entrance switchboard is served by a separate transformer. Two out of five service entrance switchboards are dedicated for emergency service including fire pump and fire alarm power. A backup diesel generator provides emergency power.

Utility Company Description

ComEd is a utility company under the umbrella of Exelon Company. Its headquarter is located in Chicago. ComEd is currently providing electricity for Spertus. The following chart shows Market Value Energy Charges (MVECs) and Load Weighted Average Market Values (LWAMVs) with June 2006 Billing Period and Ending January 1, 2007. Assume rough total energy consumption of the building is in the range of 800-1,000 KW.

	Summer MVECs			Nonsummer MVECs			
Delivery Service Customer Class	Peak (cents/kWh)	Off-Peak (cents/kWh)	Non-TOU (cents/kWh)	Peak (cents/kWh)	Off-Peak (cents/kWh)	Non-TOU (cents/kWh)	LWAMV (cents/kWh)
Nonresidential (3)							
With Only Watt-hour Only	9.587	4.855	7.384	7.078	4.989	5.989	6.787
0 to 25 kW	9.502	4.813	7.191	7.038	4.955	5.936	6.701
Over 25 to 100 kW	9.417	4.813	7.089	7.037	4.966	5.924	6.633
Over 100 to 400 kW	9.260	4.666	6.883	6.996	4.934	5.888	6.496
Over 400 to 800 kW	9.207	4.655	6.799	6.972	4.903	5.822	6.416
Over 800 to 1,000 kW	9.168	4.574	6.758	6.966	4.875	5.811	6.374
Over 1,000 to 3,000 kW	9.031	4.488	6.582	6.876	4.786	5.696	6.224
Over 3,000 to 6,000 kW	9.031	4.481	6.480	6.866	4.739	5.622	6.137
Over 6,000 to 10,000 kW	9.003	4.489	6.407	6.881	4.718	5.588	6.081
Over 10,000 kW	8.798	4.388	6.195	6.751	4.604	5.448	5.903

Visit ComEd website at http://www.exeloncorp.com/ourcompanies/comed/

Service Entrance

The service entrance is located at the north-western corner of the building and consists of one electrical vault and five service entrances. Four out of five service entrances are converted to 480Y/277V mainly serve mechanical equipments and emergency services. One service entrance is 208Y/120V to sever lighting and communication loads. Transformers at service entrances are provide by ComEd.

Voltage Systems

A combination of 480Y/277V, 3-phase, 4-wire and 208Y/120V, 3-phase, 4-wire voltages are utilized in the building. Majority of lighting system is served by 120V, while most of mechanical equipments are fed from 480Y/277V, 3-phase service.

Emergency Power Systems

There are two systems serving emergency services in this building. Two service entrances are connected to automatic transfer switches that are also tied to on-site emergency generator. On-site emergency generator is a 450kW, 480/277V, 3PH, 4W, AC diesel power generator. The two systems are connected to two automatic transfer switches that serve emergency fire pump, fire alarm power, emergency lighting system, elevators and mechanical equipments including sewage ejector and sump pumps. The emergency system is in conformance with the Chicago building code, article 18-27-700. Separate neutral wires are also provided for all exit signs and emergency lighting circuits. The building also has 30Kva UPS battery system located in the main electrical room in the basement. This system provides backup power for at least 30 minutes in the event of power loss. This allows data to be backed up before the information systems power down.

Location of Switchgear

There are total of five main switchboards in which two of them are for emergency services. All main switchboards are located in the main electrical switchgear room in the basement of the building. There are seven 208/120V distribution located on every other floors in the electrical closets to serve lighting and communication systems. Three 480/277V mechanical distribution panels are located on the first, fifth, and tenth floor of the building. There are four emergency distribution panels in which three of them are 480/277V located in the basement, first floor, and penthouse. One 208/120V emergency distribution panel is located in the basement. Most of the panel boards are located in either the electrical closet or mechanical room on odd number floors. There are three panel boards that are located in the vestibule adjacent to the theater on the third level.

MAJOR EQUIPMENT LOCATION SCHEDULE					
Tag	**Type of Equipment**	**Floor Level**	**Room No.**	**Room Name**	**Drawings**
MSWB-1	480/277V Main Switchboard	Basement	L-09	Main Electrical Switchgear	E2.00
MSWB-2	480/277V Main Switchboard	Basement	L-09	Main Electrical Switchgear	E2.00
GSWB-1	208/120V Main Switchboard	Basement	L-09	Main Electrical Switchgear	E2.00
OMDP-1	480/277V Mechanical Distribution Panel	First Floor	101	Workshop	E2.01
10MDP-1	480/277V Mechanical Distribution Panel	Tenth Floor	1006	Electrical Closet	E2.10
5MDP-1	480/277V Mechanical Distribution Panel	Fifth Floor	501	Mechanical	E2.05
9G-1	208/120V Distribution Panel	Ninth Floor	904	Electrical Room	E2.09
11G-1	208/120V Distribution Panel	Penthouse	1101	Mechanical Penthouse	E2.11
0G-1	208/120V Distribution Panel	Basement	L-09	Main Electrical Switchgear	E2.00
3G-1	208/120V Distribution Panel	Third Floor	302	Vestibule	E2.03
5G-1	208/120V Distribution Panel	Fifth Floor	502	Electrical Closet	E2.05
7G-1	208/120V Distribution Panel	Seventh Floor	705	Electrical Closet	E2.07
T-C1	480-208/120V Transformer	N/A	N/A	N/A	N/A
T-C2	208-208/120V Transformer	N/A	N/A	N/A	N/A
T-EM1	480-208/120V Transformer	Basement	L-10	Central Housekeeping	E2.00
T-EM2	480-208/120V Transformer	Basement	L-06	Transfer Switch Room	E2.00
T-EM3	480-240/120V Transformer	Basement	L-05	Maint. Workroom	E2.00
T-EM4	480-240/120V Transformer	Penthouse	1102	Machine Room	E2.11
ESWB-1	480/277V Emergency Service Switch	Basement	L-10	Central Housekeeping	E2.00
ESWB-2	480/277V Emergency Service Switch	Basement	L-27	Fire B. Pump/Water Meter Room	E2.00
1EDP-1	480/277V Emergency Distribution Panel	First Floor	104	Emergency Generator	E2.01
11EDP-1	480/277V Emergency Distribution Panel	Penthouse	1102	Machine Room	E2.11
OEDP-1	208/120V Emergency Distribution Panel	Basement	L-10	Central Housekeeping	E2.00
OEDP-2	480/277V Emergency Distribution Panel	Basement	L-06	Transfer Switch Room	E2.00
ATS-1	208/120V Transfer Switch	Basement	L-06	Transfer Switch Room	E2.00
ATS-2	208/120V Transfer Switch	Basement	L-10	Central Housekeeping	E2.00
ATS-3	480/277V Transfer Switch	Basement	L-05	Maint. Workroom	E2.01
ATS-4	480/277V Transfer Switch	Penthouse	1102	Machine Room	E2.11
G	480/277V Diesel Generator	First Floor	104	Emergency Generator	E2.01

PANELBOARDS						
Tag	**Voltage**	**Main Size**	**Floor**	**Room No.**	**Room Name**	**Drawing**
0G-2	208/120 3P/4W	150A MLO	Basement	L-09	Main Electrical Switchgear	E2.00
0G-3	208/120 3P/4W	150A MLO	Basement	L-09	Main Electrical Switchgear	E2.00
0G-4	208/120 3P/4W	150A MLO	Basement	L-09	Main Electrical Switchgear	E2.00
3G-2	208/120 3P/4W	150A MLO	Third Floor	302	Vestibule	E2.03
3G-3	208/120 3P/4W	225A MLO	Third Floor	302	Vestibule	E2.03
3G-4	208/120 3P/4W	150A MLO	Third Floor	302	Vestibule	E2.03
5G-2	208/120 3P/4W	225A MLO	Fifth Floor	502	Electrical Closet	E2.05
5G-3	208/120 3P/4W	150A MLO	Fifth Floor	502	Electrical Closet	E2.05
7G-2	208/120 3P/4W	150A MLO	Seventh Floor	705	Electrical Closet	E2.07
7G-3	208/120 3P/4W	225A MLO	Seventh Floor	705	Electrical Closet	E2.07
9G-2	208/120 3P/4W	225A MLO	Ninth Floor	904	Electrical Room	E2.09
9G-3	208/120 3P/4W	150A MLO	Ninth Floor	904	Electrical Room	E2.09
11G-2	208/120 3P/4W	150A MLO	Penthouse	1101	Machanical Penthouse	E2.11
11G-3	208/120 3P/4W	150A MLO	Penthouse	1101	Machanical Penthouse	E2.11
0C-1	208/120 3P/4W	100A MCB	Basement	L-09	Main Electrical Switchgear	E2.00
3C-1	208/120 3P/4W	175A MCB	Third Floor	302	Vestibule	E2.03
0U-1	208/120 3P/4W	60A MCB	Basement	L-09	Main Electrical Switchgear	E2.00
5U-1	208/120 3P/4W	100A MCB	Fifth Floor	502	Electrical Closet	E2.05
0E-1	208/120 3P/4W	60A FUSE	Basement	L-09	Main Electrical Switchgear	E2.00
0E-2	120 MULT 1P	N/A	Basement	L-09	Main Electrical Switchgear	E2.00
0E-3	208/120 3P/4W	60A FUSE	Basement	L-09	Main Electrical Switchgear	E2.00
3E-1	208/120 3P/4W	60A FUSE	Third Floor	302	Vestibule	E2.03
2E-1	120 MULT 1P	N/A	Second Floor	202	Dimmer Room	E2.02
5E-1	208/120 3P/4W	60A FUSE	Fifth Floor	502	Electrical Closet	E2.05
7E-1	208/120 3P/4W	60A FUSE	Seventh Floor	705	Electrical Closet	E2.07
9E-1	208/120 3P/4W	60A FUSE	Ninth Floor	904	Electrical Room	E2.09
9E-2	120 MULT 1P	N/A	Ninth Floor	904	Electrical Room	E2.09
11E-1	240/120 2P/3W	50A FUSE	Penthouse	1101	Machanical Penthouse	E2.11
0L-1	208/120 3P/4W	100A MLO	Basement	L-09	Main Electrical Switchgear	E2.00
3L-1	208/120 3P/4W	100A MLO	Third Floor	302	Vestibule	E2.03
5L-1	208/120 3P/4W	100A MLO	Fifth Floor	502	Electrical Closet	E2.05
7L-1	208/120 3P/4W	100A MLO	Seventh Floor	705	Electrical Closet	E2.07
9L-1	208/120 3P/4W	100A MLO	Ninth Floor	904	Electrical Room	E2.09
0L-2	208/120 3P/4W	100A MLO	Basement	L-09	Main Electrical Switchgear	E2.00
5L-2	208/120 3P/4W	100A MLO	Fifth Floor	502	Electrical Closet	E2.05
5L-3	208/120 3P/4W	100A MLO	Fifth Floor	502	Electrical Closet	E2.05
9L-2	208/120 3P/4W	100A MLO	Ninth Floor	904	Electrical Room	E2.09
9L-3	208/120 3P/4W	100A MLO	Ninth Floor	904	Electrical Room	E2.09
9L-4	208/120 3P/4W	100A MLO	Ninth Floor	904	Electrical Room	E2.09
9L-5	208/120 3P/4W	100A MLO	Ninth Floor	904	Electrical Room	E2.09
9L-6	208/120 3P/4W	100A MLO	Ninth Floor	904	Electrical Room	E2.09
9L-7	208/120 3P/4W	100A MLO	Ninth Floor	904	Electrical Room	E2.09
9L-8	208/120 3P/4W	100A MLO	Ninth Floor	904	Electrical Room	E2.09
9L-9	208/120 3P/4W	100A MLO	Ninth Floor	904	Electrical Room	E2.09
0M-1	480/277 3P/4W	400A MLO	Basement	L-09	Main Electrical Switchgear	E2.00
0M-2	480/277 3P/4W	400A MLO	Basement	L-09	Main Electrical Switchgear	E2.00

PANELBOARDS						
Tag	**Voltage**	**Main Size**	**Floor**	**Room No.**	**Room Name**	**Drawing**
3M-1	480/277 3P/4W	400A MCB	Third Floor	302	Vestibule	E2.03
5M-1	480/277 3P/4W	400A MCB	Fifth Floor	502	Electrical Closet	E2.05
7M-1	480/277 3P/4W	400A MCB	Seventh Floor	705	Electrical Closet	E2.07
9M-1	480/277 3P/4W	400A MCB	Ninth Floor	904	Electrical Room	E2.09
9M-2	480/277 3P/4W	400A MLO	Ninth Floor	904	Electrical Room	E2.09
10M-1	480/277 3P/4W	225A MLO	Tenth Floor	1006	Electrical Closet	E2.10
10M-2	480/277 3P/4W	400A MLO	Tenth Floor	1006	Electrical Closet	E2.10

Over-Current Devices

The main over-current device in the main service entrance switchboards are circuit breaker. There are two 2000A circuit breakers protecting all 480/277V distribution panels (excluding emergency distribution panels). 208/120V distribution panels are also protected by 2000A circuit breaker. The branch circuits in the main service entrance switchboards are protected by circuit breakers. In the emergency main service entrances, branch over-current devices are fuse protected.

Transformers

The transformers for main service entrances are provided by the utility company, ComEd. The two main transformers are step-down transformer to convert 480V to 208/120V in emergency service system.

INDIVIDUAL TRANSFORMER SCHEDULE							
Tag	**Primary Voltage**	**Secondary Voltage**	**Size (kVA)**	**Type**	**Temp. Rise**	**Taps**	**Mounting**
T-EM1	480	208/120	75	Dry	90°C in a 40°C ambient	(2)2.5%	Pad on floor
T-EM2	480	208/120	75	Dry	90°C in a 40°C ambient	(2)2.5%	Pad on floor
T-EM3	480	240/120	9	Dry	90°C in a 40°C ambient	(2) 5%	Pad on floor
T-EM4	480	240/120	2	Dry	90°C in a 40°C ambient	(2) 5%	Pad on floor
T-C1	208	208/120	30	Isolation	N/A	N/A	Isolation Pad
T-C2	208	208/120	45	Isolation	N/A	N/A	Isolation Pad

Special Equipments

No capacitors for power factor correction are located in the building. However the building has uninterruptable power supply of 30kVA/ 24kVA, .8 PF unit with 208V in and 208/120V out. The system is equipped with 30 minute duration battery cabinet at 24KW load. The UPS is located in the main electrical room in the basement.

Lighting Loads

General ambient light is provided by a combination of halogen downlight and fluorescent direct light that is integrated with ceiling grid system. High intensity discharge source is utilized to illuminate lobby atrium and sculpture wall. The museum space is equipped with recessed track system allowing for flexibility and control.

Lighting Loads											
Fixture type	**Lamp Type**	**Lamp Wattage**	**# of Lamps**	**Ballast Type**	**Operating Voltage**	**luminaire Input Watts**	**Ballast Factor**	**Start Current**	**Operating Current**	**Start Power factor**	**Operating Power Factor**
L2	Halogen MR11	20	1	n/a	12	20	n/a	n/a	n/a	n/a	n/a
L3	Ceramic Metal Halide	39	1	Integral Magnetic Ballast	120	55	1	0.45	0.5	n/a	0.9
L5	Halogen MR16	50	1	n/a	12	50	n/a	n/a	n/a	n/a	n/a
L5b	Halogen MR16	50	1	n/a	12	50	n/a	n/a	n/a	n/a	n/a
L6	Compact Fluorescent	26	1	Integral Electronic Ballast	120	26	1.1	n/a	0.24	n/a	0.98
L8	Halogen PAR30	75	1	n/a	120	75	n/a	n/a	n/a	n/a	n/a
L12	Halogen PAR30	75	1	n/a	120	75	n/a	n/a	n/a	n/a	n/a
L12b	Halogen MR16	50	1	n/a	12	50	n/a	n/a	n/a	n/a	n/a
L12c	Halogen MR16	50	1	n/a	12	50	n/a	n/a	n/a	n/a	n/a
L14	Linear Fluorescent	32	1	Integral Electronic Ballast	120	34	0.9	n/a	0.29	n/a	0.98
L14b	Linear Fluorescent	25	1	Integral Electronic Ballast	120	28	0.95	n/a	0.24	n/a	0.98
L14c	Linear Fluorescent	17	1	Integral Electronic Ballast	120	22	1	n/a	0.19	n/a	0.97
L15	Linear Fluorescent	32	1	Integral Electronic Ballast	120	34	0.9	n/a	0.29	n/a	0.98
L16	Linear Fluorescent	32	1	Integral Electronic Ballast	120	34	0.9	n/a	0.29	n/a	0.98
L17	Compact Fluorescent	40	2	Integral Electronic Ballast	120	40	1	n/a	0.4	n/a	0.98
L18	Linear Fluorescent	32	2	Integral Electronic Ballast	120	63	0.88	n/a	0.53	n/a	0.99
L19	Linear Fluorescent	32	3	Integral Electronic Ballast	120	91	0.88	n/a	0.78	n/a	0.99
L21	Linear Fluorescent	32	1	Integral Electronic Ballast	120	34	0.9	n/a	0.29	n/a	0.98
L22	Linear Fluorescent	32	2	Integral Electronic Ballast	120	63	0.88	n/a	0.53	n/a	0.99
L31a	Ceramic Metal Halide	70	7	Integral Electronic Ballast	120	658	1	2.5	2.1	n/a	0.35
L31b	Ceramic Metal Halide	70	7	Integral Electronic Ballast	120	658	1	2.5	2.1	n/a	0.35
L32	Ceramic Metal Halide	70	7	Integral Electronic Ballast	120	658	1	2.5	2.1	n/a	0.35
L33	Linear Fluorescent	32	1	Integral Electronic Ballast	120	34	0.9	n/a	0.29	n/a	0.98

Mechanical and Other Loads

The central plant consists of two 149 tons air cooled packaged liquid chillers with R-134 refrigerant located on the roof and electric heating coils located in AHUs. 60,000 CFM air handling unit locates on the 5th floor. It distributes air to basement-7th floor. While 40,000 CFM air handling unit located on the roof supplies air to 7th-10th floor. Air is supplied to series of fan powered variable air volume units to supply air. 2,400 gallon bladder expansion tanks are located in the mechanical room on the fifth floor. Two chillers for air conditioning are rated at 150 tons in cooling capacity.

Mechanical Equipment Loads									
Load Tag	Load Description	Loads Amps	Loads HP	Motor Amps	Phases	Voltage	Assumed Power Factor	Equivalent Load in Kva	Equivalent Load in KW
AC-1	Air compressor - fire protection	10	1	16	1	120	0.83	1.9	1.6
AC-5.1	Museum storage 408 AC unit - 5 tons	39	n/a	n/a	3	480	n/a	32.0	n/a
AC-7.1	Archives 703 AC unit - 5 tons	39	n/a	n/a	3	480	n/a	32.0	n/a
AC-7.2	Conservation 701 AC unit - 3 tons	26	n/a	n/a	3	480	n/a	22.0	n/a
BB-A	West Elevation Baseboard heater	13	n/a	n/a	1	277	n/a	3.5	n/a
BB-B	East Elevation Baseboard heater	13	n/a	n/a	1	277	n/a	3.5	n/a
CH-1	Chiller - 150 tons	288	n/a	n/a	3	480	n/a	185.0	n/a
CH-2	Chiller - 150 tons	288	n/a	n/a	3	480	n/a	185.0	n/a
CUH-A	Stairway cabinet unit heater	15	n/a	n/a	3	480	n/a	12.0	n/a
CUH-B	Stairway cabinet unit heater	18	n/a	n/a	3	480	n/a	15.0	n/a
CHWP-1	Chilled water pump	34	25	34	3	480	0.92	28.3	26.0
CHWP-2	Chilled water pump	34	25	34	3	480	0.92	28.3	26.0
DC-1	Dry cooler	14	10	14	3	480	0.92	11.6	10.7
DCS-1	Dust collector system	5	2	3.4	3	480	0.85	2.8	2.4
EF-A	4th floor exhaust fans	4	0.25	5.8	1	120	0.75	0.7	0.5
EF-1	Comed exhaust fan	5	3	4.8	3	480	0.86	4.0	3.4
EF-2	Comed exhaust fan	5	3	4.8	3	480	0.86	4.0	3.4
EF-3	Generator room exhaust fan	5	0.33	7.2	1	120	0.76	0.9	0.7
EF-4	Loading dock exhaust fan	6	5	56	1	120	0.88	6.7	5.9
EF-5	Workshop exhaust fan	5	0.33	7.2	1	120	0.76	0.9	0.7
EF-6	Atrium exhaust fan	21	15	21	3	480	0.91	17.5	15.9
EF-7	Atrium exhaust fan	4	2	3.4	1	480	0.84	2.8	2.4
EF-8	Conservation center exhaust fan	4	0.25	5.8	1	120	0.73	0.7	0.5
EF-9	Pantry 905 exhaust fan	4	0.25	5.8	1	120	0.73	0.7	0.5
EF-10	Toilet/Locket room exhaust fan	3	1.5	3	3	480	0.83	2.5	2.1
EF-11	Toilet/Locket room exhaust fan	6	0.5	9.8	1	120	0.81	1.2	1.0
EF-12	Atrium exhaust fan	27	20	n/a	1	480	0.91	n/a	n/a
EF-13	Atrium exhaust fan	27	20	n/a	1	480	0.91	n/a	n/a
EF-14	Switchgear room exhaust fan	5	0.33	7.2	1	120	0.76	0.9	0.7
EF-15	Kitchen/copy room 510 exhaust fan	3	0.1	4.4	1	120	0.75	0.5	0.4
ER-1	AHU-1 Exhaust fan	27	20	27	3	480	0.91	22.4	20.4
ER-2	AHU-1 Exhaust fan	27	20	27	3	480	0.91	22.4	20.4
ER-3	AHU-2 Exhaust fan	21	15	21	3	480	0.9	17.5	15.7
ER-4	AHU-2 Exhaust fan	21	15	21	3	480	0.9	17.5	15.7
EHC-1	Electric heating coil AHU-1	217	n/a	n/a	3	480	n/a	180.0	n/a
EHC-2	Electric heating coil AHU-2	217	n/a	n/a	3	480	n/a	180.0	n/a
EHC-3	Electric heating coil Auditorium	60	n/a	n/a	3	480	n/a	50.0	n/a
EHC-L.1	Electric heating coil basement	17	n/a	n/a	1	120	n/a	2.0	n/a
ELEV-PE1	Passenger Elevator	52	40	52	3	480	0.93	43.2	40.2
ELEV-PE2	Passenger Elevator	52	40	52	3	480	0.93	43.2	40.2
ELEV-PE3	Passenger Elevator	52	40	52	3	480	0.93	43.2	40.2
ELEV-PE4	Freight Elevator	96	75	124	3	480	0.95	103.1	97.9

Load Tag	Load Description	Loads Amps	Loads HP	Motor Amps	Phases	Voltage	Assumed Power Factor	Equivalent Load in Kva	Equivalent Load in KW
EWC-1	Electric water cooler	n/a	n/a	n/a	1	120	n/a	n/a	n/a
EWC-2	Electric water cooler	n/a	n/a	n/a	1	120	n/a	n/a	n/a
FCU-L.1	Net-pop room fan coil unit	n/a	n/a	n/a	1	120	n/a	n/a	n/a
FCU-L.2	Photo studio fan coil unit	n/a	n/a	n/a	1	120	n/a	n/a	n/a
FCU-2.1	Dimmer room fan coil unit	n/a	n/a	n/a	1	120	n/a	n/a	n/a
FCU-4.1	Data room fan coil unit	n/a	n/a	n/a	1	120	n/a	n/a	n/a
FCU-5.1	Electric room fan coil unit	n/a	n/a	n/a	1	120	n/a	n/a	n/a
FCU-7.1	Electric room fan coil unit	n/a	n/a	n/a	1	120	n/a	n/a	n/a
FCU-8.1	TR room fan coil unit	n/a	n/a	n/a	1	120	n/a	n/a	n/a
FCU-9.1	Elevator machine room fan coil unit	n/a	n/a	n/a	1	120	n/a	n/a	n/a
FCU-10.1	TR room fan coil unit	n/a	n/a	n/a	1	120	n/a	n/a	n/a
FCU-11.1	Elevator machine room fan coil unit	7	1.5	10	1	277	0.83	2.8	2.3
FCU-11.2	Elevator machine room fan coil unit	7	1.5	10	1	277	0.83	2.8	2.3
FP-1	Fire pump	156	125	156	3	480	0.94	129.7	121.9
FPB-A	Fan powered box	1	0.17	2.2	1	277	0.75	0.6	0.5
FPB-B	Fan powered box	1.5	0.25	2.9	1	277	0.76	0.8	0.6
FPB-C	Fan powered box	1.5	0.25	2.9	1	277	0.76	0.8	0.6
FPB-D	Fan powered box	2	0.33	3.6	1	277	0.75	1.0	0.7
FPB-E	Fan powered box	2	0.33	3.6	1	277	0.75	1.0	0.7
FPB-F	Fan powered box w/ electric heat	n/a	0.17	2.2	1 or 3	277/480	0.75	0.6	0.5
FPB-G	Fan powered box w/ electric heat	n/a	0.25	2.9	1 or 3	277/480	0.76	0.8	0.6
FPB-H	Fan powered box w/ electric heat	n/a	0.25	2.9	1 or 3	277/480	0.76	0.8	0.6
FPB-I	Fan powered box w/ electric heat	n/a	0.33	3.6	1 or 3	277/480	0.75	1.0	0.7
FPB-J	Fan powered box w/ electric heat	n/a	0.33	3.6	1 or 3	277/480	0.75	1.0	0.7
JP-1	Jockey pump	5	2	3.4	3	480	0.85	2.8	2.4
H-1	AHU-2 Humidifier - stage #1	44	n/a	n/a	3	480	n/a	36.0	n/a
H-2	AHU-2 Humidifier - stage #2	44	n/a	n/a	3	480	n/a	36.0	n/a
SF-1	AHU-1 Supply fan	40	30	40	3	480	0.91	33.3	30.3
SF-2	AHU-1 Supply fan	40	30	40	3	480	0.91	33.3	30.3
SF-3	AHU-1 Supply fan	40	30	40	3	480	0.91	33.3	30.3
SF-4	AHU-1 Supply fan	40	30	40	3	480	0.91	33.3	30.3
SF-5	AHU-2 Supply fan	34	25	34	3	480	0.91	28.3	25.7
SF-6	AHU-2 Supply fan	34	25	34	3	480	0.91	28.3	25.7
SF-7	AHU-2 Supply fan	34	25	34	3	480	0.91	28.3	25.7
SF-8	AHU-2 Supply fan	34	25	34	3	480	0.91	28.3	25.7
UH-A	Typical unit heater	6	n/a	n/a	3	480	n/a	5.0	n/a
UH-B	Loading dock unit heater	42	n/a	n/a	3	480	n/a	35.0	n/a
UH-C	Penhouse unit heater	18	n/a	n/a	3	480	n/a	15.0	n/a
VAV	Variable air volume terminal unit	n/a	n/a	n/a	1 or 3	277/480	n/a	n/a	n/a
WH-1	Water heater - 5 gallon	17	n/a	n/a	3	120	n/a	2.0	n/a
WH-2	Water heater - 10 gallon	29	n/a	n/a	3	208	n/a	6.0	n/a
WH-3	Water heater - 20 gallon	29	n/a	n/a	3	208	n/a	6.0	n/a
WH-4	Water heater - 30 gallon	25	n/a	n/a	3	208	n/a	9.0	n/a
WH-5	Water heater - 40 gallon	34	n/a	n/a	3	208	n/a	12.0	n/a
WH-6	Water heater - 66 gallon	34	n/a	n/a	3	208	n/a	12.0	n/a
WH-7	Water heater - 88 gallon	22	n/a	n/a	3	480	n/a	18.0	n/a
Total								**1916.0**	**754.7**

Plumbing Equipment Loads									
Load Tag	**Load Description**	**Loads Amps**	**Loads HP**	**Motor Amps**	**Phases**	**Voltage**	**Assumed Power Factor**	**Equivalent Load in Kva**	**Equivalent Load in KW**
HP-1	House pump	42	30	40	3	480	0.92	33.3	30.6
SE-1	sewage ejector	4	1.5	3	3	480	0.82	2.5	2.0
SP-1	Sump pump - drain tile	6	3	4.8	3	480	0.85	4.0	3.4
SP-2	Sump pump - electrical rooms	5	0.33	3.6	1	120	0.76	0.4	0.3
SP-3	Sump pump - elevator pit	5	0.33	3.6	1	120	0.76	0.4	0.3
Total								**40.6**	**36.7**

Service Entrance Size

Service Entrance Size - Summary Table			
Phase	**Load-KVA**	**Voltage System**	**Load - Amps**
Conceptual/ Schematic Design	1767.53	480Y/277V	2126.01
Design Development	3645.35	480Y/277V	4384.67
Working Drawings	459.11	208Y/120V	1274.36
Working Drawings	1696.4	480Y/277V	2450.45
Actual Conditions - Service Entrance 1	n/a	480Y/277V	2000.00
Actual Conditions - Service Entrance 2	n/a	480Y/277V	1600.00
Actual Conditions - Service Entrance 3	n/a	208Y/120V	2000.00
Actual Conditions - Service Entrance 4	n/a	480Y/277V	200.00
Actual Conditions - Service Entrance 5	n/a	480Y/277V	400.00
Total Actual Conditions - All Services		n/a	**6200.00**

Concept/Schematic Phases - Load per Square Foot			
Space Type	**VA/Sq.ft.**	**Area (Sq.ft.)**	**kVA**
Museum	14	26850	375.9
Library	11	13425	147.675
Office	12	71440	857.28
Classroom	12	9110	109.32
Arena	13	5920	76.96
Student Union	13	15415	200.395
	Total	**142160**	**1767.53**
	Total Amperage @ 480V		**2126.01**

Design Development - NEC Loading				
Type of Load	**VA/Sq.ft.**	**Sq.ft.**	**Demand Factor**	**kVA**
Office Lighting	3.5	58015	1	203.05
Store Lighting	3	1670	1	5.01
School Lighting	3	22535	1	67.61
Assembly/Auditoriums Lighting	1	48190	1	48.19
Restaurant Lighting	2	2000	1	4.00
Storage Space Lighting	0.25	13425	1	3.36
Receptacles	1	145000	10000 VA @ 1.0, .5	77.50
Central Heating System	2.8 [1]	145000	1	406.00
Central Fan System	4 [1]	145000	1	580.00
Perimeter Heating / Ventilation System	9.7 [1]	145000	1	1406.50
Chiller Plant	5.8 [1]	145000	1	841.00
Warming Kitchen	10	280	1	2.80
Electric Water Heaters	60 kw per	4 units	1	0.24
Elevators	25 kw per	4 units	1	0.1
			Total	**3645.35**

[1] VA/Sq.ft. provided by the engineer

Working Drawings - Actual Loading for 208Y/120V			
Load Description	**Demand Factor**	**Load KVA**	**Demand Load KVA**
Lighting	n/a	n/a	331.21
Receptacles	n/a	n/a	77.50
Computer	0.8	15	12.00
Mechanical	0.8	63	50.40
		Total (KVA)	**471.11**
		Total Amperage @ 208V	**1307.67**

Working Drawings - Actual Loading for 480Y/277V			
Load Description	**Demand Factor**	**Load KVA**	**Demand Load KVA**
Mechanical	1	1506	1506.00
Elevators	0.5	238	119.00
		Total (KVA)	**1625.00**
		Total Amperage @ 480V	**2347.32**

Environmental Stewardship Design

- Photocell is integrated to lighting system along the east façade of the building to adjust light level accordingly to daylight contribution. Dimming ballast must be provided for light fixtures in these areas.

- Automated on/off lighting control is utilized in library, open office and work area, and other common areas to help save energy when the spaces are not being occupied. Lights on and off based on the different schedules depending on type of space and its duration of occupancy. Light switch in room control on-off operation of lights. Flash light will occur two minutes before lights turn off. If 'on' button is pressed, lights in that zone are to remain on

- Occupancy sensor technology is also utilized throughout the building. There are three occupancy sensor wiring configurations being used in this building including:
    - Multiple ceiling mounted sensors – one switch – no greater than 600 watts load
    - Ceiling mounted sensor – one switch – no greater than 600 watts load
    - Multiple ceiling mounted sensors – one switch – greater than 600 watts load

Design Issues

Since the building is 11 storeys tall, it is appropriate to provide electrical closets on every other floor. Voltage drop may be an issue when branch circuit gets further away from distribution panels.

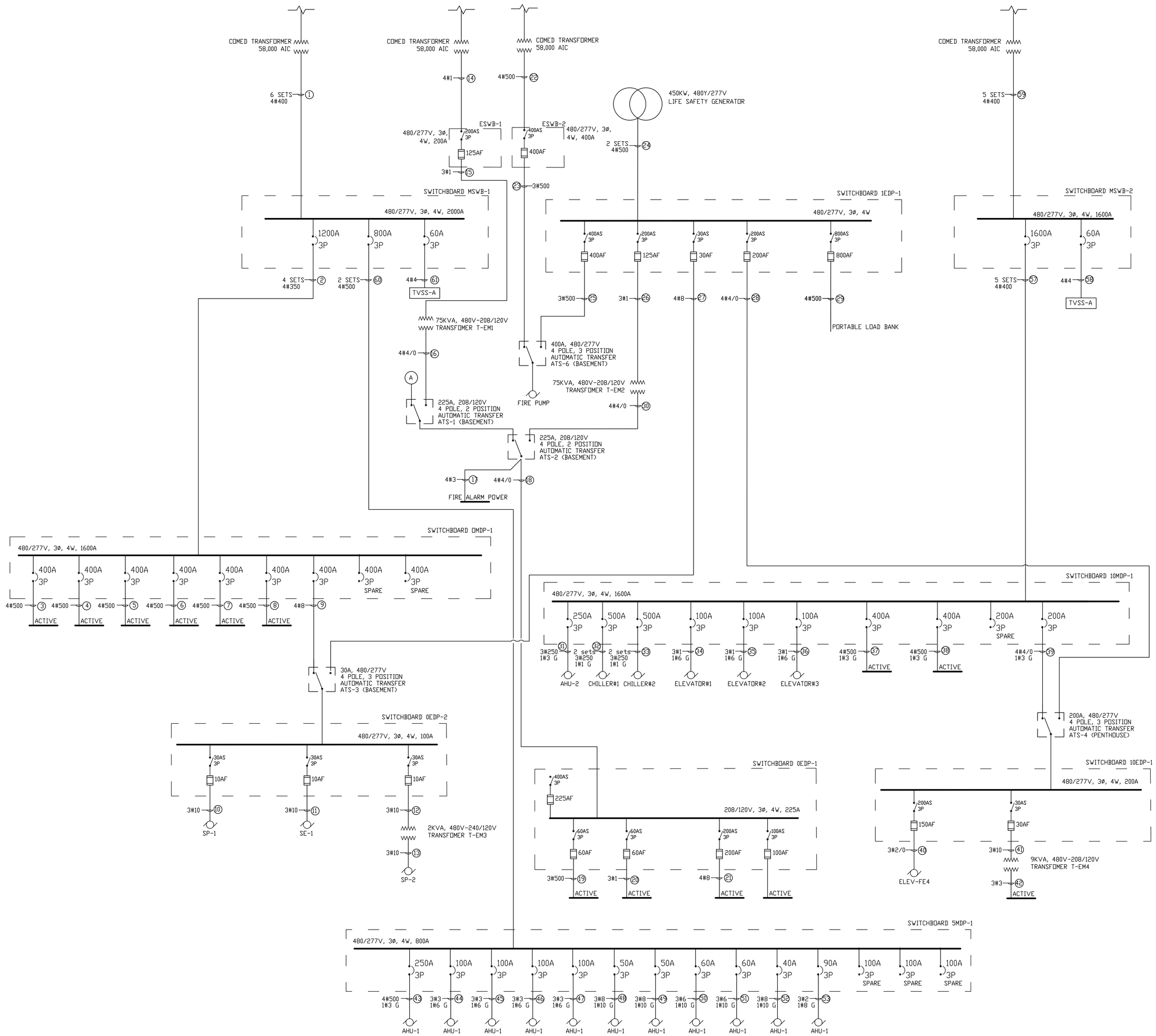
Communication Systems

- Fire Alarm System
    - The fire alarm system is normally powered by its own feeder from ESWB-1 emergency service entrance switchboard. If power is lost, automatic transfer switch ATS-2 switches the power source to the emergency generator. This system includes heat detector, smoke detector, beam detector, sensors, voice communication speaker with visual alarm device, light safety alarm notification light, and manual pull boxes located throughout the building.

- Information Technology System
    - The main NET POP/ Data closet is located in the basement of the building. It supplies data through 100 PAIR ARMM to serve sub data closets on the fourth, sixth, eighth, and tenth floor and main sever room on the fifth floor. Data outlets are located throughout the building, to provide service for computers, phones, and AV equipment

- Security System
    - The security system includes door contacts, card readers, electric strike, security closed circuit television system outlet, and video cameras.

Appendix A
Single-Line Diagrams



OWNER:
SPERTUS INSTITUTE OF JEWISH STUDIES
610 South Michigan Avenue, Chicago IL 60605

PROJECT MANAGEMENT:
INST. PROJECT MANAGEMENT
1 East Jackson Boulevard, Chicago IL 60604
Tel 312 362 8856 Fax 312 362 5907
U.S. EQUITIES DEVELOPMENT
20 North Michigan Avenue, Chicago IL 60602
Tel 312 456 7000 Fax 312 456 0054

ARCHITECT OF RECORD:
KRUECK ■ SEXTON
221 West Erie, Chicago IL 60610
TEL 312 787 0056 FAX 312 787 8415

ASSOCIATED ARCHITECT:
VOA
224 South Michigan Avenue, Chicago IL 60604
TEL 312 554 1400 FAX 312 554 1412

GENERAL CONTRACTOR:
W.E.O'NEIL
2751 North Clybourn Avenue, Chicago IL 60614
Tel 773 755 1611 Fax 773 327 4784

	DATE	DESCRIPTION

REVISIONS

NO.

AE481 - SENIOR THESIS PROJECT

KEY SECTION

SHEET TITLE

SINGLE-LINE DIAGRAM
480Y/277V DISTRIBUTION SYSTEM

PROJECT NO.

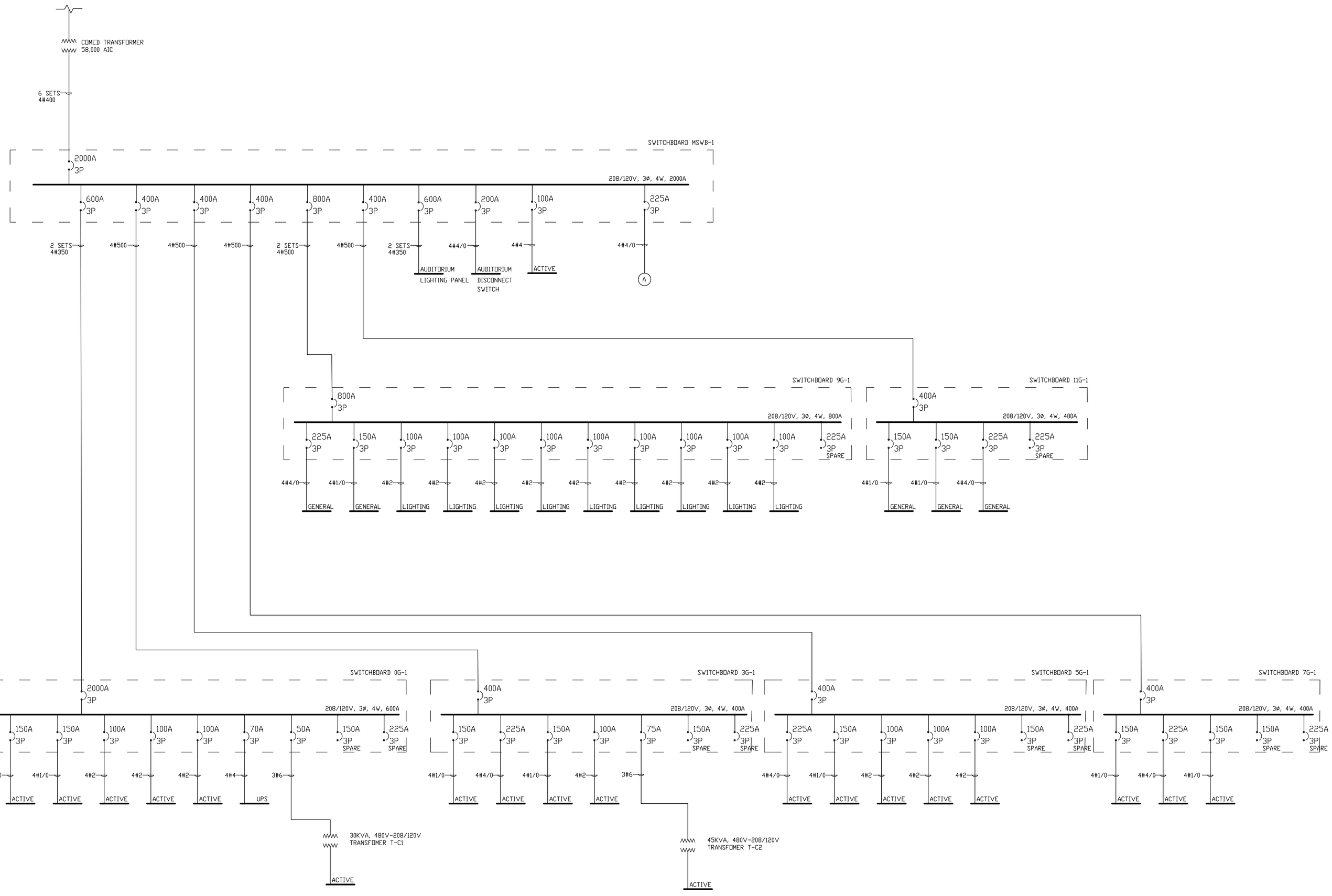
SHEET NO.
E.01

DRAWN BY:
KANIS GLAEWKETGARN

CHECKED BY:

SCALE:

DATE:
NOVEMBER 4, 2008



OWNER:
SPERTUS INSTITUTE OF JEWISH STUDIES
610 South Michigan Avenue, Chicago IL 60605

PROJECT MANAGEMENT:
INST. PROJECT MANAGEMENT
1 East Jackson Boulevard, Chicago IL 60604
Tel 312 362 8856 Fax 312 362 5907
U.S. EQUITIES DEVELOPMENT
20 North Michigan Avenue, Chicago IL 60602
Tel 312 456 7000 Fax 312 456 0054

ARCHITECT OF RECORD:
KRUECK ■ SEXTON
221 West Erie, Chicago IL 60610
TEL 312 787 0056 FAX 312 787 8415

ASSOCIATED ARCHITECT:
VOA
224 South Michigan Avenue, Chicago IL 60604
TEL 312 554 1400 FAX 312 554 1412

GENERAL CONTRACTOR:
W.E.O'NEIL
2751 North Clybourn Avenue, Chicago IL 60614
Tel 773 755 1611 Fax 773 327 4784

	DATE	DESCRIPTION

REVISIONS

NO.

AE481 - SENIOR THESIS PROJECT

KEY SECTION

SHEET TITLE

SINGLE-LINE DIAGRAM
208Y/120V DISTRIBUTION SYSTEM

PROJECT NO.	SHEET NO. E.02
DRAWN BY: KANIS GLAEWKETGARN	
CHECKED BY:	
SCALE:	
DATE: NOVEMBER 4, 2008	

Appendix B
HID Ballast Cutsheets

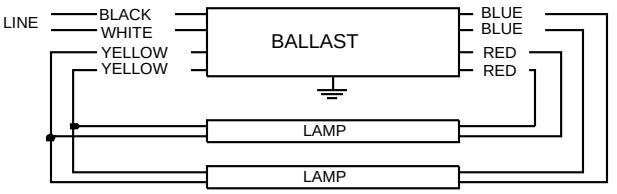
FIXTURE TYPE L22

RCN-2S32-SC	
Brand Name	CENTIUM
Ballast Type	Electronic
Starting Method	Programmed 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.
F17T8	2	17	32/00	0.33	39	1.00	10	0.99	1.7	2.56
F25T8	2	25	32/00	0.45	53	0.95	10	0.99	1.7	1.79
* F32T8	2	32	32/00	0.53	63	0.88	10	0.99	1.7	1.40

Wiring Diagram



Diag. 21

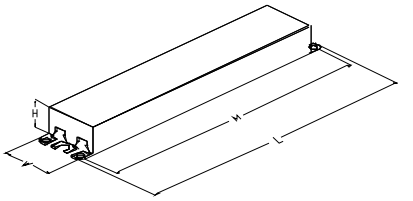
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	22L	55.9
White	22L	55.9
Blue	26R	66
Red	26R	66
Yellow	36L	91.4
Gray		0
Violet		0

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

Enclosure



Enclosure Dimensions

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

Revised 09/14/2007

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

FIXTURE TYPE L22

RCN-2S32-SC	
Brand Name	CENTIUM
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Notes:

Section I - Physical Characteristics

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

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

Section II - Performance Requirements

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

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

2.3 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power (except T8/HO and FT5 ballasts).

2.4 Ballast shall operate from 60 Hz input source of 120V, 277V or 347V as applicable with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast. IntelliVolt models shall operate from 50/60 Hz input source of 120V through 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

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

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

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

2.8 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

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

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

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

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

Section III - Regulatory Requirements

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

3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable. Models with -HAZ suffix meet UL 935 Type HL (hazardous location) requirements.

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

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

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

Section IV - Other

4.1 Ballast shall be manufactured in a factory certified to ISO 9002 Quality System Standards.

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

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

NOTE: The use of Optanium (IOP) and ICN-2P32-N models is recommended to reduce striation in energy-saving T8 lamps (25W, 28W or 30W).

Remote or tandem wiring of energy-saving T8 lamps (25W, 28W or 30W) is only recommended for Optanium (IOP) models.

Revised 09/14/2007

ADVANCE
O'HARE INTERNATIONAL CENTER - 10275 WEST HIGGINS ROAD
ROSEMONT, ILLINOIS 60018
TELEPHONE: (847) 390-5000 FAX: (847) 390-5109

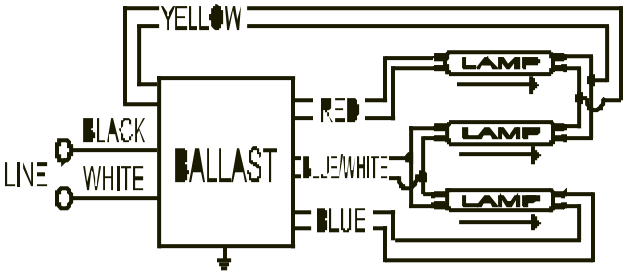
FIXTURE TYPE L19

RCN-3S32-SC	
Brand Name	CENTIUM
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series/Parallel
Input Voltage	120
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
F17T8	3	17	32/00	0.51	61	1.00	10	0.99	1.7	1.64
F25T8	3	25	32/00	0.65	77	0.95	10	0.99	1.7	1.23
* F32T8	3	32	32/00	0.78	91	0.88	10	0.99	1.7	0.97

Wiring Diagram



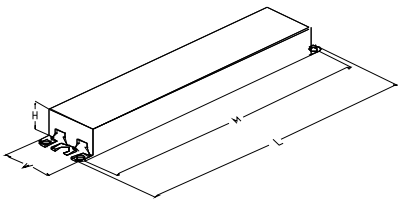
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	22L	55.9
White	22L	55.9
Blue	46R	116.8
Red	36R	91.4
Yellow	36L	91.4
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White	36R	91.4
Brown		0
Orange		0
Orange/Black		0
Black/White		0
Red/White		0

Enclosure



Enclosure Dimensions

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

Revised 09/14/2007

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

FIXTURE TYPE L19

RCN-3S32-SC	
Brand Name	CENTIUM
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series/Parallel
Input Voltage	120
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Notes:

Section I - Physical Characteristics

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

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

Section II - Performance Requirements

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

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

2.3 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power (except T8/HO and FT5 ballasts).

2.4 Ballast shall operate from 60 Hz input source of 120V, 277V or 347V as applicable with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast. IntelliVolt models shall operate from 50/60 Hz input source of 120V through 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

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

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

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

2.8 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

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

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

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

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

Section III - Regulatory Requirements

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

3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable. Models with -HAZ suffix meet UL 935 Type HL (hazardous location) requirements.

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

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

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

Section IV - Other

4.1 Ballast shall be manufactured in a factory certified to ISO 9002 Quality System Standards.

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

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

NOTE: The use of Optanium (IOP) and ICN-2P32-N models is recommended to reduce striation in energy-saving T8 lamps (25W, 28W or 30W).

Remote or tandem wiring of energy-saving T8 lamps (25W, 28W or 30W) is only recommended for Optanium (IOP) models.

Revised 09/14/2007

ADVANCE
O'HARE INTERNATIONAL CENTER - 10275 WEST HIGGINS ROAD
ROSEMONT, ILLINOIS 60018
TELEPHONE: (847) 390-5000 FAX: (847) 390-5109

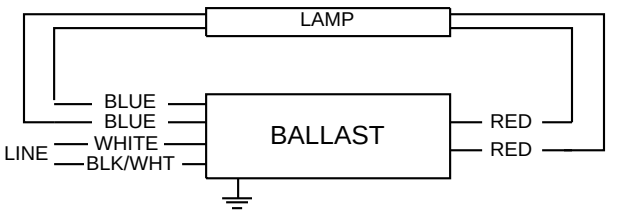
FIXTURE TYPE
L14,15,16,21,33

RCN-1S32-SC	
Brand Name	CENTIUM
Ballast Type	Electronic
Starting Method	Programmed 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.
F17T8	1	17	32/00	0.19	22	1.00	10	0.97	1.7	4.55
F25T8	1	25	32/00	0.24	28	0.95	10	0.98	1.7	3.39
* F32T8	1	32	32/00	0.29	34	0.90	10	0.98	1.7	2.65

Wiring Diagram



Diag. 20

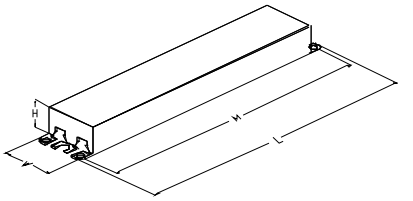
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black		0
White	22L	55.9
Blue	36L	91.4
Red	26R	66
Yellow		0
Gray		0
Violet		0

	in.	cm.
Yellow/Blue		0
Blue/White		0
Brown		0
Orange		0
Orange/Black		0
Black/White	22L	55.9
Red/White		0

Enclosure



Enclosure Dimensions

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

Revised 09/14/2007

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

FIXTURE TYPE
L14,15,16,21,33

RCN-1S32-SC	
Brand Name	CENTIUM
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120
Input Frequency	60 HZ
Status	Active

Electrical Specifications

Notes:

Section I - Physical Characteristics

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

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

Section II - Performance Requirements

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

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

2.3 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power (except T8/HO and FT5 ballasts).

2.4 Ballast shall operate from 60 Hz input source of 120V, 277V or 347V as applicable with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast. IntelliVolt models shall operate from 50/60 Hz input source of 120V through 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

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

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

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

2.8 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

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

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

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

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

Section III - Regulatory Requirements

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

3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable. Models with -HAZ suffix meet UL 935 Type HL (hazardous location) requirements.

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

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

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

Section IV - Other

4.1 Ballast shall be manufactured in a factory certified to ISO 9002 Quality System Standards.

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

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

NOTE: The use of Optanium (IOP) and ICN-2P32-N models is recommended to reduce striation in energy-saving T8 lamps (25W, 28W or 30W).

Remote or tandem wiring of energy-saving T8 lamps (25W, 28W or 30W) is only recommended for Optanium (IOP) models.

FIXTURE TYPE
L14,15,16,21,33

Revised 09/14/2007

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, ILLINOIS 60018
TELEPHONE: (847) 390-5000 FAX: (847) 390-5109

FIXTURE TYPE L17

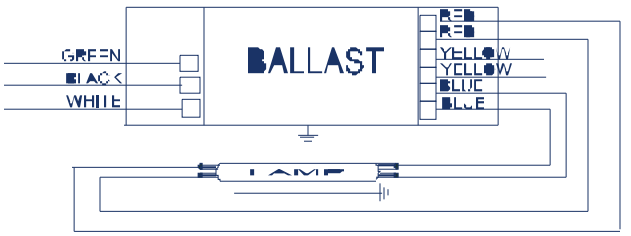
ICN-2S24@120V

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



For 1 lamp operation, do not use yellow leads

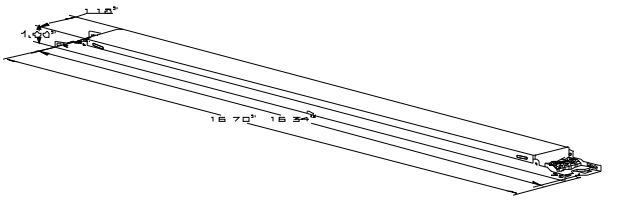
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

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

FIXTURE TYPE L17

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

Notes:

Section I - Physical Characteristics

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

1.2 Ballast shall be provided with integral leads or poke-in wire trap connectors color-coded per ANSI C82.11.

Section II - Performance Requirements

2.1 Ballast shall be Programmed Start.

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

2.3 Ballast shall operate from 50/60 Hz input source of _____ (120V through 277V or 347V through 480V) with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

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

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

2.6 Ballast shall have a minimum ballast factor of 1.00 for primary lamp application.

2.7 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

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

2.9 Ballast shall have a Class A sound rating.

2.10 Ballast shall have a minimum starting temperature of _____ {-18C (0F) or -29C (-20F)} for primary lamp. Consult lamp manufacturer for temperature versus light output characteristics.

2.11 Ballast shall provide Lamp EOL Protection Circuit.

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

2.13 Ballast shall have a hi-low switching option when operating (4) F54T5/HO lamps to allow switching from 4-2 lamps, 3-2 lamps or 3-1 lamp.

2.14 Four-lamp ballast shall have semi-independent lamp operation.

Section III - Regulatory Requirements

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

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

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

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

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

3.6 Ballast shall comply with UL Type CC rating.

Section IV - Other

4.1 Ballast shall be manufactured in a factory certified to ISO 9002 Quality System Standards.

4.2 Ballast shall carry a five-year warranty from date of manufacture against defects in material or workmanship, including replacement, for operation at a maximum case temperature of 70C. Ballasts with a "90C" designation in their catalog number shall also carry a three-year warranty at a maximum case temperature of 90C.

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

Revised 09/01/2004

ADVANCE
O'HARE INTERNATIONAL CENTER - 10275 WEST HIGGINS ROAD
ROSEMONT, ILLINOIS 60018
TELEPHONE: (847) 390-5000 FAX: (847) 390-5109

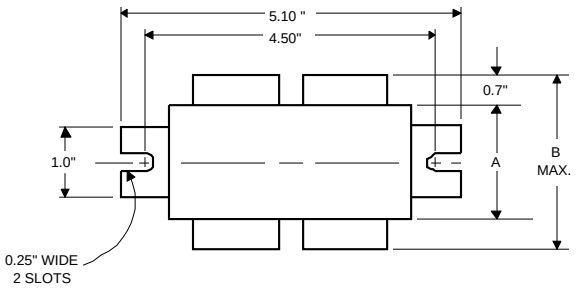
FIXTURE TYPE L3

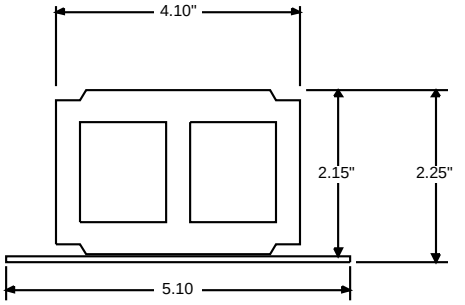
Metal Halide Lamp Ballast

Catalog Number 71A5005P
For 35/39W M130
60 Hz HX-HPF
Status: Active

DIMENSIONS AND DATA

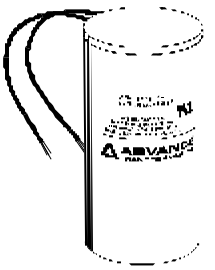
2 X 4 CORE





~~INPUT VOLTS~~		120				
CIRCUIT TYPE	HX-HPF					
POWER FACTOR (min)	90%					
REGULATION						
Line Volts	±5%					
Lamp Watts	±10%					
LINE CURRENT (Amps)						
Operating		0.50				
Open Circuit		1.10				
Starting		0.45				
UL TEMPERATURE RATINGS						
Insulation Class	H(180°C)					
Coil Temperature Code	1029	A				
MIN. AMBIENT STARTING TEMP.	-20°F or -30°C					
NOM. OPEN CIRCUIT VOLTAGE	230					
INPUT VOLTAGE AT LAMP DROPOUT		100				
INPUT WATTS	55					
RECOMMENDED FUSE (Amps)		3				
CORE and COIL						
Dimension (A)	0.83					
Dimension (B)	1.70					
Weight (lbs.)	2					
Lead Lengths	12"					
CAPACITOR REQUIREMENT						
Microfarads	28.0					
Volts (min.)	120					
Fault Current Withstand (amps)						
60 Hz TEST PROCEDURES (Refer to Advance Test Procedure for HID Ballasts - Form 1270)						
High Potential Test (Volts)						
1 minute	2000					
2 seconds	2500					
Open Circuit Voltage Test (Volts)	205-255					
Short-Circuit Current Test (Amps)						
Secondary Current	0.60-0.75					
Input Current		0.30 0.50	-	-	-	-

Capacitor: 7C280M12



Capacitance: 28
Dia/Oval Dim: 1.5
Height: 2.9
Temp Rating: 105°C

Ignitor: LI533-H4

Ballast to Lamp Distance (BTL) = 15 feet
Temp Rating: 105°C

Wiring Diagram:

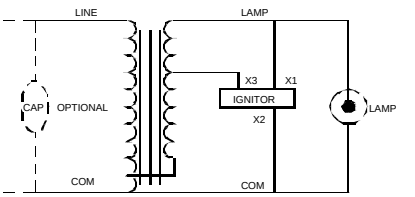


Fig. F

U.L. RECOGNIZED

Typical Ordering Information

(please call Advance for suffix availability)

Order Suffix	Description
500D.	Ballast With Ignitor and Dry Film Capacitor
510D.	Ballast w/Welded Bracket, Ignitor, & Dry Film Capacitor
600.	Ballast and Ignitor, No Capacitor
610.	Ballast with Welded Bracket and Ignitor, No Capacitor

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

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

06/22/00

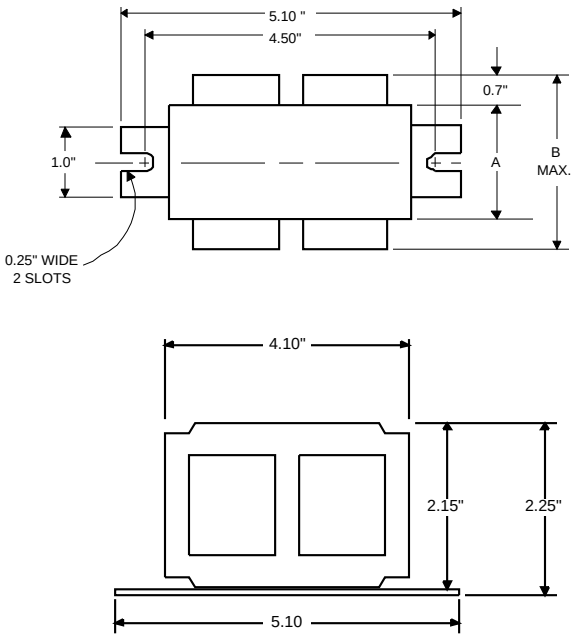
FIXTURE TYPE L31a, 31b, 32

Metal Halide Lamp Ballast

Catalog Number 71A5205P
For 70W M98
60 Hz HX-NPF
Status: Active

DIMENSIONS AND DATA

2 X 4 CORE



INPUT VOLTS		120				
CIRCUIT TYPE	HX-NPF					
POWER FACTOR (min)	35%					
REGULATION						
Line Volts	±5%					
Lamp Watts	±10%					
LINE CURRENT (Amps)						
Operating		2.10				
Open Circuit		0.30				
Starting		2.50				
UL TEMPERATURE RATINGS						
Insulation Class	H(180°C)					
Coil Temperature Code	1029	B				
MIN. AMBIENT STARTING TEMP.	-20°F or -30°C					
NOM. OPEN CIRCUIT VOLTAGE	255					
INPUT VOLTAGE AT LAMP DROPOUT		90				
INPUT WATTS	94					
RECOMMENDED FUSE (Amps)		6				
CORE and COIL						
Dimension (A)	1.50					
Dimension (B)	2.65					
Weight (lbs.)	3.5					
Lead Lengths	12"					
CAPACITOR REQUIREMENT						
Microfarads						
Volts (min.)						
Fault Current Withstand (amps)						
60 Hz TEST PROCEDURES (Refer to Advance Test Procedure for HID Ballasts - Form 1270)						
High Potential Test (Volts)						
1 minute	2000					
2 seconds	2500					
Open Circuit Voltage Test (Volts)	230-280					
Short-Circuit Current Test (Amps)						
Secondary Current						
Input Current	0.85-1.25	2.00 3.00	-	-	-	-

Capacitor:

This ballast does not require the use of a capacitor.

Wiring Diagram:

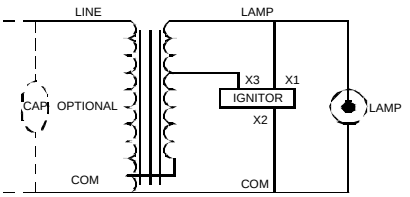


Fig. F

U.L. RECOGNIZED

Ignitor: LI533-H4

Ballast to Lamp Distance (BTL) = 10 feet
Temp Rating: 105°C

Typical Ordering Information

(please call Advance for suffix availability)

Order Suffix	Description
600.P	Thermally Protected Ballast with Ignitor, No Capacitor
610.P	Thermally Protected Ballast w/Welded Bracket, Ignitor, No Capacitor

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

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

03/04/05

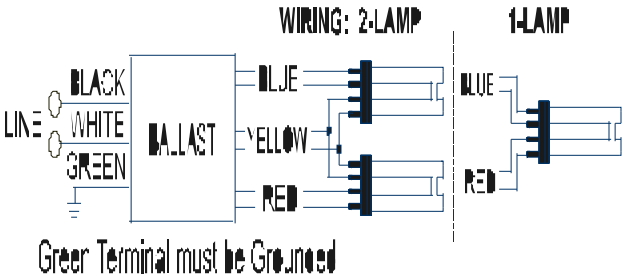
FIXTURE TYPE L6

ICF-2S26-H1-LD@120	
Brand Name	SMARTMATE
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F.
* CFM26W/GX24Q	1	26	0/-18	0.24	29	1.10	10	0.98	1.5	3.79
CFM26W/GX24q	2	26	0/-18	0.45	54	1.00	10	0.99	1.5	1.85
CFM32W/GX24q	1	32	0/-18	0.31	36	0.98	10	0.98	1.5	2.72
CFM42W/GX24q	1	42	0/-18	0.38	46	0.98	10	0.98	1.5	2.13
CFQ26W/G24q	1	26	0/-18	0.23	27	1.00	10	0.98	1.5	3.70
CFQ26W/G24q	2	26	0/-18	0.43	51	1.00	10	0.99	1.5	1.96
CFS21W/GR10q	2	21	0/-18	0.42	51	1.12	10	0.99	1.5	2.20
FT24W/2G11	2	24	0/-18	0.41	48	0.93	10	0.99	1.5	1.94

Wiring Diagram



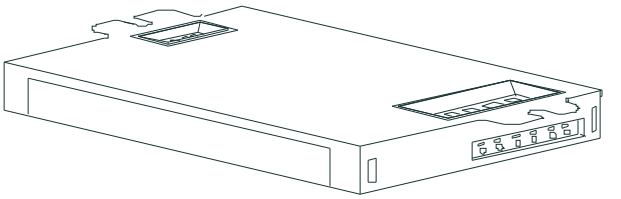
The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.
Black	0.0	
White	0.0	
Blue	0.0	
Red	0.0	
Yellow	0	
Gray		
Violet		

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

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 09/02/2004

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

FIXTURE TYPE L6

ICF-2S26-H1-LD@120	
Brand Name	SMARTMATE
Ballast Type	Electronic
Starting Method	Programmed Start
Lamp Connection	Series
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

Notes:

Section I - Physical Characteristics

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

1.2 Ballast shall be available in a plastic/metal can or all metal can construction to meet all plenum requirements.

1.3 Ballast shall be provided with poke-in wire trap connectors color coded per ANSI C82.11.

Section II - Performance Requirements

2.1 Ballast shall be Programmed Start except for ballasts with -QS suffix, which shall be Rapid Start.

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

2.3 Ballast shall operate from 50/60 Hz input source of 120V through 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the IntelliVolt ballast. RCF models shall operate from 60 Hz input source of 120V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

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

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

2.6 Ballast shall have a minimum ballast factor of 1.00 for primary lamp application.

2.7 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.

2.8 Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when operated at nominal line voltage with primary lamp.

2.9 Ballast shall have a Class A sound rating.

2.10 Ballast shall have a minimum starting temperature of -18C (0F) for primary lamp. Ballasts for PL-H lamps shall have a minimum starting temperature of -30C (-20F) for primary lamp.

2.11 Ballast shall provide Lamp EOL Protection Circuit.

2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

Section III - Regulatory Requirements

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

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

3.3 Ballast shall be rated for use in air-handling spaces.

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

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

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

Section IV - Other

4.1 Ballast shall be manufactured in a factory certified to ISO 9002 Quality System Standards.

4.2 Ballast shall carry a five-year warranty from date of manufacture against defects in material or workmanship, including replacement, for operation at a maximum case temperature of 75C and three-years for a maximum case temperature of 85C (90C 3year warranty for ICF1H120-M4-XX, ICF2S42-90C-M2-XX and ICF2S70-M4-XX modesls).

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

Revised 09/02/2004

ADVANCE
O'HARE INTERNATIONAL CENTER - 10275 WEST HIGGINS ROAD
ROSEMONT, ILLINOIS 60018
TELEPHONE: (847) 390-5000 FAX: (847) 390-5109