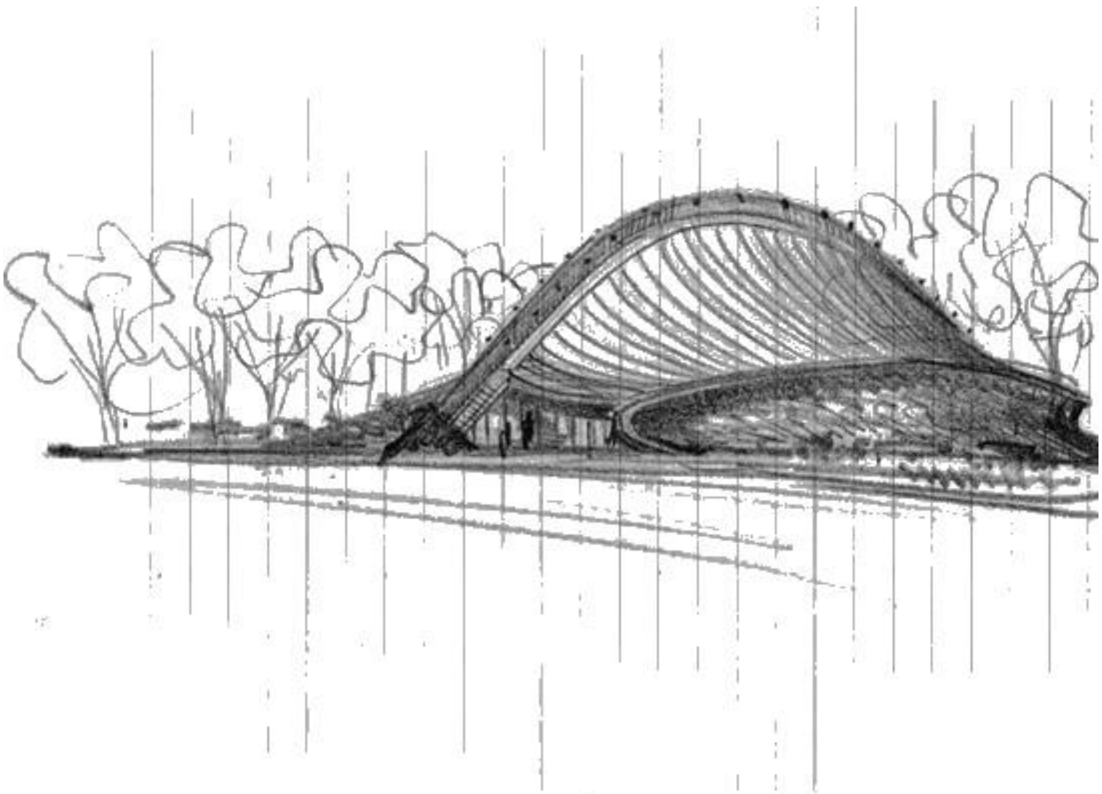


David S. Ingalls Rink

73 Sachem Street, New Haven, CT 06501

Tech Report II: Electrical Systems Evaluation

Amy Chengyue Huan

Lighting/Electrical

Faculty Advisor: Dr. Houser

Electrical Advisor: Leslie Beahm

10.14.13

|Executive Summary

The following report provides a comprehensive study of the current electrical system of David S. Ingalls Rink. Detailed analysis were developed based on electrical drawings and schedules for preliminary electrical system criteria and as-built electrical system, as well as evaluation and proposed changes to the existing conditions.

The overall renovation of building electrical system for David S. Ingalls Rink provides an effective and effective way of operation. The existing building does not contain special occupancy equipment and special systems regarding data storage. Higher efficiency transformer and better quality equipment can be used to increase the lifecycle and reduce the cost of ownership. Building control system integration and energy reduction techniques can be used to reduce the operation cost and make the building more environmentally friendly.

Table of Contents

|General Building Data

Building name: David S. Ingalls Rink
Date Constructed: 1953 - 1959 (Renovation 2008-2010)
Location: New Haven, CT
Site: 73 Sachem St, New Haven, CT
Building Occupant Name: Yale University
Occupancy or function types: Assembly A-4. The constructed building contains ground floor Rink, Concourse, lower level Locker Rooms, Fitness Center, Schley Club Room and other utility rooms.
Site Area: 1.48 ac
Building Footprint: 47,983 sf
Total gsf: 61,646 sf
Num. of Stories above Grade: 1
Total Levels: 2
Major standards and requirements:

ANSI – American National Standards Institute
IESNA – Illuminating Engineering Society of North America
NEC – National Electrical Code

PART I: Preliminary Electrical System Criteria

|Preliminary Electrical Load Calculation

By using estimated load values per unit area and demand factors, the preliminary electrical loads were broken down and the total power density for the building can be calculated as following:

Type	Area (SF)	VA/SF	Demand Factor	KVA
Lighting	61,646	2	1.0	123
Receptacles	61,646	3	1.0	10
			0.5	87
HVAC	61,646	9	1.0	554
Special Equipment	61,646	3	0.8	148
			Total KVA	922
			w/ 25% Spare Capacity **Total**	1152

Table1 | Preliminary Load Calculation

|Utility Company

Yale' Central Power Plant provides steam, chilled water and electricity to the campus. The plant utilizes cutting-edge technology to produce energy at maximum attainable efficiency. With three 6.2 megawatt gas turbines and three 1.5 megawatt peaking and emergency diesel generators, the Central Power Plant has a total capacity to produce 18 megawatts of electricity and 340,000 pounds per hour of steam for heating. The facility also has five steam driven chillers that can provide the campus with 14,600 tons of chilled water when at full capacity.

|Preliminary Building Utilization Voltage

Building Utilization Voltage |480Y/277V
Lighting |277V
Receptacle |120V
HVAC |480V 3 phase
Special Equipment
Elevator |208V
Audio Signal Processing |120V

|Emergency System Requirements

The emergency system mainly supports lighting for egress upon loss of power. The system can also supply loads like ventilation, fire pumps, and fire alarms for safety. A diesel generator at 480/277V will provide adequate power in case of an emergency and is common in similar building applications. Assume 1/3 of the lighting in corridor will be used as egress, the preliminary emergency power can be estimated as:

0.78W/SF (ASHRAE Standard 90.1)/3 * 20ksf = 5200VA

In compliance with International Building Code, the Emergency Power System should be constructed as indicated below:

2702.2.1 Group A occupancies.
Emergency power shall be provided for emergency voice/alarm communication systems in Group A occupancies in accordance with Section 907.5.2.2.4.
2702.2.2 Smoke control systems.
Standby power shall be provided for smoke control systems in accordance with Section 909.11.
2702.2.3 Exit signs.
Emergency power shall be provided for *exit* signs in accordance with Section 1011.6.3.
2702.2.4 Means of egress illumination.
Emergency power shall be provided for *means of egress* illumination in accordance with Section 1006.3.
2702.2.5 Accessible means of egress elevators.
Standby power shall be provided for elevators that are part of an *accessible means of egress* in accordance with Section 1007.4.
2702.2.16 Underground buildings.
Emergency and standby power shall be provided in underground buildings in accordance with Sections 405.8 and 405.9.
2702.2.19 Elevators.
Standby power for elevators shall be provided as set forth in Sections 3003.1, 3007.9 and 3008.9.
2702.2.20 Smokeproof enclosures.
Standby power shall be provided for smokeproof enclosures as required by Section 909.20.6.2.

|Special Occupancy Requirements
Based on NEC 2011 Chapter 5, David S Ingalls Rink meets the following category:

Section 518 | Assembly Occupancies

|Special Equipment
Based on NEC 2011 Chapter 6, David S. Ingalls Rink may need the following special equipment:

Section 620 | Elevators
Section 625 | Electric Vehicle Charging System
Section 640 | Audio Signal Processing, Amplification, and Reproduction Equipment
Section 645 | Information Technology Equipment
Section 695 | Fire Pumps

|System Characteristic Priority Assessment

Reliability	Low
Power Quality	Med
Redundancy	Low
Initial Cost	Low
Long Term Ownership Cost	Med
Flexibility	Med

|Optional Backup Power

The optional standby power supplies general loads to public or private facilities where life safety does not depend on the performance of the system. For David S. Ingalls Rink, the optional backup power might be needed for cooling load for the ice surface.

|Potential Special/Communication Systems

Potential special communication systems are listed below:

Telephone/data

Fire Alarm

- 907.2.1.1 System initiation in Group A occupancies with an occupant load of 1,000 or more. Activation of the fire alarm in Group A occupancies with an *occupant load* of 1,000 or more shall initiate a signal using an emergency voice/alarm communications system in accordance with Section 907.5.2.2. [F]

> **907.5.2.2 Emergency voice/alarm communication systems.** Emergency voice/alarm communication systems required by this code shall be designed and installed in accordance with NFPA 72. The operation of any automatic fire detector, sprinkler waterflow device or manual fire alarm box shall automatically sound an alert tone followed by voice instructions giving *approved* information and directions for a general or staged evacuation in accordance with the building's fire safety and evacuation plans required by Section 404 of the *International Fire Code*. In high-rise buildings, the system shall operate on a minimum of the alarming floor, the floor above and the floor below. Speakers shall be provided throughout the building by paging zones. At a minimum, paging zones shall be provided as follows:
>
> 1. Elevator groups.
> 2. *Exit stairways*.
> 3. Each floor.
> 4. *Areas of refuge* as defined in Section 1002.1.

Overhead Paging/Intercom

Access Control

Security – Intrusion Detection, Video Surveillance

|Other Building Services

Telephone

|Major Equipment

Potential major equipment that will require space in the building includes switchgear, generator, main transformer, step-down transformer, automatic transfer switch and panelboards. Large storage spaces may needed for equipment such as ice welders and Zamboni.

PART II: Existing Electrical System

|Actual Connected Building Load

The actual connected building loads are listed as following:

Type	KVA
Lighting	46
Receptacles	261
HVAC	273
Special Equipment	461
Total	1041

Table2 | Existing Building Load

Type	KVA
MCC	240
Garage	120
Dimmer Panel	38
Duplex Water Booster	39
A/V	24
Total	461

Table3 | Special Equipment Load Detail

|Utility Company

Since Yale's Central Power Plant serves power to David S. Ingalls rink, the utility rate schedule is not available.

|Building Utilization Voltage

Building Utilization Voltage |480Y/277V
Lighting |480Y/277V
Receptacle |208Y/120V
HVAC |480Y/277V
Special Equipment
    Elevator |208Y/120V, 3 phase
    A/V Rack |208Y/120V, 3phase

|Emergency Power System

The emergency power distribution system is designed as the source of electrical energy upon failure or outage of the normal power source. For David S. Ingalls Rink, Automated Transfer Switches (ATS) was used to switch the emergency panels to emergency power in the case of main power failure. A step-down transformer with a secondary end of 208Y/120V was installed to provide lower voltage for the emergency receptacle panel.

The equipment that are connected to the emergency power systems include emergency lighting, low air compressor and fire alarm control panels. The emergency lighting panelboard has a utilization voltage of 480Y/277V, and operates on a 100 amp bus. The emergency receptacle panelboard operates on 208Y/120V utilization voltage with a 100 amp bus. Switch bypass devices (SBD) and shunt relay devices were provided to power egress lighting regardless of fixture switch position. The device is capable of bypassing the local control including switch, dimmer, occupancy sensor or relay when normal utility power has been lost.

Generator information to be provided by electrical engineers.

480 Y/277V 42K AIC 3Ø-4W					ELP-N								BUS: 100 AMP MAIN: 70 AMP CB		
	LOAD SERVED	WIRE SIZE	TRIP	POLE	LOAD IN kVA ØA		ØB		ØC		POLE	TRIP	WIRE SIZE	LOAD SERVED	
1	Lower Level Lighting	2#12+G- 3/4"C	20	1	1.51	0.25					1	20	2#12+G- 3/4"C	Upper Level Lighting	2
3	South Lower Lights	2#12+G- 3/4"C	20	1			0.70	0.30			1	20	2#12+G- 3/4"C	North Entrance Lighting	4
5	West Lighting	2#12+G- 3/4"C	20	1					0.50	0.50	1	20	2#12+G- 3/4"C	East Lighting	6
7	Interior South Lighting	2#12+G- 3/4"C	20	1	0.50	0.50					1	20	2#12+G- 3/4"C	Exterior South Lighting	8
9	Ramp Lighting	2#12+G- 3/4"C	20	1			0.50	2.81			1	20	2#12+G- 3/4"C	West Em. Lighting	10
11	Exit Lights	2#12+G- 3/4"C	20	1					0.30	0.00	1	20		SPARE	12
13	Exit Lights	2#12+G- 3/4"C	20	1	0.30	0.00					1	20		SPARE	14
15	SPARE		20	1			0.00	0.50			1	20	2#12+G- 3/4"C	Team Lounge	16
17	SPARE		20	1					0.00	0.95	1	20	2#12+G- 3/4"C	Schley Room	18
19	SPARE		20	1	0.00	0.00					1	20		SPARE	20
21	SPARE		20	1			0.00	0.00			1	20		SPARE	22
23	SPARE		20	1					0.00	0.00	1	20		SPARE	24
25	ERP VIA EXF	3#10+#10G-3/4"C	30	3	2.00	3.22					3	30	4#10+#10G-3/4"C	EDR- SEC 1 & SEC 2	26
27							1.00	3.22							28
29									0.00	3.22					30
	LOAD PER PHASE				8.28		9.04		5.47						
	TOTAL =						22.79 kVA						27 AMPS	A = AFI BREAKER	

NOTES: ☐ FEED THROUGH LUGS ☐ FLUSH ☐ 600KCM LUGS ☐ ISOLATED GROUND BUS G = GFI BREAKER

Table4 | Emergency Lighting Panelboard Schedule

208 Y/120V 65K AIC 3Ø-4W					ERP								BUS: 100 AMP MAIN: 60 AMP CB		
	LOAD SERVED	WIRE SIZE	TRIP	POLE	LOAD IN kVA ØA		ØB		ØC		POLE	TRIP	WIRE SIZE	LOAD SERVED	
1	Low Air Compressor	2#12+G- 3/4"C	20	1	1.00	1.00					1	20	2#12+G- 3/4"C	FACP	2
3	SPARE		20	1			0.00	1.00			1	20	2#12+G- 3/4"C	FACP	4
5	SPARE		20	1					0.00	0.00	1	20		SPARE	6
7	SPARE		20	1	0.00	0.00					1	20		SPARE	8
9	SPARE		20	1			0.00	0.00			1	20		SPARE	10
11	SPARE		20	1					0.00	0.00	1	20		SPARE	12
	LOAD PER PHASE				2.00		1.00		0.00						
	TOTAL =						3.00 kVA						8 AMPS	A = AFI BREAKER	

NOTES: ☐ FEED THROUGH LUGS ☐ FLUSH ☐ 600KCM LUGS ☐ ISOLATED GROUND BUS G = GFI BREAKER

Table4 | Emergency Receptacle Panelboard Schedule

|Special Occupancy Requirement

There is no special occupancy requirement based on the design documents.

|Special Equipment

David S. Ingalls Rink is designed with the following special equipment:

- Section 640 | Audio Signal Processing, Amplification, and Reproduction Equipment
  Camera video distribution system and instant replay system are provided in the rink area. Additional audio system was added to the Team Lounge, Strength and Conditioning Room, Locker Room during renovation.
- Section 645 | Information Technology Equipment

|Existing Electrical Systems

Main Service and Distribution Equipment

- Switchboards: Dead front, completely metal enclosed, self-supporting switchboard structure, independent of wall supports for equipment rated 1200 amperes and larger provided with surge protection devices. The enclosure meets the NEMA 1 indoor construction. The existing 15KV puffer selector switch is located in the main electrical room on the lower level.
- Panelboard: Panelboards are complied with UL, NEC and NEMA standards with surge protection devices. The main distribution has a configuration of 480Y/277V, 3 phase and 4 wire with 1600 Amp bus and 100,000 A.I.C rating. The sub distribution panels have configuration of 208Y/120V, 3 phase and 4 wires with 800 Amp bus and 65,000 A.I.C rating.

Service Transformer

- Pad Mounted Distribution Transformers: Pad mounted main distribution transformers were provided with 3 phase, liquid immersed, dead front secondary distribution type, tamperproof and weatherproof, and suitable for mounting on concrete pad. The system has a 13,800V Delta, 3 phase, 3 wire primary voltage and configuration; 480Y/277V, 3 phase, 4 wire secondary voltage and configuration, and 95kV Basic Lighting Impulse Insulation Level.

Distribution Step down transformer

- Dry Type Transformers: Ventilated, dry type transformers with drip-proof openings were provided with 3 phase delta primary, grounded wye secondary, copper windings, U.L. listed and labeled KVA ratings and voltages. Transformer configurations include: 225KVA, 480 Volts, 3 phase, 3 wire primary; 208Y/120V, 3 phase, 4 wire secondary / 150KVA , 480 Volts, 3 phase, e wire primary; 208Y/120V, 3 phase, 4 wire secondary / 30 KVA, 480 Volts, 3 phase, 3 wire primary; 208Y/120V, 3 phase, 4 wire secondary / 15KVA, 480 Volts, 3 phase, 3 wire primary; 208Y/120V, 3 phase, 4 wire secondary.

Wiring

Raceway & Wire	**Application**
Threaded Rigid Steel Conduit	Elevator machine rooms, pits & shafts; fire pump, jockey pump, smoke exhaust fan feeders, and associated control circuits; exposed outdoors, roofs, or penetrations through concrete slabs or equipment pads; circuits above 600 volts. MI cable cold leads.
Electrical Metallic Conduit (EMT) *Galvanized steel* *Die-cast fittings not acceptable*	Interior, dry locations for: switchboard and panelboard feeders, branch feeders, lighting and appliance circuitry; homeruns to overcurrent protection device; fire alarm, telecommunications, sound & video consultant/vendor specifications, and security consultant/vendor specifications.
Rigid Non-metallic Conduit	Below grade, below slab, outdoors where exposed to physical damage and in corrosive locations where shown on drawings, encased in concrete, concrete duckbanks.
Flexible Metal Conduit *Interlocked flexible galvanized steel*	Final connections minimum 18 inches and less than six(6) feet only for lighting and appliance branch circuitry in accessible voids of suspended ceilings; final connections minimum 18 inches and less than three(3) feet to motors in mechanical rooms, other interior dry locations, or where located in plenums or other spaces used for environmental air.
Liquidtight Flexible Metal Conduit *Interlocked flexible galvanized steel core with permanently bonded PVC jacket*	Final connections minimum 18 inches and less than three(3) feet only for lighting and appliance and motor branch circuitry in exposed wet of damp locations. Do not use in plenums or other spaces used for environmental air.
Metal Clad Cable (MC)	Lighting and appliance branch circuitry concealed in dry wall partitions and accessible voids of suspended ceiling except homeruns to overcurrent devices which shall be EMT.
Optical Fiber/Communications Cable Raceway	Inner duct for communications applications in conduit or ductwork
Surface Metal Raceway	Exclude in concealed locations.
Flexible Cable Tray	Low voltage, voice, data and video systems in exposed locations and above accessible ceilings.

Table5| Wiring Schedule

30 ampere circuit	No.10
40 ampere circuit	No.8
50 ampere circuit	No.6
60 ampere circuit	No.6

Table6| Wire Size Table

Size	Type
No. 10, 12, 14 AWG	THHN/THWN-2
No. 8 AWG through No.1 AWG	THHN/THWN-2
No. 1/0 AWG and larger	XHHW-2

Table7| Conductor Type

Switches

- Local Wall Switches: Premium specification grade, quite operating AC switches, rated 20 amps at 120 volts. Single pole, double pole, 3-way, or 4-way operations.
- Pilot Light Switches: 20A, single pole, with neon-lighted handle, illuminated when switch is "on".
- Key-Operated Switches: 120/277V, 20A, single pole, with factory-supplied key in lieu of switch handle.
- Automatic Transfer Switch: ATS equipment compatible with the existing emergency power system was provided. The electrically-operated, mechanically-held, double-throw automatic transfer switch complies with the requirements of UL 1008 and NFPA 11, Level1. Three-pole switches are provided with a fully rated, solid, un-switched neutral terminal. Four-pole switches are provided with full-capacity neutral switching.
- Duplex Convenience Receptacles: Receptacles are standard NEMA 5-20R configuration. Two-pole, three-wire grounding type, with molded nylon body and face, premium specification grade, rated 20 amps at 125 volts.
- Ground fault circuit interrupter (GFCI) receptacles: Comply with UL2003 and rated 20 amps with 20 amp feed-through rating, 125 volt duplex, NEMA 5-20R.
- Wallbox Dimmers: Wallbox dimmers rated for loads and voltages to be controlled. 100 watts rated Lutron Maestro Series dimmers were used in vicinity of Decora-style wiring devices and switches. 1000 watt rated Lutron Faedra series dimmers were used in the vicinity of standard wiring devices and switches.
- Occupancy Sensors
  - Ceiling mounted occupancy sensor switches with dual-technology types, combination infrared PIR/ultrasonic or PIR/microphonic types.
  - Wall mounted occupancy sensor switches for control of single/multi circuit lighting loads. Intelligent self-adjusting multi-technology types, combination infrared PIR/ultrasonic or PIR/microphonic , with integral manual override "off" switch.

|Optional Backup Power

The existing building does not have optional backup power system.

|Special / Communication Systems

Detailed requirements of special communication systems can be found in specifications include the following:

Security system

Telecommunication System

CATV system - The Cable TV distribution system is located in the rink area.

POINT OF SALE system

Personal computer networks

Bathroom Emergency Call System
- Complete bathroom call systems are provided in handicap accessible bathroom as required by code.

Electric Frost Prevention
- Cables are mineral insulated type with two conductors with a single cold splice at one end. Each system is controlled by a combination time clock and temperature sensing probe. 3 wire temperature sensing probes for automatic operation of the system. MaterTrace Controller with two temperature inputs with two-dole dual, SCT per phase, 800 amps, 1 cycle inrush switching contacts.

Fire Alarm System
- The system receives 120 VAC emergency power via circuit breakers with handle locking devices. The system incorporates one-way voice communication and tone generating capabilities.

|Dedicated Electrical/Communication Systems Space

The main electrical communication systems spaces are located on the lower level floor with a total area of 600SF (1% of total building SF).

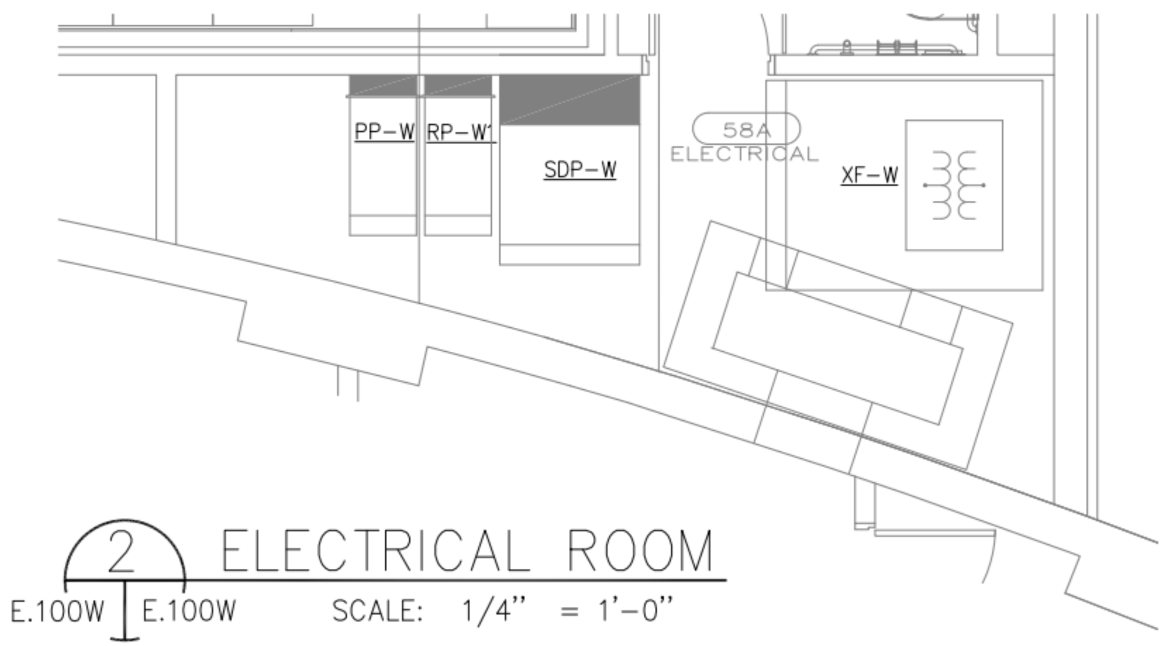


Figure 1| Electrical Room Detail

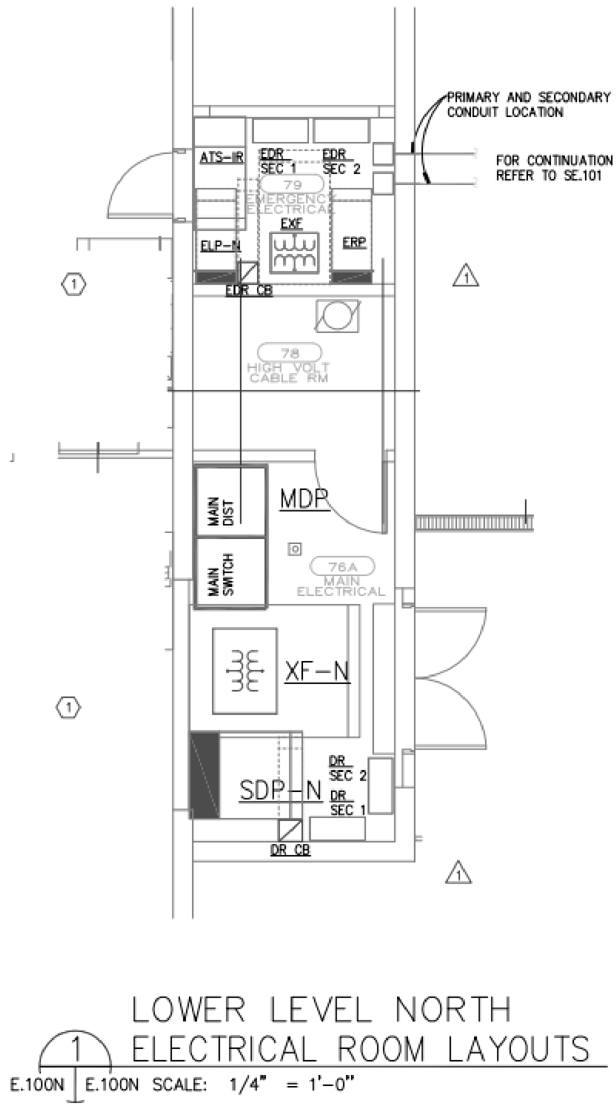


Figure 2| Electrical Room Detail

|Energy Reduction

The building is not LEED Certified. Information regarding energy savings is not available at this time.

|Single Line Diagram

Please see attachment on the last page.

PART III: System Evaluation

|Building Loads

	Preliminary	Actual
Lighting	123	46
Receptacles	97	261
HVAC	554	273
Special Equipment	148	461
Total	1152	1041

Table8| System Loads Comparison

The as-built building load value is lower than the preliminary electrical system load calculation. The actual lighting load is 62% less than the estimated load. However, due to the inconsistency of panelboard schedule with several receptacle and mechanical loads mixed up, loads on receptacle panel are way higher than the estimation; and the HVAC load much lower than the predicted value. There is more special equipment than expected such as existing MCC and garage, which leads to a higher as-built load value.

|Building Utilization Voltage

The only difference between preliminary building utilization voltage and the actual utilization voltage is the HVAC system. Based on the actual HVAC building load indicated in Table 8 which is way lower than the estimated power, the as-designed 277V 3 phase as-built voltage systems may provide sufficient amount of electricity.

|Emergency Power System

Information regarding fuel and power source for building electrical system are not available at this time.

All as-built emergency system equipment used is in accordance with the corresponding code. Assuming existing emergency alternate service panel connects to another existing source, using batteries instead would result in better maintenance and lower initial cost for a building at this size.

|Electrical Equipment

The major changes of David S. Ingalls rink renovation included replacing existing 150KVA transformer with a new 750 KVA pad mounted transformer and reconnecting some feeders to the new panelboards. The adjustment to the system is appropriate regarding the building electrical system characteristics. Choices of wiring and switches all meet the industrial standards. Switchboard is most widely used low voltage sub-distribution equipment. For a building at 60 ksf gross area, changing it to switchgear will not have a significant impact on space efficiency and operation economics.

|Optional Back-up Power

The current electrical system does not use any optional back-up power for emergency. As it is also said in *PART I | Optional Backup Power,* the only occasion where optional standby is needed would be to keep the ice cold. Considering Ingalls Rink's game schedule, less than 50% of the hockey games are played home, therefore it is not necessary to invest an optional stand-by power for the playfield.

|Cost of Ownership Reduction

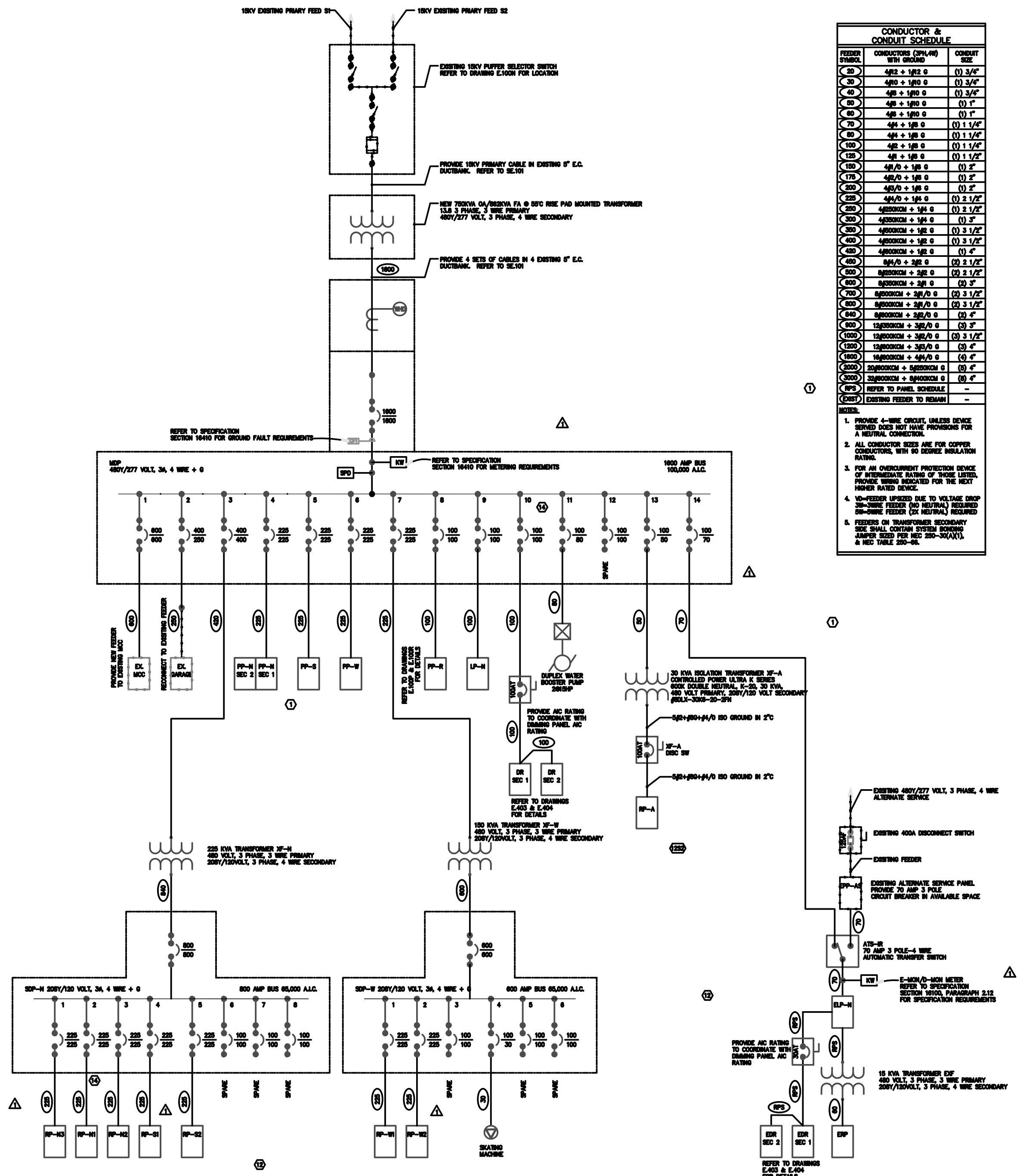
The impact of reducing the cost of ownership is both financial and environmental. Using higher quality equipment will increase the product lifecycle, which may contributes to the overall maintenance costs, operating cost, and replacement cost. With a more efficient transformer, there can be greater amount of utility savings with enhanced productivity and better system performance. VFD control over HVAC applications such as fans, pumps, air handlers, and hillers can be beneficial at energy saving and thermal aspects.

|Potential System Integration

Integration control system can be used for receptacle load panels to reduce the operation cost and provides more energy savings. Integrated building alarm signaling devices can be used to combine fire, weather, public, process, paging announcements together for more intelligent systems. By integrating fire alarm system and HVAC controls, the ventilation system can automatically adjust the operation mode based on the smoke and air flow. Since there's little daylight contribution to the building, integration of lighting and shades systems is not necessary.

|Energy Reduction Techniques

PV arrays may not seem to be effective for a historic and iconic building since the installation may have a significant change to the existing building exterior. Wind generation may not be affective in the New Haven area for a low rise building. Energy reduction techniques like trigeneration can be used to reduce the refrigeration and ventilation cost for the ice arena. Demand reduction and demand shifting techniques can be used to reduce the overall operation cost.



CONDUCTOR & CONDUIT SCHEDULE

FEEDER SYMBOL	CONDUCTORS (3PH,4W) WITH GROUND	CONDUIT SIZE
20	4#12 + 1#12 G	(1) 3/4"
30	4#10 + 1#10 G	(1) 3/4"
40	4#8 + 1#10 G	(1) 3/4"
50	4#6 + 1#10 G	(1) 1"
60	4#6 + 1#10 G	(1) 1"
70	4#4 + 1#8 G	(1) 1 1/4"
80	4#4 + 1#8 G	(1) 1 1/4"
100	4#2 + 1#8 G	(1) 1 1/4"
125	4#1 + 1#6 G	(1) 1 1/2"
150	4#1/0 + 1#6 G	(1) 2"
175	4#2/0 + 1#6 G	(1) 2"
200	4#3/0 + 1#6 G	(1) 2"
225	4#4/0 + 1#4 G	(1) 2 1/2"
250	4#250KCM + 1#4 G	(1) 2 1/2"
300	4#350KCM + 1#4 G	(1) 3"
350	4#500KCM + 1#2 G	(1) 3 1/2"
400	4#500KCM + 1#2 G	(1) 3 1/2"
420	4#600KCM + 1#2 G	(1) 4"
450	8#4/0 + 2#2 G	(2) 2 1/2"
500	8#250KCM + 2#2 G	(2) 2 1/2"
600	8#350KCM + 2#1 G	(2) 3"
700	8#500KCM + 2#1/0 G	(2) 3 1/2"
800	8#500KCM + 2#1/0 G	(2) 3 1/2"
840	8#600KCM + 2#2/0 G	(2) 4"
900	12#350KCM + 3#2/0 G	(3) 3"
1000	12#500KCM + 3#2/0 G	(3) 3 1/2"
1200	12#600KCM + 3#3/0 G	(3) 4"
1600	16#600KCM + 4#4/0 G	(4) 4"
2000	20#600KCM + 5#250KCM G	(5) 4"
3000	32#600KCM + 8#400KCM G	(8) 4"
RPS	REFER TO PANEL SCHEDULE	-
EXIST	EXISTING FEEDER TO REMAIN	-

NOTES:

1. PROVIDE 4-WIRE CIRCUIT, UNLESS DEVICE SERVED DOES NOT HAVE PROVISIONS FOR A NEUTRAL CONNECTION.
2. ALL CONDUCTOR SIZES ARE FOR COPPER CONDUCTORS, WITH 90 DEGREE INSULATION RATING.
3. FOR AN OVERCURRENT PROTECTION DEVICE OF INTERMEDIATE RATING OF THOSE LISTED, PROVIDE WIRING INDICATED FOR THE NEXT HIGHER RATED DEVICE.
4. VD=FEEDER UPSIZED DUE TO VOLTAGE DROP 3W=3WIRE FEEDER (NO NEUTRAL) REQUIRED 5W=5WIRE FEEDER (2X NEUTRAL) REQUIRED
5. FEEDERS ON TRANSFORMER SECONDARY SIDE SHALL CONTAIN SYSTEM BONDING JUMPER SIZED PER NEC 250-30(A)(1), & NEC TABLE 250-66.

RECORD DRAWING 02/26/10

Yale University

Central Campus

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New Haven, CT 06520

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20 DAVIS STREET HAMDEN, CT

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NO.	DATE	REVISION
12S2	02/23/09	02/23/09 BULL #12 SUPP #2
14	02/06/09	02/06/09 BULLETIN #14
12	12/16/08	12/16/08 BULLETIN #12
1	06/16/08	06/16/08 BULLETIN #1
1	05/05/08	Addendum 1CD
3	03/31/08	Issue
2	03/07/08	Permit Review
1	02/29/08	50% CD

ISSUE/REVISION

PROJECT NAME
RENOVATIONS AND ADDITIONS

BUILDING NAME & ADDRESS
DAVID S. INGALLS RINK
73 SACHEM STREET, NEW HAVEN, CT 06510

PROJECT NUMBER
06102401

DRAWING TITLE
SINGLE LINE DIAGRAM

SCALE	DRAWN BY
NONE	JR
CAD FILENAME	DATE
E002	31 December 2007

DRAWING NUMBER
E.002
XX of YY