R.W. Kern Center

Hampshire College

893 West Street

Amherst, Massachusetts 01002

TECHNICAL REPORT II

Complete | OCT. 21 2015

Jesse Rathod

Lighting | Electrical

Lighting Advisor | Dr. Kevin Houser

Electrical Advisor | Gary Golaszewski

Executive Summary

The focus and purpose of the R.W. Kern Center design is that it is to in addition to achieving a Living Building Status - net-zero energy, waste, and water - it is to act as multifunctional learning, teaching, and exhibition space as it will be the home of admissions, and serve as Hampshire College's informational hub.

In this document the electrical system - design, layout, and equipment - are to be studied in accordance with respective code requirements, feasibility, and project relativity. First the building requirements are analyzed for an estimated electrical system (Part I), which is then compared to the existing actual electrical system (Part II). Thirdly the estimated electrical system is then compared to the existing system. Lastly, the differences between the estimated and existing systems are discussed and potential energy-saving system strategies, solutions and modifications are discussed.

Table of Contents

1. Executive Summary
2. Table of Contents
3. .....-
4. General Building Data
5. Part I .....Preliminary Load Calculation
   .....Local Utility Company
   .....Utility Rate
6. .....Preliminary Building Utilization Voltage
   .....Emergency Power Requirements
7. .....-
8. .....Special Occupancy Requirements
   .....Electrical Priority Assessment
   .....Optional Back-Up Power Loads
   .....Potential Low-Voltage/Communications systems
9. .....-
   .....Electrical Equipment Space Requirements

10. Part II.....Connected Loads
11. .....-
12. .....-
13. .....Building Utilization Voltage
   .....Emergency Power
   .....Special Occupancy Requirements
   .....Special Equipment
14. .....Electrical Equipment Rating Specifications
15. .....-

Table of Contents

16. .....Electrical Equipment Rating Specifications

17. .....-

18. .....-

.....Loads Under Optional Backup Power

.....Low Voltage + Communications Systems

19. .....Allocated Equipment Floor Space

.....Energy Reduction Methods

20. Part III.....Evaluation of Design Criteria and Current Design

.....Estimated Loads vs. Actual Building Loads

21. .....Utility Rate Schedule Selection

.....Building Utilization Voltage

.....Electrical Equipment

.....Emergency Power System

.....Optional Backup Power

22. .....Control System Integration

Appendix A .....Electrical Riser

Appendix B .....Lighting Fixture Schedule

Appendix C .....Mechanical Equipment Schedule

Appendix D .....Electrical Equipment Details

General Building Data

Building name

R.W. Kern Center

Location and site

893 West Street

Amherst, Massachusetts 01002

Building Occupant Name

Hampshire College

Occupancy | Function Types

Office & Classroom | B

Meeting & Assembly | A-3

Retail | M

Utilities & Storage | S-1

Size [TOTAL SQUARE FEET]

15,000 SF

Number of Stories

Two Stories [ABOVE GRADE]—Three Stories Total

Primary Lighting/Electrical Project Team Members

Owner: Hampshire College | www.hampshire.edu

Architect of record: Bruner/Cott | www.brunercott.com

Electrical Engineer: RW Sullivan Engineering | www.rwsullivan.com

Daylighting + Lighting Designer: Lewis Lighting Design | www.rwsullivan.com

Code Consultant: Harold R Cutler, PE | www.manta.com

Living Building Challenge - Material: Integrated Eco Strategy | www.integratedecostrategy.com

Living Building Challenge - Strategy: Coldham & Hartman | www.coldhamandhartman.com

Fire Protection Engineer: Rybak Engineering | www.rybakengineering.com

Energy Environment + Renewables: South Mountain Company | www.southmountain.com

Construction Manager: Wright Builders | www.wright-builders.com

Mechanical Engineer: Kohler & Lewis Engineering | www.kohlerandlewis.com

Part I | Develop the Electrical Systems Criteria and Scope of Work

Preliminary Load Calculation

The following anticipated preliminary load calculations computed below is based on information found in article 220 of the 2011 National Electrical Code standards. Assuming the building type is an office building with a net square footage of 15,000 sf, the calculations for lighting and receptacle, HVAC equipment and any specialty equipment are as follows:

Load Type	Load	Demand Factor	Units	Total Load (kVA)
Lighting	3.5 VA/ft^2	125%	15,000 ft^2	65625
Receptacles	180 VA/Rec	1st 10 KVA - 100% Remaining - 50%	196 Receptacles	22590
HVAC - Office Building	7 VA/ft^2	100%	15,000 ft^2	105000
			Total Load (VA)	193215

Table I.I Estimated Building Loads based on NEC 2011 standards.

Total kW	**193215**

Local Utility Company

The local utility company that serves the Hampshire college campus is EverSource - Northeast Utilities Energy Power Supplier. R.W. Kern Center uses secondary power [Supplied by exterior Pad Mounted Transformer] at 800A 208/120V, 3Ø, 4 wire (2 sets 4#600 KCMILS).

Preliminary Utility Rate Schedule

The R.W. Kern Center total preliminary load calculation is 193.215 kW. As such, the utility rate falls under the "GV" description, as follows:

Rate GV, Commercial and Industrial

For commercial or industrial customers with demands not exceeding 1,000 kW. Customers must pay for necessary transforming, regulating and controlling apparatus.

- Customer Charge (per month): $194.96
- Distribution Demand Charges
  - First 100 kW (per kW): $5.61
  - Excess over 100 kW (per kW): $5.37
- Energy Charge (per KWh): 8.98 cents
- Distribution Energy Charges
  - First 200,000 kWh (per kWh): 0.609 cents
  - All additional kWh (per kWh): 0.511 cents

Costs apply to the Hampshire College as a whole

Based on the utility rate, preliminary calculations show the yearly cost of provided power to the R.W. Kern Center comes to be approximately : $13,339 /mo. (not including overall costs)

References

https://www.eversource.com/Content/docs/default-source/rates-tariffs/2015-nh-electric-rates.pdf?sfvrsn=2
https://www.eversource.com/Content/docs/default-source/rates-tariffs/1052.pdf?sfvrsn=14

Preliminary Building Utilization Voltage

The R.W. Kern Center brings in power via an exterior pad mounted transformer at 208/120 V. Being an admissions building, there are not to be any oversized specialized pieces of equipment. By bringing in the voltage at 208/120 V the need for a step-down transformer is avoided. The need for large equipment (specifically mechanical) has been substituted with many smaller units. The largest of the mechanical equipment - the heat pumps, and tankless water heaters - will be placed on 208 V in three phases.

Emergency Power Requirements

The R.W. Kern Center, according to IBC 2015 is classified as a Business building. Contained within the buildings envelope are also Assembly - 2 and Assembly - 3 spaces. Seeing as the Kern Center is an admissions building, it will deal with student records and files. However, the data is to be stored in an offsite location. The systems to be considered for emergency power include: emergency lighting, elevator/lift, fire alarm, egress signage. Emergency power for exit signs are to be battery powered, all other emergency systems are to be placed on generator power.

2702.1.2 Electrical

Emergency power systems and standby power systems required by this code or the *International Fire Code* shall be installed in accordance with the *International Fire Code*, NFPA 70, NFPA 110 and NFPA 111.

2702.1.3 Load Transfer

Emergency power systems shall automatically provide secondary power within 10 seconds after primary power is lost, unless specified otherwise in this code. Standby power systems shall automatically provide secondary power within 60 seconds after primary power is lost, unless specified otherwise in this code.

2702.2.1 Emergency alarm systems

Emergency power shall be provided for emergency alarm systems as required by Section 415.5.

2702.2.2 Elevators and platform lifts.

Standby power shall be provided for elevators and platform lifts as required in Sections 1009.4, 1009.5, 3003.1, 3007.8 and 3008.8.

Secton 1009.4/.5 Elevators/Lifts

Standby power shall be provided in accordance with Chapter 27 and Section 3003.

3003.1.2 One elevator.

Where only one elevator is installed, the elevator shall automatically transfer to standby power within 60 seconds after failure of normal power.

2702.2.3 Emergency responder radio coverage systems

Standby power shall be provided for emergency responder radio coverage systems required in Section916 and the *International Fire Code*. The standby power supply shall be capable of operation the emergency responder radio coverage system for a duration of not less than 24 hours.

2702.2.4 Emergency voice/alarm communication systems.

Emergency power shall be provided for emergency voice/alarm communication systems as required Section 907.5.2.2.5. The system shall be capable of powering the required load for a duration of not less than 24 hours, as required in NFPA 72.

2702.2.5 Exit Signs.

Emergency power shall be provided for exit signs as required in Section 1013.6.3. The system shall be capable of powering the required load for a duration of not less than 90 minutes.

2702.2.11 Means of egress illumination.

Emergency power shall be provided for means of egress illumination as required in Section 1008.3. The system shall be capable of powering the required load for a duration of not less than 90 minutes.

1008.3.1 General

Spaces that require two means of egress, an emergency electrical system shall automatically illuminate:

Aisles

Corridors

Exit access stairways and ramps

1008.3.2 Buildings

Buildings that require two or more *means of egress*, an emergency electrical system shall automatically illuminate:

Interior exit access stairways and *ramps*

Interior and exterior exit stairways and *ramps*

Exit passageways

Vestibules and areas on the level of discharge used for *exit discharge* in accordance with Section 1028.1.

Exterior landings as required by Section 1010.1.6 for *exit doorways* that lead directly to the *exit discharge.*

10089.3.3 Room and Spaces

An emergency electrical system shall automatically illuminate all of the following:

Electrical equipment rooms

Fire command centers

Fire pump rooms

Generator rooms

Public restrooms with an area greater than 300 square feet

1008.3.4 Duration

The emergency power system shall provide power for a a duration of not less than 90 minutes and shall consist of storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Section 2702.

1008.3.5 Illumination level under emergency power

Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 1 fc (11 lux) and a minimum at any point of 0.1 fc (1 lux) measured along the path of egress at floor level. Illumination levels shall be permitted to decline to 0.6 fc (6 lux) average and a minimum at any point of 0.06 fc (.6 lux) at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ration of 40 to 1 shall not be exceeded.

2702.2.15 Smoke control systems..

Standby power shall be provided for smoke control systems as required in Section 404.7, 909.11, 909.20.6.2, and 909.21.5.

Special Occupancy Requirements

Based on an analysis of Chapter 5 of the NEC 2011, the R.W. Kern Center contains spaces that may apply Article 518 - Assembly Occupancies, and Article 520 -Audience Areas of Motion Picture and Television Studios.

Electrical Priority Assessment

Reliability	High
Power Quality	Medium
Redundancy	High
Low First Cost	Low
Low Life Cycle Cost	High
Flexibility	Medium

Optional Back-Up Power Loads

In addition to the emergency lighting, and fire alarm systems, the financial aid and admissions offices are important considerations for emergency UPS power in order to maintain records . Furthermore, the panel boards that are connected to the kitchens may also be considered for back up power loading.

Potential Low-Voltage/Communications systems

Telephone/Data

CATV/CCTV

Access Control

Security

Fire Alarm—IBC 2015 Requirements

907.2 Where required—new buildings and structures.

An *approved* fire alarm system installed in accordance with the provisions of this code and NFPA 72 shall be provided in new buildings and structures in accordance with Sections 907.2.1 through 907.2.23 and provide occupant notification in accordance with Section 907.5, unless other requirements are provided by another section of this code.

Not fewer than one manual fire alarm box shall be provided in an *approved* location to initiate a fire alarm signal for fire alarm systems employing automatic fire detectors or water flow detection devices. Where other section of this code allow elimination of fire alarm boxes due to sprinklers, a single fire alarm box shall be installed.

907.2.1 Group A.

A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group A occupancies where the occupant load due to the assembly occupancy is 300 or more. Group A occupancies not separated from one another in accordance with Section 707.3.10 shall be considered as a single occupancies for the purposes of applying this section.

Potential Low-Voltage/Communications systems (continued)

907.2.2 Group B

A manual fire alarm system shall be installed in Group B occupancies where one of the following conditions exists:

1. The combined Group B *occupant load* of all floors is 500 or more.
2. The Group B *occupant load* is more than 100 persons above or below the lowest *level of exit discharge*.
3. The *fire area* contains an ambulatory care facility.

Exception: Manual fire alarm boxes are not required where the building is equipped through with an *automatic sprinkler* system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler flow.

Electrical Equipment Space Requirements

There is space in the basement that provides ample floor space for the various electrical, mechanical, and other specialized equipment. The floor space within the R.W. Kern Center is required by the following equipment:

Electrical	Mechanical	Other
UPS Systems	AHUs	Compost units
Panel Boards	Fire Pump	Water harvesting

Part II | Understand and Describe the Current Electrical Systems Design

Connected Loads

The following tables outline the connected lighting, mechanical, receptacle and special equipment loads on the R.W. Kern Center. Each load is accounted for and the total system volt-amps are calculated in accordance to their respective multipliers.

	Lighting							
Level	Unit	Quantity	Length (ft)/Fixture	Load (Watts) */ft if applicable	Power Factor	Demand Factor	Net Total (VA)	Total System Load (VA)
Basement	S02	1	-	30	100%	1	30	**9135**
	S04	11	-	33			363	
	W02	1	-	7			7	
Ground	P01	21	4	12.5			1050	
	P02	5	-	15			75	
	P04	18	-	33			594	
	P05	14	4	12.5			700	
	R01	5	-	14			70	
	S02	28	-	30			840	
	S03	8	-	30			240	
	W01	11	-	33			363	
	W02	6	-	7			42	
	W03	3	-	14			42	
	W06	2	-	5			10	
	W07	2	2	10			40	
Second	P01	27	4	12.5			1350	
	P04	22	-	33			726	
	P05	8	4	12.5			400	
	R01	11	-	14			154	
	S01	11	-	30			330	
	S02	27	-	30			810	
	S03	10	-	30			300	
	W01	8	-	33			264	
	W02	3	-	7			21	
	W03	1	-	14			14	
Attic	U1	10	-	30			300	

Table II.I Connected existing lighting loads.

Connected Loads

	Mechanical							
Level	Unit	Quantity	Load (HP/MCA/KW)	Volts (V)	Phase	Resulting Load	Demand Factor	NetTotal System Load (VA)
Basement	HP - W06	1	0.19 A	208	1ϕ	39.52		
	HP - W08	2	0.19 A	208	1ϕ	79.04		
Ground	AC - 1	1	0.5 HP	120	1ϕ	518.0555556		
	HP - A12	1	1.12 A	208	1ϕ	232.96		
	HP - A15	3	1.45 A	208	1ϕ	904.8		
	HP - A30	2	2.5 A	208	1ϕ	1040		
	HP - A36	1	3.33 A	208	1ϕ	692.64		
	HP - A48	1	3.41 A	208	1ϕ	709.28		
	HP - C15	1	0.35 A	208	1ϕ	72.8		
	HP - E240	2	45 A	208	3ϕ	32423.04		
	HP - L12	2	0.34 A	208	1ϕ	141.44		
	HP - W06	3	0.19 A	208	1ϕ	118.56		
	HP - W18	2	0.38 A	208	1ϕ	158.08		
	HP - W240	2	45 A	208	3ϕ	32423.04		
	WH - 7-1	1	16 kW	208	3ϕ	5764.096		
	WH - 7-3	1	16 kW	208	3ϕ	5764.096		
Second	HP - W06	4	0.19 A	208	1ϕ	158.08		
	BC - 1	1	1.93 A	120	1ϕ	231.6		
	BC - 2	1	0.64 A	120	1ϕ	76.8	0.8	**84856**
	BC - 3	1	1.08 A	120	1ϕ	129.6		
	CF - 1	2	2.5 A	120	1ϕ	600		
	HP - A08	1	1.05 A	208	1ϕ	218.4		
	HP - A15	1	1.45 A	208	1ϕ	301.6		
	HP - A18	3	1.56 A	208	1ϕ	973.44		
	HP - A30	1	2.5 A	208	1ϕ	520		
	HP - C18	3	0.45 A	208	1ϕ	280.8		
	HP - C24	2	0.54 A	208	1ϕ	224.64		
	HP - W06	4	0.19 A	208	1ϕ	158.08		
	HP - W08	1	0.19 A	208	1ϕ	39.52		
	WH - 7-2	1	16 kW	208	3ϕ	5764.096		
Attic	ERV-1	1	11.5 A	208	1ϕ	2392		
	ERV-2	1	11.3 A	120	1ϕ	1356		
	ERV-3	1	11.5 A	208	1ϕ	2392		
	ERV-4	1	11.3 A	120	1ϕ	1356		
	ERV-5	1	11.3 A	120	1ϕ	1356		
	ERV-6	1	11.3 A	120	1ϕ	1356		
	ERV-7	1	11.5 A	208	1ϕ	2392		
	ERV-8	1	11.3 A	120	1ϕ	1356		
	ERV-9	1	11.3 A	120	1ϕ	1356		

Table II.II Connected existing mechanical loads.

Connected Loads

	Receptacle							
Level	Unit	Quantity	Volts	Amps	Resulting Total (VA)	Gross Total Load (VA)	Demand Factor	Net Receptacle Load (VA)
Basement	Duplex	11	125	20	27500	552500	100% *50% after 10 kVA	**281250**
	Quad	1	125	20	2500			
	Special	0	125	20	0			
Ground	Duplex	77	125	20	192500			
	Quad	13	125	20	32500			
	Special	7	125	20	17500			
Second	Duplex	77	125	20	192500			
	Quad	23	125	20	57500			
	In-Ground	6	125	20	15000			
	Special	0	125	20	0			
Attic	Duplex	6	125	20	15000			
	Quad	0	125	20	0			
	Special	0	125	20	0			

Table II.III Connected existing receptacle loads.

	Specialty Equipment						
Level	Unit	Quantity	Load (Watts)	Power Factor	Gross Total Load	Demand Factor	Net Total Load (VA)
Basement	-	-	-	0.85	3463.75	0.75	**2597**
Ground	AP - 1 Refrigerator	2	200				
	AP - 2 Under-Counter Refrigerator	2	100				
	AP - 3 Espresso Ma-chine	2	1000				
	AP - 4 P.O.S. System	1	75				
	AP - 5 Coffee Brewer	2	1000				
	AP - 6 Countertop Heated Display	1	200				
	AP - 7 Ice Maker	2	150				
	AP - 8 Dishwasher	2	1350				
Second	-	-	-				
Attic		-	-				

Table II.IV Connected existing specialty equipment loads.

Total Lighting Load: 9135 VA
Total Mechanical Load: 84856 VA
Total Receptacle Load: 281250 VA
Total Specialty Equipment Load: 2597 VA

Net Total Connected Loads: 377838 VA

Utility Company and Rate Schedule

Utility company and rate schedule are the same as listed in section one of this publication.

Building Utilization Voltage

The current power being distributed by the exterior pad mounted transformer is, 208/120V, 3Φ, 4W service power. The required delivered power is not excessive and therefore is placed on a safer 208/120 V service.

Loads under voltage classes

120 V | Lighting + Receptacle + Exceptional Mechanical Equipment

208 V | Mechanical Equipment + Elevator + Inverter

Emergency Power

The equipment connected to emergency power include, dry system air compressor, egress lighting, fire protection room lighting, 50% lighting, Elevator. The emergency power is to be provided for by battery, photovoltaics through a series of inverters, and from generators located outside of the scope of the R.W. Kern Center.

Special Occupancy Requirements

There are no elements or characteristics of the R.W. Kern Center that require special consideration according to section 500 of NEC 2011.

Special Equipment

Section 6 of NEC 2011: Special Equipment explains requirements that apply to equipment that necessitates more in depth consideration. The aforementioned equipment in the R.W. Kern Center are listed below:

Article 620 | Elevators

Article 645 | Information Technology Equipment

Article 690 | Solar Photovoltaic (PV) Systems

Electrical Equipment Rating Specifications

Major Electrical Equipment

Wiring

Branch: All branch circuit, remote control, signal circuit and interlock wiring are copper, rated at 600 Volts.

Conductors: Minimum #12 AWG, soft drawn 98% conductive copper with 90°, XHHN 600 Volt insulation.

Feeders: All feeder wiring shall be aluminum.

Insulation

All insulation is to be as follows:

Description	Location		
	Dry	Damp	Wet
Copper Branch Circuits #6 AWG and smaller	XHHW	XHHW	XHHW
Copper Branch Circuits larger than #6 AWG	XHHW	XHHW	XHHW-2
Copper Feeders not listed below	XHHW	XHHW	XHHW-2
All Aluminum Feeders	XHHW-2	XHHW-2	XHHW-2
All Service Feeders, Exterior Feeders and Exterior Branch Circuits	XHHW-2	XHHW-2	XHHW-2
All Feeders connected to 100% rated circuit breakers	XHHW-2	XHHW-2	XHHW-2

Table II.V Instructions on insulation installation for listed wire rating.

Physical Separation of Normal and Emergency Systems

Emergency electrical raceways that are a part of the emergency distribution system shall be located in spaces fully protected by an approved automatic fire suppression system or in spaces with a one hour fire resistance rating.

All portions of the emergency system, such as feeders are installed in a two hour fire rated enclosure, with details provided by R.W. Sullivan engineering.

Exterior Pad Mounted Transformer

The pad mounted transformer, provided by R.W. Sullivan Engineering, is located along the west façade. of the building. Power iis stepped down from the primary campus service loop and served from the transformer at 800A 208/120V, 3Ø, 4W through two sets of 4#600KCMILS—4" conduit with 14" spare conduit.

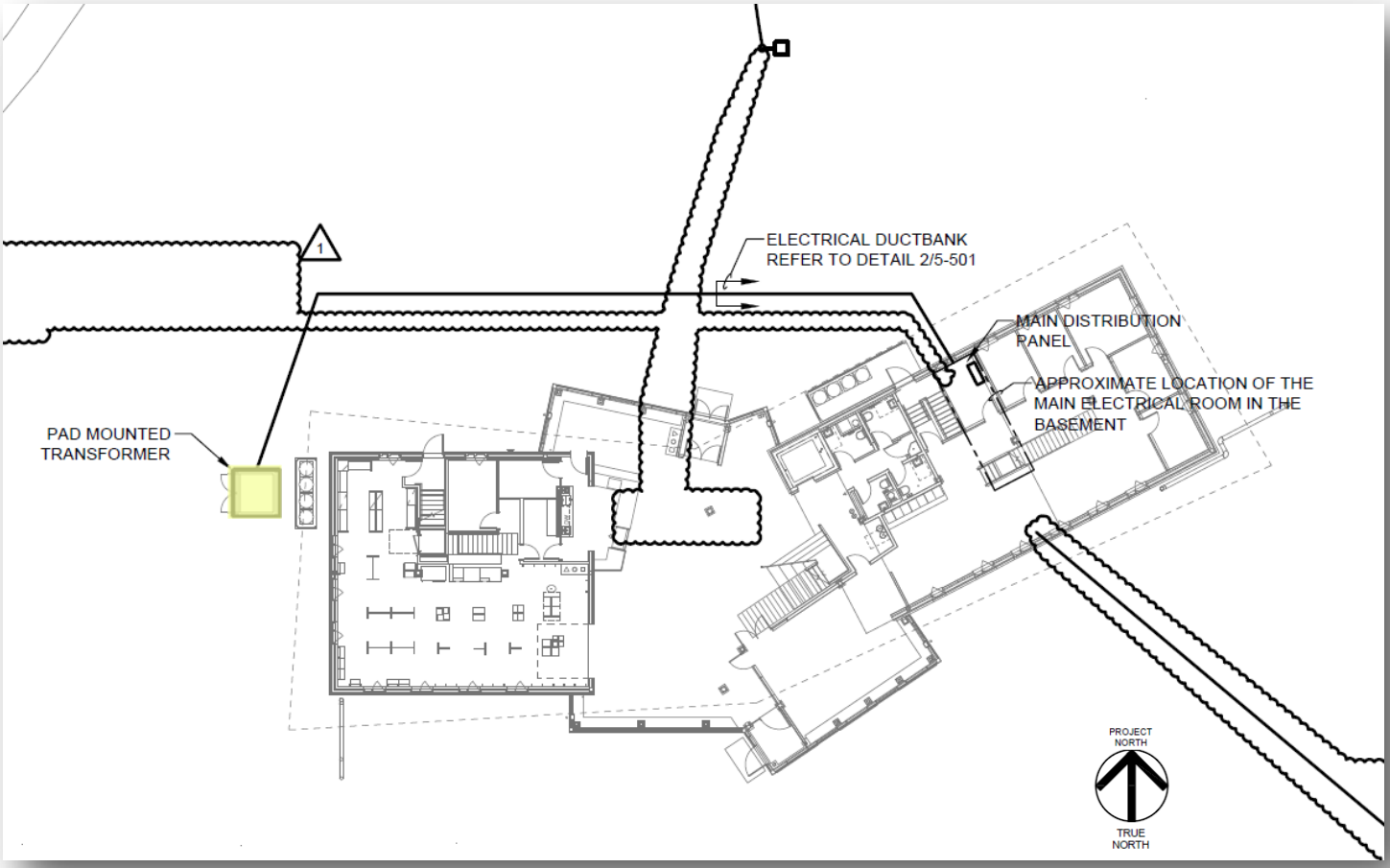


Figure II.I Site Plan showing location of exterior pad mounted transformer.

Panelboards

All branch circuit panelboards are bolt-in, with thermal magnetic circuit breakers with minimum 100 ampere frame through 100 ampere trip sizes. 20 ampere, single polse circuit breakers are UL listed as type SWD for lighting circuits. The enclosures are to be at least 20" wide and 5-3/4" deep made from galvanized steel and NEMA rated.

Panel Name	Voltage	Main Bus	MLO	MTG	Phase	AIC	Total Poles	1 Pole CBs
MDP	208Y/120V	800 A	-	FLR	3	42,000	48	16
LB1	208/120 V	-	100 A	S	3	42,000	42	42

Table II.VI Existing Panelboard details

Panel Name	Voltage	Main Bus	MLO	MTG	Phase	AIC	Total Poles	1 Pole CBs
PB1	208/120 V	-	150 A	S	3	42,000	42	42
MB1	208/120 V	-	400 A	S	3	42,000	42	30
P12	208/120 V	-	100 A	S	3	42,000	42	24
MA1	208/120 V	-	125 A	S	3	42,000	42	36
P11	208/120 V	-	125 A	S	3	42,000	42	42
L11	208/120 V	-	100 A	S	3	42,000	42	42
P21	208/120 V	-	150 A	R	3	42,000	42	42
L21	208/120 V	-	100 A	R	3	42,000	42	42
P22	208/120 V	-	200 A	R	3	42,000	42	42
L22	208/120 V	-	100 A	R	3	42,000	42	42

Table II.VI (continued) Existing Panelboard details

Faceplate

Faceplates are to be provided on incandescent recessed fixtures which opened for access to the interior of the fixture, serve as a ceiling trim, and are positively held to the fixture body by adjustable means that permit the faceplate to be drawn up to the ceiling as tight as necessary to ensure complete contact of faceplate with ceiling surrounding the fixture.

Receptacles

Duplex Receptacles: Industrial Grade Extra Heavy Duty type Federal Specification rated for 125 volts, 20 amperes unless otherwise indicated on contract drawings and conform to WC596 standards. Receptacles shall have wire bundling clamps on all terminals including ground; terminal screws shall be#10. A full wrap-around bridge strap shall be provided with locking finger tabs to secure the face. Ground contact spring shall be formed on bridge, riveted grounds are not acceptable. Receptacles shall have an ID labeling system area to positively identify the circuit; face and body shall be high impact resistant nylon.

Isolated Ground receptacles: rated for 125 volts, 20 amperes unless otherwise indicated on contract drawings. The receptacles shall conform to Federal Specification WC-596 standards and comply with NEC section 250-146(d) and section 410-56(c). Equipment grounding contacts are connected only to the green grounding screw terminal of the device and have inherent electrical isolation from the mounting strap. Devices shall be listed and labeled as Isolated Ground Receptacles. The isolation method shall be integral to the receptacle construction and not dependent on removable parts.

Switches

Toggle switches shall be full sized, heavy duty AC type rated for 120/277 volts, 20 amperes and comply with Federal Specification WS 896. Mounting strap shall be one-piece nickel plated steel with integral ground. Terminals shall external screw-pressure plate back and side wired to accept # 14 - #10 AWG wire. Contacts shall be silver alloy. Switches located in 'Wet Locations' or 'Damp Locations' shall be provided with weatherproof covers.

Motor Starters

General purpose motor starters are to be NEMA 1 enclosure with padlock ears, except in wet locations where they are to be NEMA 3R with conduit hubs. Type and size of starters are to be recommended by motor manufacturer. All 208 volt starters minimum sizes are as follows:

A. Less than 1/2 HP: NEMA Size 0

B. 1/2 to 7-1/2 HP: NEMA Size 1

C. 10 HP: NEMA Size 2

D. 15 to 25 HP: NEMA Size 3

Each starter is equipped with a primary and secondary fused control power transformer sized 50 VA above the minimum rating, two LED indicating lights, "RED" for run; "GREEN" for stop, a mechanical H-O-A selector switch.

Uninterruptable Power System

There is no UPS system used in the R.W. Kern Center.

Loads Under Optional Backup Power

In-Building Radio System

The system shall be capable of operating on an independent battery for at least 12 hours.

Low Voltage + Communications Systems

In-Building Radio System

The in-building radio system shall be an integral component of the life safety equipment of a building or structure. The primary function shall be to provide reliable firefighter communications at the required signal strength within the specified areas. The system shall be required to provide coverage at the specified level within 95% of a building's floor area and also 95% of the stairwells.

Projection Screens

Lighting Control

Intelligent lighting control communicating digitally via CAT-5e low voltage cabling requires under 4 mA of current in order to function. Furthermore, automated sensor technologies are available with zero, one, or two integrated Class 1 switching relays are capable of 120/277/347 VAC with load ratings of 800 W at 120 VAC, 1200 W at 277 VAC, 1500 W at 347 VAC, and 1/4 HP motor.

Access Control

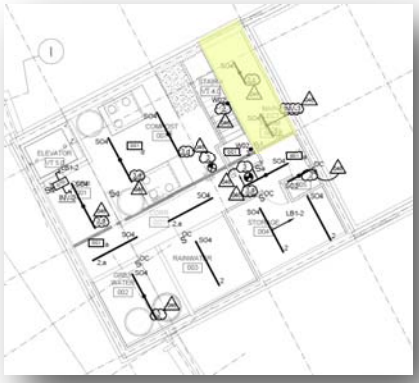
Telephone & Data

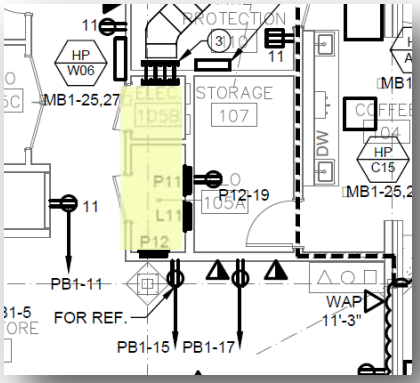
Allocated Equipment Floor Space

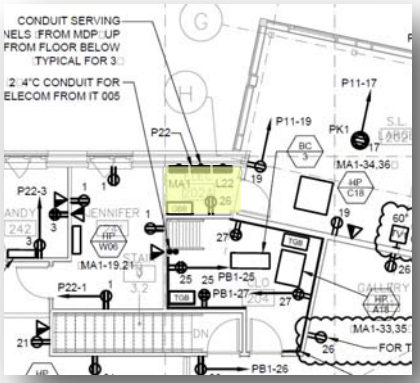
The following list addresses the floor space required for electrical and telecommunications systems:

Total Building SF

16,000 SF







Basement Floor SF

Electrical | 117 SF (.7%)

IT | 10 SF (~.06 %)

Ground Floor SF

Electrical| 64 SF (.4%)

Second Level SF

Electrical | 32 SF (.2%)

Energy Reduction Methods

Though the R.W. Kern Center is not pursuing a LEED status in particular, it is pursuing the status of Living Building V 2.1 and Net Zero. As a result, a 5,500 SF photovoltaic array has been placed on the roof. The panels are to be provided by Sunpower X series at 18 W/SF. Estimates of 1,100 kWh per kW of installed photovoltaics are expected.

The building also includes a sub-metering system that allows for continuous energy-use monitoring and allows for feedback and improvement.

Electrical System Single Line Riser Diagram

See appendix A for electrical system single line riser diagram.

Part III | Evaluation of Design Criteria and Current Design

Estimated Loads vs. Actual Building Loads

The estimated loads are A large reason for the difference in the calculated load is the difference in receptacle loads. As per IEC 2010, receptacles are to be evaluated at 180 VA/rec. However, in the R.W. Kern Center heavy duty receptacles (2500 VA each) are used compared to the receptacles used in the estimation. Furthermore, there are more receptacles than required by NEC 2011 standards. In addition to taking both of these differences into account, there is "special equipment" that are not considered in the initial load estimate. In light of these factors the actual building loads amount to 377847 VA, which is almost 200% more than the estimated building load—193215 VA. See tables III.I and III.II for load breakdown. It may be noted that, if the 180 VA receptacle loads are assumed for the existing load calculation, then the resulting total building load amounts to 112488 VA—roughly 50% of the estimated load.

Improvement: scheduling/50% outlet control, occupancy sensor to loads

Load Type	Load	Demand Factor	Units	Total Load (VA)
Lighting	3.5 VA/ft^2	125%	15,000 ft^2	65625
Receptacles	180 VA/Rec	1st 10 KVA - 100% Remaining - 50%	196 Receptacles	22590
HVAC - Office Building	7 VA/ft^2	100%	15,000 ft^2	105000
			Total Load (VA)	193215

Table III.I Estimated connected loads breakdown.

Load Type	Load	Demand Factor	Units	Total Load (VA)
Lighting	3.5 VA/ft^2	125%	15,000 ft^2	9135
Receptacles	2500 VA/Rec 180 VA/Rec	1st 10 KVA - 100% Remaining - 50%	221 Rec	281250 15891
HVAC - Office Building	Varies *See table II.II	100%	Varies *See table II.II	84865
Special Equipment	Varies *See table II.IV	100%	Varies *See table II.IV	2597
			Total Load (VA)	377847 112488

Table III.II Estimated connected loads breakdown.

Utility Rate Schedule Selection

The current utility rate schedule is the most appropriate. Considering the Hampshire Colleges various power requirements, the chosen utility service is the optimal service plan.

Building Utilization Voltage

The current building utilization voltage is 120/208V. This voltage is appropriate for several reasons. As the R.W. Kern Center is a small facility, and does not require large mechanical devices; therefore, it does not make sense to provide a larger voltage for potentially only a couple pieces of larger mechanical equipment and then needing to be stepped down via multiple transformers to provide proper voltage power for the majority of the buildings loads. Furthermore, the use of smaller mechanical equipment allows for higher building efficiency and space energy use.

Electrical Equipment

Material choice is very limited because of the strict guidelines and requirements of the Living Building Challenge guidelines. The use of an energy load metering system is critical for the optimization of energy use. However, a feedback system for each piece of equipment should be considered. Wireless componentry is becoming an integral part of system design and is critical for optimal system efficiency. This is an important consideration as a part of the redesign strategy. However, with respect to the system design there is not a large amount redundancy in the system. As an admissions building, there is not a terrible need for redundancy.

Emergency Power System

The current emergency power is provided largely by photovoltaic, generator, and battery power. Reliability of power is a high concern in this project and so should be redundant. With photovoltaic power provided through an inverter, and generator power provided via an offsite located generator, there is a level of redundancy that is adequate for the R.W. Kern Center. Any added power supply would require more space, which is unnecessary.

Optional Back-Up Power

The only back-up power in the building is provided to the inter-communication system. The only other equipment that may be considered for optional back-up power is the security system, and kitchen receptacles, the refrigerators in particular. Otherwise there are no other pieces of equipment that necessitate back-up power.

Control System Integration

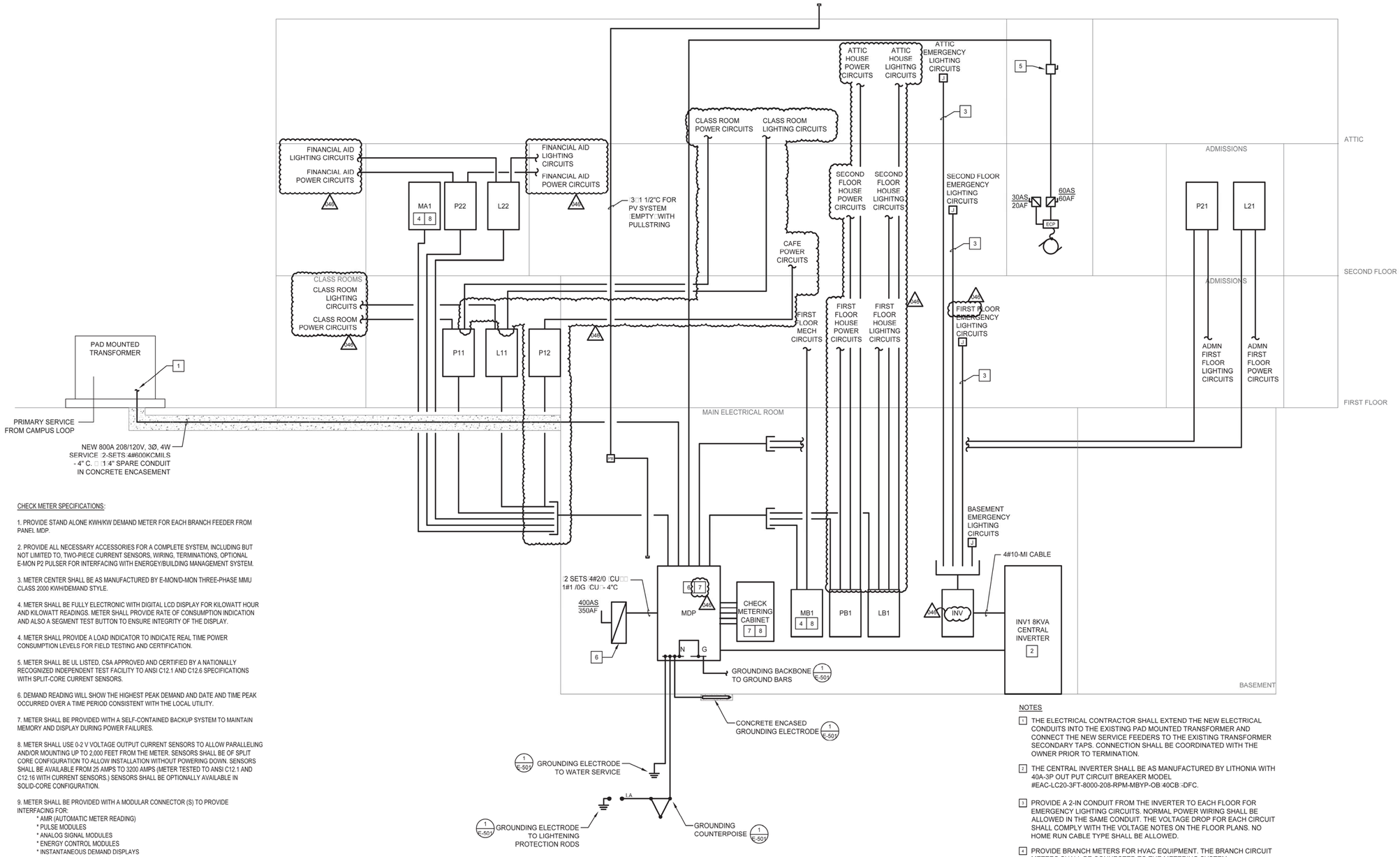
Additionally, as a part of redesign, strategies such as daylighting, plug load control, demand response, scheduling, high-end trim/tuning, and HVAC integration are to be considered. With the supplementation and integration of these systems these strategies can result in 30-60% of respective load energy savings.

References

ASHRAE Standard 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings. 2010th ed. N.p.: ASHRAE, n.d. Print.

International Energy Conservation Code, 2012. Country Club Hills, IL: International Code Council, 2011. Print.

National Electric Code 2011. NEMA, Print.



CHECK METER SPECIFICATIONS:

1. PROVIDE STAND ALONE KWH/KW DEMAND METER FOR EACH BRANCH FEEDER FROM PANEL MDP.

2. PROVIDE ALL NECESSARY ACCESSORIES FOR A COMPLETE SYSTEM, INCLUDING BUT NOT LIMITED TO, TWO-PIECE CURRENT SENSORS, WIRING, TERMINATIONS, OPTIONAL E-MON P2 PULSER FOR INTERFACING WITH ENERGEY/BUILDING MANAGEMENT SYSTEM.

3. METER CENTER SHALL BE AS MANUFACTURED BY E-MON/D-MON THREE-PHASE MMU CLASS 2000 KWH/DEMAND STYLE.

4. METER SHALL BE FULLY ELECTRONIC WITH DIGITAL LCD DISPLAY FOR KILOWATT HOUR AND KILOWATT READINGS. METER SHALL PROVIDE RATE OF CONSUMPTION INDICATION AND ALSO A SEGMENT TEST BUTTON TO ENSURE INTEGRITY OF THE DISPLAY.

4. METER SHALL PROVIDE A LOAD INDICATOR TO INDICATE REAL TIME POWER CONSUMPTION LEVELS FOR FIELD TESTING AND CERTIFICATION.

5. METER SHALL BE UL LISTED, CSA APPROVED AND CERTIFIED BY A NATIONALLY RECOGNIZED INDEPENDENT TEST FACILITY TO ANSI C12.1 AND C12.6 SPECIFICATIONS WITH SPLIT-CORE CURRENT SENSORS.

6. DEMAND READING WILL SHOW THE HIGHEST PEAK DEMAND AND DATE AND TIME PEAK OCCURRED OVER A TIME PERIOD CONSISTENT WITH THE LOCAL UTILITY.

7. METER SHALL BE PROVIDED WITH A SELF-CONTAINED BACKUP SYSTEM TO MAINTAIN MEMORY AND DISPLAY DURING POWER FAILURES.

8. METER SHALL USE 0-2 V VOLTAGE OUTPUT CURRENT SENSORS TO ALLOW PARALLELING AND/OR MOUNTING UP TO 2,000 FEET FROM THE METER. SENSORS SHALL BE OF SPLIT CORE CONFIGURATION TO ALLOW INSTALLATION WITHOUT POWERING DOWN. SENSORS SHALL BE AVAILABLE FROM 25 AMPS TO 3200 AMPS (METER TESTED TO ANSI C12.1 AND C12.16 WITH CURRENT SENSORS.) SENSORS SHALL BE OPTIONALLY AVAILABLE IN SOLID-CORE CONFIGURATION.

9. METER SHALL BE PROVIDED WITH A MODULAR CONNECTOR (S) TO PROVIDE INTERFACING FOR:
   * AMR (AUTOMATIC METER READING)
   * PULSE MODULES
   * ANALOG SIGNAL MODULES
   * ENERGY CONTROL MODULES
   * INSTANTANEOUS DEMAND DISPLAYS

10. PROVIDE E-MON P2 PULSER AND ASSOCIATED MODULAR PLUG FOR CONNECTION TO EACH KWH/KWD METER.

11. PROVIDE E-MON ENERGY SOFTWARE PACKAGE TO PROVIDE ANALYTICAL CHARTS, GENERATE BILLING, AND MONITOR DEMAND. PROVIDE SOFTWARE AND COMPUTER, INCLUDING PRINTER, MONITOR, AND ETHERNET CARD, FOR COMPLETE OPERATION.

12. PROVIDE RS232K CONNECTION FROM MMU TO THE E-MON ENERGY SOFTWARE COMPUTER.

13. PROVIDE EKM-E CONNECTION TO PROVIDE ETHERNET CONNECTION FROM HOST COMPUTER TO ALLOW MONITORING FROM A REMOTE SITE.

14. THE SYSTEM SHALL ALLOW MONITORING OF THE NETWORKED METERS FROM A WORKSTATION ON SITE. WORKSTATION SHALL BE LOCATED IN THE SITE FACILITY'S OFFICE OR AS DIRECTED BY THE OWNER. THE SYSTEM SHALL ALSO ALLOW FOR REMOTE CONTROL MONITORING OF THE SYSTEM FROM A REMOTE OFFICE VIA ETHERNET CONNECTION. THE SOFTWARE SHALL BE PROVIDED AT REMOTE LOCATION AS DIRECTED BY THE OWNER. THE CONTRACTOR SHALL PROVIDE ALL HARDWARE, SOFTWARE, AND PROGRAMMING NECESSARY FOR COMPLETE SYSTEM OPERATION.

15. TRAINING: THE CONTRACTOR SHALL PROVIDE FACTORY FOR (2) STAFF MEMBERS FOR (2) 4-HOUR SESSIONS.

NOTES

1. THE ELECTRICAL CONTRACTOR SHALL EXTEND THE NEW ELECTRICAL CONDUITS INTO THE EXISTING PAD MOUNTED TRANSFORMER AND CONNECT THE NEW SERVICE FEEDERS TO THE EXISTING TRANSFORMER SECONDARY TAPS. CONNECTION SHALL BE COORDINATED WITH THE OWNER PRIOR TO TERMINATION.
2. THE CENTRAL INVERTER SHALL BE AS MANUFACTURED BY LITHONIA WITH 40A-3P OUT PUT CIRCUIT BREAKER MODEL #EAC-LC20-3FT-8000-208-RPM-MBYP-OB 40CB -DFC.
3. PROVIDE A 2-IN CONDUIT FROM THE INVERTER TO EACH FLOOR FOR EMERGENCY LIGHTING CIRCUITS. NORMAL POWER WIRING SHALL BE ALLOWED IN THE SAME CONDUIT. THE VOLTAGE DROP FOR EACH CIRCUIT SHALL COMPLY WITH THE VOLTAGE NOTES ON THE FLOOR PLANS. NO HOME RUN CABLE TYPE SHALL BE ALLOWED.
4. PROVIDE BRANCH METERS FOR HVAC EQUIPMENT. THE BRANCH CIRCUIT METERS SHALL BE CONNECTED TO THE METERING SYSTEM.
5. NON-FUSED DISCONNECT SHALL BE MOUNTED AT THE TOP OF THE SHAFT. THE DISCONNECT SHALL BE WIRED IN SERIES WITH THE MAIN ELEVATOR DISCONNECT.
6. THE PHOTOVOLTAIC CONDUCTORS SHALL BE TERMINATED ON THE LOAD SIDE OF THE PV DISCONNECT. THE LINES SIDE OF THE PV DISCONNECT SHALL TERMINATE ON THE INCOMING LUGS OF THE MDP.
7. PROVIDE A METER FOR EACH OF THE BRANCH FEEDER WITHIN THE MDP.
8. ALL THE HVAC BRACH METERS AND THE MDP BRANCH FEEDER METER DISPLAYS SHALL BE LOCATED IN A SINGLE CABINET. THE SIZE OF THE CABINET SHALL BE COORDINATED WITH THE NUMBER OF METERS. REFER TO CHECK METER SPECIFICATIONS FOR METERS AND SYSTEM REQUIREMENTS

0 4' 8' 16'

PROJECT NORTH

IF THIS SHEET IS NOT: 22" x 34", IT HAS BEEN REDUCED OR ENLARGED.

10/20/2014 1:45:15 PM

Bruner/Cott

Bruner/Cott & Associates, Inc.
130 Prospect Street
Cambridge, Massachusetts 02139
617 492 8400
www.brunercott.com

Architecture/Urban Design
Preservation/Landscape Architecture
Space Planning/Interior Design

R. W. Sullivan Engineering
MEP / FP Engineering . Code . Commissioning
The Schrafft Center
529 Main Street, Suite 203
Boston, Massachusetts 02129-1107
Phone: (617) 523-8227
Fax: (617) 523-8016
www.rwsullivan.com
RWS JOB # 130579.01

	Date	Remarks
1	01/12/2015	BULLETIN #015
2	01/29/2015	BULLETIN #018
3	03/20/2015	BULLETIN #026
040	06/24/2015	BULLETIN #040
046	07/24/2015	BULLETIN #046

Date	October 30, 2014
Scale	NONE
Project Number	329-00
Drawn By	GSD

R.W. KERN CENTER

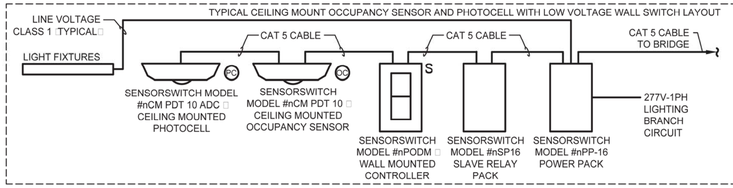
HAMPSHIRE COLLEGE
893 West Street
Amherst, MA 01002

CONSTRUCTION DOCUMENTS

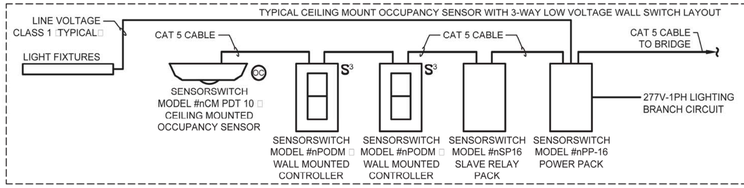
ELECTRICAL POWER RISER

E-300

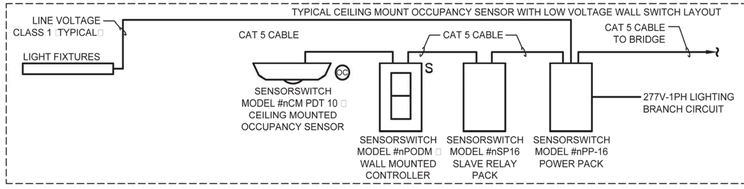
TYPICAL CEILING MOUNT OCCUPANCY SENSOR AND PHOTOCELL WITH LOW VOLTAGE WALL SWITCH LAYOUT



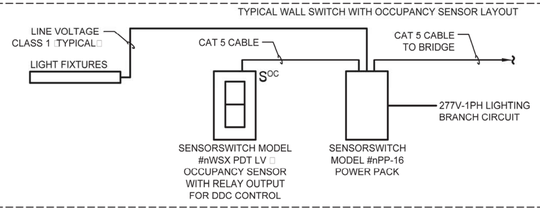
TYPICAL CEILING MOUNT OCCUPANCY SENSOR WITH 3-WAY LOW VOLTAGE WALL SWITCH LAYOUT



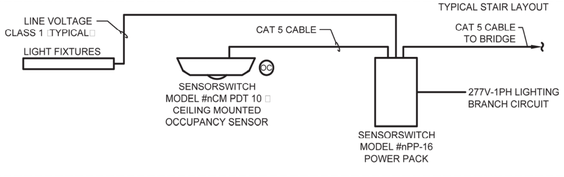
TYPICAL CEILING MOUNT OCCUPANCY SENSOR WITH LOW VOLTAGE WALL SWITCH LAYOUT



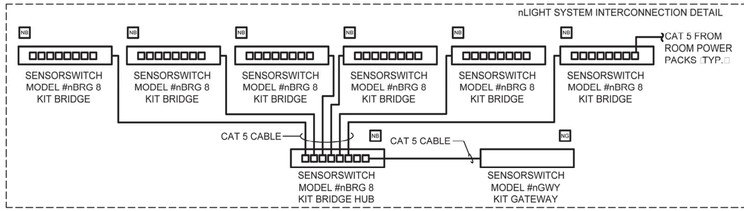
TYPICAL WALL SWITCH WITH OCCUPANCY SENSOR LAYOUT



TYPICAL STAIR LAYOUT



nLIGHT SYSTEM INTERCONNECTION DETAIL



NLIGHT SYSTEM DESIGN NOTES:

1. ONE RELAY IS NEEDED PER CIRCUIT TO BE CONTROLLED AND CAN RESIDE WITHIN SENSORS, WALLPODS, OR RELAY PACKS. FINAL PLACEMENT SHALL BE DETERMINED BY THE ELECTRICAL CONTRACTOR IN THE FIELD. PROVIDE RELAYS AS NEEDED TO SWITCH ALL DESIRED LOADS.
2. FINAL PLACEMENT OF THE BRIDGE S AND GATEWAY S DEVICES SHALL BE DETERMINED BY THE ELECTRICAL CONTRACTOR IN THE FIELD.
3. ALL DEVICES HAVE RJ-45 FEMALE PORTS. MAKING CAT-5 E CABLES WITH T568B MALE TERMINATIONS IS REQUIRED. IT IS IMPERATIVE THAT ALL CAT-5 CABLES BE TESTED WITH A LAN CABLE TESTER TO VERIFY PROPER TERMINATIONS.
4. COMPUTER FOR HOSTING SENSORVIEW SOFTWARE PROVIDED BY OWNER.

1 nLIGHT LIGHTING CONTROL SYSTEM WIRING DETAILs | NTS

LIGHTING FIXTURE SCHEDULE

FIXTURE TYPE	DESCRIPTION	LIGHT FIXTURE ACCEPTABLE MANUFACTURERS AND CATALOG NUMBER		LAMPS		FIXTURE TOTAL WATTAGE	MOUNTING	VOLTAGE	NOTES
		MANUFACTURER	CATALOG NUMBER	QUANTITY	TYPE				
L01	SURFACE MOUNTED LINEAR LED COVE LIGHT	ECOSENSE FEELUX	-	-	LED	2.6W/FT	SURFACE	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
P01	CABLE SUSPENDED LINEAR LED PENDANT	FLUXWERX	VU1-R-B-D-35-A-LENGTH-D-D-M-03-	-	LED	12.5W/FT	PENDANT	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
P02	STEM MOUNTED DECORATIVE LED PENDANT	TEGAN	TG-KAQP-SPG-SMDE-SS-AL-LED-VOLTAGE-DSO-KAP-SPK-0-10V-	-	LED	15W	PENDANT	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
P03	CABLE SUSPENDED LINEAR LED PENDANT	FLUXWERX	PR1-B-A-C-35-A-LENGTH-D-D-M-03-	-	LED	10W/FT	PENDANT	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
P04	CABLE SUSPENDED DECORATIVE LINEAR FLUORESCENT	VODE	105-BF-01-LENGTH-A-CC-60-IB-A-VOLTAGE-X-HE-AL-0-0-0	1	F28T5/835 /ALTO	33W	PENDANT	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
P05	CABLE SUSPENDED DECORATIVE LINEAR PENDANT	FLUXWERX	VU1-R-B-B-35-A-LENGTH-D-D-M-03-	-	LED	12.5W/FT	PENDANT	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
R01	4.5" CEILING RECESSED LED DOWNLIGHT	USA1	1020-B1-10-LRTD4-9014-M2-35KS-30-NCSM-VOLT-DIML2-MOUNTING	-	LED	14W	RECESSED	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
R02	4.5" CEILING RECESSED LED WALLWASHER	USA1	1251-B1-10-LRTW4-6014-M2-35KS-NCSM-VOLTAGE-DIML2-MOUNTING	-	LED	14W	RECESSED	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
R03	CEILING RECESSED LINEAR LED WALLWASHER	ALW	LPR1WT-DRY-HP7-3000-UNV-WH-	-	LED	28W	RECESSED	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
S01	SURFACE CEILING MOUNTED ADJUSTABLE LED DOWNLIGHT	LITELAB	J02PAR30-3-A-SNOOT-T-P-15-OL-SF-PNT	1	Sorax SP30L-18-25 D-830-03	30W	SURFACE	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
S02	SURFACE CEILING MOUNTED ADJUSTABLE LED DOWNLIGHT	LITELAB	J02PAR30-3-A-SNOOT-T-P-15-OL-SF-PNT	1	Sorax SP30L-18-25 D-830-03	30W	SURFACE	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
S03	TO BE SELECTED BY ARCHITECT	-	-	-	-	-	SURFACE	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
S04	SURFACE CEILING MOUNTED DECORATIVE LINEAR FLUORESCENT	BARTCO	IPR5MS-1-28-U-PSNS-F-SM-SA	1	F28T5/835 /ALTO	33W	SURFACE	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
W01	SURFACE WALL MOUNTED DECORATIVE LINEAR FLUORESCENT WALLWASHER	VODE	107-WG-01-LENGTH-A-WA-6-IP-AE-VOLTAGE-X-B-SO-35-19-0-AL-0	1	F28T5/835 /ALTO	33W	SURFACE	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
W02	SURFACE WALL MOUNTED DECORATIVE LED	TEGAN	TG-KLS16-AL-LED-VOLTAGE-DSO	-	LED	7W	SURFACE	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
W03	SURFACE WALL MOUNTED DECORATIVE LED	TEGAN	TG-KLS25-AL-LED-VOLTAGE-DSO	-	LED	14W	SURFACE	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
W04	EXTERIOR SURFACE WALL MOUNTED LED EXIT LIGHT	DESIGN PLAN	SP2012-AS-5-D	-	LED	1W	SURFACE	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
VP	ELEVATOR PIT LIGHT	LITHONIA	OLVTWM	-	LED	15W	SURFACE	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
⊗	EXIT SIGN	LITHONIA	EDGR-GMR-EL-SD1	-	LED	5W	UNIVERSAL MOUNTING	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
W06	EXTERIOR SURFACE WALL MOUNTED LED SCONCE, 3000K, 555 LUMENS, DIFFUSED OPTICS, DIE CAST ALUMINUM CONSTRUCTION, ATHERACITE ALUMINUM FINISH, BUILT IN POWER SUPPLY.	DESIGN PLAN	GK50105DH	-	LED	5W	UNIVERSAL MOUNTING	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
W07-4	EXTERIOR CURTAIN WALL MOUNTED LED LINEAR LIGHT, 3.5"W X 4'L, 896 LM/FT, 3000K, EVEN DISTRIBUTION LENS, ALUMINUM CONSTRUCTION, SATIN BLACK FINISH, INTEGRAL POWER SUPPLY.	ELEMENTS	D3-R4-LS-30-VOLTAGE- HE-R-B	-	LED	10W PER LINEAR FOOT	SURFACE	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES
W07-6	EXTERIOR CURTAIN WALL MOUNTED LED LINEAR LIGHT, 3.5"W X 6'L, 896 LM/FT, 3000K, EVEN DISTRIBUTION LENS, ALUMINUM CONSTRUCTION, SATIN BLACK FINISH, INTEGRAL POWER SUPPLY.	ELEMENTS	D3-R6-LS-30-VOLTAGE- HE-R-B	-	LED	10W PER LINEAR FOOT	SURFACE	120	REFER TO NOTES BELOW FOR APPLICABLE NOTES

DELTA

~~LIGHTING FIXTURE SCHEDULE NOTES:~~

~~LF1. COORDINATE AND VERIFY REQUIRED LEADTIME WITH ARCHITECT PRIOR TO INSTALLATION FOR REQUIRED~~

LIGHTING FIXTURE NOTES BELOW ARE TYPICAL AND APPLY TO ALL LIGHT FIXTURES AS REQUIRED BY THE INSTALLATION LOCATION AND FLOOR PLANS UNLESS SPECIFICALLY NOTED ON REMARKS COLUMN:

LF1. REFER TO ARCHITECT'S REFLECTED CEILING PLANS AND ELEVATIONS FOR FINAL LOCATIONS AND MOUNTING HEIGHTS OF ALL FIXTURES.

LF2. CATALOG NUMBERS INDICATED ARE FOR REFERENCE ONLY. CONTRACTOR IS RESPONSIBLE FOR FINAL FIXTURE COORDINATION AND INSTALLATION. CONTRACTOR SHALL PROVIDE ALL ACCESSORIES REQUIRED FOR INSTALLATION OF LIGHT FIXTURES INCLUDING, BUT NOT LIMITED TO, BAR HANGERS, SWIVEL STEM HANGERS, PENDANTS, END CAPS, CONNECTORS, MOUNTING BOXES, MOUNTING CLIPS,

LF3. COORDINATE LIGHTING FIXTURE INSTALLATION AND TRIM KIT WITH CEILING TYPE. PROVIDE FRAME KIT AS REQUIRED TO INSTALL FIXTURE IN CEILING TYPE.

LF4. ALL FLUORESCENT LAMPS SHALL HAVE A MINIMUM CRI RATING OF 82.

LF5. FINAL FINISHES AND COLORS OF ALL LIGHT FIXTURES SHALL BE APPROVED BY ARCHITECT AND LIGHTING DESIGNER.

LF6. ALL FIXTURES SHALL BE SUPPORTED FROM THE BUILDING STRUCTURE BY THREADED ROD OR CHAIN. REFER TO THE SPECIFICATIONS FOR METHOD. SUPPORTING FIXTURES FROM HUNG CEILING IS NOT ALLOWED.

LF7. ALL INCANDESCENT LAMPS SHALL BE SOFT-WHITE TYPE, DOUBLE-LIFE TYPE.LF8. NUMBER OF FACES, DIRECTIONAL ARROWS AND MOUNTING AS SHOWN ON THE PLAN.

LF9. COORDINATE TASK LIGHT FIXTURE INSTALLATION WITH CASEWORK AS DETAILED ON ARCHITECTURAL DRAWINGS.

LF10. PROVIDE REQUIRED NUMBER OF BALLASTS TO ACCOMMODATE LIGHTING FIXTURES WITH MULTI-LEVEL SWITCHING AS INDICATED ON FLOOR PLANS.

MOUNTING HEIGHTS OF PENDANT FIXTURES.

LF12. FIXTURE SHALL BE U.L. WET LOCATION LISTED.

LF13. FIXTURE SHALL BE U.L. DAMP LOCATION LISTED.

LF14. PROVIDE ELECTRONIC DIMMER BALLAST AS MANUFACTURED BY LUTRON, HI-LUME MODEL FOR 1% DIMMING RATING ONLY. COORDINATE WITH FLUORESCENT DIMMING CONTROL SWITCHES, LIGHT FIXTURE AND/ OR SYSTEM FOR A COMPLETE AND OPERABLE SYSTEM. ONLY LUTRON HI-LUME DIMMING BALLASTS ARE ACCEPTABLE.

LF15. REFER TO CIVIL AND LANDSCAPE SITE PLANS FOR FINAL SITE LIGHT FIXTURE LOCATIONS.

LF16. PROVIDE A COMPLETE AND OPERABLE SYSTEM INCLUDING ALL NECESSARY MOUNTING HARDWARE, POWER FEEDS, WIRING CONNECTRIONS, BALLASTS, DRIVERSM AND CONTROL INTERFACES.

LF17. PROVIDE OVERALL LIGHTED LENGTHS AS SHOWN ON ARCHITECTURAL DRAWINGS.

LF18. PROVIDE OVERALL LIGHTED LENGTHS AS SHOWN ON ARCHITECTURAL DRAWINGS USING 4' AND 8' FIXTURE BODIES.

LF19. MOUNTED IN AN ARCHITECTURAL DETAIL. SEE DRAWINGS FOR MOUNTING CONFIGURATION AND HARDWARE REQUIREMENTS.

Bruner/Cott

Bruner/Cott & Associates, Inc.
130 Prospect Street
Cambridge, Massachusetts 02139
617 492 8400
www.brunercott.com

Architecture/Urban Design
Preservation/Landscape Architecture
Space Planning/Interior Design

R. W. Sullivan Engineering
MEP / FP Engineering . Code . Commissioning
The Schrafft Center
529 Main Street, Suite 203
Boston, Massachusetts 02129-1107
Phone: (617) 523-6227
Fax: (617) 523-8016
www.rwsullivan.com
RWS JOB # 130579.01

	Date	Remarks
041	06/18/2015	BULLETIN #041
052	09/16/2015	BULLETIN #052

Date	October 30, 2014
Scale	NONE
Project Number	329-00
Drawn By	GSD

R.W. KERN CENTER

HAMPSHIRE COLLEGE
893 West Street
Amherst, MA 01002

CONSTRUCTION DOCUMENTS

ELECTRICAL SCHEDULES

E-400

IF THIS SHEET IS NOT: 22" x 34", IT HAS BEEN REDUCED OR ENLARGED.

10/20/2014 1:45:15 PM

MECHANICAL EQUIPMENT SCHEDULE

THE ELECTRICAL CONTRACTOR SHALL PROVIDE ALL CIRCUIT BREAKERS, FEEDERS, BRANCH CIRCUITS, AND ELECTRICAL DEVICES INDICATED ON THIS SCHEDULE

SYMBOL	LOCATION	DESCRIPTION	HP / MCA / KW	PANEL - CKT NO.	VOLTS (V)	PHASE (Ø)	CIRCUIT BREAKER	FEEDER	CONNECTION								REMARKS
									$ TP	VFD	⊠	□J	▨J	∿	J	WP	
HP W06	REFER TO PLANS	WALL MOUNTED HEAT PUMP	0.19A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP W08	REFER TO PLANS	WALL MOUNTED HEAT PUMP	0.19A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP W12	REFER TO PLANS	WALL MOUNTED HEAT PUMP	0.38A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP W18	REFER TO PLANS	WALL MOUNTED HEAT PUMP	0.38A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP C15	REFER TO PLANS	HEAT PUMP	0.35A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP C18	REFER TO PLANS	HEAT PUMP	0.45A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP C24	REFER TO PLANS	HEAT PUMP	0.54A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP A08	REFER TO PLANS	HEAT PUMP	1.05A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP A12	REFER TO PLANS	HEAT PUMP	1.21A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP A15	REFER TO PLANS	HEAT PUMP	1.45A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP A18	REFER TO PLANS	HEAT PUMP	1.56A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP A24	REFER TO PLANS	HEAT PUMP	2.25A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP A30	REFER TO PLANS	HEAT PUMP	2.50A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP A36	REFER TO PLANS	HEAT PUMP	3.33A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP A48	REFER TO PLANS	HEAT PUMP	3.41A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP L12	REFER TO PLANS	HEAT PUMP	0.34A	SEE PLANS	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
HP W240	EXTERIOR	HEAT PUMP UNIT 1	45A	MB1-7,9,11	208V	3Ø	50A-3P	4#6 □ 1#10G - 1"C.					•	•	•	•	PROVIDE 60AS/50AF
	EXTERIOR	HEAT PUMP UNIT 2	45A	MB1-13,15,17	208V	3Ø	50A-3P	4#6 □ 1#10G - 1"C.					•	•	•	•	PROVIDE 60AS/50AF
HP E240	EXTERIOR	HEAT PUMP UNIT 1	45A	MB1-6,8,10	208V	3Ø	50A-3P	4#6 □ 1#10G - 1"C.					•	•	•	•	PROVIDE 60AS/50AF
	EXTERIOR	HEAT PUMP UNIT 2	45A	MB1-12,14,16	208V	3Ø	50A-3P	4#6 □ 1#10G - 1"C.					•	•	•	•	PROVIDE 60AS/50AF
BC 1	ATTIC ACCESS STORAGE	BC CONTROLLER	1.93A	MB1-3	120V	1Ø	15A-1P	2#12 □ 1#12G - 3/4"C.				•		•	•		
BC 2	ATTIC ACCESS STORAGE	BC CONTROLLER	0.64A	MB1-4	120V	1Ø	15A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
BC 3	CLOSET 204	BC CONTROLLER	1.08A	MB1-5	120V	1Ø	15A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
ERV 1	ATTIC	ENERGY RECOVERY VENTILATOR	11.5A	MA1-6,8	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
ERV 2	ATTIC	ENERGY RECOVERY VENTILATOR	11.3A	MA1-7	120V	1Ø	20A-1P	2#12 □ 1#12G - 3/4"C.				•		•	•		
ERV 3	ATTIC	ENERGY RECOVERY VENTILATOR	11.5A	MA1-9,11	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
ERV 4	ATTIC	ENERGY RECOVERY VENTILATOR	11.3A	MA1-10	120V	1Ø	20A-1P	2#12 □ 1#12G - 3/4"C.				•		•	•		
ERV 5	ATTIC	ENERGY RECOVERY VENTILATOR	11.3A	MA1-12	120V	1Ø	20A-1P	2#12 □ 1#12G - 3/4"C.				•		•	•		
ERV 6	ATTIC	ENERGY RECOVERY VENTILATOR	11.3A	MA1-13	120V	1Ø	20A-1P	2#12 □ 1#12G - 3/4"C.				•		•	•		
ERV 7	ATTIC	ENERGY RECOVERY VENTILATOR	11.5A	MA1-14,16	208V	1Ø	20A-2P	2#12 □ 1#12G - 3/4"C.				•		•	•		
ERV 8	ATTIC	ENERGY RECOVERY VENTILATOR	11.3A	MA1-15	120V	1Ø	20A-1P	2#12 □ 1#12G - 3/4"C.				•		•	•		
ERV 9	ATTIC	ENERGY RECOVERY VENTILATOR	11.3A	MA1-17	120V	1Ø	20A-1P	2#12 □ 1#12G - 3/4"C.				•		•	•		
ERV 10	RENAMED ERV-6																
AC 1	FIRE PROTECTION ROOM	AIR COMPRESSOR	1/2 HP	MB1-2,3	120V	1Ø	20A-1P	2#12 □ 1#12G - 3/4"C.				•		•	•		
WH 7-1	FIRST FLOOR CUSTODAL CLOSET	TANKLESS WATER HEATER	16KW	REFER TO FLOOR PLANS	208V	3Ø	60A-3P	4#4 □ 1#10G - 1 1/4"C				•		•	•		
WH 7-2	SECOND FLOOR CUSTODAL CLOSET	TANKLESS WATER HEATER	16KW	REFER TO FLOOR PLANS	208V	3Ø	60A-3P	4#4 □ 1#10G - 1 1/4"C				•		•	•		
WH 7-3	FIRST FLOOR CUSTODAL CLOSET	TANKLESS WATER HEATER	16KW	REFER TO FLOOR PLANS	208V	3Ø	60A-3P	4#4 □ 1#10G - 1 1/4"C				•		•	•		

1 ADDENDUM #1

IF THIS SHEET IS NOT: 22" x 34", IT HAS BEEN REDUCED OR ENLARGED.

10/20/2014 1:45:15 PM

Bruner/Cott

Bruner/Cott & Associates, Inc.
130 Prospect Street
Cambridge, Massachusetts 02139
617 492 8400
www.brunercott.com

Architecture/Urban Design
Preservation/Landscape Architecture
Space Planning/Interior Design

RWS
R. W. Sullivan Engineering
MEP / FP Engineering . Code . Commissioning
The Schrafft Center
529 Main Street, Suite 203
Boston, Massachusetts 02129-1107
Phone: (617) 523-8227
Fax: (617) 523-8016
www.rwsullivan.com
RWS JOB # 130579.01

	Date	Remarks
1	01/29/2015	BULLETIN #018
4	05/21/2015	BULLETIN #031
041	06/18/2015	BULLETIN #041

Date	October 30, 2014
Scale	NONE
Project Number	329-00
Drawn By	GSD

R.W. KERN CENTER

HAMPSHIRE COLLEGE
893 West Street
Amherst, MA 01002

CONSTRUCTION DOCUMENTS

ELECTRICAL SCHEDULES

E-401

SCHEDULE OF PANEL BOARDS 208 / 120 VOLT, 3 PHASE, 4 WIRE

PANEL NAME	MAIN MCB	MAIN MLO	MTG.	AIC RATING	TOTAL POLES	BRANCH CIRCUIT BREAKERS: 1 POLE CIRCUIT BREAKERS 15A	20A	20A GF	30A	40A	50A	60A	2 POLE CIRCUIT BREAKERS 15A	20A	30A	40A	50A	60A	3 POLE CIRCUIT BREAKERS 15A	20A	30A	40A	50A	60A	70A	100A	125A	150A	200A	TOTAL SPACES	NOTES
LB1		100A	S	42K	42		42																							
PB1		150A	S	42K	42		42																		4					
MB1		400A	S	42K	42		30							4									4	2						
P12		100A	S	42K	24		24																							
MA1		125A	S	42K	42		36							6										1						
P11		125A	S	42K	42		42																							
L11		100A	S	42K	42		42																							
P21		150A	R	42K	42		42																							
L21		100A	R	42K	42		42																							
P22		200A	R	42K	42		42																							
L22		100A	R	42K	42		42																							

SCHEDULE OF PANELBOARDS 208/120 VOLT, 3-PHASE, 4-WIRE NOTES:

1.

LEGEND OF FEEDERS SIZES - COPPER CONDUCTORS

FEEDER TAG SYMBOL	CONDUCTORS (3-PHASE, 3-WIRE WITH GROUND) OR (1-PHASE, 3-WIRE WITH GROUND)	RACEWAY SIZE CONDUIT	CONDUCTORS (3-PHASE, 4-WIRE WITH GROUND)	RACEWAY SIZE CONDUIT	NOMINAL AMPERE RATING
1	3#4 1#10G.	1"			
2			4#4 1#10G.	1¼"	60
3	3#4 1#8G.	1"			
4			4#4 1#8G.	1¼"	70
5	3#1 1#8G.	1½"			
6			4#1 1#8G.	1½"	100
7	3#1/0 1#6G.	1½"			
8			4#1/0 1#6G.	2"	125
9	3#1/0 1#6G.	1½"			
10			4#1/0 1#6G.	2"	150
11	3#2/0 1#6G.	2"			
12			4#2/0 1#6G.	2"	175
13	3#3/0 1#6G.	2"			
14			4#3/0 1#6G.	2"	200
15	3#4/0 1#4G.	2"			
16			4#4/0 1#4G.	2½"	225
17	3#250 KCMIL 1#4G.	2½"			
18			4#250 KCMIL 1#4G.	3"	250
19	3#350 KCMIL 1#4G.	3"			
20			4#350 KCMIL 1#4G.	3"	300
21	3#500 KCMIL 1#3G.	3½"			
22			4#500 KCMIL 1#3G.	4"	350
23	3#600 KCMIL 1#3G.	3½"			
24			4#600 KCMIL 1#3G.	4"	400
25	6#250 KCMIL 2#2G.	2 2½"			
26			8#250 KCMIL 2#2G.	2 3"	500
27	6#350 KCMIL 2#1G.	2 3"			
28			8#350 KCMIL 2#1G.	2 3"	600
29	6#600 KCMIL 2#1/0G.	2 3½"			
30			8#600 KCMIL 2#1/0G.	2 4"	800
31	9#400 KCMIL 3#2/0G.	3 3"			
32			12#400 KCMIL 3#2/0G.	3 3"	1000
33	9#600 KCMIL 3#3/0G.	3 3½"			
34			12#600 KCMIL 3#3/0G.	3 4"	1200
35	12#600 KCMIL 4#4/0G.	4 3½"			
36			16#600 KCMIL 4#4/0G.	4 4"	1600
37	15#600 KCMIL 5#250 KCMIL G.	5 3½"			
38			20#600 KCMIL 5#250 KCMIL G.	5 4"	2000

FEEDER SIZE NOTES:

1. 600KCMIL FEEDERS SHALL BE PROVIDED WITH MAC ADAPTERS AS REQUIRED TO COORDINATE WITH BREAKER LUG SIZES.
2. SEE SPECIFICATIONS FOR ACCEPTABLE CONDUCTOR TYPES.

DISTRIBUTION PANEL "MDP" SCHEDULE

208Y/120-VOLTS	3 PHASE	4 WIRE	42,000 AIC
MAIN BUS-800A	NEUTRAL BUS: FULL SIZE		GROUND BUS: FULL SIZE
MAIN DEVICE: MAIN CIRCUIT BREAKER		MOUNTING SURFACE	

CIRCUIT NUMBER	EQUIPMENT DESCRIPTION	OVERCURRENT DEVICE FRAME	TRIP	POLE	FEEDER SIZE	NOTES
M	MAIN CIRCUIT BREAKER	1200A	800A	3	REFER TO ELECTRIC POWER RISER	
1	PANEL LB1	100A	100A	3	SEE NOTE 1.	
2	PANEL PB1	225A	125A	3	SEE NOTE 1.	
3	PANEL MB1	400A	300A	3	SEE NOTE 1.	
4	PANEL L11	100A	60A	3	SEE NOTE 1.	
5	PANEL P11	225A	125A	3	SEE NOTE 1.	
6	PANEL L21	100A	100A	3	SEE NOTE 1.	
7	PANEL P21	225A	150A	3	SEE NOTE 1.	
8	PANEL L22	100A	100A	3	SEE NOTE 1.	
9	PANEL P22	225A	200A	3	SEE NOTE 1.	
10	PANEL LA1	225A	200A	3	SEE NOTE 1.	
11	PANEL PA1	100A	60	3	SEE NOTE 1.	
12	PANEL MA1	225A	125A	3	SEE NOTE 1.	
13	PV SYSTEM	225A	200A	3	SEE NOTE 1.	
14	ELEVATOR	225A	100A	3	SEE NOTE 1.	
15	INVERTER	100A	30A	3	SEE NOTE 1.	PROVIDE WITH LSIG
16	PANEL P12	100A	60A	3	SEE NOTE 1.	
17	PREPARED SPACE	100A				
18	PREPARED SPACE	100A				

NOTES:

1. REFER TO LEGEND FEEDERS FOR THE FEEDER SIZE AND CONDUIT ASSOCIATED WITH THE TRIP UNIT NOTED.

BRANCH CIRCUIT SCHEDULE

CIRCUIT BREAKERS	CONDUCTORS
120 VOLT & 277 VOLT 1Ø, 2W. CIRCUITS	
30A-1P	2#10 1#10G - 3/4"C.
40A-1P	2#8 1#10G - 3/4"C.
50A-1P	2#6 1#10G - 3/4"C.
60A-1P	2#6 1#10G - 3/4"C.
208 VOLT & 480 VOLT 1Ø, 2W. CIRCUITS	
20A-2P	2#12 1#12G - 3/4"C.
30A-2P	2#10 1#10G - 3/4"C.
40A-2P	2#8 1#10G - 3/4"C.
50A-2P	2#6 1#10G - 3/4"C.
60A-2P	2#6 1#10G - 3/4"C.
120/208 VOLT & 277/480 VOLT 1Ø, 3W. CIRCUITS ("+" INDICATES TO PROVIDE (2) PHASE CONDUCTORS & (1) NEUTRAL CONDUCTOR IN 1Ø CIRCUITS)	
20A-2P+	3#12 1#12G - 3/4"C.
30A-2P+	3#10 1#10G - 3/4"C.
40A-2P+	3#8 1#10G - 3/4"C.
50A-2P+	3#6 1#10G - 3/4"C.
60A-2P+	3#6 1#10G - 3/4"C.
208 VOLT & 480 VOLT 3Ø, 3W. CIRCUITS	
20A-3P	3#12 1#12G - 3/4"C.
30A-3P	3#10 1#10G - 3/4"C.
40A-3P	3#8 1#10G - 3/4"C.
50A-3P	3#6 1#10G - 3/4"C.
60A-3P	3#6 1#10G - 3/4"C.
120/208 VOLT & 277/480 VOLT 3Ø, 4W. CIRCUITS ("+" INDICATES TO PROVIDE (3) PHASE CONDUCTORS & (1) NEUTRAL CONDUCTOR IN 3Ø CIRCUITS)	
20A-3P+	4#12 1#12G - 3/4"C.
30A-3P+	4#10 1#10G - 3/4"C.
40A-3P+	4#8 1#10G - 3/4"C.
50A-3P+	4#6 1#10G - 1"C.
60A-3P+	4#6 1#10G - 1"C.

IF THIS SHEET IS NOT: 22" x 34". IT HAS BEEN REDUCED OR ENLARGED.

10/20/2014 1:45:15 PM

Bruner/Cott

Bruner/Cott & Associates, Inc.
130 Prospect Street
Cambridge, Massachusetts 02139
617 492 8400
www.brunercott.com

Architecture/Urban Design
Preservation/Landscape Architecture
Space Planning/Interior Design

RWS
R. W. Sullivan Engineering
MEP / FP Engineering . Code . Commissioning
The Schrafft Center
529 Main Street, Suite 203
Boston, Massachusetts 02129-1107
Phone: (617) 523-8227
Fax: (617) 523-8016
www.rwsullivan.com
RWS JOB # 130579.01

	Date	Remarks
1	01/12/2015	BULLETIN #015
2	01/29/2015	BULLETIN #018
4	05/21/2015	BULLETIN #031
046	07/24/2015	BULLETIN #046

Date	October 30, 2014
Scale	NONE
Project Number	329-00
Drawn By	GSD

R.W. KERN CENTER

HAMPSHIRE COLLEGE
893 West Street
Amherst, MA 01002

CONSTRUCTION DOCUMENTS

ELECTRICAL SCHEDULES

E-402