2010

Technical Report 2
Drexel University Rec Center
Philadelphia, PA

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Executive Summary

The following report provides a comprehensive analysis of the existing electrical and power distribution system of the Drexel University Recreation Center. Compiled using the drawings and specifications provided by the architect and electrical engineer, it presents a description of the voltage, power sources, emergency distribution, and all switchgear and electrical equipment including mechanical and communications systems. A single line diagram and schedules of all transformers, luminaires, provide an in-depth overview of the design.

The 84,400ft three story recreation center's overall electric system is fed through an interior service entrance from Drexel's main campus system and is delivered at 13.2kVA. Once transformed to 480Y/277V, this is distributed via main distribution panels throughout the building, converted to 208Y/120V for receptacle and appliance loads.

Three service entrance sizing methods are performed, using overall building type, NEC load determination, and actual loading derived from panelboard and mechanical schedules. Even with an added 25% for future expansion, the actual size of the service entrance was much larger than what was calculated due to safety and system design considerations.

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Drexel University Recreation Center

general building information

location | NW Corner of 33rd and Market Streets Philadelphia, PA

building occupant | Drexel University faculty and students

occupancy type | Gymnasium/Lounge Café

size | The entire athletic center is 250,000sf but the addition covered by this investigation is 84,000sf

total levels | Three levels above grade

dates of construction | June 2008-December 2009

actual cost | $41 million

project delivery method | Design-bid-build with a gross maximum price

primary project team

Drexel University	*owner*
Sasaki Associates	*architecture* *interiors* *landscaping*
EwingCole	*mechanical/electrical/plumbing* *structural* *fire protection*
Pennoni Associates	*civil* *site design* *geotechnical/environmental engineering*
Turner Construction	*contractor*

restaurant fit-out

LDL Studio Inc.	*architect*
FXBonnes Associates Inc.	*mechanical/electrical/plumbing* *fire protection*

Summary Description of Distribution System

The DRC's electrical system is a radial system with a 13.2 kV service entrance in the main electrical room in the basement of the Fitness Center. Existing PECO service switchgear in the Nesbit Building feeds the service entrance to the DRC. A 1500kVA transformer that steps down the voltage from 13.2kV to a 480Y/277V, 3P, 4W voltage system is located in a newly constructed substation to feed the new addition as well as the existing part of the DAC. A 2500A main distribution system provides power 480Y/277V power to all loads. Dry-type step-down transformers convert power to 208Y/120V, 3P, 4W for receptacles and appliance loads, while lighting panels use the 277V power. An indoor diesel emergency generator rated at 350kW, 480Y/277P, 3P, 4W provides backup power to emergency branches powering emergency/egress lighting, sewage ejector pumps, existing sump pumps, and boiler controls.

Utility Company Information

The DRC is a powered by PECO as a part of Drexel University's campus system. PECO, a subsidiary of Exelon Corporation, is based in Philadelphia and serves southeastern Pennsylvania.

2301 Market Street
P.O. Box 8699
Philadelphia, PA 19101
www.peco.com

Drexel receives General Service under PECO's GS rate schedule. The monthly costs per kWh under this schedule are as follows:

VARIABLE DISTRIBUTION SERVICE CHARGE:
3.64¢ per kWh for the first 80 hours' use of billing demand
1.71¢ per kWh for the next 80 hours' use of the billing demand
1.08¢ per kWh for additional use; except
0.47¢ per kWh over both 400 hours' use of billing demand and 2,000 kWh

Plus the COMPETITIVE TRANSITION CHARGE:
8.86¢ per kWh for the first 80 hours' use of billing demand
4.18¢ per kWh for the next 80 hours' use of billing demand
2.64¢ per kWh for additional use; except
1.17¢ per kWh over both 400 hours' use of billing demand and 2,000 kWh

Service Entrance

The Drexel Recreation Center is tied into Drexel's campus system and fed directly from the Nesbit Building through an existing manhole in the exterior plaza to the north of the building. All components of the service entrance are owned and provided by Drexel, the owner. Metering, as well as all equipment is indoors in centrally located electrical room 132 located on the basement level below the gymnasium.

The primary transformer, located on a 4" concrete pad inside the electrical room, is rated at 1500kVA, and converts 13.2kV to the 480Y/277V, 3P, 4W serving the Rec Center's main power system. The main distribution switchboard distributes power through typical normal power feeders out to existing transformers and panels on each additional floor.

Voltage systems

Power enters the Drexel Rec Center on a 480Y/277V, 3P, 4W voltage system. Lighting panels are all fed by 480/277V 3P, 4W feeders EXCEPT in the restaurant, which uses its own distribution panel for lighting and steps down to a 208/120V bus for lighting panels operating at 120V.Receptacles and appliance loads operate at 120V and are fed off of a 208Y/120V, 3P, 4W feeder. Most mechanical equipment runs on 460V for 3P operation or 208/120V for 1P operation.

Emergency Power Systems

A 350kW/437.5kVA liquid cooled emergency natural gas generator is located in the central emergency generator room 133 next to the electric room in the basement, on the north side of the building. The generator has starting batteries with battery charger that operates on 120V AC. A diesel belly tank is provided at the base of the generator for a minimum of 17 hours back-up.

Main emergency automatic transfer switches feed two emergency main power distribution panels also located in room 133. The 250A main distribution panel is powered by a 200A 4P automatic transfer switch and serves all HVAC equipment and emergency power to the restaurant. The 100A emergency distribution panel is powered by a 100A 4P automatic transfer switch and provides backup power for the elevators, security monitoring system, and automatic exterior door locks.

In addition to supplying all emergency power to the Rec Center addition, the generator also replaces the existing Daskalakis Athletic Center Generator. Emergency power is provided to the existing facility through a 150A 4P automatic transfer switch connected to an existing 250A

emergency distribution panel located in the existing DAC main electric room. Normal power for this panel is provided by the existing DAC sub-station.

Locations of Switchgear

The main utility transformer and unit sub-station are located at the service entrance in electrical switchgear room 132, on the main level beneath the gymnasium. A main emergency switchboard located in the emergency generator room provides power to the emergency distribution panels. There are six main distribution panels, two emergency, two standard distribution, and two power panels, all located in the first floor mechanical area either in the electrical switchgear room, adjacent emergency generator room, or nearby boiler room, with one switchboard feeding the restaurant from the restaurant's electrical room. Two transformers located in the electrical room on each of the upper floors convert the power down to 208/120V power. The restaurant converts all of its power for lighting, receptacle, and mechanical loads locally in its own electrical room and janitor storage closet. Below are the major equipment and panelboard schedules for the Drexel University Recreation Center.

Major Equipment Schedule						
Tag	**Type**	**Floor**	**Room**	**Room Name**	**DWG Number**	**Detail**
ATS-ES-1	Transfer Switch	First	133	Emer. Gen. Rm	E1-01A	E5-01
ATS-ES-2	Transfer Switch	-	-	Ex. DAC Main Elec. Rm.	-	E5-01
ATS-OS-1	Transfer Switch	First	133	Emer. Gen. Rm	E1-01A	E5-01
DP-1	Dist. Panel	First	132	Elec. Swgr Rm.	E1-01A	E5-01
DP-3	Dist. Panel	First		Restaurant	E1-01B	-
DP-L	Dist. Panel	First	151	Rest. Elec. Room	E3.1R	-
EDP-ES-1	Emerg. Dist. Panel	First	133	Emer. Gen. Rm	E1-01A	E5-01
EDP-OS-1	Emerg. Dist. Panel	First	133	Emer. Gen. Rm.	E1-01A	E5-01
EG-1	Em. Generator	First	133	Emer. Gen. Rm.	E1-01A	E5-01
EMP1-L	Dist. Panel	First	151	Rest. Elec. Room	E3.1R	-
EMSWBD	Em. Main Switchboard	First	133	Emer. Gen. Rm	E1-01A	E5-01
PP-1	Power Panel	First	136	Boiler Room	E1-01A	E5-01

PP-3	Power Panel	Third	302	Elec. Room	E1-03A	E5-01
SS-1	Substation	First	132	Elec. Swgr Room	E1-01A	E5-01
T-1	Transformer	First	132	Elec. Swgr Room	E1-01A	E5-01
T-2	Transformer	First	132	Elec. Swchgr Room	E1-01A	E5-01

Tag	Type	Floor	Room	Room Name	DWG Number	Detail
T-3	Transformer	Second	202	Elec. Room	E1-02A	E5-01
T-4	Transformer	Third	302	Elec. Room	E1-03A	E5-01
T-5	Transformer	First	133	Emer. Gen. Room	E1-01A	E5-01
T-6	Transformer	Third	302	Elec. Room	E1-03A	E5-01
T-7	Transformer	First	133	Emer. Gen. Room	E1-01A	E5-01
T-8	Transformer	Second	202	Elec. Room	E1-02A	E5-01
T-9	Transformer	First	151	Rest. Elec. Room	E3.1R	-
T-10	Transformer	First	151	Rest. Elec. Room	E3.1R	-
T-11	Transformer	First	151	Rest. Elec. Room	E3.1R	-

*note: DWGs denoted with suffix R are part of the restaurant fit-out plans.

Panelboard Schedule						
Tag	Voltage System	Main Size/Type	Floor	Room	Room Name	Drawing Number
AP-1-1	208/120V 3P,	250A	First	132	Elec.	E1-01A
AP-1-2	208/120V 3P,	80A MCB	First	137	Future Chiller	E1-01A
AP-2-1	208/120V 3P,	225A	Secon	202	Elec. Room	E1-02A
AP-2-2	208/120V 3P,	60A MCB	Secon	213	Elec. Room	E1-02A
AP-2-3	208/120V 3P,	80A MCB	Secon	213B	Elec. Room	E1-02A
AP-3-1	208/120V 3P,	150A	Third	302	Elec. Room	E1-03A
AP-3-2	208/120V 3P,	80A MCB	Third	302	Elec. Room	E1-03A
EMP1-L	208/120V 3P,	150A	First	151	Elec. Room	E3.1R
EMP2-L	208/120V 3P,	150A	First	151	Elec. Room	E3.1R
ESAP-1-1	208/120V 3P,	0A MLO	First	133	Emer.	E1-01A
ESAP-3-1	208/120V 3P,	60A MLO	Third	302	Elec. Room	E1-03A
ESLP-1-1	480/277V 3P,	60A MLO	First	133	Emer.	E1-01A
ESLP-3-1	480/277V 3P,	60A MCS	Third	302	Elec. Room	E1-03A
GDP-L	208/120V 3P,	175A	First	151	Elec. Room	E3.1R
KP1-L	208/120V 3P,	225A	First	Rest.	Kitchen	E3.0R
KP2-L	208/120V 3P,	225A	First	Rest.	Kitchen	E3.0R
LP-1-1	480/277V 3P,	60A MCB	First	132	Elec.	E1-01A

LP-2-1	480/277V 3P,	60A MCB	Secon	202	Elec. Room	E1-02A
LP-3-1	480/277V 3P,	60A MCB	Third	302	Elec. Room	E1-03A
MP-H	208/120V 3P,	175A	First	151	Elec. Room	E3.1R
MP-L	240/120V 3P,	125A	First	Rest.	Jan. Closet	E3.0R

Tag	Voltage System	Main Size/Type	Floor	Room	Room Name	Drawing Number
NDP-L	208/120V 3P, 4W	175A MLO	First	151	Elec. Room	E3.1R
OSAP-1-1	208/120V 3P, 4W	100A MLO	First	133	Emer. Generator Room	E1-01A
OSAP-2-1	208/120V 3P, 4W	225A MLO	Second	202	Elec. Room	E1-02A
RP-L	208/120V 3P, 4W	225A MLO	First	Rest.	Staff Corr.	E3.0R

Over-current Devices

Circuit breakers are the main source of over-current protection in the DRC. The service entrance is protected by a 2500 Amp Frame and 2500 Amp Trip circuit breaker. The generator is equipped with a 700A main electronic type circuit breaker feeding the emergency power distribution panel. It is also equipped with a Ground Fault Sensing Coil (GFSC) that detects a ground fault occurrence but will not cause the circuit break to trip. Most of the normal individual panel boards have bolt on circuit breakers sized in accordance with the NEC with AIC ratings of 18,000, with a few feeding through to a second section of main lug only. All emergency panels are main lug only. Elevators are protected by 100 and 60A fuses. All transformers are protected by disconnect switches rated in accordance to the transformer load. At the service entrance, a Transient Voltage Surge Suppressor is installed with a 60A fuse disconnect before the Unit Substation.

Transformers

The Drexel Rec Center utilizes 10 dry-type “step-down” transformers providing 208/120 volt utilization voltage to appliance panels, located in electrical rooms on each floor. The main utility transformer is located at the service entrance in electrical switchgear room 132. All transformers operate at optimal efficiency when loaded to 35% of rated capacity. They are required to meet the NEMA TP-1 energy standard in compliance with the EPA Energy Star program. On the following page is an individual transformer schedule for the DRC.

Individual Transformer Schedule							
Tag	**Primary Voltage**	**Secondary Voltage**	**Size**	**Type**	**Temp. Rise**	**Taps**	**Mounting**
T -1	13200V, 3PH, 3W	480Y/277V, 3PH, 4W	1500	N/A	150°C	(4) 2.5%	Pad-Mounted on Floor
T-2	480V, 3PH, 3W	208Y/120V, 3PH, 4W	75	dry-type, ventilated	150°C	(4) 2.5%	Pad-Mounted on Floor
T-3	480V, 3PH, 4W	208/120V 3PH, 4W	75	dry-type, ventilated	150°C	(4) 2.5%	Pad-Mounted on Floor
T-4	480V, 3PH, 3W	208Y/120V 3PH, 4W	45	dry-type, ventilated	150°C	(4) 2.5%	Pad-Mounted on Floor
T-5	480V, 3PH, 3W	208Y/120V 3PH, 4W	15	dry-type, ventilated	150°C	(4) 2.5%	Pad-Mounted on Floor
T-6	480V, 3PH, 3W	208Y/120V 3PH, 4W	15	dry-type, ventilated	150°C	(4) 2.5%	Pad-Mounted on Floor
T-7	480V, 3PH, 3W	208Y/120V 3PH, 4W	30	dry-type, ventilated	150°C	(4) 2.5%	Pad-Mounted on Floor
T-8	480V, 3PH, 3W	208Y/120V 3PH, 4W	45	dry-type, ventilated	150°C	(4) 2.5%	Pad-Mounted on Floor
T-9	480V, 3PH, 3W	208Y/120V 3PH, 4W	45	dry-type, ventilated	150°C	(4) 2.5%	Pad-Mounted on Floor
T-10	480V, 3PH, 3W	208Y/120V 3PH, 4W	45	dry-type, ventilated	150°C	(4) 2.5%	Pad-Mounted on Floor
T-11	480V, 3PH, 3W	240Y/120V 3PH, 4W	45	dry-type, ventilated	150°C	(4) 2.5%	Pad-Mounted on Floor

Grounding

The grounding system consists of an underground water pipe, the steel building frame, steel reinforcing bars in the floor slab and made electrodes. The primary ground point is a ground ring connected to the unit substation main ground bus and building metal frame with ¾-inc, 10-foot long copper-clad steel electrodes to ground the outdoor electrical distribution equipment and the emergency generator. A ground grid of ¾-inch 10-foot copper clad electrodes is located at each corner of the building. Three electrodes in each location are located 10 feet apart and connected with bare #3/0 AWG copper conductors. An additional ground bus is located at each telecommunications room and each room with fire alarm, security, and paging equipment.

Special Equipment

Surge protectors are provided in the main and emergency power switchboards and main normal and normal/emergency power distribution panels providing two levels of surge protection for the electrical distribution systems in accordance with the IEEE.

Lighting Loads

A majority of the lighting throughout the rec center is 4100K linear or compact fluorescent, complimenting the cool colors of the exposed concrete and glass architecture and providing a comfortable, consistent transition throughout the spaces. Halogen incandescent track lighting is used in the restaurant to provide additional flexibility in the space. Induction lighting is used in the rock climbing wall for long lamp-life and low maintenance costs. Below is the luminaire schedule for the Drexel Rec Center.

Luminaire Schedule									
Type	Light Source	Lamp Type	Lamp Watts	Ballast Type	Voltage	Fixture Watts	Ballast Factor	Current	Power Factor
A1	FLUOR	[2] F28T5	28	ELECTRONIC, PS	277	63	1.03	0.23	0.99
A1R	INCAN	MR-16	50	-	120	50	-	0.42	1
A2	FLUOR	[2] F32T8	32	ELECTRONIC, PS	277	63	0.88	0.23	0.99
A2R	FLUOR	32W CFL	32	ELECTRONIC	120	36	0.98	0.31	0.98
A3	FLUOR	[2] F28T5	28	ELECTRONIC, PS	277	63	1.03	0.23	0.99
A3R	INCAN	MR-16	50	-	120	50	-	0.42	1
A4	FLUOR	[2] F32T8	32	ELECTRONIC, PS	277	63	0.88	0.23	0.99
A4R	INCAN	[4] MR-16	35	-	120	140	-	1.16	1
A5	FLUOR	[2] F28T5	28	ELECTRONIC, PS	277	63	1.03	0.23	0.99
A6	FLUOR	[2] F14T5	14	ELECTRONIC, PS	277	34	1.06	0.13	0.98

*note: luminaire types with suffix R refer to luminaires located in the restaurant.

Type	Light Source	Lamp Type	Lamp Watts	Ballast Type	Voltage	Fixture Watts	Ballast Factor	Current	Power Factor
A7	FLUOR	[2] F21T5	21	ELECTRONIC, PS	277	48	1.02	0.17	0.98
A8	FLUOR	F28T5	28	ELECTRONIC, PS	277	63	1.03	0.23	0.99
C1	FLUOR	PLT-32	32	ELECTRONIC	277	38	1.05	0.14	0.98
C1R	INCAN	MR-16	35	INTEGRAL XFRMR	120	35	-	0.29	1
C2	FLUOR	[2] PLT-32	32	ELECTRONIC	277	76	1	0.28	0.98
C3	FLUOR	PLT-32	32	ELECTRONIC	277	38	1.05	0.14	0.98
C4	FLUOR	PLT-32	32	ELECTRONIC	277	38	1.05	0.14	0.98
C4R	INCAN	PAR32	75	-	120	75	-	0.625	1
C5	FLUOR	PLT-32	32	ELECTRONIC	277	38	1.05	0.14	0.98
C6	FLUOR	PLT-32	32	ELECTRONIC	277	38	1.05	0.14	0.98
C7	LED	-	15	INTEGRAL DRIVER	120	15W/FT	-	0.03	-
D2	FLUOR	F54T5HO	54	ELECTRONIC, PS	277	62	0.99	0.24	0.9
D3	FLUOR	[2] F32T8	32	ELECTRONIC, PS	277	63	0.88	0.23	0.99
E1R	LED	-	1.1	INTEGRAL DRIVER	120	1.1/FT	-	0.03	-
E5R	LED	-	1.1	INTEGRAL DRIVER	120	1.1/FT	-	0.03	-
F1R	FLUOR	[2] F32T8	32	ELECTRONIC, PS	120	63	0.88	0.53	0.99
F2R	FLUOR	F32T8	32	ELECTRONIC, PS	120	34	0.9	0.29	0.98
F3R	FLUOR	F32T8	32	ELECTRONIC, PS	120	34	0.9	0.29	0.98
G1	INCAN	MR-16 WFL	50	-	277	50	-	0.18	1
G1R	INCAN	[5] A19	60	-	120	300	-	2.5	1
H2	FLUOR	[5] PLT-26	26	ELECTRONIC	277	31	1.05	0.11	0.98
H5	MH	70WMHPAR38	70	ELECTRONIC	277	94	1	0.45/0.37	0.90 (MIN)
J2	FLUOR	F32T8	32	ELECTRONIC, PS	277	34	0.9	0.13	0.98
J4	LED	-	18W/F	INTEGRAL	277	18/FT	-	0.03	-

			T	DRIVER					

*note: luminaire types with suffix R refer to luminaires located in the restaurant.

Type	Light Source	Lamp Type	Lamp Watts	Ballast Type	Voltage	Fixture Watts	Ballast Factor	Current	Power Factor
K1	INDUC	QL 85	85	HF GENERATOR	277	89	-	0.4	0.92
K3	CMH	PAR30MH39	39	ELECTRONIC	277	45	1	.22/.20	0.9
M1	INDUC	QL 85	85	HF GENERATOR	277	89	-	0.4	0.92
M2	INDUC	QL 85	85	HF GENERATOR	277	89	-	0.4	0.92
N1	FLUOR	[2] PLT-32	32	ELECTRONIC	277	76	1	0.28	0.98
N2	FLUOR	[2] F18DTT	26	ELECTRONIC, PS	277	58	1.05	0.21	0.98
N3	FLUOR	F14T5	14	ELECTRONIC, PS	277	19	1.07	0.07	0.9
N4	FLUOR	[2] F14T5	14	ELECTRONIC, PS	277	34	1.06	0.13	0.98
PA	FLUOR	[2] F28T5/SEC	28	ELECTRONIC, PS	277	63	1.03	0.23	0.99
PB	FLUOR	[8] PLT-32	32	ELECTRONIC	277	76	1	0.28	0.98
R1R	INCAN	[6] A19	60	-	120	60	-	0.5	1
S1R	INCAN	MR-16	50	-	120	50	-	0.42	1
T1	FLUOR	[2] F32T8	32	ELECTRONIC, PS	277	63	0.88	0.23	0.99
T2	FLUOR	[2] F32T8	32	ELECTRONIC, PS	277	63	0.88	0.23	0.99
T3	FLUOR	[2] F32T8	32	ELECTRONIC, PS	277	63	0.88	0.23	0.99
X1	LED	-	1.5	INTEGRAL DRIVER	277	1.5/FT	-	0.03	-
X1R	LED	-	32.5	INTEGRAL DRIVER	120	32.5/FT	-	0.03	-
X2	LED	-	3	INTEGRAL DRIVER	277	3/FT	-	0.03	-
Z1	CMH	CMH ED17	70	ELECTRONIC	277	94	1	0.55/0.37	0.90 (MIN)

*note: luminaire types with suffix R refer to luminaires located in the restaurant.

Lighting Controls

The DAC utilizes occupancy sensors in offices, restrooms, and storage areas with 30-minute automatic shut-off in compliance with ASHRAE/IESNA 90.1. The largely glass façade provides the opportunity for daylight harvesting in the lobby, corridor spaces, fitness center, and gymnasium. In these spaces, photocells control the fluorescent lighting with on/off switching in the corridors and fitness area and three-way switching in the gymnasium.

The group fitness rooms and restaurant are controlled by zones, with dimming capabilities in the sports bar and restaurant for a transition between casual daytime dining or sporting events and an intimate evening setting.

Mechanical and Other Loads

Drexel's Athletic Center is conditioned by seven direct expansion rooftop air-handling units ranging from 1,880cfm for the lobby to 32,550cfm in the fitness/weight rooms. Three parallel BHP hot water heaters are located below the gymnasium partner with the 3,000 gallon fuel oil tank located in an underground vault to power the duel heating system. Four AHUs are variable air volume and three are constant volume, utilizing an associated supply, return, and exhaust duct distribution. Shell space was provided in the mechanical room for a future water cooled chiller.

Motor control centers and panelboards provide electrical distribution within the central mechanical system. Mechanical system chilled and condenser water pumps, domestic water pumps, exhaust and supply fans, cooling towers, and other control systems are served by normal power from the main distribution panels.

Mechanical Equipment Schedule									
Tag	Description	Load	Units	Motor Amps	Volts	Phase	Assumed Power Factor	Load in KVA	Load in KW
RTU-1	MULTIPURPOSE GYM SUPPLY FAN	25	HP	34	460	3Ø	0.95	27.09	25.74
	MULTIPURPOSE GYM RETURN FAN	10	HP	14	460	3Ø	0.95	11.15	10.59
RTU-2	WEIGHTS/FITNESS SUPPLY FAN	30	HP	40	460	3Ø	0.95	31.86	30.27
	WEIGHTS/FITNESS RETURN FAN	10	HP	14	460	3Ø	0.95	11.15	10.59

Tag	Description	Load	Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW
RTU-3	WEIGHTS/FITNESS SUPPLY FAN	2@20	HP	54	460	3Ø	0.95	43.02	40.87
	WEIGHTS/FITNESS RETURN FAN	40	HP	52	460	3Ø	0.95	41.43	39.36
RTU-4	FITNESS SUPPLY FAN	15	HP	21	460	3Ø	0.95	16.73	15.89
	FITNESS RETURN FAN	5	HP	7.6	460	3Ø	0.95	6.06	5.75
RTU-5	FIRST FLOOR SUPPLY FAN	20	HP	27	460	3Ø	0.95	21.51	20.44
	FIRST FLOOR RETURN FAN	5	HP	7.6	460	3Ø	0.95	6.06	5.76
RTU-6	UPPER LOBBY SUPPLY FAN	1.54	HP	3	460	3Ø	0.85	2.39	2.03
RTU-7	RESTAURANT SUPPLY FAN	15	HP	21	460	3Ø	0.95	16.73	15.89
	RESTAURANT RETURN FAN	5	HP	7.6	460	3Ø	0.95	6.06	5.76
B-1	BOILER	3/4	HP	1.6	460	3Ø	0.85	0.60	0.51
B-2	BOILER	3/4	HP	1.6	460	3Ø	0.85	0.60	0.51
B-3	BOILER	3/4	HP	1.6	460	3Ø	0.85	0.60	0.51
P-HW01	HEATING HOT WATER LOOP	1-1/2	HP	3	460	3Ø	0.85	2.39	2.03
P-HW02	HEATING HOT WATER LOOP	1-1/2	HP	3	460	3Ø	0.85	2.39	2.03
P-HW03	HEATING HOT WATER LOOP	1-1/2	HP	3	460	3Ø	0.85	2.39	2.03
P-HW04	HEATING HOT WATER LOOP	7-1/2	HP	11	460	3Ø	0.95	8.76	8.33
P-HW05	HEATING HOT WATER LOOP	7-1/2	HP	11	460	3Ø	0.95	8.76	8.33
P-FTR01	RADIATION LOOP	1-1/2	HP	3	460	3Ø	0.85	2.39	2.03
P-FTR02	FINN TUBE RADIATION LOOP	1-1/2	HP	3	460	3Ø	0.85	2.39	2.03
P-DHW01	DOMESTIC HOT WATER HEATER	1/3	HP	7.2	120	1Ø	0.75	0.86	0.65
FCU-1(AH)	ELEC. SWGR ROOM 132	6	FLA	-	208	3Ø	0.85	2.16	1.84
FCU-1(CU)	ELEC. SWGR ROOM 132	9.7	FLA	-	460	3Ø	0.95	7.73	7.34
CRU-1(AH)	MDF ROOM 131	13.2	FLA	-	460	3Ø	0.95	10.52	9.99
CRU-1(CU)	MDF ROOM 131 - CONDENSING	12.8	FLA	-	208	3Ø	0.95	10.20	9.69
EF-1	BOILER ROOM 136 EXHAUST	1	HP	2.1	460	3Ø	0.85	1.67	1.42

Tag	Description	Load	Units	Motor Amps	V	Phase	Assumed Power Factor	Load in KVA	Load in KW
EF-2	EMERGENCY GENERATOR ROOM	5	HP	16.7	208	3Ø	0.95	6.02	5.72
EF-2A	EMERGENCY GENERATOR ROOM	3	HP	7.5	208	3Ø	0.85	2.70	2.30
EF-3	LOCKER ROOM EXHAUST	1	HP	2.1	460	3Ø	0.85	1.67	1.42
EF-4	EQUIP ISSUE / STOR 128 EXHAUST	1/6	HP	4.4	120	1Ø	0.75	0.53	0.40
EF-5	ELECTRICAL ROOM 202 EXHAUST	1/6	HP	4.4	120	1Ø	0.75	0.53	0.40
EF-6	ELECTRICAL ROOM 303 EXHAUST	1/6	HP	4.4	120	1Ø	0.75	0.53	0.40
EF-7	ALCOVE 206, 306 EXHAUST	1/6	HP	4.4	120	1Ø	0.75	0.53	0.40
EF-8	GYM STORAGE EXHAUST	1/6	HP	4.4	120	1Ø	0.75	0.53	0.40
SF-1	BOILER COMBUSTION	2	HP	3	460	3Ø	0.85	2.39	2.03
ERH-1	ELECTRIC REHEAT COIL	1/100	HP	-	208	1Ø	0.75	10.00	7.50
EUH-1	ELECTRIC UNIT HEATER	1/100	HP	-	208	1Ø	0.75	10.00	7.50
EUH-2	ELECTRIC UNIT HEATER	1/100	HP	-	208	1Ø	0.75	10.00	7.50
CEUH-1	ELECTRIC UNIT HEATER	7/100	HP	-	208	1Ø	0.75	70.00	52.50
CEUH-2	ELECTRIC UNIT HEATER	7/100	HP	-	208	1Ø	0.75	70.00	52.50
CEUH-3	ELECTRIC UNIT HEATER	7/100	HP	-	208	1Ø	0.75	70.00	52.50
UH-1	UNIT HEATER	1/50	HP	-	120	1Ø	0.75	20.00	15.00
UH-2	UNIT HEATER	1/50	HP	-	120	1Ø	0.75	20.00	15.00
UH-3	UNIT HEATER	1/50	HP	-	120	1Ø	0.75	20.00	15.00
UH-4	UNIT HEATER	1/50	HP	-	120	1Ø	0.75	20.00	15.00
UH-5	UNIT HEATER	1/50	HP	-	120	1Ø	0.75	20.00	15.00
UH-6	UNIT HEATER	1/50	HP	-	120	1Ø	0.75	20.00	15.00
UH-7	UNIT HEATER	1/50	HP	-	120	1Ø	0.75	20.00	15.00
UH-8	UNIT HEATER	1/50	HP	-	120	1Ø	0.75	20.00	15.00
UH-9	UNIT HEATER	1/50	HP	-	120	1Ø	0.75	20.00	15.00
UH-10	UNIT HEATER	1/50	HP	-	120	1Ø	0.75	20.00	15.00
SS-1(AH)	ELEVATOR MACH. ROOM 102	0.4	FLA	-	120	1Ø	0.75	48.00	36.00
SS-1(CU)	ELEVATOR MACH. ROOM 102	0.6	FLA	-	120	1Ø	0.75	72.00	54.00

SS-2(AH)	ELEVATOR MACH. ROOM 109	0.4	FLA	-	120	1Ø	0.75	48.00	36.00

Tag	Description	Load	Units	Motor Amps	V	Phase	Assumed Power Factor	Load in KVA	Load in KW
SS-2(AH)	ELEVATOR MACH. ROOM 109	0.4	FLA	-	120	1Ø	0.75	48.00	36.00
SS-2(CU)	ELEVATOR MACH. ROOM 109	0.6	FLA	-	120	1Ø	0.75	72.00	54.00
SS-3A	IT 203A	0.2	FLA	-	208	1Ø	0.75	0.04	0.03
SS-3B	IT 203B	0.2	FLA	-	208	1Ø	0.75	0.04	0.03
SS-3(CU)	IT 203A, AV 203B	12.5	FLA	-	208	1Ø	0.85	2.21	1.88
SS-4A	IT 303A	0.2	FLA	-	208	1Ø	0.75	0.04	0.03
SS-4B	IT 303B	0.2	FLA	-	208	1Ø	0.75	0.04	0.03
SS-4(CU)	IT 303A, AV 303B	12.5	FLA	-	208	1Ø	0.85	2.60	2.21
FOP-1	DUPLEX BOILER TRANSFER	2@3/4	HP	3.2	460	3Ø	0.85	5.10	4.33
(FU) P-CW01	FUTURE CHILLED WATER PUMP	30	HP	40	460	3Ø	0.95	31.87	30.28
(FU) P-CW02	FUTURE CHILLED WATER PUMP	30	HP	40	460	3Ø	0.95	31.87	30.28
(FU) P-CW03	FUTURE CHILLED WATER PUMP	30	HP	40	460	3Ø	0.95	31.87	30.28
(FU) P-CW04	FUTURE CHILLED WATER PUMP	75	HP	96	460	3Ø	0.95	76.49	72.66
(FU) P-CW05	FUTURE CHILLED WATER PUMP	75	HP	96	460	3Ø	0.95	76.49	72.66
GBP-A	GAS BOOSTER PUMP	1	HP	2.1	460	3Ø	0.85	1.67	1.42
HWRP-A	HOT WATER RETURN	1/12	HP	-	120	1Ø	0.75	0.08	0.06
SP-A	SUMP PUMP	3/10	HP	5.8	120	1Ø	0.75	0.70	0.52
RWRP-1	REUSE PUMPS	2@5	HP	15.2	460	3Ø	0.95	12.10	11.50
FP-5-1	VAV - 113	1/5	HP	5.8	120	1Ø	0.75	0.70	0.52
FP-5-2	VAV - 114	1/5	HP	5.8	120	1Ø	0.75	0.70	0.52
FP-5-3	VAV - OFFICE AND STORAGE	1/5	HP	5.8	120	1Ø	0.75	0.70	0.52
JP	JOCKEY PUMP	0.5	HP	9.8	120	1Ø	0.85	1.18	1.00
RH-1	RADIANT HEATER	-	-	3.2	120	1Ø	0.85	5.10	4.34
RH-2	RADIANT HEATER	-	-	3.2	120	1Ø	0.85	5.10	4.34
RH-3	RADIANT HEATER	-	-	3.2	120	1Ø	0.85	5.10	4.34
RH-4	RADIANT HEATER	-	-	3.2	120	1Ø	0.85	5.10	4.34
RH-5	RADIANT HEATER	-	-	3.2	120	1Ø	0.85	5.10	4.34
RH-6	RADIANT HEATER	-	-	3.2	120	1Ø	0.85	5.10	4.34

RH-7	RADIANT HEATER	-	-	3.2	120	1Ø	0.85	5.10	4.34

Tag	Description	Load	Units	Motor Amps	V	Phase	Assumed Power Factor	Load in KVA	Load in KW
RH-8	RADIANT HEATER	-	-	3.2	120	1Ø	0.85	5.10	4.34
RH-9	RADIANT HEATER	-	-	3.2	120	1Ø	0.85	5.10	4.34
RH-10	RADIANT HEATER	-	-	3.2	120	1Ø	0.85	5.10	4.34
								Total Load (kw)	1115.75

Plumbing Equipment Schedule									
Tag	Description	Load	Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW
GBP-A	CENTRIFUGAL PLUMBING PUMP	1	HP	2.1	480	3Ø	0.85	1.75	1.48
HWRP-A	IN LINE PLUMBING PUMP	1/12	HP	-	115	1Ø	0.75	0.01	0.01
RWRP-A/B	MULTISTAGE PLUMBING PUMP	5	HP	7.6	480	3Ø	0.95	6.32	6.00
SP-A	SUBMERSIBLE PLUMBING PUMP	3/10	HP	5.8	115	1Ø	0.75	26.34	19.75
							Total Load (kw)	27.24	

Architectural Equipment Schedule									
Tag	Description	Load	Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW
E-1	Holeless Hydraulic Elevator	40	HP	52	480	3Ø	0.85	43.23	36.75
E-2	Holed Elevator	20	HP	27	480	3Ø	0.75	22.45	16.84
							Total Load (kw)	53.58	

Kitchen Equipment Schedule									
Tag	Description	Load	Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW
1	GAS CONVECTION OVEN	0.5	HP	9.8	120	1Ø	0.85	1.18	1.00
2	BASKET FRYER	-	-	-	115	1Ø	0.75	0.17	0.13
3	FRYER HOLDER STATION	-	-	10	120	1Ø	0.85	1.20	1.02
5	BASKET FRYER	-	-	-	115	1Ø	0.75	0.17	0.13
6	BASKET FRYER	-	-	-	115	1Ø	0.75	0.17	0.13
7	RANGE WITH OVEN	-	-	4.8	120	1Ø	0.75	0.60	0.45
8	REFRIGERATED CHEF BASE	-	-	9.8	115	1Ø	0.85	1.13	0.96
9	GAS GRIDDLE	-	-	9.8	120	1Ø	0.85	1.18	1.00
13	COOK & HOLD	-	-	14.4	208	1Ø	0.85	3.00	2.55
14A	EXHAUST HOOD CONTROLS	-	-	15	120	1Ø	0.85	1.80	1.53
14B	EXHAUST HOOD MAKEUP AIR UNIT	2	HP	6	208	3Ø	0.85	2.16	1.84
14C	EXHAUST HOOD EXHAUST FAN #1	1	HP	3.3	208	3Ø	0.85	1.19	1.01
14D	EXHAUST HOOD EXHAUST FAN #2	1.5	HP	4.7	208	3Ø	0.85	1.69	1.44
15	FIRE SUPRESSION SYSTEM	-	-	15	120	1Ø	0.85	1.80	1.53
16	FOOD PREP TABLE	0.5	HP	10.3	120	1Ø	0.85	1.19	1.01
21	HOT/COLD DROP	0.25	HP	21	120	1Ø	0.75	2.52	1.89
23	COLD DROP IN	0.25	HP	7.5	115	1Ø	0.75	0.86	0.65
25	FOOD PREP TABLE	0.5	HP	10.3	120	1Ø	0.85	1.24	1.05
28	REFRIGERATOR	0.5	HP	9.1	115	1Ø	0.85	1.05	0.89
29	REFRIGERATOR	0.5	HP	9.1	115	1Ø	0.85	0.91	0.78
30	WARMER	-	-	8.5	120	1Ø	0.75	1.02	0.77
32A	ICE MACHINE	-	-	10	208	1Ø	0.85	2.08	1.77
32B	ICE MACHINE CONDENSER	-	-	2.6	208	1Ø	0.75	0.54	0.41
34	UNDERCOUNTER REFRIGERATOR	0.25	HP	4.7	115	1Ø	0.75	0.54	0.41
36	LETTUCE CRISPER	0.25	HP	5	120	1Ø	0.75	0.60	0.45
39	SLICER	0.33	HP	6.3	120	1Ø	0.75	0.76	0.57
41	SALAD PREP UNIT	0.2	HP	7.2	120	1Ø	0.75	0.86	0.65
43	LETTUCE CRISPER	0.25	HP	5	120	1Ø	0.75	0.60	0.45
45	SODA DISPENSER	-	-	3.2	120	1Ø	0.75	0.38	0.29

Tag	Description	Load	Units	Motor Amps	Voltage	Phase	Assumed Power Factor	Load in KVA	Load in KW
46	COFFEE MAKER	-	-	15	120	1Ø	0.85	1.80	1.53
48	HORIZONTAL FREEZER	0.25	HP	5.8	115	1Ø	0.75	0.67	0.50
49	HOT CARVING SHELF	-	-	6	120	1Ø	0.75	0.72	0.54
55A	WALK IN COOLER LIGHTING	-	-		120	1Ø	0.75	0.25	0.19
55B	WALK IN COOLER EVAPORATOR COILS	0.05	HP	0.6	120	1Ø	0.75	0.25	0.19
55C	WALK IN COOLER CONDENSING UNIT	-	-	7.8	208	3Ø	0.85	2.81	2.39
56A	EXTERIOR WALK IN LIGHTS &	-	-	12	120	1Ø	0.85	1.50	1.28
56B	EXTERIOR WALK IN EVAPORATOR COILS	-	-	0.6	208	1Ø	0.75	2.14	1.61
56C	EXTERIOR WALK IN EVAPORATOR COILS	-	-	8.22	208	1Ø	0.85	2.14	1.82
56D	EXTERIOR WALK-IN CONDENSING UNIT	-	-	10.3	208	3Ø	0.85	3.71	3.15
104	BOTTLE COOLER	-	-	5.2	115	1Ø	0.75	0.60	0.45
105	BLENDER STATION	-	-	20	115	1Ø	0.85	2.30	1.96
110	UNDERCOUNTER DISHWASHER	-	-	36.4	208	1Ø	0.85	7.57	6.44
113	BACKBAR COOLER	0.33	HP	7.5	115	1Ø	0.75	0.86	0.65
114A	ICE MAKER	-	-	15	208	1Ø	0.75	3.12	2.34
114B	ICE MAKER CONDENSER	-	-	2.6	208	1Ø	0.75	0.54	0.41
117	PASS-THRU BACKBAR COOLER	-	-	5.7	115	1Ø	0.75	0.66	0.49
118	PASS-THRU COCKTAIL STATION	-	-	20	120	1Ø	0.85	2.40	2.04
							Total Load (kw)	**54.66**	

Service Entrance Size

Below are three service entrance sizing methods, each more specific than the one before. As you can see, the load calculations vary from method to method. The first method approaches the building as a type and area, for use during the Schematic design phases to get a general idea of the load. During design development, the load is divided by type and the loads are calculated based on what type of load is present in a more accurate square footage breakdown of the project based on loads given in the NEC. The actual loading method is used to create the construction documents, and should be the most accurate sizing calculation. Demand factors are taken into effect for a more precise look at the breakdown of the building. All loads were taken directly from panelboard schedules and mechanical schedules for accurate calculations. The actual size

Conceptual/Schematic Phases: Load per Square foot Method			
Building Type	**VA/sf**	**Building Area**	**VA**
Recreation Center	13	84,400	1097200
		Total kVA	1097.2
		Total Current at 480V	**1319.72A**

Design Development - NEC Loading			
Load Type	**VA/sf**	**Load Area**	**VA**
Lighting - Schools	3	77,300	231900
Lighting - Restaurant	3	7,100	21300
Receptacles	0.5	84,400	42200
Full-Service Kitchen	20	800	16000
HVAC	6	84,400	506400
Computers	200	1,100	220000
Plumbing	-	-	120
Elevators	-	-	100
		Total kVA	1038
		Total Current (amps) at 480V	**1248.54**

Working Drawings- Actual Loading			
Load Type	**Demand Factor**	**Load KVA**	**Demand KVA**
Lighting	-	95.51	95.51
Receptacles	-	248.79	148.79
Mechanical	0.8	1328.54	1062.83
Plumbing	0.8	34.41	27.53
Elevators	0.5	65.68	328.40
Kitchen	0.65	66.61	43.29
		Total kVA (plus 25%)	1706.35
		Total Current at 480V	**2132.93**

Working Drawings- Actual Loading			
Phase	**Load-kVA**	**Voltage System**	**Load-Amps**
Conceptual/Schematic Design	1097.2	480Y/277V	1319.72
Design Development	1038	480Y/277V	1248.54
Working Drawings	1706.35	480Y/277V	2132.93
Actual Conditions - Service Entrance	-	480Y/277V	2500
		Total Actual Conditions	**2500**
		Summary: Available VA/SF	**24.63**

Environmental Stewardship Design

The electrical system was designed for a LEED certified construction. The allowable lighting power density followed ASHRAE Standard 90.1 using the building type method. Photocells harvest daylight and perform on/off switching throughout the building. Occupancy sensors are used in the restrooms and small offices in accordance with auto-shutoff requirements.

Design Issues

The majority of the building perimeter was glass, and heavy electrical and telecomm loads were located at these areas (mostly exercise equipment), making it difficult to route different services or locate wiring devices at these locations. On the upper floors, conduit couldn't run below the floor slab or use poke-thru devices because it would be visible to occupants on the floors below with the exposed concrete structure ceilings. Routing conduits and locating wiring devices in the

floor slab and through the building core was the only option. The architects created a pinch point in a way with an expansion joint which added extra planning and coordination.

The concrete structure with exposed slabs caused an emphasis on coordination for the design team in placing system conduits, back boxes, and floor boxes prior to the concrete pour. The rough-in and branch wiring for the lighting and audio-visual systems in the exposed concrete ceiling above had to be premeditated, coordinated and set (mostly light fixtures, photocells, speakers, LCDs, etc). Same for the floor boxes.

The 12" concrete slab in which the conduit was routed was actually a structural slab so criteria was created for conduit routing within the slab in order to maintain structural integrity.

The designer had to make their own ground using the steel provided throughout the building due to the concrete structure.

A special silencing muffler had to be specified to exhaust the generator onto the roof because generator exhaust and noise was an issue.

Another issue was day light harvesting and its integration with emergency lighting in the fitness areas. Entire fixtures were put on the Square D lighting control system when on emergency power so that they weren't on 24/7, and they had to be re-wired during testing to take a signal from the life safety transfer switch to get a signal.

Communication Systems

Fire Alarm

The Athletic Center utilizes a full sprinkler system supplied by the city's water supply and designed in accordance with NFPA 13. The floor control stations are located in stair towers 3 and 4 and served from a combination sprinkler riser including floor control valve assemblies, test valves, and drains. A manual fire alarm system is installed with an interfaced control system tied into a campus supervising system. Activation initiates an emergency voice/alarm communication system with using speaker strobes that are white in color. Smoke detection is provided in electrical/telecom rooms, above doors controlled by the system, in elevator lobbies, elevator machine rooms, and in HVAC ducts.

Telecommunications

Voice and data are provided to the conference rooms, offices, and retail space via 4" PVC sleeves in cable trays mounted within the structural concrete slabs. Emergency phones are located

in the elevator lobbies, equipment issue room, gymnasium, retail café, and recreation spaces to provide quick response in case of injury during physical activity. A fire alarm annunciator with live voice capability is located at the security desk at the east lobby entrance.

Security systems

Electronic security control modules are located in the main security room east of the electrical room on the ground level beneath the gymnasium . Each main entrance is controlled by electronic locks with an emergency override located at the security desk. Electronic locks also guard the gymnasium entrance and each stairway. A pole mounted security camera monitors the exterior on the eastern and alternate north entrance to the new facility, with interior cameras located in the athletics gallery. Swipe card access is required to enter the recreation center, and is located beyond the security desk.

AV

The audiovisual system in the athletic center incorporates an audio/paging system through pendant speakers throughout the lobby and fitness area, as well as ceiling mounted speakers in the gymnasium. LCD screens are located in the climbing lounge, at the east and west lobby entrances, with a total of twenty screens mounted on each floor of the fitness area. AV equipment rooms are provided on the second and third floors with the second floor space feeding the LCD screens and speakers on the first floor.

Appendix A

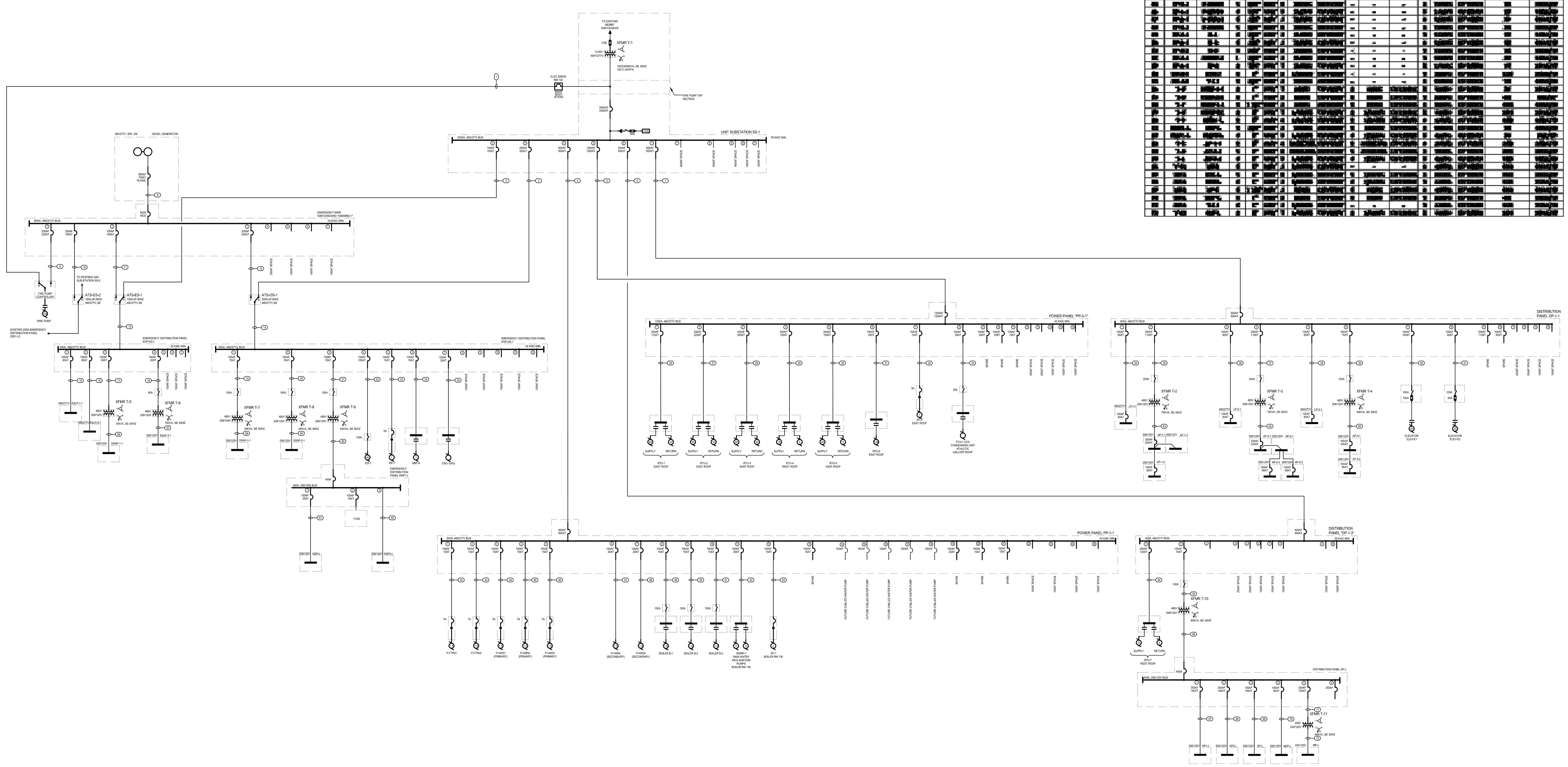
Single-Line Diagram Drawing List

E0-03 Single Line Diagram

E0-03-1 Single Line Diagram – New Work – Normal

E0-03-2 Single Line Diagram – New Work – Normal

E0-05 Single Line Diagram – New Work - Emergency



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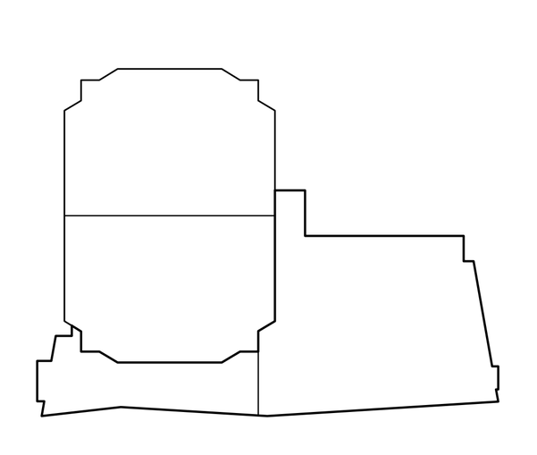
No.	Description	Date
	TECH REPORT 2	10/27/2010

DWG ISSUE & REVISION HISTORY

Stamp

Project Engineer — Mary Alcaraz
Engineering Leader — Michael Ginder

Key Plan



Project Title:

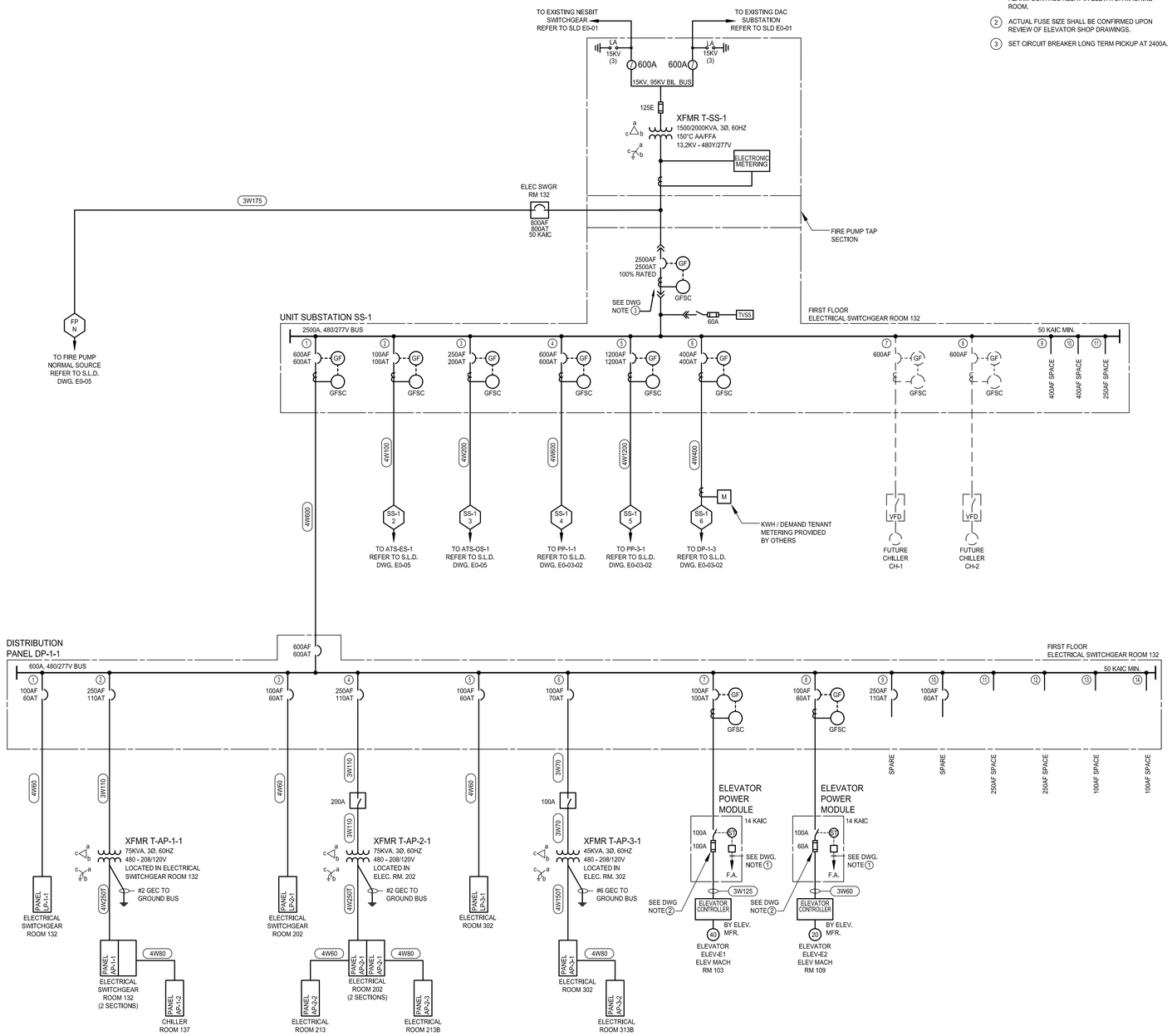
DREXEL UNIVERSITY RECREATION CENTER

Drawing Title:

SINGLE LINE DIAGRAM

Project No. 26549 Scale: NTS
Drawn By: BJG
Checked By:
Approved By:
Date: OCT. 27, 2010

Drawing No. E0-01



DRAWING NOTES:

1. PROVIDE CONTROL WIRING IN CONDUIT TO FIRE ALARM CONTROL RELAY IN ELEVATOR MACHINE ROOM.
2. ACTUAL FUSE SIZE SHALL BE CONFIRMED UPON REVIEW OF ELEVATOR SHOP DRAWINGS.
3. SET CIRCUIT BREAKER LONG TERM PICKUP AT 2400A.

FEEDER IDENTIFICATION SCHEDULE	
TAG	WIRE (Cu) & CONDUIT
2W20	2#12 & #12 G, 3/4"C
3W20	3#12 & #12 G, 3/4"C
3W25	3#10 & #10 G, 3/4"C
3W30	3#10 & #10 G, 3/4"C
3W35	3#8 & #10 G, 3/4"C
3W40	3#8 & #10 G, 3/4"C
3W45	3#6 & #10 G, 1"C
3W50	3#6 & #10 G, 1"C
3W60	3#6 & #10 G, 1"C
3W70	3#4 & #8 G, 1-1/2"C
3W80	3#2 & #8 G, 1-1/2"C
3W90	3#2 & #8 G, 1-1/2"C
3W100	3#2 & #8 G, 1-1/2"C
3W110	3#1 & #6 G, 1-1/2"C
3W125	3#1/0 & #6 G, 2"C
3W150	3#1/0 & #6 G, 2"C
3W175	3#2/0 & #6 G, 2"C
3W200	3#3/0 & #6 G, 2"C
3W225	3#4/0 & #4 G, 2-1/2""C
3W250	3-[250KCMIL & #4 G, 3"C
3W300	3-[350KCMIL & #4 G, 3"C
3W350	3-[500KCMIL & #2 G, 4"C
3W400	3-[500KCMIL & #2 G, 4"C
3W450	3-[600KCMIL & # 2 G, 4"C
3W500	2-[3-[250KCMIL & #2 G, 3"C]
3W600	2-[3-[350KCMIL & #1 G, 3"C]
3W700	2-[3-[500KCMIL & #1/0 G, 4"C]
3W800	2-[3-[500KCMIL & #1/0 G, 4"C]
3W900	3-[3-[350KCMIL & #2/0 G, 3"C]
3W1000	3-[3-[500KCMIL & #2/0 G, 4"C]
3W1200	3-[3-[600KCMIL & # 3/0 G, 4"C]
3W1400	4-[3-[500KCMIL & #4/0 G, 4"C]
3W1600	4-[3-[600KCMIL & # 4/0 G, 4"C]
3W1800	5-[3-[500KCMIL & 250KCMIL G, 4"C]
3W2000	5-[3-[600KCMIL & 250KCMIL G, 4"C]
3W2500	6-[3-[600KCMIL & 350KCMIL G, 4"C]
3W3000	8-[3-[500KCMIL & 500KCMIL G, 4"C]
3W4000	10-[3-[600KCMIL & 500KCMIL G, 4"C]

FEEDER IDENTIFICATION SCHEDULE	
TAG	WIRE (Cu) & CONDUIT
4W20	4#12 & #12 G, 3/4"C
4W25	4#10 & #10 G, 3/4"C
4W30	4#10 & #10 G, 3/4"C
4W35	4#8 & #10 G, 3/4"C
4W35T	4#8 & #8 G, 1"C
4W40	4#8 & #10 G, 3/4"C
4W45	4#6 & #10 G, 1"C
4W50	4#6 & #10 G, 1"C
4W50T	4#6 & #8 G, 1"C
4W60	4#6 & #10 G, 1"C
4W60G	4#6 & #10 G, #10 IG, 1"C
4W70	4#4 & #8 G, 1-1/2"C
4W80	4#2 & #8 G, 1-1/2"C
4W90	4#2 & #8 G, 1-1/2"C
4W100	4#2 & #8 G, 1-1/2"C
4W100T	4#1 & #8 G, 1-1/2"C
4W100TG	4#1 & #8 G, #8 IG, 1-1/2"C
4W110	4#1 & #6 G, 1-1/2"C
4W125	4#1/0 & #6 G, 2"C
4W150	4#1/0 & #6 G, 2"C
4W150T	4#1/0 & #6 G, 2"C
4W175	4#2/0 & #6 G, 2"C
4W200	4#3/0 & #6 G, 2"C
4W225	4#4/0 & #4 G, 2-1/2"C
4W250	4-[250KCMIL & #4 G, 3"C
4W250T	4-[250KCMIL & #2 G, 3"C
4W300	4-[350KCMIL & #4 G, 3"C
4W350	4-[500KCMIL & #2 G, 4"C
4W400	4-[500KCMIL & #2 G, 4"C
4W400T	4-[600KCMIL & #1/0 G, 4"C
4W400TG	4-[600KCMIL & #1/0 G, #1/0 IG, 4"C
4W450	4-[600KCMIL & # 2 G, 4"C
4W500	2-[4-[250KCMIL & #2 G, 3"C]
4W500T	2-[4-[250KCMIL & #1/0 G, 3"C]
4W500TG	2-[4-[250KCMIL & #1/0 G, #1/0 IG, 3"C
4W600	2-[4-[350KCMIL & #1 G, 3"C]
4W700	2-[4-[500KCMIL & #1/0 G, 4"C]
4W800	2-[4-[500KCMIL & #1/0 G, 4"C]
4W800T	2-[4-[500KCMIL & #2/0 G, 4"C]
4W900	3-[4-[350KCMIL & #2/0 G, 3"C]
4W1000	3-[4-[500KCMIL & #2/0 G, 4"C]
4W1000T	3-[4-[500KCMIL & 250KCMIL G, 4"C]
4W1200	3-[4-[600KCMIL & # 3/0 G, 4"C]
4W1400	4-[4-[500KCMIL & #4/0 G, 4"C]
4W1600	4-[4-[600KCMIL & # 4/0 G, 4"C]
4W1800	5-[4-[500KCMIL & 250KCMIL G, 4"C]
4W1800T	5-[4-[500KCMIL & 350KCMIL G, 4"C]
4W2000	5-[4-[600KCMIL & 250KCMIL G, 4"C]
4W2500	6-[4-[600KCMIL & 350KCMIL G, 4"C]
4W3000	8-[4-[500KCMIL & 500KCMIL G, 4"C]
4W4000	10-[4-[600KCMIL & 500KCMIL G, 4"C]

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GENERAL NOTES:

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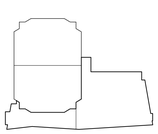
No.	Description	Date
2	PERMIT/CONSTRUCTION SET	08/04/2008
1	BID PACKAGE NO. 2	05/19/2008
0	GMP ISSUE	04/28/2008

DWG ISSUE & REVISION HISTORY

Stamp

Project Engineer — Mary Alcaraz
Engineering Leader — Michael Ginder

Key Plan



Project Title:

DREXEL UNIVERSITY
RECREATION CENTER

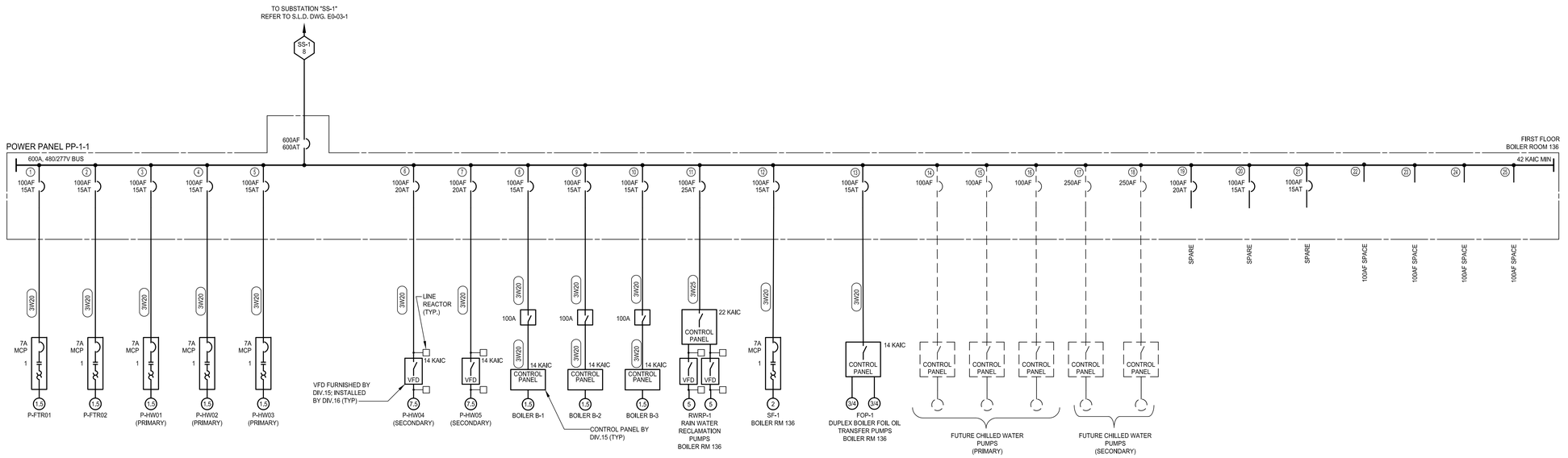
Drawing Title:

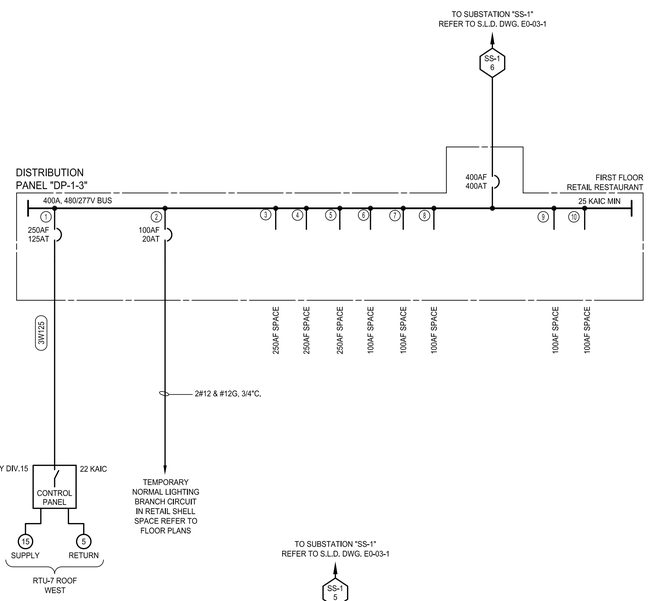
SINGLE LINE DIAGRAM
NEW WORK - NORMAL

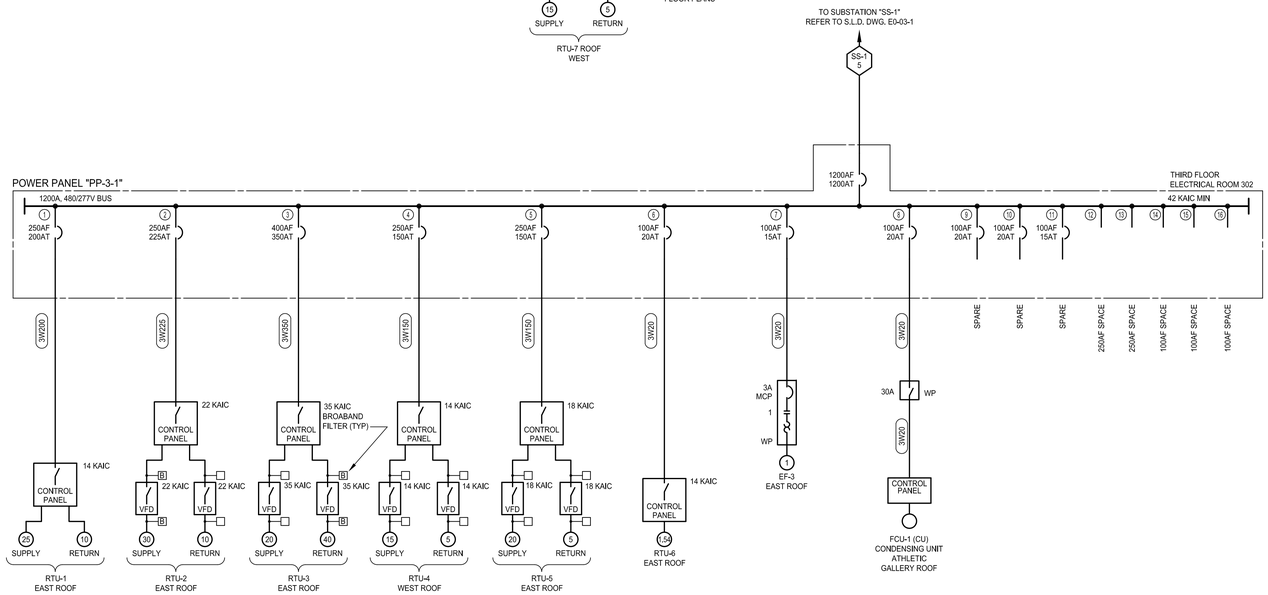
Project No. 26549 Scale: NTS
Drawn By: ALA
Checked By:
Approved By:
Date: AUG. 4, 2008

Drawing No.

E0-03-1







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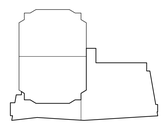
Stamp

Project Engineer — Mary Alcaraz
Engineering Leader — Michael Ginder

Key Plan



Project Title:

DREXEL UNIVERSITY RECREATION CENTER

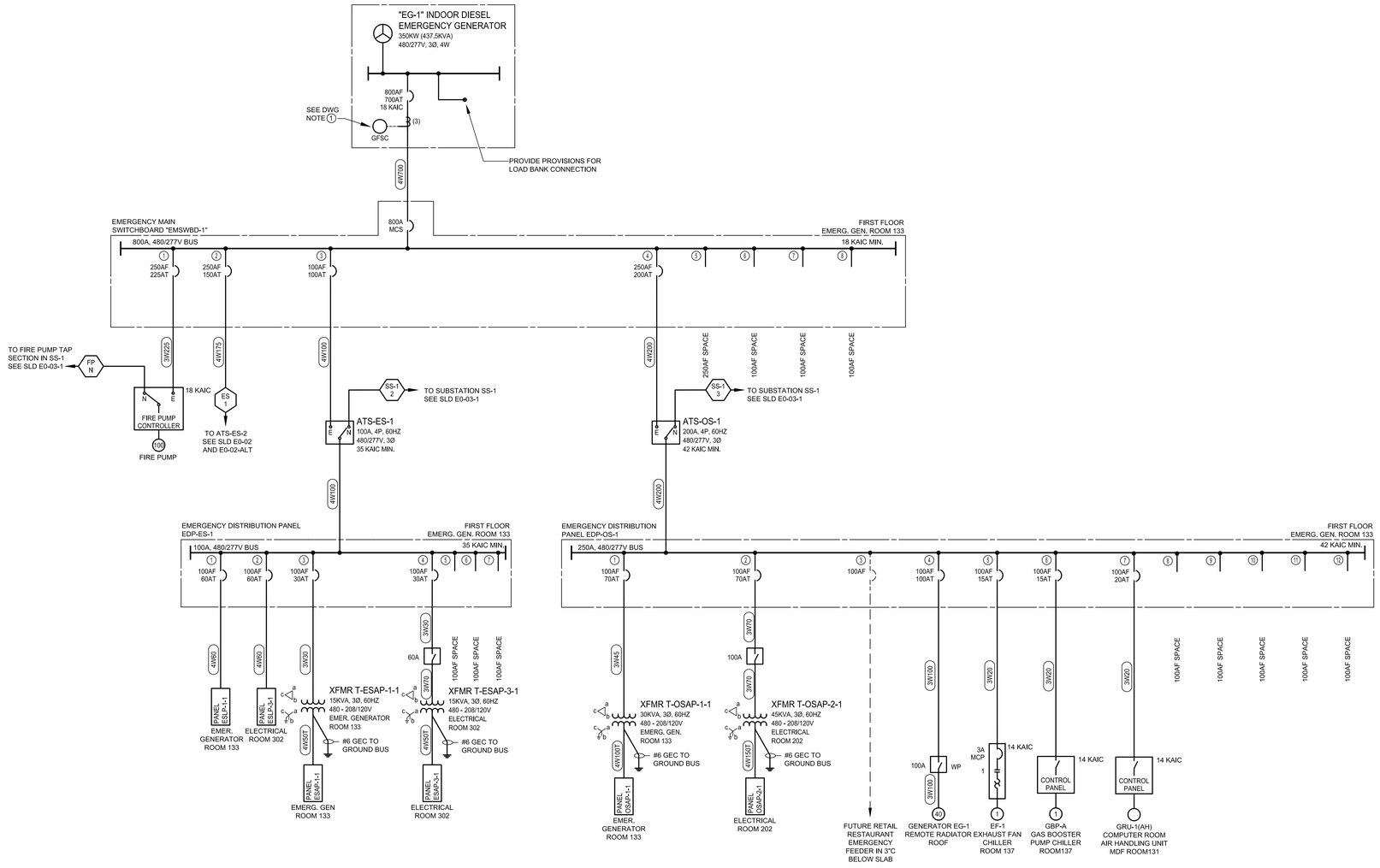
Drawing Title:

SINGLE LINE DIAGRAM NEW WORK - NORMAL

Project No. 26549 **Scale:** NTS
Drawn By: ALA
Checked By:
Approved By:
Date: AUG. 4, 2008

Drawing No.

E0-03-2



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DWG ISSUE & REVISION HISTORY

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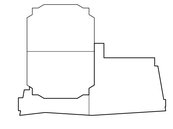


Project Title:

DREXEL UNIVERSITY RECREATION CENTER

Drawing Title:

SINGLE LINE DIAGRAM - NEW WORK EMERGENCY

Project No. 26549 **Scale:** NTS
Drawn By: MHG
Checked By:
Approved By:
Date: AUG. 4, 2008

Drawing No.

E0-05

Fixture Types H5, Z1

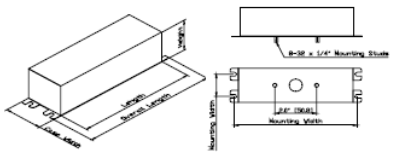
PHILIPS ADVANCE

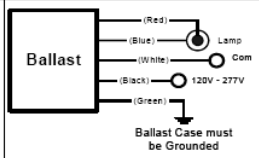
e-Vision® Electronic Ballast for Metal Halide Lamps

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

DIMENSIONS AND DATA

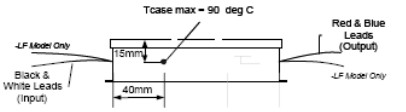
Lamp Number	Lamp Watts	Input Volts	Catalog Number*	Line Current (Amps)	Input Power (Watts)	Min Power Factor	Wiring Diag	Fig.	Weight (lb)	Max. Distance to Lamp (ft)
39W Watt Lamp, ANSI Code M130 Minimum Starting Temp -20°C/-4°F										
1	39	120	IMH-39-E-XXX	0.38	44	0.9	3	E	0.6	5
		277		0.16	43					





Wiring Diagram 3

Case Figure	Overall Length	Case Length	Case Width	Height	Mountin Length	Mounting Width
E	140mm [5.5"]	127mm [5.0"]	44mm [1.7"]	30mm [1.2"]	135mm [5.3"]	26mm [1.0"]



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 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, Leads exit either end

Data is based on tests performed by Philips Advance in a controlled environment and is 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.

Philips Lighting Electronics N.A.
10275 West Higgins Road • Rosemont, IL 60018 • www.philips.com/advance
Tel: 800-322-2086 • Fax: 800-423-1882 • Customer Support: 800-372-3331 • OEM Support: 866-915-5886

70	E17	E26 Med	64547	MP70/U/MED	M98/O	20	Clear	Universal	0	15000V 10000H	5200	3400	75	3000	10,11
			64546	MP70/C/U/MED	M98/O	20	Coated	Universal	0	15000V 10000H	4700	3100	75	2900	10,11
			64625	MPD70/U/MED/840	M98/O	20	Clear	Universal	0	7500V 6000H	5500	4000	80	4200	10,11
			64621	MPD70/C/U/MED/840	M98/O	20	Coated	Universal	0	7500V 6000H	5100	3800	82	4000	10,11

METALARC PULSE START
High Output, Reduced Color Shift, Low Wattage, Quartz, PAR Type – Open or Enclosed Fixtures

Watts	Bulb	Base	Product Number	Ordering Abbreviation	ANSI Code	Pkg Qty	Beam Type	Beam Angle	Operating Position	Fix Req	Avg Rated Life (hrs)	MBCP	Approx Lumens (initial)	CRI	CCT (K)	Symbols & Footnotes
70	PAR38	E26 Med Skt	64590	MP70PAR38/U/SP20/ECO	M98/O	6	SP	20	Universal	0	8500	18000	3400	75	3200	10,11,15, 16
			64592	MP70PAR38/U/FL35/ECO	M98/O	6	FL	35	Universal	0	8500	10000	3400	75	3200	10,11,15, 16
			64594	MP70PAR38/U/VWFL65/ECO	M98/O	6	VWFL	65	Universal	0	8500	3000	3400	75	3200	10,11,15, 16

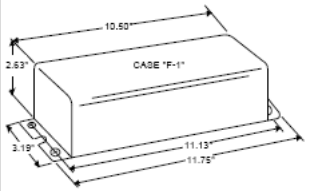
Fixture Type K3

PHILIPS ADVANCE

Metal Halide Lamp Ballast

Catalog Number 72C5282
For 70W M98
60 Hz HX-HPF
Status: Active

DIMENSIONS AND DATA

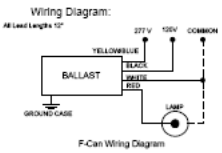


INPUT VOLTS		120	277		
CIRCUIT TYPE	HX-HPF				
POWER FACTOR (min)	90%				
REGULATION					
Line Volts	±5%				
Lamp Watts	±10%				
LINE CURRENT (Amps)					
Operating		0.85	0.37		
Open Circuit		1.60	0.75		
Starting		1.25	0.55		
UL TEMPERATURE RATINGS					
Insulation Class	A (105°C)				
Coil Temperature Code	T029				
MIN. AMBIENT STARTING TEMP.	-20°F or -30°C				
NOM. OPEN CIRCUIT VOLTAGE	255				
INPUT VOLTAGE AT LAMP DROPOUT		84	194		
INPUT WATTS	94				
RECOMMENDED FUSE (Amps)		4	2		
CORE and COIL					
Dimension (A)					
Dimension (B)	6.5				
Weight (lbs.)	12"				
Lead Lengths					
CAPACITOR REQUIREMENT					
Microfarads					
Volts (min.)					
Fault Current Withstand (amps)					
60 Hz TEST PROCEDURES (Refer to Philips Lighting Electronics N.A. TEST Procedure for HID Ballasts - Form 127					
High Potential Test (Volts)	1600				
1 minute	2000				
2 seconds	230-260				
Open Circuit Voltage Test (Volts)					
Short-Circuit Current Test (Amps)	0.95-1.20				
Secondary Current					
Input Current		0.65-0.95	0.25-0.40	-	-

Capacitor:

The capacitor is included as part of the potted assembly.

Wiring Diagram:



P-Can Wiring Diagram

Ignitor: IN CAN

The ignitor is included as part of the potted assembly.

Ballast to Lamp Distance (BTL) - 10 feet
Temp Rating: 90°C

Typical Ordering Information
(please call Philips Lighting Electronics N.A. for suffix availability)

Order Suffix	Description

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PHILIPS LIGHTING ELECTRONICS N.A.
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Customer Support/Technical Service: 800-372-3331 · OEM Support: 866-915-5886

Revised: 02/09/10

Watts	Bulb	Base	Number	Ordering Abbreviation	Code	Qty	Type	Angle	Position	Req	Life (hrs)	MBCP	(initial)	CRI	(K)	Footnotes
39	PAR30LN	E26 Med	64756	MCP39PAR30LN/U/830/FL	M130/0	6	FL	30	Universal	0	9000	7400	2300	85	2900	1,3,4, 5,10,11
70	PAR30LN	E26 Med	64745	MCP70PAR30LN/U/830/SP	M139/0	6	SP	12	Universal	0	9000	46000	4400	85	2900	1,4,5

Fixture Types M1, M2

Manufacturer:	Philips Lighting	
Lamp Power:	85 Watts	
Supply Current:	0.345 Amps	
Supply Voltage:	180-265 Volts	
Operating Frequency:	2.65 Megahertz	
Cap:	Special click-fit	
Bulb Finish:	Colour 840 Phosphor	Soda-Lime
Bulb Type:	P-110	
Overall Length:	180.5 mm	
Mass:	200 grams	
Atmosphere:	Ar-Kr-Ne | Hg-amalgam	
Luminous Flux:	6,000 lm @ 100 hours	4,200 lm @ 60,000 hrs
Luminous Efficacy:	71 lm/W @ 100 hours	49 lm/W @ 12,000 hrs
Colour Temperature & CRI:	CCT: 4000K	CRI: Ra 80+
Chromaticity Co-ordinates:	CCx: 0.390	CCy: 0.390
Burning Position:	Universal	
Rated Life:	100,000 hours (to 50% lumen depreciation)	
Warm Up / Re-strike Time:	30 seconds	Instantaneous
Factory:	Turnhout, Belgium	
Date of Manufacture:	April 1992	
Original / Present Value:		