Technical Report 2 (100% Submission)

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National Intrepid Center of Excellence | Bethesda, MD

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Executive Summary

The following report provides a comprehensive analysis of the electrical systems implemented in the National Intrepid Center of Excellence. At two stories and a total of 72,000 square feet, the building will be utilized as a state of the art facility for the research, diagnosis, and treatment of veterans with traumatic brain injuries and psychological health issues. In the coming pages, a thorough analysis and description of the special characteristics of the electrical systems, including a summary of the total building electrical load is presented. A single-line diagram of the existing electrical distribution system was created for a complete understanding of the layout. Various communication systems are also briefly explained.

The overall electrical system design for this building is somewhat complex, and it includes many specialized features to accommodate for the medical equipment. As a healthcare facility, there are various pieces of equipment that must be properly wired and protected. The emergency system was carefully designed to ensure that computers and special medical devices remain running during a power outage. Continually powering the life safety and critical branches ensures that each system is safely operating.

Upon analysis of the lighting, receptacle, mechanical, and other architectural loads, the service entrance size was determined. The existing service entrance size is much larger than what was calculated. This is due to numerous system design considerations. A significant amount of space was also left for future expansion. Overall, with this type of medical facility, there are many factors that must be included for the building operation and safety of its occupants. When sizing an electrical system, all of these issues must be considered.

Section I: Power Distribution Systems

Single-Line Diagram Drawing List

The following existing drawings were used to create the single-line diagram. They can be found in Appendix A.

E5.01 - Normal Power Riser Diagram
E5.02 - Emergency Power Riser Diagram
E6.01 - Switchboard Elevation and Schedule and Equipment Schedule

Single-Line Diagram

A Single-Line Diagram of the existing distribution system is included. The following is the feeder schedule that corresponds to this diagram located in Appendix A:

FEEDER SCHEDULE

TAG	FROM	TO	NO. OF SETS	CONDUIT (PER SET)		CONDUCTORS (PER SET)									SIZE OF OVERCURRENT PROTECTION	FRAME OR SWITCH SIZE	REMARKS
						PHASE CONDUCTORS			NEUTRAL CONDUCTORS			GROUND CONDUCTORS					
				SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE			
25A-1	CL1B	T-13	1	3/4"	EMT	3	10AWG	CU THWN	0	10AWG	CU THWN	1	10AWG	CU THWN	25	25/3P	
25A-2	LSL1B	T-12	1	3/4"	EMT	3	10AWG	CU THWN	0	10AWG	CU THWN	1	10AWG	CU THWN	25	25/3P	
25A-3	CL1A	T-11	1	3/4"	EMT	3	10AWG	CU THWN	0	10AWG	CU THWN	1	10AWG	CU THWN	25	25/3P	
50-1	T-13	CR1B	1	1"	EMT	3	6AWG	CU THWN	1	6AWG	CU THWN	1	10AWG	CU THWN	50	50/3P	
50-2	T-12	LSR1B	1	1"	EMT	3	6AWG	CU THWN	1	6AWG	CU THWN	1	10AWG	CU THWN	50	50/3P	
50-3	LSL1B	LSL2B	1	1"	EMT	3	6AWG	CU THWN	1	6AWG	CU THWN	1	10AWG	CU THWN	50	50/3P	
50-4	LSL1A	LSLPA	1	1"	EMT	3	6AWG	CU THWN	1	6AWG	CU THWN	1	10AWG	CU THWN	50	50/3P	
50-5	T-11	CR1A	1	1"	EMT	3	6AWG	CU THWN	1	6AWG	CU THWN	1	10AWG	CU THWN	50	50/3P	
50-6	LSL1A	LSL2A	1	1"	EMT	3	6AWG	CU THWN	1	6AWG	CU THWN	1	10AWG	CU THWN	50	50/3P	
50-7	R-GEN	LSL1A	1	1"	EMT	3	6AWG	CU THWN	1	6AWG	CU THWN	1	10AWG	CU THWN	50	50/3P	
50A-1	L1	T-5	1	3/4"	EMT	3	6AWG	CU THWN	0	6AWG	CU THWN	1	10AWG	CU THWN	50	50/3P	
50A-2	LSL1A	T-10	1	3/4"	EMT	3	6AWG	CU THWN	0	6AWG	CU THWN	1	10AWG	CU THWN	50	50/3P	
90A-1	SWBD	T-2	1	1 1/4"	EMT	3	2AWG	CU THWN	0	2AWG	CU THWN	1	8AWG	CU THWN	90	90/3P	
90A-2	SWBD	T-3	1	1 1/4"	EMT	3	2AWG	CU THWN	0	2AWG	CU THWN	1	8AWG	CU THWN	90	90/3P	
100-1	T-5	R1	1	1 1/2"	EMT	3	1AWG	CU THWN	1	1AWG	CU THWN	1	8AWG	CU THWN	100	100/3P	
100-2	DP1	LPA	1	1 1/2"	EMT	3	1AWG	CU THWN	1	1AWG	CU THWN	1	8AWG	CU THWN	100	100/3P	
100-3	DP2	RPB	1	1 1/2"	EMT	3	1AWG	CU THWN	1	1AWG	CU THWN	1	8AWG	CU THWN	100	100/3P	
100-4	LSL1A	LSL1B	1	1 1/2"	EMT	3	1AWG	CU THWN	1	1AWG	CU THWN	1	8AWG	CU THWN	100	100/3P	
100-5	EDP1	CL1B	1	1 1/2"	EMT	3	1AWG	CU THWN	1	1AWG	CU THWN	1	8AWG	CU THWN	100	100/3P	
100-6	T-10	LSR1A	1	1 1/2"	EMT	3	1AWG	CU THWN	1	1AWG	CU THWN	1	8AWG	CU THWN	100	100/3P	
100B	DP3	MEG	1	1 1/2"	EMT	3	1AWG	CU THWN	2	1AWG	CU THWN	2	8AWG	CU THWN	100	100/3P	
125-1	WIREWAY	R2A1	1	2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	6AWG	CU THWN	125	125/3P	
125-2	WIREWAY	R2A2	1	2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	6AWG	CU THWN	125	125/3P	
125-3	R2B2	R2B3	1	2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	6AWG	CU THWN	125	125/3P	
125-4	WIREWAY	R1A1	1	2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	6AWG	CU THWN	125	125/3P	
125-5	WIREWAY	R1A2	1	2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	6AWG	CU THWN	125	125/3P	
125-6	WIREWAY	R1B1	1	2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	6AWG	CU THWN	125	125/3P	
125-7	WIREWAY	R1B2	1	2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	6AWG	CU THWN	125	125/3P	
125-8	WIREWAY	ELEV. #1	1	2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	6AWG	CU THWN	125	125/3P	
125-9	WIREWAY	ELEV. #2	1	2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	6AWG	CU THWN	125	125/3P	
125A-1	L2A	T-8	1	1 1/2"	EMT	3	1/0AWG	CU THWN	0	1/0AWG	CU THWN	1	6AWG	CU THWN	125	125/3P	
125A-2	L1A	T-6	1	1 1/2"	EMT	3	1/0AWG	CU THWN	0	1/0AWG	CU THWN	1	6AWG	CU THWN	125	125/3P	
125A-3	L1B	T-7	1	1 1/2"	EMT	3	1/0AWG	CU THWN	0	1/0AWG	CU THWN	1	6AWG	CU THWN	125	125/3P	
150-1	SWBD	L1	1	2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	6AWG	CU THWN	150	150/3P	
150-2	DP2	RPC	1	2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	6AWG	CU THWN	150	150/3P	
150-3	SWBD	L1A	1	2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	6AWG	CU THWN	150	150/3P	
150-4	SWBD	L1B	1	2"	EMT	3	1/0AWG	CU THWN	1	1/0AWG	CU THWN	1	6AWG	CU THWN	150	150/3P	
150B-1	T-2	RPVL	1	2"	EMT	3	1/0AWG	CU THWN	2	1/0AWG	CU THWN	2	6AWG	CU THWN	150	150/3P	
150B-2	T-3	DP3	1	2"	EMT	3	1/0AWG	CU THWN	2	1/0AWG	CU THWN	2	6AWG	CU THWN	150	150/3P	
150B-3	DP2	RPA	1	2"	EMT	3	1/0AWG	CU THWN	2	1/0AWG	CU THWN	2	6AWG	CU THWN	150	150/3P	
150B-4	DP3	SNW MELT	1	2"	EMT	3	1/0AWG	CU THWN	2	1/0AWG	CU THWN	2	6AWG	CU THWN	150	150/3P	
175-1	SWBD	FLUROSC.	1	2"	EMT	3	2/0AWG	CU THWN	1	2/0AWG	CU THWN	1	6AWG	CU THWN	175	175/3P	
175-2	SWBD	PET/CT	1	2"	EMT	3	2/0AWG	CU THWN	1	2/0AWG	CU THWN	1	6AWG	CU THWN	175	175/3P	
175-3	SWBD	MRI	1	2"	EMT	3	2/0AWG	CU THWN	1	2/0AWG	CU THWN	1	6AWG	CU THWN	175	175/3P	
175A	L2B	T-9	1	2"	EMT	3	2/0AWG	CU THWN	0	2/0AWG	CU THWN	1	6AWG	CU THWN	175	175/3P	
200-1	SWBD	ATS-LS	1	2"	EMT	3	3/0AWG	CU THWN	1	3/0AWG	CU THWN	1	6AWG	CU THWN	200	200/3P	
200-2	DP1	LPC	1	2"	EMT	3	3/0AWG	CU THWN	1	3/0AWG	CU THWN	1	6AWG	CU THWN	200	200/3P	
225-1	SWBD	H2	1	2 1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225/3P	
225-2	DP2	RPD	1	2 1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225/3P	
225-3	SWBD	L2A	1	2 1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225/3P	
225-4	SWBD	L2B	1	2 1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225/3P	
225-5	WIREWAY	R2B1	1	2 1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225/3P	
225-6	WIREWAY	R2B2	1	2 1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225/3P	
225-7	G	ATS-LS	1	2 1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225/3P	
225-8	ATS-LS	LSL1A	1	2 1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225/3P	
225-9	EDP1	CL1A	1	2 1/2"	EMT	3	4/0AWG	CU THWN	1	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225/3P	
225A	SWBD	T-4	1	2"	EMT	3	4/0AWG	CU THWN	0	4/0AWG	CU THWN	1	4AWG	CU THWN	225	225/3P	

FEEDER SCHEDULE

TAG	FROM	TO	NO. OF SETS	CONDUIT (PER SET)		CONDUCTORS (PER SET)									SIZE OF OVERCURRENT PROTECTION	FRAME OR SWITCH SIZE	REMARKS
						PHASE CONDUCTORS			NEUTRAL CONDUCTORS			GROUND CONDUCTORS					
				SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE	No.	SIZE	TYPE			
250-1	T-8	WIREWAY	1	2 1/2"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	4AWG	CU THWN	250	250/3P	
250-2	T-6	WIREWAY	1	2 1/2"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	4AWG	CU THWN	250	250/3P	
250-3	SWBD	WIREWAY	1	2 1/2"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	4AWG	CU THWN	250	250/3P	
250-4	T-7	WIREWAY	1	2 1/2"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	4AWG	CU THWN	250	250/3P	
250-5	UPS	BATT CAB 1	1	2 1/2"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	4AWG	CU THWN	250	250/3P	
250-6	UPS	BATT CAB 2	1	2 1/2"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	4AWG	CU THWN	250	250/3P	
250-7	DP-UPS	PDU1	1	2 1/2"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	4AWG	CU THWN	250	250/3P	
250-8	DP-UPS	PDU2	1	2 1/2"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	4AWG	CU THWN	250	250/3P	
400-1	SWBD	DP1	2	2"	EMT	3	3/0AWG	CU THWN	1	3/0AWG	CU THWN	1	3AWG	CU THWN	400	400/3P	
400-2	T-9	WIREWAY	2	2"	EMT	3	3/0AWG	CU THWN	1	3/0AWG	CU THWN	1	3AWG	CU THWN	400	400/3P	
500-1	EDP1	UPS	2	2 1/2"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	2AWG	CU THWN	500	500/3P	
500-2	EDP1	BY-PASS	2	2 1/2"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	2AWG	CU THWN	500	500/3P	
500-3	UPS	BY-PASS	2	2 1/2"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	2AWG	CU THWN	500	500/3P	
500-4	BY-PASS	DP-UPS	2	2 1/2"	EMT	3	250KCMIL	CU THWN	1	250KCMIL	CU THWN	1	2AWG	CU THWN	500	500/3P	
500B-1	T-4	DP2	2	3"	EMT	3	250KCMIL	CU THWN	2	250KCMIL	CU THWN	2	2AWG	CU THWN	500	500/3P	W/ IG & EQUIP. GROUND
600-1	G	ATS-EM	2	3"	EMT	3	350KCMIL	CU THWN	1	350KCMIL	CU THWN	1	1AWG	CU THWN	600	600/3P	
600-2	SWBD	ATS-EM	2	3"	EMT	3	350KCMIL	CU THWN	1	350KCMIL	CU THWN	1	1AWG	CU THWN	600	600/3P	
600-3	ATS-EM	EDP1	2	3"	EMT	3	350KCMIL	CU THWN	1	350KCMIL	CU THWN	1	1AWG	CU THWN	600	600/3P	
3000	T-1	SWBD	9	4"	EMT	3	500KCMIL	CU THWN	1	500KCMIL	CU THWN	1	500KCMIL	CU THWN	3000	3000/3P	INSULATED GROUNDING WIRE

NOTES:
1. REFER TO RISER DIAGRAM FOR FEEDER TAGS

AL=ALUMINUM
CU=COPPER

Summary Description of Distribution System

NICoE's overall electrical system is a radial system with one point of service entrance at the southwest corner. It is powered by a 2500kVA transformer that steps down the voltage from 13.8kV to a 480Y/277V, 3P, 4W voltage system. A 3000A switchboard provides power to all equipment loads. Transformers feed a 208Y/120V, 3P, 4W system to receptacles and some lighting devices. An exterior emergency generator rated at 400kW, 480Y/277V, 3P, 4W provides backup power to both life safety and equipment branches. A UPS battery backup system is also utilized for Server Room emergency power.

Utility Company Information

NICoE is connected to the National Naval Medical Center's campus system. It is served by Pepco, the electric utility company that provides service to Washington, DC and several counties in Maryland. The company's address and website are as follows:

701 Ninth Street, N.W.
Washington, DC 20001
www.pepco.com

Since the building is currently under construction, it will not be occupied until Fall 2009. The available rates are as follows:

Generation (10/01/08-5/31/09)

$0.12201 per kwh

Transmission

June to October - $0.00342 per kwh
November to May - $0.00342 per kwh

Distribution Service

June to October - $0.003367 per kwh
November to May - $0.01780 per kwh

Service Entrance

Located at the National Naval Medical Center, NICoE is tied into the campus electrical system. The utility company provides electricity to the campus at one location, and each building is fed through the campus distribution system. All of the service entrance components are provided and owned by the Navy. NICoE's individual electric use is monitored by the building owner with the use of an electronic meter.

The service entrance is located on the southwest corner of the site. This location keeps it in close proximity to the main electrical rooms in the building, which are also located in this area. The transformer provides power directly into the Main Electrical Room 1124.

The main utility transformer is located on a 6"concrete pad. It will be served from the existing 15kV primary loop feeders, via the 15kV loop switch in manhole MH76 that is located northeast of the building (opposite corner from the service entrance). As part of the Navy's campus infrastructure upgrade project, a new 15kV air-circuit breaker service disconnect switch and transformer will be provided. The primary transformer is rated at 2500kVA, 13.8kV to 480Y/277V, 3P, 4W. It is an outdoor pad-mounted oil-filled type. This power will be utilized in the building via a 12-way concrete encased duct bank. A transient voltage suppression system is also located at the service entrance.

The main switchboard is also located in the Main Electrical Room. This unit then provides power to other electrical rooms for distribution throughout the building.

Voltage Systems

The service entrance provides the building with a 480Y/277V, 3P, 4W voltage system. Most of the lighting operates at 277V off of a 480Y/277V, 3P, 4W feeder, with the exception of a select number of specialty and incandescent fixtures that operate at 120V off of a 208Y/120V, 3P, 4W feeder. All of the receptacles also operate at 120V off of a 208Y/120V, 3P, 4W feeder. Motors that are 1/2 HP and larger operate at 460V, 3P, and those smaller than 1/2 HP require a 115V, 1P connection.

Emergency Power System

As a healthcare facility, it is very important that an emergency electrical system be designed. In case of an outage, it is crucial that some equipment and devices receive continuous power.

A 400kW/500kVA diesel-driven standby emergency generator, located southwest of the building (next to the utility transformer) supports the emergency power system. It will operate at 100 percent rated output for a minimum of eight hours. The generator contains two unit-mounted circuit breakers that each serve an automatic transfer switch (ATS). These automatic transfer switches are 4-pole and are provided with an

isolation by-pass switch. There is a Life Safety ATS that serves the egress lighting and exit lighting, fire alarm system, medical gas alarms, and automatic doors used for building egress. The Equipment ATS serves HVAC and plumbing loads necessary for patient safety, selected lighting and receptacles, the nurse call system, security systems and devices, and data processing and other equipment as specified by the owner.

When there is a problem or disruption in the primary electrical service, the automatic transfer switch is activated and a signal is sent to the generator for startup. At this point, power is transferred to all of the emergency circuits powering the life safety and equipment loads.

The server room contains other specialty equipment such as a UPS, battery cabinets, and PDUs, as further described in the Special Equipment section. During a power outage, there is about a five to seven second delay from when the normal power drops and when the generator picks up. The UPS (battery powered) bridges that time gap so that power to the PDUs is maintained and computer loads run continuously. This ensures that power will not be lost to important data and processing equipment during a power outage.

Locations of Switchgear

The main utility transformer and emergency generator are located near the southwest corner of the building. All of the major equipment is located in the Main Electric Room or other dedicated Electrical Rooms. Most of the lighting and appliance panel boards and load centers are located in the various Electrical Rooms. Panels dedicated for a specific room or area are located within their corresponding spaces.

The following are complete equipment, lighting, and appliance schedules for NICoE.

MAJOR EQUIPMENT SCHEDULE

TAG	TYPE OF EQUIPMENT	FLOOR LEVEL	ROOM NO.	ROOM NAME	DRAWING NO.
SWBD	SWITCHBOARD	FIRST	1124	MAIN ELEC.	E2.01
DP1	DISTRIBUTION PANEL	FIRST	1012A	ELECTRICAL	E2.01
DP2	DISTRIBUTION PANEL	FIRST	1012A	ELECTRICAL	E2.01
DP3	DISTRIBUTION PANEL	FIRST	1040	ELECTRICAL	E2.01
EDP1	EMERG. DISTR. PANEL	FIRST	1123	EMERG. ELEC.	E2.01
T-1	TRANSFORMER	EXT. ON GRADE	N/A	SW OF BLDG.	E2.00
T-2	TRANSFORMER	FIRST	1124	MAIN ELEC.	E2.01
T-3	TRANSFORMER	FIRST	1124	MAIN ELEC.	E2.01
T-4	TRANSFORMER	FIRST	1124	MAIN ELEC.	E2.01
T-5	TRANSFORMER	FIRST	1124	MAIN ELEC.	E2.01
T-6	TRANSFORMER	FIRST	1101	ELECTRICAL	E2.01
T-7	TRANSFORMER	FIRST	1040	ELECTRICAL	E2.01
T-8	TRANSFORMER	SECOND	2081	ELECTRICAL	E2.02
T-9	TRANSFORMER	SECOND	2018	ELECTRICAL	E2.02
T-10	EMERGENCY TRANSFORMER	FIRST	1101	ELECTRICAL	E2.01
T-11	EMERGENCY TRANSFORMER	FIRST	1101	ELECTRICAL	E2.01
T-12	EMERGENCY TRANSFORMER	FIRST	1040	ELECTRICAL	E2.01
T-13	EMERGENCY TRANSFORMER	FIRST	1040	ELECTRICAL	E2.01
GENERATOR	GENERATOR	EXT. ON GRADE	N/A	SW OF BLDG.	E2.00
ATS-EM	TRANSFER SWITCH	FIRST	1123	EMERG. ELEC.	E2.01
ATS-LS	TRANSFER SWITCH	FIRST	1123	EMERG. ELEC.	E2.01

PANEL BOARDS						
TAG	VOLTAGE SYSTEM	MAIN SIZE	FLOOR LEVEL	ROOM NO.	ROOM NAME	DRAWING NO.
RPVL	208Y/120V,3P,4W	150A MCB	FIRST	1127	VR LAB	E2.01
L1	480Y/277V,3P,4W	225A MLO	FIRST	1124	ELECTRICAL	E2.01
LCP-L1	480Y/277V,3P,4W	100A MCB	FIRST	1124	ELECTRICAL	E2.01
R1	208Y/120V,3P,4W	100A MCB	FIRST	1124	ELECTRICAL	E2.01
LPC	480Y/277V,3P,4W	100A MCB	FIRST	1130A	EQMT STOR	E2.01
RPC	208Y/120V,3P,4W	150A MCB	FIRST	1130A	EQMT STOR	E2.01
RPA	208Y/120V,3P,4W	150A MCB	FIRST	1010A	STORAGE	E2.01
LPA	480Y/277V,3P,4W	100A MCB	FIRST	1010A	STORAGE	E2.01
RPD	208Y/120V,3P,4W	225A MCB	FIRST	1008	CONTROL	E2.01
LCP-RPD	208Y/120V,3P,4W	100A MCB	FIRST	1008	CONTROL	E2.01
RPB	208Y/120V,3P,4W	100A MCB	FIRST	1004	COFFEE	E2.01
L1A	480Y/277V,3P,4W	150A MCB	FIRST	1101	ELECTRICAL	E2.01
LCP-L1A	480Y/277V,3P,4W	100A MCB	FIRST	1101	ELECTRICAL	E2.01
R1A1	208Y/120V,3P,4W	125A MCB	FIRST	1101	ELECTRICAL	E2.01
R1A2	208Y/120V,3P,4W	125A MCB	FIRST	1101	ELECTRICAL	E2.01
L1B	480Y/277V,3P,4W	150A MCB	FIRST	1040	ELECTRICAL	E2.01
R1B1	208Y/120V,3P,4W	125A MCB	FIRST	1040	ELECTRICAL	E2.01
R1B2	208Y/120V,3P,4W	125A MCB	FIRST	1040	ELECTRICAL	E2.01
LSL1A	480Y/277V,3P,4W	100A MLO	FIRST	1101	ELECTRICAL	E2.01
LSR1A	208Y/120V,3P,4W	100A MCB	FIRST	1101	ELECTRICAL	E2.01
CL1A	480Y/277V,3P,4W	225A MLO	FIRST	1101	ELECTRICAL	E2.01
CR1A	208Y/120V,3P,4W	50A MCB	FIRST	1101	ELECTRICAL	E2.01
LSL1B	480Y/277V,3P,4W	100A MLO	FIRST	1040	ELECTRICAL	E2.01
LSR1B	208Y/120V,3P,4W	50A MCB	FIRST	1040	ELECTRICAL	E2.01
CL1B	480Y/277V,3P,4W	100A MLO	FIRST	1040	ELECTRICAL	E2.01
CR1B	208Y/120V,3P,4W	50A MCB	FIRST	1040	ELECTRICAL	E2.01
LSLPA	480Y/277V,3P,4W	50A MCB	FIRST	1010A	STORAGE	E2.01
H2	480Y/277V,3P,4W	225A MCB	SECOND	2115	MECHANICAL	E2.02
L2A	480Y/277V,3P,4W	225A MCB	SECOND	2081	ELECTRICAL	E2.02
LCP-L2A	480Y/277V,3P,4W	100A MCB	SECOND	2081	ELECTRICAL	E2.02
R2A1	208Y/120V,3P,4W	125A MCB	SECOND	2081	ELECTRICAL	E2.02
R2A2	208Y/120V,3P,4W	125A MCB	SECOND	2081	ELECTRICAL	E2.02
L2B	480Y/277V,3P,4W	225A MCB	SECOND	2081	ELECTRICAL	E2.02
LCP-L2B	480Y/277V,3P,4W	100A MCB	SECOND	2081	ELECTRICAL	E2.02
R2B1	208Y/120V,3P,4W	175A MCB	SECOND	2018	ELECTRICAL	E2.02
R2B2	208Y/120V,3P,4W	225A MCB	SECOND	2018	ELECTRICAL	E2.02
R2B3	208Y/120V,3P,4W	125A MCB	SECOND	2018	ELECTRICAL	E2.02
LSL2A	480Y/277V,3P,4W	50A MCB	SECOND	2081	ELECTRICAL	E2.02
LSL2B	480Y/277V,3P,4W	50A MCB	SECOND	2018	ELECTRICAL	E2.02

NOTES:
1. ALL PANEL BOARDS SHALL BE 42-POLE.

KEY:
A/N=AS NOTED

Over-current Devices

Circuit breakers are the main source of over-current protection throughout the building. A 15kV air-circuit breaker service disconnect switch is provided at the utility service entrance. The switchboard main device will consist of a fixed-mount power circuit breaker, and the distribution sections will be composed of molded-case circuit breakers in a group-mounted construction. Normal distribution panels consist of Type 1 enclosed circuit breakers with an AIC rating of 18,000 or 42,000. The emergency distribution panel is Type 1 enclosed main lugs only with an AIC rating of 22,000. Most of the individual panel boards contain a

main circuit breaker with a few being main lugs only. They are all Type 1 enclosed panels with most of the lighting circuit breakers having an AIC rating of 42,000 and receptacle circuit breakers with an AIC rating of 10,000. All specialty rooms and equipment are protected by enclosed circuit breakers. Elevators contain shunt trip enclosed circuit breakers.

Transformers

The building utilizes a total of 13 transformers. The utility transformer (T-1) is located at the southwest corner of the building's exterior. The other devices are located in dedicated electrical rooms throughout the structure. T-2 to T-9 serve the normal electrical power system, while T-10 to T-13 service the emergency loads. These pieces of equipment serve to step-down voltage to accommodate various loads.

INDIVIDUAL TRANSFORMER SCHEDULE

TAG	PRIMARY VOLTAGE	SECONDARY VOLTAGE	SIZE	TYPE	TEMP. RISE	TAPS	MOUNTING	REMARKS
T-1	13800V,3PH,3W	480Y/277V,3PH,4W	2500	N/A	N/A	N/A	PAD-MOUNTED ON GRADE	
T-2	480V,3PH,3W	208Y/120V,3PH,4W	45	DRY TYPE	115 DEGREE C	(4) 2.5%	PAD-MOUNTED ON FLOOR	K-13 RATED
T-3	480V,3PH,3W	208Y/120V,3PH,4W	45	DRY TYPE	115 DEGREE C	(4) 2.5%	PAD-MOUNTED ON FLOOR	K-13 RATED
T-4	480V,3PH,3W	208Y/120V,3PH,4W	150	DRY TYPE	115 DEGREE C	(4) 2.5%	PAD-MOUNTED ON FLOOR	K-13 RATED
T-5	480V,3PH,3W	208Y/120V,3PH,4W	30	DRY TYPE	115 DEGREE C	(4) 2.5%	PAD-MOUNTED ON FLOOR	
T-6	480V,3PH,3W	208Y/120V,3PH,4W	75	DRY TYPE	115 DEGREE C	(4) 2.5%	PAD-MOUNTED ON FLOOR	
T-7	480V,3PH,3W	208Y/120V,3PH,4W	75	DRY TYPE	115 DEGREE C	(4) 2.5%	PAD-MOUNTED ON FLOOR	
T-8	480V,3PH,3W	208Y/120V,3PH,4W	75	DRY TYPE	115 DEGREE C	(4) 2.5%	PAD-MOUNTED ON FLOOR	
T-9	480V,3PH,3W	208Y/120V,3PH,4W	112.5	DRY TYPE	115 DEGREE C	(4) 2.5%	PAD-MOUNTED ON FLOOR	
T-10	480V,3PH,3W	208Y/120V,3PH,4W	30	DRY TYPE	115 DEGREE C	(4) 2.5%	PAD-MOUNTED ON FLOOR	
T-11	480V,3PH,3W	208Y/120V,3PH,4W	15	DRY TYPE	115 DEGREE C	(2) 5%	PAD-MOUNTED ON FLOOR	
T-12	480V,3PH,3W	208Y/120V,3PH,4W	15	DRY TYPE	115 DEGREE C	(2) 5%	PAD-MOUNTED ON FLOOR	
T-13	480V,3PH,3W	208Y/120V,3PH,4W	15	DRY TYPE	115 DEGREE C	(2) 5%	PAD-MOUNTED ON FLOOR	

NOTES:
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KEY:
A/N=AS NOTED

Special Equipment

Special equipment is provided for the Server Room. This includes an Un-interruptible Power Supply (UPS) that is rated at 225kVA, 480V to 480V. Back-up power is provided for a minimum of eight minutes by battery cabinets. Two Power Distribution Units (PDU) rated at 125kVA, 480V - 208Y/120V, 3P, 4W, distribute the UPS output to the Server Room equipment branch circuiting. Each PDU is composed of a main input breaker, transformer (K20 rated), and two main circuit breaker panel boards. Located between the UPS output and PDU inputs is an external by-pass switch to allow for continuity of service to the Server Room loads if the UPS is taken off-line.

There is no power factor correction or power generation devices.

Lighting Loads

A majority of the lighting in the L-shaped "bar" area is generally functional with fluorescent downlights. Other fixtures are used in spaces with specialized medical operations. Corridors contain a mix of linear fluorescents, downlights, and LEDs to create visual interest in the long hallways. Decorative and custom fixtures that provide indirect, wallwash, accent, and track lighting are placed in lobbies, waiting rooms, and other similar areas. Exterior fixtures located at entrances, exits, pathways, recreation areas and service

spaces provide lighting for nighttime use. A large curtainwall system and clerestories provide a large amount of daylight in the space throughout the day.

Fluorescent and H.I.D. sources operate on 480Y/277 volts (H.I.D. ballasts in Appendix B) and incandescents run from 208Y/120 volt panels. Timers, occupancy sensors, and photosensors are utilized and connected through control panels throughout the building. These automatic shutoff devices fulfill the ASHRAE/IESNA 90.1 shutoff requirements.

LIGHTING FIXTURE SCHEDULE

TYPE	LAMP	WATTAGE	NO. OF LAMPS	BALLAST TYPE	VOLTAGE	INPUT WATTS	BALLAST FACTOR	CURRENT	POWER FACTOR
AA2	(1) 32W CFL 3500K	32	1	ELECTRONIC 5% DIMMING, PS	277	38	1.05	0.14/0.22(max)	0.98
AB	(1) 32W CFL 3500K	32	1	ELECTRONIC, PS	277	36	0.98	0.13/0.22(max)	0.98
AC	(1) 37W MR16 IR 25 DEG NFL	37	1	INTEGRAL XFMR	277	37	-	0.13	1
AE1	(1) 32W CFL 3500K	32	1	ELECTRONIC, PS	277	36	0.98	0.13/0.22(max)	0.98
AE2	(1) 32W CFL 3500K	32	1	ELECTRONIC 5% DIMMING, PS	277	38	1.05	0.14/0.22(max)	0.98
AF	(1) 35W PAR16FL HALOGEN	50	1	-	120	50	-	0.42	1
CA	WHITE LED	50	1	-	120	50	-	1.73	1
DA2	(2) 100W HALOGEN, INCLUDED	100	2	-	120	200	-	1.67	1
DA2F	FIBER OPTIC ILLUMINATOR W/TWO LAMPS	0	0	-	120	0	-	0.00	-
DA4	LED FEATURE CEILING	225	1	-	120	225	-	1.88	1
DA5	(36) 14W T5, 6500K, INCLUDED	14	36	10% DIMMING	277		0.95		0.95
DB	(3) 60W G9 FROST	60	3	-	120	180	-	1.50	1
DC	(1) 14W T5 3500K	14	1	ELECTRONIC, PS	120	19	1.07	0.16/0.27(max)	0.98
DD	INTEGRAL RED LED	6	1	-	120	6	-	0.05	1
DE	(3) 60W A LAMP	60	3	-	120	180	-	1.50	1
EXC	INTEGRAL RED LED	7	1	-	277	7	-	0.03	1
EXW	INTEGRAL RED LED	7	1	-	277	7	-	0.03	1
F1-1	(1) 39W T5HO	39	1	ELECTRONIC 10% DIMMING, PS	277	43	1.02	0.16/0.27(max)	0.98
F1-2	(1) 25W T8 3500K	25	1	ELECTRONIC, PS	277	28	0.95	0.1/0.17(max)	0.98
F1A-1	(1) 54W T5HO	54	1	ELECTRONIC 10% DIMMING, PS	277	63	1	0.23/0.39(max)	0.98
F1A-2	(1) 32W T8 3500K	32	1	ELECTRONIC, PS	277	35	1.01	0.13/0.22(max)	0.98
F2-1	(1) 39W T5HO	39	1	ELECTRONIC, PS	277	43	1.02	0.16/0.27(max)	0.98
F2-2	(1) 25W T8 3500K	21	1	ELECTRONIC, PS	277	28	0.95	0.1/0.17(max)	0.98
F2A-1	(1) 54W T5HO	54	1	ELECTRONIC, PS	277	62	1.02	0.52/0.88(max)	0.96
F2A-2	(1) 32W T8 3500K	32	1	ELECTRONIC, PS	277	35	1.01	0.13/0.22(max)	0.98
F3	(1) 39W T5H0 3500K	39	1	ELECTRONIC, PS	277	85	1	0.31/0.53(max)	0.98
F3A	(1) 54W T5HO 3500K	54	1	ELECTRONIC, PS	277	62	1.02	0.52/0.88(max)	0.96
F4	(1) 54W T5HO 3500K	54	1	ELECTRONIC, PS	277	62	1.02	0.52/0.88(max)	0.96
F5	(1) 25W T8 3500K	25	1	ELECTRONIC, PS	277	28	0.95	0.1/0.17(max)	0.98
F5A	(1) 32W T8 3500K	32	1	ELECTRONIC, PS	277	35	1.01	0.13/0.22(max)	0.98
F6	(1) 32W TT CFL 3500K	32	1	ELECTRONIC DIMMING, PS	277	36	0.98	0.13/0.22(max)	0.98
F7	(1) 32W TT CFL 3500K	32	1	ELECTRONIC DIMMING, PS	277	36	0.98	0.13/0.22(max)	0.98
F8	(1) 24W T5HO 3500K	24	1	ELECTRONIC, PS	277	27	1.02	0.1/0.17(max)	0.98
F9	(1) 18W CFL 3500K	18	1	ELECTRONIC, RS	277	20	1.05	0.17/0.29(max)	0.99
F10-1	(2) 13W CFL 3500K	13	2	ELECTRONIC, PS	277	29	1	0.25/0.38(max)	0.99
F10-2	(2) 13W CFL 3500K	13	2	ELECTRONIC, PS	277	29	1	0.25/0.38(max)	0.99
F10-3	(2) 13W CFL 3500K	13	2	ELECTRONIC, PS	277	29	1	0.25/0.38(max)	0.99
F10-4	(2) 13W CFL 3500K	13	2	ELECTRONIC, PS	277	29	1	0.25/0.38(max)	0.99
F10-5	(2) 13W CFL 3500K	13	2	ELECTRONIC, PS	277	29	1	0.25/0.38(max)	0.99
F11	(1) 18W CFL 3500K	18	1	ELECTRONIC, RS	277	20	1.05	0.17/0.29(max)	0.99
F12	(1) 54W T5HO 3500K	54	1	ELECTRONIC 10% DIMMING, PS	277	63	1	0.23/0.39(max)	0.98
F13	(1) 54W T5HO 3500K	54	1	ELECTRONIC 10% DIMMING, PS	277	63	1	0.23/0.39(max)	0.98
F14	(1) 32W TT CFL 3500K	32	1	ELECTRONIC 10% DIMMING, PS	277	38	1.05	0.14/0.22(max)	0.98
F16	(2) 54W T5HO 3500K	54	2	ELECTRONIC, PS	277	120	1	1/1.7(max)	0.98
FA1	(2) 54W T5HO 3500K	54	2	ELECTRONIC, PS	277	120	1	1/1.7(max)	0.98
FA2	(2) 54W T5HO 3500K	54	2	ELECTRONIC 10% DIMMING, PS	277	63	1	0.23/0.39(max)	0.98
FB1	(1) 54W T5HO 3500K	54	1	ELECTRONIC, PS	277	62	1.02	0.52/0.88(max)	0.96
FB2	(1) 54W T5HO 3500K	54	1	ELECTRONIC 10% DIMMING, PS	277	63	1	0.23/0.39(max)	0.98
FC	(2) 32W T8 3500K	32	2	ELECTRONIC, IS	277	77	1.2	0.28/0.48(max)	0.98
FD	(3) 32W T8 3500K	32	3	ELECTRONIC, IS	277	94	1	0.34/0.58(max)	0.99
FE	(1) 32W T8 3500K	32	1	ELECTRONIC, PS	277	35	1.01	0.13/0.22(max)	0.98
FF	(2) 32W T8 3500K	32	2	ELECTRONIC, IS	277	77	1.2	0.28/0.48(max)	0.98
FH-1	(1) 54W T5HO	54	1	ELECTRONIC 10% DIMMING, PS	277	63	1	0.23/0.39(max)	0.98
FH-2	(2) 50W MR16	50	2	REMOTE ELECTRONIC XFMR	277	100	-	0.36	1
FI-1	(2)39W T5HO 3500K	39	2	ELECTRONIC, PS	277	43	1.02	0.16/0.27(max)	0.98
FI-2	(3) 75W MR16	75	3	-	277	225	-	0.81	1
FJ	(2) 32W T8 3500K	32	2	ELECTRONIC, IS	277	77	1.2	0.28/0.48(max)	0.98

LIGHTING FIXTURE SCHEDULE									
TYPE	LAMP	WATTAGE	NO. OF LAMPS	BALLAST TYPE	VOLTAGE	INPUT WATTS	BALLAST FACTOR	CURRENT	POWER FACTOR
FK1	(4) 32W T8 3500K	32	4	ELECTRONIC, IS	277	143	1.18	0.52/0.0.88(max)	0.99
FK2	(4) 32W T8 3500K	32	4	ELECTRONIC, IS	277	143	1.18	0.52/0.0.88(max)	0.99
FK3	(4) 32W T8 3500K	32	4	ELECTRONIC, IS	277	143	1.18	0.52/0.0.88(max)	0.99
FK4	(4) 32W T8 3500K	32	4	ELECTRONIC, IS	277	143	1.18	0.52/0.0.88(max)	0.99
FL	(1) 54W T5HO 3500K	54	1	ELECTRONIC, PS	277	62	1.02	0.52/0.88(max)	0.96
FM	(1) 14W T5 3500K	14	1	ELECTRONIC, PS	277	19	1.07	0.16/0.27(max)	0.98
H1	(1) 39W T4MH 3000K	39	1	ELECTRONIC	120	46	1	0.39	0.95
H2	(1) 39W T4MH 3000K	351	1	ELECTRONIC	120	46	1	0.39	0.95
H2A	(1) 39W T4MH 3000K	312	1	ELECTRONIC	120	46	1	0.39	0.95
H2B	(1) 39W T4MH 3000K	117	1	ELECTRONIC	120	46	1	0.39	0.95
H2C	(1) 39W T4MH 3000K	117	1	ELECTRONIC	120	46	1	0.39	0.95
H3	(1) 150W T6MH 3000K	150	1	ELECTRONIC	277	166	1	0.60	0.9
H4	(1) 70W T4MH 3000K	70	1	ELECTRONIC	277	84	1	0.31	0.9
L1	WARM WHITE LED	25.2	1	INTEGRAL XFMR	277	25.2	-	0.09	1
L1A	WARM WHITE LED	24.15	1	INTEGRAL XFMR	277	24.15	-	0.09	1
L1B	WARM WHITE LED	16.8	1	INTEGRAL XFMR	277	16.8	-	0.06	1
L1C	WARM WHITE LED	30.66	1	INTEGRAL XFMR	277	30.66	-	0.11	1
L2	WARM WHITE LED	8.4	1	INTEGRAL XFMR	277	8.4	-	0.03	1
L4	WARM WHITE LED 90 CRI	1	1	INTEGRAL XFMR	120	1	-	0.01	1
OBA	(1) 32W CFL 3500K	32	1	ELECTRONIC DIMMING, PS	277	36	0.98	0.13/0.22(max)	0.98
OPA	(1) MH175 ED17 3700K	175	1	ELECTRONIC	277	191	1	0.70	0.9
OWA	(1) 32W CFL 3500K	32	1	ELECTRONIC DIMMING, PS	277	36	0.98	0.13/0.22(max)	0.98
S1	COOL WHITE LED	14.3	1	INTEGRAL XFMR	277	14.3	-	0.05	1
S1A	COOL WHITE LED	57.2	1	INTEGRAL XFMR	277	57.2	-	0.21	1
S3	(1) 13WCFL	13	1	ELECTRONIC, PS	277	16	1	0.13/0.12(max)	0.96
T1	(1) 40W IR PAR 30	40	1	-	120	40	-	0.33	1
T2	(1) 37W IR MR16 60 DEG WFL	37	1	-	277	37	-	0.13	1
T4	(1) 37W MR16 IR 25 DEG NFL	111	1	-	277	111	-	0.40	1
T4A	(1) 37W MR16 IR 25 DEG NFL	148	1	-	277	148	-	0.53	1
T4B	(1) 37W MR16 IR 25 DEG NFL	185	1	-	277	185	-	0.67	1
T4C	(1) 37W MR16 IR 25 DEG NFL	222	1	-	277	222	-	0.80	1
T4D	(1) 37W MR16 IR 25 NFL	37	1	-	277	37	-	0.13	1
T4E	(1) 37W MR16 IR 25 DEG NFL	74	1	-	277	74	-	0.27	1
T5	(3) 60W G9	60	3	-	120	180	-	1.50	1
T6	(1) 20W MR16 IR 40 DEG FL	20	1	-	12	20	-	1.67	1
T7	(1) 37W IR MR16 25 DEF NFL	37	1	-	277	37	-	0.13	1
T8	(1) 37W IR MR16 60 DEG WFL	74	1	-	277	74	-	0.27	1
WA-1	(1) 60W A19	60	1	-	120	60	-	0.50	1
WA-2	(1) 22W CIRCLINE CFL	22	1	ELECTRONIC, PS	120	25	0.95	0.17/0.29(max)	0.95
WB	WHITE LED	5	1	-	120	5	-	0.04	1

NOTES:
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KEY:
A/N=AS NOTED

Mechanical and Other Loads

The National Intrepid Center of Excellence contains many types of electrically powered equipment. These include mechanical fans, coils, pumps, and humidifiers; plumbing pumps and heaters; and elevators and other specialty architectural equipment. Mostly located in the Mechanical or Electrical Rooms, each piece of equipment operates at either 480 V or 120 V. The calculated loads are located in the following tables, which also include a total load in kilowatts.

MECHANICAL EQUIPMENT SCHEDULE

EQUIPMENT TAG	LOAD DESCRIPTION	LOAD MAGNITUDE	LOAD UNITS	MOTOR AMPS	VOLTAGE	PHASE	ASSUMED POWER FACTOR	LOAD IN KVA	LOAD IN KW
RF-1	MIXED FLOW FAN	30	HP	40	480	3	0.93	33.26	30.93
RF-2	MIXED FLOW FAN	30	HP	40	480	3	0.93	33.26	30.93
SF-1	DWDI FAN	100	HP	124	480	3	0.93	103.09	95.88
SF-2	DWDI FAN	100	HP	124	480	3	0.93	103.09	95.88
SF-3	VENTILATION FAN	3/4	HP	1.6	480	3	0.85	1.33	1.13
P-1	CHILLED WATER PUMP	25	HP	34	480	3	0.93	28.27	26.29
P-2	CHILLED WATER PUMP	25	HP	34	480	3	0.93	28.27	26.29
P-3	HEATING HOT WATER PUMP	15	HP	21	480	3	0.93	17.46	16.24
P-4	HEATING HOT WATER PUMP	15	HP	21	480	3	0.93	17.46	16.24
CP-1	CONDENSATE PUMP	2	HP	3.4	480	3	0.85	2.83	2.40
FCU-1	FAN COIL	1/10	HP	2.64	120	1	0.75	0.32	0.24
FCU-2	FAN COIL	1/2	HP	1.1	480	3	0.85	0.91	0.78
UH-1	HOT WATER UNIT HEATER	1/20	HP	1.32	120	1	0.75	0.16	0.12
UH-2	HOT WATER UNIT HEATER	1/20	HP	1.32	120	1	0.75	0.16	0.12
CUH-1	CABINET HOT WATER UNIT HEATER	1/4	HP	5.8	120	1	0.75	0.70	0.52
CUH-2	CABINET HOT WATER UNIT HEATER	1/8	HP	3.3	120	1	0.75	0.40	0.30
CUH-3	CABINET HOT WATER UNIT HEATER	1/8	HP	3.3	120	1	0.75	0.40	0.30
EF-1	ROOF EXHAUST FAN	3	HP	4.8	480	3	0.85	3.99	3.39
EF-2	ROOF EXHAUST FAN	2	HP	3.4	480	3	0.85	2.83	2.40
EF-3	VENTILATION FAN	3/4	HP	1.6	480	3	0.85	1.33	1.13
EF-4	VENTILATION FAN	1/4	HP	5.8	120	1	0.75	0.70	0.52
EF-5	VENTILATION FAN	1 1/2	HP	3	480	3	0.85	2.49	2.12
EF-6	ROOF RELIEF FAN	5	HP	7.6	480	3	0.93	6.32	5.88
EF-7	ROOF RELIEF FAN	5	HP	7.6	480	3	0.93	6.32	5.88
EF-8	ROOF HOT LAB FAN	3/4	HP	1.6	480	3	0.85	1.33	1.13
EF-10	MRI EXHAUST FAN	1/4	HP	5.8	120	1	0.75	0.70	0.52
EF-11	ROOF MRI EXHAUST FAN	1/6	HP	4.4	120	1	0.75	0.53	0.40
EF-12	ROOF SERVER EXHAUST FAN	1/3	HP	7.2	120	1	0.75	0.86	0.65
CRAC-1	COMPUTER RM SELF-CONTAINED AC UNIT	23.9	KVA	49.79	480	3	0.93	23.90	38.50
CRAC-2	COMPUTER RM SELF-CONTAINED AC UNIT	23.9	KVA	49.79	480	3	0.93	23.90	38.50
CRAC-3	COMPUTER RM SELF-CONTAINED AC UNIT	23.9	KVA	49.79	480	3	0.93	23.90	38.50
CRAC-4	COMPUTER RM SELF-CONTAINED AC UNIT	27.4	KVA	57.08	480	3	0.93	27.40	44.14
CRAC-5	COMPUTER RM SELF-CONTAINED AC UNIT	27.4	KVA	57.08	480	3	0.93	27.40	44.14
CRAC-6	COMPUTER RM SELF-CONTAINED AC UNIT	18.7	KVA	38.96	480	3	0.93	18.70	30.12
CRAC-7	COMPUTER RM SELF-CONTAINED AC UNIT	18.7	KVA	38.96	480	3	0.93	18.70	30.12
HDU-1	HIGH DENSITY COMPUTER ROOM AC UNIT	2	FLA	2	120	1	0.75	0.24	0.18
HDU-2	HIGH DENSITY COMPUTER ROOM AC UNIT	2	FLA	2	120	1	0.75	0.24	0.18
HDU-3	HIGH DENSITY COMPUTER ROOM AC UNIT	2	FLA	2	120	1	0.75	0.24	0.18
HDU-4	HIGH DENSITY COMPUTER ROOM AC UNIT	2	FLA	2	120	1	0.75	0.24	0.18
HDU-5	HIGH DENSITY COMPUTER ROOM AC UNIT	2	FLA	2	120	1	0.75	0.24	0.18
HDU-6	HIGH DENSITY COMPUTER ROOM AC UNIT	2	FLA	2	120	1	0.75	0.24	0.18
HDU-7	HIGH DENSITY COMPUTER ROOM AC UNIT	2	FLA	2	120	1	0.75	0.24	0.18
HDU-8	HIGH DENSITY COMPUTER ROOM AC UNIT	2	FLA	2	120	1	0.75	0.24	0.18
HDU-9	HIGH DENSITY COMPUTER ROOM AC UNIT	2	FLA	2	120	1	0.75	0.24	0.18
RPU-1	REFRIGERANT PUMP	2.1	FLA	2.1	480	3	0.85	1.75	1.48
H-1	STEAM HUMIDIFIER	20	FLA	20	480	3	0.93	16.63	15.46
H-2	STEAM HUMIDIFIER	32	FLA	32	480	3	0.93	26.60	24.74
H-3	STEAM HUMIDIFIER	32	FLA	32	480	3	0.93	26.60	24.74
								TOTAL LOAD (KW)	700.64

PLUMBING EQUIPMENT SCHEDULE

EQUIPMENT TAG	LOAD DESCRIPTION	LOAD MAGNITUDE	LOAD UNITS	MOTOR AMPS	VOLTAGE	PHASE	ASSUMED POWER FACTOR	LOAD IN KVA	LOAD IN KW
HWRP-1	DOMESTIC HOT WATER PUMP	1/12	HP	2.2	120	1	0.75	0.26	0.20
DWH-1	STEAM FIRED WATER HEATER	2	HP	3.4	480	3	0.85	2.83	2.40
DWH-2	STEAM FIRED WATER HEATER	2	HP	3.4	480	3	0.85	2.83	2.40
VP-1	VACUUM PUMP	2	HP	3.4	480	3	0.85	2.83	2.40
SP-1	STORM PUMP	1/2	HP	9.8	115	1	0.85	1.13	0.96
								TOTAL LOAD (KW)	8.36

ARCHITECTURAL EQUIPMENT SCHEDULE

EQUIPMENT TAG	LOAD DESCRIPTION	LOAD MAGNITUDE	LOAD UNITS	MOTOR AMPS	VOLTAGE	PHASE	ASSUMED POWER FACTOR	LOAD IN KVA	LOAD IN KW
ELEVATOR #1	ELEVATOR	50	HP	65	480	3	0.93	54.04	50.26
ELEVATOR #2	ELEVATOR	50	HP	65	480	3	0.93	54.04	50.26
FLUOR RM	FLUOROSCOPY ROOM CONTROLS	140.00	A	140	480	3	0.7	116.39	81.48
MEG	MEG EQUIPMENT	80.00	A	80	480	3	0.7	66.51	46.56
PET/CT	PET/CT EQUIPMENT	140.00	A	140	480	3	0.7	116.39	81.48
MRI	MRI EQUIPMENT	140.00	A	140	480	3	0.7	116.39	81.48
								TOTAL LOAD (KW)	391.50

Service Entrance Size

The following are three service entrance sizing methods. It is noticeable that the total loads calculated in each of the methods vary for each calculation. Used during the conceptual and schematic design phases, the Square Foot Method gives a general size that depends on the building type and area. The NEC Loading Method is completed as part of design development. Using the total building area or the area specific to that load type, multiplied by the VA/sq.ft. for the specific load category, a more accurate demand load is calculated. Finally, by using the actual connected loads in the building, multiplied by the demand factors to account for system usage, the Actual Loading Method is used when creating construction documents. This value should be the closest the actual service entrance size used in the building. Since calculating all of the actual lighting and electrical loads from each panel board becomes very complex, the value for these load types was used from the NEC Loading Method. These values are considered demand loads, so the demand factors do not need to be applied for these lighting and receptacle values (in the Actual Loading Method). All other loads are actual values provided in the existing construction documents. For loads in which only circuit breaker sizes were available, 80% of that load was used.

SERVICE ENTRANCE SIZE: SQUARE FOOT METHOD			
BUILDING TYPE	AREA (SQ. FT.)	VA / SQ. FT.	VA
OUTPATIENT CARE	72000	20	1440000
		TOTA KVA	1440
		TOTAL CURRENT @ 480V	1732

SERVICE ENTRANCE SIZE: NEC LOADING			
LOAD TYPE	AREA (SQ. FT.)	VA / SQ. FT.	VA
LIGHTING	72000	2	144000
RECEPTACLES	72000	0.5	36000
FANS & PUMPS	72000	2	144000
COMPUTER RM A/C	1020	12	12240
MEDICAL EQUIPMENT	1900	25	47500
COMPUTERS	1020	200	204000
		TOTA KVA	**588**
		TOTAL CURRENT @ 480V	**707**

NOTES:
1. FANS AND PUMPS INCLUDE MECHANICAL AND PLUMBING EQUIPMENT
2. MEDICAL EQUIPMENT INCLUDES SPECIALTY DEVICES FOR MRI, PET/CT, FLUOROSCOPY, AND MEG ROOMS.

SERVICE ENTRANCE SIZE: ACTUAL LOADING			
LOAD TYPE	DEMAND FACTOR	CONNECTED LOAD (VA)	DEMAND LOAD (VA)
LIGHTING	-	144000	144000
RECEPTACLES	-	36000	36000
FANS & PUMPS	0.8	480186	384149
COMPUTER RM A/C	1	166060	166060
ELEVATORS	0.5	108080	54040
MEDICAL EQUIPMENT	1	415692	415692
COMPUTERS	1	200000	200000
		TOTA KVA	**1400**
		TOTAL CURRENT @ 480V	**1684**

NOTES:
1. FANS AND PUMPS INCLUDE MECHANICAL AND PLUMBING EQUIPMENT
2. MEDICAL EQUIPMENT INCLUDES SPECIALTY DEVICES FOR MRI, PET/CT, FLUOROSCOPY, AND MEG ROOMS.

SERVICE ENTRANCE SIZE			
PHASE	LOAD (KVA)	VOLTAGE SYSTEM (V)	LOAD (A)
SQUARE FOOTAGE METHOD	1440	480	1732
NEC LOADING METHOD	588	480	707
ACTUAL LOADING METHOD	1400	480	1684
ACTAUL CONDITIONS - SERVICE ENTRANCE	2494	480	3000

VA PER SQ.FT. (TOTAL OF 72,000 SQ.FT.)	35

When comparing all three methods, the NEC Loading Method was the smallest. This is due to the fact that the VA/sq.ft. were underestimated for this building type. The server room and various types of medical equipment are responsible for loads larger than normal. The Actual Loading Method value was slightly smaller than the Square Footage Method. This is primarily because the heating and cooling loads are received from a central plant, and they are not accounted for in this building. Overall, the actual conditions service entrance size used for the existing system was higher than that calculated. This is due to the fact that the demand loads, instead of the actual connected loads were used for lighting and receptacles. Also, many of the panel boards were not fully utilized in order to leave room for future expansion. Other design factors may have been considered when sizing the system.

Environmental Stewardship Design

The building is being designed for a LEED Silver rating. However, there are no "green" electrical systems that are to be implemented. The allowable lighting power density specified ASHRAE Standard 90.1 was closely followed in the lighting design. Occupancy sensors are also used in most spaces.

Design Issues

There were no major design issues encountered during the design of NICoE's electrical system. The only problem was the size of the utility service and transformer of the existing building. The existing 15KV service was inadequate to accommodate the new loads. Also, the previous transformer was upgraded from 500KVA to 2000KVA to support the new system. The call for a UPS in the server room shows that power supply and quality to this area was possibly a concern.

Section II: Communication Systems

Fire Alarm System

The fire alarm system's main function is to notify building occupants of a fire emergency. The system is voice activation type and consists of ADA compliant strobes and audible speakers. It includes duct mounted smoke detectors, manual pull stations, photoelectric smoke detectors, sprinklers, annunciation panels, wall-mounted panels, and radio frequency transmitter and associated equipment. The main fire alarm control panel, along with other critical panels, is located in the Emergency Equipment Room 112A. All other devices are spread throughout the building according to all fire protection codes.

Audiovisual System

Various spaces throughout the building contain speakers and flat panel displays for general patient viewing. Audiovisual input and output panels are positioned for multimedia connections throughout different areas. The Auditorium, Media Dive Room, Classroom, and Research/Tech Room contain projectors and projection screens for seminars and presentations. Cameras are located on the second floor Physical Therapy and Occupational Therapy spaces. They are also present to monitor patient progress in the ADL Suite and Recreational Therapy area.

Telephone/Data System

The telephone and data systems are connected to the interior server room with 4" conduit. Almost every room contains voice/data and computer outlets for occupant usage. Media and wireless outlets are also widespread. Nurse call technologies are located in most of the spaces. These enable maximum patient care at anytime and from anywhere. The main telecommunications room is located on the ground floor adjacent to the Main Electrical Room. Each floor will also be provided with a local telecommunications closet.

Security Systems

The security system consists of card readers in various locations of the building. They are placed outside of select spaces for limited access. A dedicated conduit system is provided.

Appendix A:
Single-Line Diagram

PEPCO
WASHINGTON, DC

15 KV LOAD INTERRUPTER SWITCH — T-1

13.8 KV
480Y/277V, 3ø, 4W

2500 KVA

3000

3000AT 3P

SWITCHBOARD

480Y/277V, 3ø, 4W

M

TVSS | 90AT 3P | 150AT 3P | 150AT 3P | 225AT 3P | 225AT 3P | 175AT 3P | 175AT 3P | 175AT 3P | SPARE | 250AT 3P | 225AT 3P | 90AT 3P | 200AT 3P | SPARE | SPARE | 500AT 3P | 400AT 3P | 225AT 3P | 225AT 3P | SPARE | 150AT 3P

G — 600A 3P — 225A 3P

90A-1 — 480Y/277V 3ø, 3W / 208Y/120V 3ø, 4W — T-2 K13 45 KVA — 150A 3P — 150B-1 — RPVL 150A 3P — 225A

150-3 — L1A 150A 3P — 225A — 100A 3P — 125A 3P
- 125A-2 — LCP-L1A 100A — 480Y/277V 3ø, 3W / 208Y/120V 3ø, 4W — T-6 75 KVA — 250-2 — 125-4 — 125-5 — R1A1 125A 3P 225A — R1A2 125A 3P 225A

150-4 — L1B 150A 3P — 225A — 100A 3P — 125A 3P
- 125A-3 — LCP-L1B 100A — 480Y/277V 3ø, 3W / 208Y/120V 3ø, 4W — T-7 75 KVA — 250-4 — 125-6 — 125-7 — R1B1 125A 3P 225A — R1B2 125A 3P 225A

175-3 — 125A 3P — MRI
175-2 — 125A 3P — PET/CT
175-1 — 125A 3P — FLUOROSCOPY

125-8 — 125A 3P — ELEV. #1
125-9 — 125A 3P — ELEV. #2
250-3

200-1 — 260A ATS-LS
600-2 — 600A ATS-EM

600-1
225-7
150-1 — L1 225A — 100A 3P — 50A 3P
- 50A-1 — LCP-L1 100A — 480Y/277V 3ø, 3W / 208Y/120V 3ø, 4W — T-5 30 KVA — R1 100A 3P 100A — 100-1

600-3 — 480V — EDP1 — 600A — 100A 3P — 500A 3P — 500A 3P — 225A 3P

100-5 — CL1B 100A — 25A 3P
- 25A-1 — 480Y/277V 3ø, 3W / 208Y/120V — T-13 15 KVA — 50-1 — CR1B 50A 3P 100A

225-9 — CL1A 225A — 25A 3P
- 25A-3 — 480Y/277V 3ø, 3W / 208Y/120V — T-11 15 KVA — 50-5 — CR1A 50A 3P 100A

500-1

225KVA — UPS
500-3 — BY-PASS
500-2
500-4 — DP-UPS 400A 3P — 200A 3P — 200A 3P

250-5 — BATTERY CABINET 1
250-6 — BATTERY CABINET 2

250-7 — 125 KVA — PDU 1 — 200A 3P — 480Y/277V 3ø, 3W / 208Y/120V 3ø, 4W — K20 125 KVA — 100A 3P — 100A 3P
250-8 — 125 KVA — PDU 2 — 200A 3P — 480Y/277V 3ø, 3W / 208Y/120V 3ø, 4W — K20 125 KVA — 100A 3P — 100A 3P

225-1 — H2 225A 3P 225A

400-1 — 480V — DP1 — 400A 3P — 400A — 100A 3P — 200A 3P
- 100-2 — LPA 100A 3P 100A
- 200-2 — LPC 100A 3P 100A

225-3 — L2A 225A 3P — 225A — 100A 3P — 125A 3P
- 125A-1 — LCP-L2A 100A — 480Y/277V 3ø, 3W / 208Y/120V 3ø, 4W — T-8 75 KVA — 250-1 — 125-1 — 125-2 — R2A1 125A 3P 125A — R2A2 125A 3P 125A

225-4 — L2B 225A 3P — 225A — 100A 3P — 175A 3P
- 175A — LCP-L2B 100A — 480Y/277V 3ø, 3W / 208Y/120V 3ø, 4W — T-9 112.5 KVA — 400-2 — 225-5 — 225-6 — R2B1 175A 3P 225A — R2B2 225A 3P 225A — 125A 3P — 125-3 — R2B3 125A 3P 225A

90A-2 — 480Y/277V 3ø, 3W / 208Y/120V 3ø, 4W — T-3 K13 45KVA — 150B-2 — 150A 3P — 208V — DP3 — 150A 3P — 225A — 100A 3P — 100B — 100A 3P — MEG

225A — 480Y/277V 3ø, 3W / 208Y/120V 3ø, 4W — T-4 K13 150 KVA — 500B — 500A 3P — 208V — DP2 — 600A — 20A 3P | 150A 3P | 150A 3P | 225A 3P | 100A 3P
- 150B-4 — SNOW MELT PANEL
- 150B-3 — RPA 150A 3P 225A
- 150-2 — RPC 150A 3P 225A
- 225-2 — RPD 225A 3P — 100A 3P — LCP-RPD 100A
- 100-3 — RPB 100A 3P 100A

225-8 — LSL1A — 100A — 50A 3P | 50A 3P | 100A 3P | 50A 3P
- 50-6 — LSL2A 50A 3P 100A
- 50-4 — LSLPA 50A 3P 100A
- 50A-2 — 480Y/277V 3ø, 3W / 208Y/120V — T-10 30 KVA — 100-6 — LSR1A 100A 3P — 100A — 50A 3P — 50-7 — R-GEN 50A
- 100-4 — LSL1B — 100A — 50A 3P | 25A 3P
  - 50-3 — LSL2B 50A 3P 100A
  - 25A-2 — 480Y/277V 3ø, 3W / 208Y/120V — T-12 15 KVA — 50-2 — LSR1B 50A 3P 100A

NATIONAL INTREPID CENTER OF EXCELLENCE

Bethesda, MD

Christine Clowes

AE 481W-Senior Project

10/24/2008

TECHNICAL REPORT 2
Single-Line Diagram

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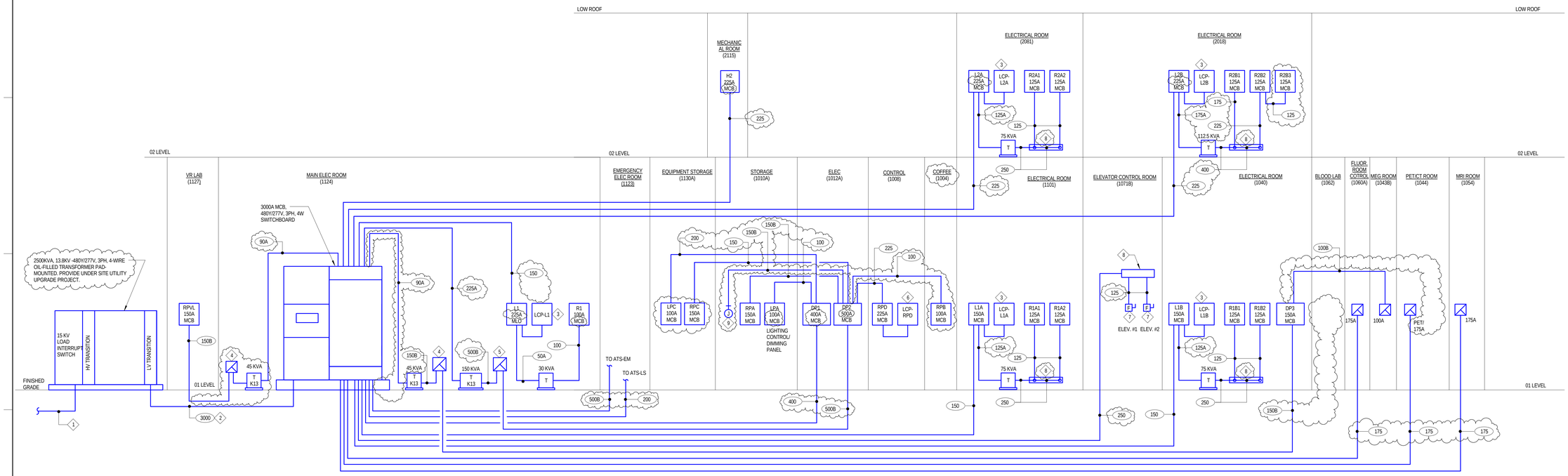

NOTES

GENERAL NOTES

1. SEE DRAWING E5.02 FOR EMERGENCY POWER RISER DIAGRAM.
2. ALL PANELBOARDS SHALL BE 42-POLE.

KEYED NOTES

1. 15KV PRIMARY FEEDER IN CONCRETE DUCTBANK PROVIDED UNDER SITE UTILITY UPGRADE PROJECT.
2. FEEDER ROUTED IN UNDERGROUND 9-WAY CONCRETE ENCASED DUCTBANK,MINIMUM 24" BELOW FINISHED GRADE. SEE DRAWING E1.01 FOR TRANSFORMER LOCATION.
3. 100A, 24-POLE, 277 VOLT LIGHTING CONTACTOR PANEL.
4. 150A, 3P, 480V ENCLOSED CIRCUIT BREAKER IN NEMA-1 ENCLOSURE. PROVIDE 200% NEUTRAL WITH DUAL LUGS.
5. 500A, 3P, 480V ENCLOSED CIRCUIT BREAKER IN NEMA-1 ENCLOSURE. PROVIDE 200% NEUTRAL WITH DUAL LUGS.
6. 100A, 24-POLE, 120V LIGHTING CONTACTOR PANEL.
7. ELEVATOR POWER MODULE, 125A, 480V, 3P SHUNT TRIP ENCLOSED CIRCUIT BREAKER.
8. 6"X6"X48" WIREWAY.
9. JUNCTION BOX FOR SNOW MELT CONTROL PANEL. SEE E2.01 FOR THE LOCATION.

FEEDER SCHEDULE

FEEDER NO.	CB SIZE (AMP)	NO. SET	WIRE NO. AND SIZE	GROUND NO. AND SIZE	CIRCUIT NO. AND SIZE	REMARKS	FEEDER NO.	CB SIZE (AMP)	NO. SET	WIRE NO. AND SIZE	GROUND NO. AND SIZE	CIRCUIT NO. AND SIZE	REMARKS
20	20	1	4#12	1#12	(1)-3/4"		300	300	1	4#350KCMIL	1#4	(1)-3"	
25	25	1	4#10	1#10	(1)-3/4"		300A	300	1	2#350KCMIL	1#4	(1)-2 1/2"	
25A	25	1	3#10	1#10	(1)-3/4"		350	350	1	4#500KCMIL	1#3	(1)-3"	
30	30	1	4#10	1#10	(1)-3/4"		350A	350	1	3#500KCMIL	1#3	(1)-3"	
35	35	1	4#8	1#10	(1)-3/4"		400	400	2	4#3/0	1#3	(2)-2"	
40	40	1	4#8	1#10	(1)-3/4"		400A	400	2	3#3/0	1#3	(2)-2"	
50	50	1	4#6	1#10	(1)-1"		450	450	2	4#4/0	1#2	(2)-2 1/2"	
50A	50	1	3#6	1#10	(1)-3/4"		500	500	2	4#250KCMIL	1#2	(2)-2 1/2"	
60	60	1	4#4	1#10	(1)-1 1/4"		500A	500	2	3#250KCMIL	1#2	(2)-2 1/2"	
70	70	1	4#4	1#8	(1)-1 1/4"		500B	500	2	5#250KCMIL	2#2	(2)-3"	W/ IG AND EQUIP. GROUND
80	80	1	4#3	1#8	(1)-1 1/4"		550	550	2	4#300KCMIL	1#1	(2)-3"	
80A	80	1	3#3	1#8	(1)-1 1/4"		600	600	2	4#350KCMIL	1#1	(2)-3"	
90	90	1	4#2	1#8	(1)-1 1/4"		600B	600	2	5#350KCMIL	2#1	(2)-3"	
90A	90	1	3#2	1#8	(1)-1 1/4"		750	750	2	4#500KCMIL	1#1/0	(2)-3"	
100	100	1	4#1	1#8	(1)-1 1/2"		750A	750	2	3#500KCMIL	1#1/0	(2)-3"	
100B	100	1	5#1	2#8	(1)-1 1/2"		800	800	3	4#300KCMIL	1#1/0	(3)-2 1/2"	
110	110	1	4#1	1#6	(1)-1 1/2"		900	900	3	4#350KCMIL	1#2/0	(3)-3"	
125	125	1	4#1/0	1#6	(1)-2"		1000	1,000	3	4#400KCMIL	1#2/0	(3)-3"	
125A	125	1	3#1/0	1#6	(1)-1 1/2"		1000A	1,000	3	3#400KCMIL	1#2/0	(3)-2 1/2"	
125B	125	1	5#1/0	2#6	(1)-2"	W/ IG AND EQUIP. GROUND	1000B	1,000	3	5#400KCMIL	1#2/0	(3)-3"	
150	150	1	4#1/0	1#6	(1)-2"		1200	1,200	4	4#350KCMIL	1#4/0	(4)-3"	
150B	150	1	5#1/0	2#6	(1)-2"		1200A	1,200	4	3#350KCMIL	1#4/0	(4)-2 1/2"	
175	175	1	4#2/0	1#6	(1)-2"		1600	1,600	5	4#400KCMIL	1#4/0	(5)-3"	
175A	175	1	3#2/0	1#6	(1)-2"		2000	2,000	6	4#400KCMIL	1#250KCMIL	(6)-3"	
200	200	1	4#3/0	1#6	(1)-2"		2500	2,500	7	4#500KCMIL	1#350KCMIL	(7)-3 1/2"	INSULATED GROUNDING WIRE
225	225	1	4#4/0	1#4	(1)-2 1/2"		3000	3,000	7	4#500KCMIL	1#400KCMIL	(9)-4"	INSULATED GROUNDING WIRE
225A	225	1	3#4/0	1#4	(1)-2"		-	-	-	-	-	-	
250	250	1	4#250KCMIL	1#4	(1)-2 1/2"								
275	275	1	4#300KCMIL	1#4	(1)-3"								

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KEY PLAN

PROJECT NORTH

SEALS AND SIGNATURES

ISSUED FOR	REV	DATE
PACKAGE 4		JUNE 30, 2008
PACKAGE 5	1	AUGUST 15, 2008

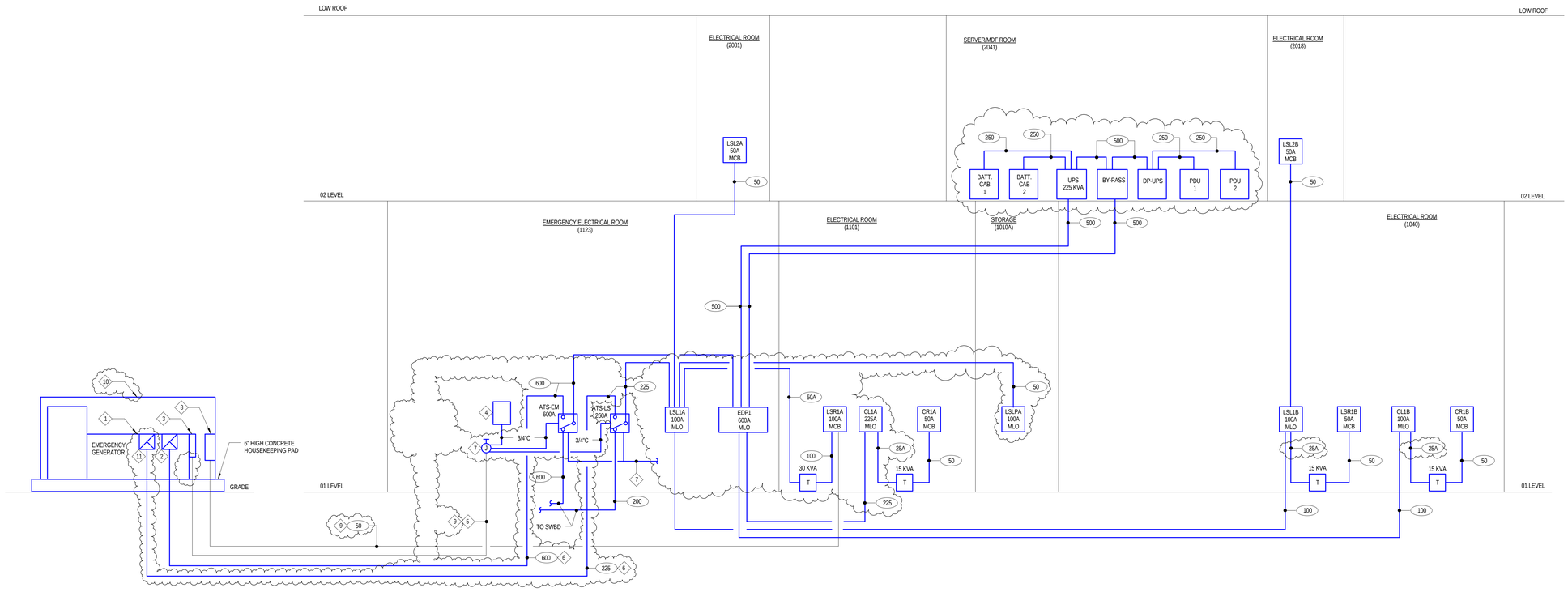
DRAWING TITLE
NORMAL POWER RISER DIAGRAM

NONE
SCALE

26423.000
PROJECT NUMBER

CD
DRAWING PHASE

E5.01
DRAWING NUMBER



NOTES

GENERAL NOTES

1. SEE DRAWING E5.01 FOR NORMAL POWER RISER DIAGRAM.
2. SEE DRAWING E5.01 FOR FEEDER SCHEDULE.
3. AUTOMATIC TRANSFER SWITCHES SHALL BE 4-POLE WITH SWITCHED NEUTRAL AND ISOLATION BY-PASS SWITCH.

KEYED NOTES

1. STAND-BY EMERGENCY DIESEL GENERATOR. 400KW, 480Y/277V, 3Ø, 4-WIRE WITH SUB-BASE FUEL TANK. GENERATOR PROVIDED IN 75 dBA OUTDOOR SOUND ATTENUATED WEATHERPROOF ENCLOSURE.
2. GENERATOR-MOUNTED CIRCUIT BREAKER, 600A, 3P.
3. GENERATOR CONTROL PANEL.
4. GENERATOR REMOTE ANNUNCIATOR.
5. CONDUIT WITH DRAG WIRE FOR GENERATOR START/STOP SIGNAL WIRING AND REMOTE ANNUNCIATOR SIGNAL WIRING.
6. FEEDER ROUTED IN UNDERGROUND 6-WAY CONCRETE ENCASED DUCTBANK, MINIMUM 24" BELOW FINISHED GRADE.
7. JUNCTION BOX FOR SIGNAL WIRING TO REMOTE ANNUNCIATOR AND GENERATOR START/STOP SIGNAL.
8. 208Y/120V, 3Ø, 4-W PANELBOARD 'R-GEN' PROVIDED BY GENERATOR MANUFACTURER FOR GENERATOR ACCESSORIES. PROVIDE PANEL WITH 1-20/2P CB AND 4-20/1P CB, WITH GENERATOR ENCLOSURE PACKAGE.
9. SEE CONCRETE DUCT BANK DETAIL (GENERATOR) ON E2.00.
10. GENERATOR OUTDOOR SOUND ATTENUATED ENCLOSURE.
11. GENERATOR MOUNTED CIRCUIT BREAKER, 225A, 30P.

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KEY PLAN

PROJECT NORTH

SEALS AND SIGNATURES

ISSUED FOR	REV	DATE
PACKAGE 4		JUNE 30, 2008
PACKAGE 5	1	AUGUST 15, 2008

DRAWING TITLE
EMERGENCY POWER RISER DIAGRAM

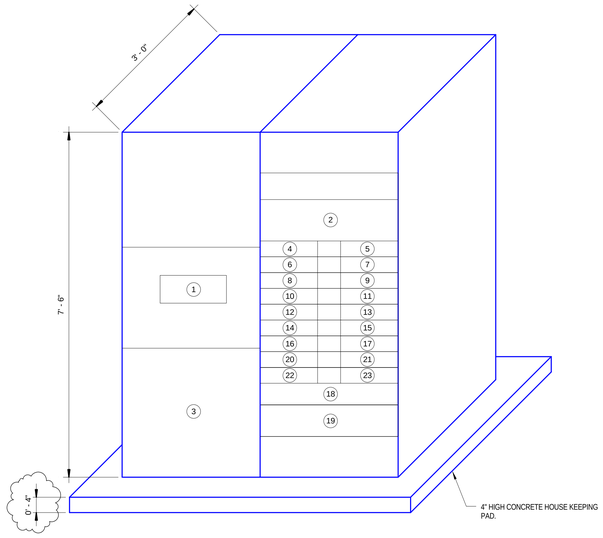
NONE

SCALE

PROJECT NUMBER
26423.000

CD — DRAWING PHASE

E5.02 — DRAWING NUMBER



1 SWITCHBOARD ELEVATION
3/4" = 1'-0"

SWITCHBOARD SCHEDULE

(3000A, 480Y/277V, 3 PHASE, 4 WIRE, 100,000 AIC)

SECTION NUMBER	BRANCH DEVICES (BREAKERS) FRAME	TRIP	POLES	NAMEPLATE DESIGNATION/ ITEMS SERVED	REMARKS
1	-	-	-	DIGITAL METER	-
2	-	-	-	TVSS	-
3	3000	3000	3	MAIN CIRCUIT BREAKER	GF PROTECTION, 100% RATED
4	225	150	3	PANEL L1A	-
5	225	150	3	PANEL L1B	-
6	225	225	3	PANEL L2A	-
7	225	225	3	PANEL L2B	-
8	225	175	3	MRI	-
9	225	175	3	CT	-
10	225	175	3	FLUOROSCOPY	-
11	225	150	3	SPARE	-
12	400	250	3	ELEVATORS	-
13	225	225	3	IMAGING TRANSFORMER (150 KVA)	SERVES PANEL DP2
14	100	90	3	TRANSFORMER (45 KVA)	SERVES PANEL DP3
15	225	200	3	ATS-LS	-
16	100	100	3	SPARE	-
17	100	100	3	SPARE	-
18	600	500	3	ATS-EM	-
19	600	400	3	PANEL DP1	-
20	225	225	3	PANEL H2	-
21	225	225	3	SPARE	-
22	100	90	3	TRANSFORMER (45 KVA)	PANEL RPVL
23	225	150	3	PANEL L1	-

MECHANICAL EQUIPMENT SCHEDULE

DESCRIPTION	HP	KVA	VOLTAGE	PHASE	COMB. STARTER/ DISC. SW. SIZE	VFD	NEMA ENCL.	CB SIZE	FEEDER AND CONDUIT	REMARKS
RF-1	30	33.3	480	3	-	VFD	1	90	3#6 + 1#8G, 3/4"C	PROVIDE 100/3 NFSS
RF-2	30	33.3	480	3	-	VFD	1	90	3#6 + 1#8G, 3/4"C	PROVIDE 100/3 NFSS
SF-1	100	103.1	480	3	-	VFD	1	225	3#2/0 + 1#4G, 2"C	PROVIDE 400/3 NFSS
SF-2	100	103.1	480	3	-	VFD	1	225	3#2/0 + 1#4G, 2"C	PROVIDE 400/3 NFSS
SF-3	3/4	1.3	480	3	1	-	1	15	3#12 + 1#12G, 3/4"C	
P-1	25	28.3	480	3	-	VFD	1	70	3#8 + 1#8G, 3/4"C	PROVIDE 100/3 NFSS
P-2	25	28.3	480	3	-	VFD	1	70	3#8 + 1#8G, 3/4"C	PROVIDE 100/3 NFSS (STANDBY)
P-3	15	17.5	480	3	-	VFD	1	40	3#10 + 1#10G, 3/4"C	PROVIDE 60/3 NFSS
P-4	15	17.5	480	3	-	VFD	1	40	3#10 + 1#10G, 3/4"C	PROVIDE 60/3 NFSS (STANDBY)
CP-1	2	2.8	480	3	1	-	1	15	3#12 + 1#12G, 3/4"C	DUPLEX
HWRP-1	1/12	0.3	120	1	MMS	-	1	20	2#12 + 1#12G, 3/4"C	
DWH-1	2	2.8	480	3	1	-	1	15	3#12 + 1#12G, 3/4"C	
DWH-2	2	2.8	480	3	1	-	1	15	3#12 + 1#12G, 3/4"C	
VP-1	2	2.8	480	3	1	-	1	15	3#12 + 1#12G, 3/4"C	EMERGENCY POWER
FCU-1	1/10	0.3	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 3.
FCU-2	1/2	0.9	480	3	1	-	1	15	3#12 + 1#12G, 3/4"C	
UH-1	1/20	0.2	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 3.
UH-2	1/20	0.2	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 3.
CUH-1	1/4	0.7	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 3.
CUH-2	1/8	0.4	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 3.
CUH-3	1/8	0.4	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 3.
EF-1	3	4.0	480	3	1	-	3R	15	3#12 + 1#12G, 3/4"C	ON ROOF
EF-2	2	2.8	480	3	1	-	3R	15	3#12 + 1#12G, 3/4"C	ON ROOF
EF-3	3/4	1.1	480	3	1	-	1	20	3#12 + 1#12G, 3/4"C	
EF-4	1/4	0.7	120	1	MMS	-	1	20	2#12 + 1#12G, 3/4"C	
EF-5	1 1/2	2.5	480	3	1	-	3R	15	3#12 + 1#12G, 3/4"C	ON ROOF
EF-6	5.0	6.3	480	3	1	-	3R	15	3#12 + 1#12G, 3/4"C	ON ROOF
EF-7	5.0	6.3	480	3	1	-	3R	15	3#12 + 1#12G, 3/4"C	ON ROOF
EF-8	3/4	1.3	480	3	1	-	3R	15	3#12 + 1#12G, 3/4"C	ON ROOF, EMERGENCY POWER
EF-10	1/4	0.7	120	1	MMS	-	3R	20	2#12 + 1#12G, 3/4"C	ON ROOF
EF-11	1/6	0.5	120	1	MMS	-	3R	20	2#12 + 1#12G, 3/4"C	ON ROOF
EF-12	1/3	0.8	120	1	MMS	-	3R	20	2#12 + 1#12G, 3/4"C	ON ROOF
CRAC-1	-	23.9	480	3	-	-	1	40	3#8 + 1#8G, 3/4"C	PROVIDE 60/3/40 FSS
CRAC-2	-	23.9	480	3	-	-	1	40	3#8 + 1#8G, 3/4"C	PROVIDE 60/3/40 FSS
CRAC-3	-	23.9	480	3	-	-	1	40	3#8 + 1#8G, 3/4"C	PROVIDE 60/3/40 FSS
CRAC-4	-	27.4	480	3	-	-	1	45	3#6 + 1#8G, 3/4"C	PROVIDE 60/3/45 FSS
CRAC-5	-	27.4	480	3	-	-	1	45	3#6 + 1#8G, 3/4"C	PROVIDE 60/3/45 FSS
CRAC-6	-	18.7	480	3	-	-	1	30	3#10 + 1#10G, 3/4"C	PROVIDE 60/3/30 FSS
CRAC-7	-	18.7	480	3	-	-	1	30	3#10 + 1#10G, 3/4"C	PROVIDE 60/3/30 FSS
HDU-1	2 FLA	0.25	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 4.
HDU-2	2 FLA	0.25	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 4.
HDU-3	2 FLA	0.25	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 4.
HDU-4	2 FLA	0.25	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 4.
HDU-5	2 FLA	0.25	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 4.
HDU-6	2 FLA	0.25	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 4.
HDU-7	2 FLA	0.25	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 4.
HDU-8	2 FLA	0.25	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 4.
HDU-9	2 FLA	0.25	120	1	-	-	1	20	2#12 + 1#12G, 3/4"C	SEE NOTE 4.
ELEVATOR #1	50	65.0	480	3	3	-	1	125	4#1 + 1#8G, 1 1/2"C	PROVIDE SHUNT TRIP CB.
ELEVATOR #2	50	65.0	480	3	3	-	1	125	4#1 + 1#8G, 1 1/2"C	PROVIDE SHUNT TRIP CB.
SP-1	1/2	1.1	115	1	-	-	-	20	2#12 + 1#12G, 3/4"C	CORD AND PLUG
RPU-1	2.1 FLA	1.8	480	3	1	-	1	20	3#12 + 1#12G, 3/4"C	
H-1	20 FLA	16.6	480	3	1	-	1	25	3#10 + 1#10G, 3/4"C	PROVIDE 30/3 NFSS
H-2	32 FLA	26.6	480	3	1	-	1	40	3#8 + 1#8G, 3/4"C	PROVIDE 60/3 NFSS
H-3	32 FLA	26.6	480	3	1	-	1	40	3#8 + 1#8G, 3/4"C	PROVIDE 60/3 NFSS

NOTE

1. VFDS PROVIDED BY DIVISION 16.
2. MMS: MANUAL MOTOR STARTER
3. INTEGRAL DISCONNECT SWITCH AND STARTER.
4. TWO CORD AND PLUG CONNECTIONS - ONE NORMAL SOURCE , ONE EMERGENCY SOURCE.

NOTES

GENERAL NOTES

1. -

KEYED NOTES

1. -
2.
3.
4.
5.

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KEY PLAN

PROJECT NORTH

SEALS AND SIGNATURES

ISSUED FOR	REV	DATE
PACKAGE 4		JUNE 30, 2008
PACKAGE 5	1	AUGUST 15, 2008

DRAWING TITLE
SWBD ELEVATION & SCHEDULE AND EQUIP SCHEDULE

SCALE
As indicated

PROJECT NUMBER
26423.000

DRAWING PHASE
CD

DRAWING NUMBER
E6.01

Appendix B:
H.I.D. Ballasts

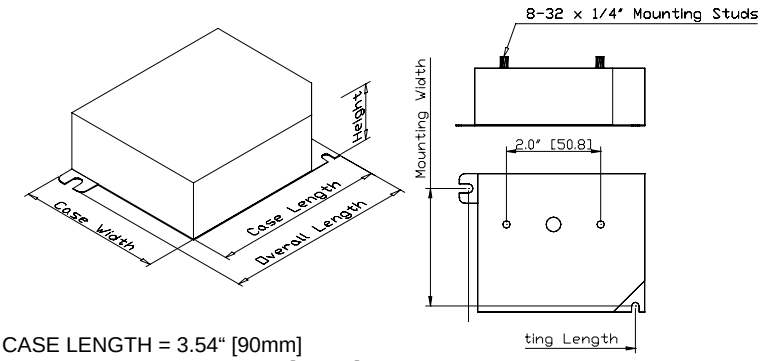
e-Vision® Electronic Ballast for Metal Halide Lamps

Catalog Number IMH-39-G
For 39W Metal Halide Lamps
ANSI M130
120-277V 50/60Hz Electronic
Status: Preliminary

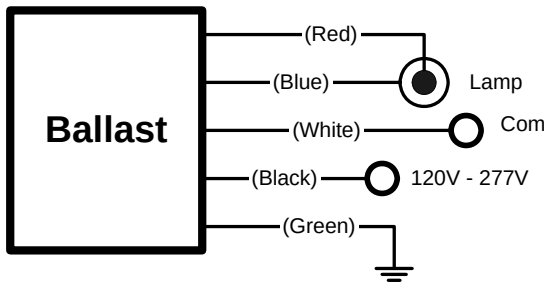
DIMENSIONS AND DATA

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											
39W Watt Lamp, ANSI Code M130 Minimum Starting Temp -30°C/-20°F												
1	39	120	IMH-39-G-xxx	0.39	46	1.0	15%	0.95	3	G	0.9	5
		277		0.18	45							

Figure G

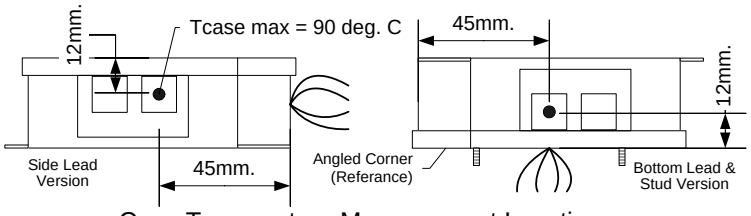


CASE LENGTH = 3.54“ [90mm]
MOUNTING LENGTH = 3.43” [87mm]
MOUNTING WIDTH = 2.64” [67mm]
OVERALL LENGTH = 3.82” [97mm]
CASE WIDTH = 3.03” [77mm]
HEIGHT = 1.18” [30mm]



Ballast Case must be Grounded

Wiring Diagram 3



Case Temperature Measurement Location

INSTALLATION & APPLICATION NOTES:

1. Maximum allowable case temperature is 90°C. See figure above for measurement location
2. Ignition pulse is 4 kV max
3. All leads are 9 inches long
4. Ballast output will shutdown after 20 minutes if lamp fails to ignite
5. Power must be cycled off – then on, after replacing lamp
6. Connect the red leads to the center terminals of the lamp when using screw base lamps

***Ordering Information**

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

Data is based on tests performed by 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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Revised 1/16/06

e-Vision® Electronic Ballast for Metal Halide Lamps

Catalog Number IMH-175-C
For (1) 150W ANSI M102, M142 or (1) 175W ANSI M137, M152 Metal Halide Lamp
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											
150 Watt Lamp, ANSI Code M102 or M142 (or 150W HPS Lamp ANSI S56) Minimum Starting Temp -30°C/-20°F												
1	150	120	IMH-175-C-xxx	1.4	169	1.0	15	0.9	1	C	2.5	5
		277		0.6	166							
175 Watt Lamp, ANSI Code M137 or M152 Minimum Starting Temp -30°C/-20°F												
1	175	120	IMH-175-C-xxx	1.7	194	1.0	15	0.9	2	C	2.5	5
		277		0.7	191							

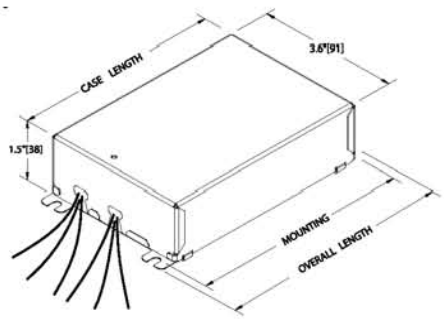
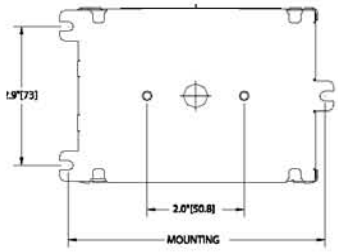
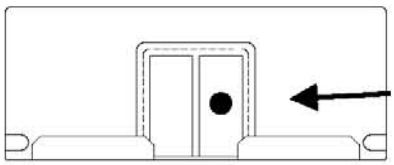


Figure C

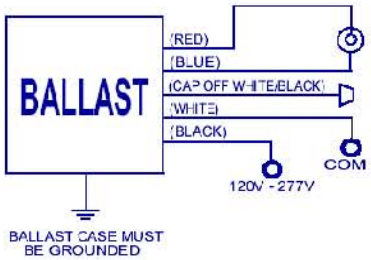
CASE LENGTH = 7.3" [184]
MOUNTING LENGTH = 7.7" [195]
MOUNTING WIDTH = 2.9" [73]
OVERALL LENGTH = 8.02" [204]
CASE WIDTH = 3.6" [91]
HEIGHT = 1.5" [38]



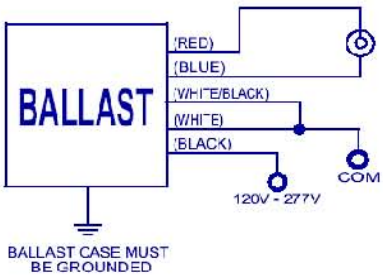


MEASURE CASE TEMPERATURE ON RIGHT HEAT SINK CLIP AT BALAST END

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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8/30/05

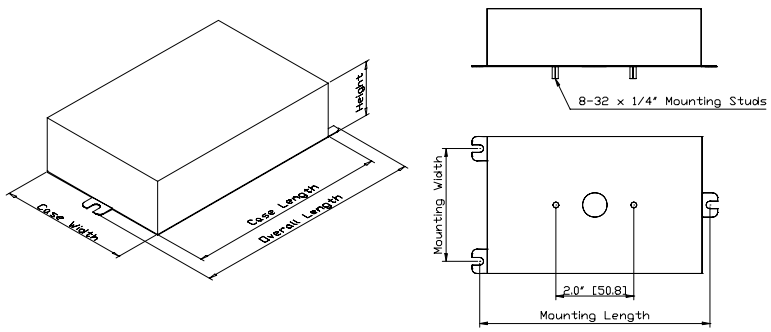
e-Vision® Electronic Ballast for Metal Halide Lamps

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

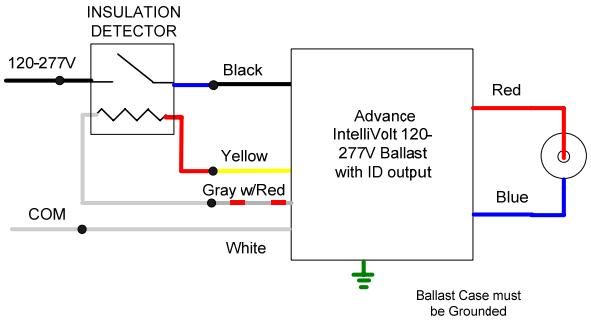
DIMENSIONS AND DATA

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

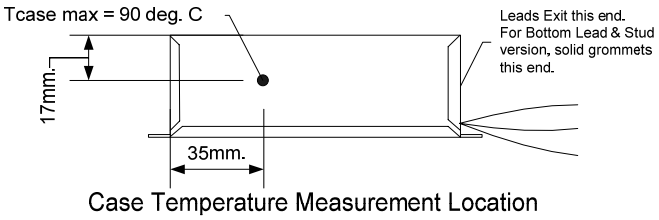


CASE LENGTH = 4.72" [120mm]
MOUNTING LENGTH = 5.20" [132mm]
MOUNTING WIDTH = 2.87" [73mm]
OVERALL LENGTH = 5.51" [140mm]
CASE WIDTH = 3.62" [92mm]
HEIGHT = 1.50" [38mm]



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

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9/29/06