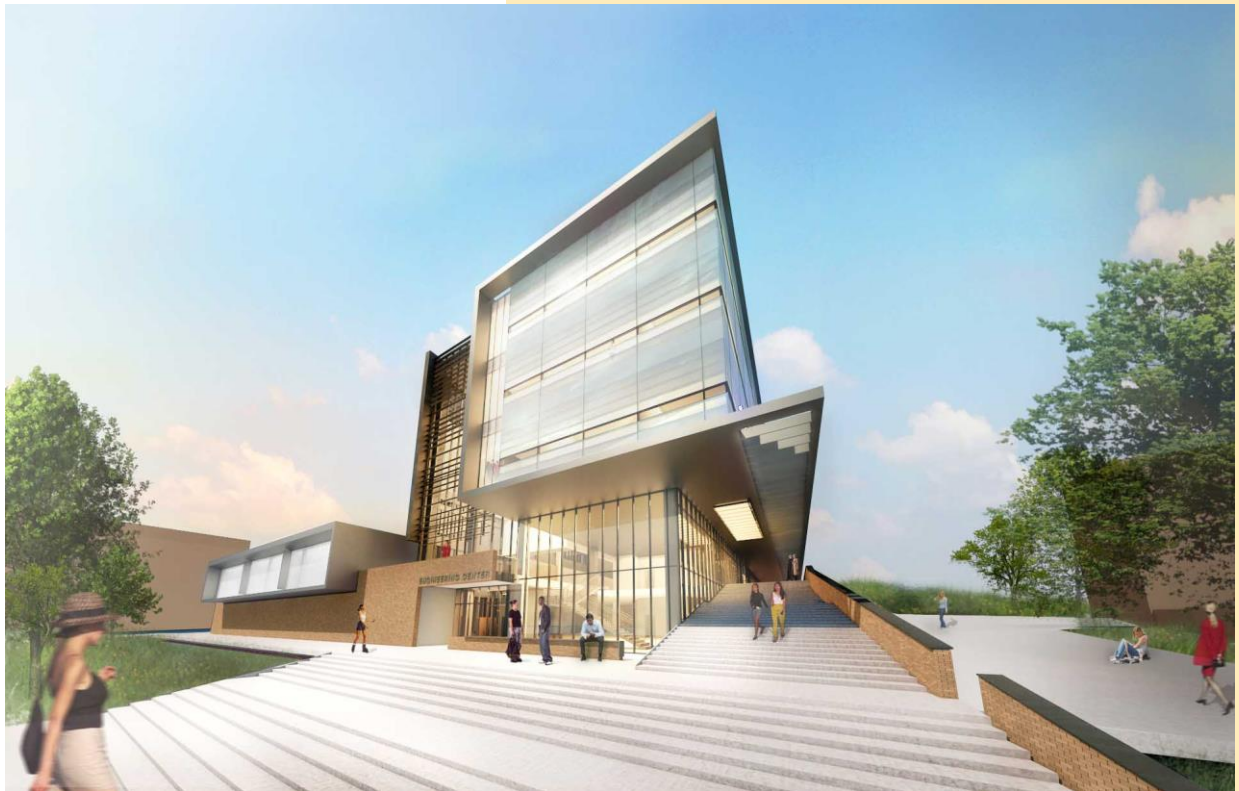


## Technical Report 2

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Oakland University Engineering Center | Rochester, MI  
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# Table of Contents

0.0	Executive Summary	3
1.0	Part 1   Develop the Electrical Systems Criteria and Scope of Work	4
0.1	Preliminary Electrical Load Calculation	4
0.2	Utility Company Service	4
0.3	Preliminary Utility Rate Schedule	4
0.4	Preliminary Building Voltage	5
0.5	Emergency Power Requirements	5
0.6	Special Occupancy Requirements	7
0.7	Priority Assessment Table	7
0.8	Optional Back-up Power Loads	7
0.9	Low Voltage + Communications Systems	7
0.10	Electrical Equipment Space Requirements	9
2.0	Part 2   Understand and Describe the Electrical Systems as Currently Designed	9
2.1	Connected Building Loads	9
2.2	Actual Utility Company Rate Schedule	11
2.3	Building Utilization Voltage	12
2.4	Emergency Power System	12
2.5	Special Occupancy Requirements	12
2.6	Special Equipment	12
2.7	Electrical Equipment Ratings	13
2.8	Low Voltage + Communication Systems	18
2.9	Electrical + Telecommunications Floor Space	18
2.10	Energy Reduction Methods	18
2.11	Single Line + Riser Diagram	19
3.0	Part 3   Evaluate Designed Systems Against Criteria	19
3.1	Estimated vs. Actual Building Loads	19
3.2	Utility Rate Schedule	19
3.3	Building Utilization Voltage	20
3.4	Electrical Equipment	20
3.5	Emergency Power System	20
3.6	Optional Back-up Power	20
3.7	Energy Reduction Strategy Suggestions	20
4.0	References	21
5.0	Appendices	22
5.1	Panel Schedules + Emergency Panel Schedules	
5.2	One-Line Diagrams + Emergency One-Line Diagram	
5.3	Riser Diagram	
5.4	Electrical Equipment Schedules	

## 0.0 Executive Summary

In this report, the electrical systems of the Engineering Center at Oakland University in Rochester, Michigan are analyzed and studied to have a better understanding of the building's existing conditions. Firstly, code and requirement design criteria were documented as well as preliminary calculations. Then, from the information found in the electrical construction documents and other documents provided by SmithGroupJJR, the actual design was analyzed. And finally, the actual design was compared briefly to the preliminary calculations and the design criteria. A few recommendations are made here to improve the design, but this comparison shows that a very comprehensive and well thought out system was designed for the Engineering Center.

### 1.1 Preliminary Electrical Load Calculation

This preliminary electrical load calculation takes into account the building type, lighting and receptacle loads, HVAC equipment, and other equipment needed. The building, according to NEC 2011 Table 220.12, would most likely be categorized as a school building by occupancy even though there are offices, labs, an auditorium, and a café within the building. With this assumption we can assume 3 VA/ft<sup>2</sup>. The demand factors used can be found in NEC 2011 Table 220.44 Demand Factors for Non-Dwelling Receptacle Loads. For the HVAC rough load calculation a rule-of thumb was used. This rule of thumb gives 6 VA/ft<sup>2</sup> for educational buildings and 7 VA/ft<sup>2</sup> for office buildings, of which, office designation was used due to the complexity of this facility and the desire not to underestimate.

Lighting + Receptacle Load						
Occupancy	Load	VA/ft <sup>2</sup>	Area (ft <sup>2</sup> )	Total VA	Demand Factor	Total VA
Schools	Lighting	3	136,653	409,959	1 (Table 220.42)	409,959
	Receptacle	1	136,653	136,653	First 10,000 VA = 1 Remainder (126,653) = 0.5	73,326.5
<b>Total kVA</b>						<b>483.29</b>

Mechanical Load						
Occupancy	Load	VA/ft <sup>2</sup>	Area (ft <sup>2</sup> )	Total VA	Demand Factor	Total W
Schools	HVAC	7	136,653	956,571	None	956,571
<b>Total kVA</b>						<b>956.57</b>

### Total Preliminary Demand Load for the Building | 1,439.86 kVA

### 1.2 Utility Company Service

The local utility company for much of Southeastern Michigan, including Rochester, is DTE Electric Company which supplies electricity and gas for the region. DTE Electric Company is based in Detroit in the One Energy Plaza building.

### 1.3 Preliminary Utility Rate Schedule

For a Primary Educational Institution, DTE would use rate schedule number D6.2 found at <http://www.dleg.state.mi.us/mpsc/electric/ratebooks/dtee/dtee1curd1throughend.pdf>. Service will only be provided to buildings desiring at least 50 kW, which works for the Engineering Center. The power supplied to the site is alternating current, three-phase and nominally at 4,800, 13,200, 24,000, 41,570 or 120,000 volts at the option of the Company. The utility rate per month is shown below in figure 1.

## **RATE PER MONTH:**

### **Full Service Customers:**

#### **Power Supply Charges:**

Demand Charge: \$11.65 per kW of on-peak billing demand  
Energy Charges: 4.298¢ per kWh for all on-peak kWh  
3.998¢ per kWh for all off-peak kWh

#### **Voltage Level Discount:**

0.15¢ per kWh at transmission level  
0.10¢ per kWh at subtransmission level

#### **Delivery Charges:**

Service Charge: \$275 per month

#### **Distribution Charges:**

For primary service (less than 24 kV) \$1.93 per kW of maximum demand.  
For service at subtransmission voltage (24 to 41.6 kV) \$0.70 per kW of maximum demand.  
For service at transmission voltage (120 kV and above) \$0.45 per kW of maximum demand.

**Substation Credit:** Available to customers where service at sub-transmission voltage level (24 to 41.6 kV) or higher is required, who provide the on-site substation including all necessary transforming, controlling and protective equipment. A credit of \$.30 per kW of maximum demand shall be applied to the maximum demand charge. A credit of .040¢ per kWh shall be applied to the energy charge where the service is metered on the primary side of the transformer.

*Figure 1 | Rate Schedule*

**NOTE |** On-peak hours, as dictated by DTE for this building type are those hours between 1100 hours and 1900 hours each day, Monday through Friday, legal holidays excluded. Without complicating the calculation with the holidays included or the substation credit subtracted, the cost is calculated and outlined below.

## **1.4 Preliminary Building Voltage**

The Engineering Center, being an academic building with offices, labs, and classrooms, will benefit most with a primary building voltage of 480/277V, 3PH. This is because most of the lighting, HVAC equipment, and other larger equipment will perform with either 277V, 480V or in some cases 208V. This 208V, as well as the receptacles, will in turn mean that there will be need for step-down transformers to 208/120V, 3PH power.

## **1.5 Emergency Power Requirements**

According to the IBC 2012 section 2702 on Emergency and Standby Power Systems, the following are required. These sections are taken directly from the IBC code. Emergency and standby systems will need to be provided and maintained, where required, in accordance with the International Fire Code.

### **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.

**2702.2.6 Accessible means of egress platform lifts**

Standby power in accordance with this section or ASME A 18.1 shall be provided for platform lifts that are part of an *accessible means of egress* in accordance with Section 1007.5.

**2702.2.7 Horizontal sliding doors**

Standby power shall be provided for horizontal sliding doors in accordance with Section 1008.1.4.3.

**2702.2.8 Semiconductor fabrication facilities**

Emergency power shall be provided for semiconductor fabrication facilities in accordance with Section 415.10.10.

**2702.2.9 Membrane structures**

Standby power shall be provided for auxiliary inflation systems in accordance with Section 3102.8.2. Emergency power shall be provided for *exitsigns* in temporary tents and membrane structures in accordance with the *International Fire Code*.

**2702.2.10 Hazardous materials**

Emergency or standby power shall be provided in occupancies with hazardous materials in accordance with Section 414.5.3.

**2702.2.11 Highly toxic and toxic materials**

Emergency power shall be provided for occupancies with highly *toxic* or *toxic* materials in accordance with the *International Fire Code*.

**2702.2.12 Organic peroxides**

Standby power shall be provided for occupancies with silane gas in accordance with the *International Fire Code*.

**2702.2.13 Pyrophoric materials**

Emergency power shall be provided for occupancies with silane gas in accordance with the *International Fire Code*.

**2702.2.14 Covered and open mall buildings**

Standby power shall be provided for voice/alarm communication systems in *covered and open mall buildings* in accordance with Section 402.7.3.

**2702.2.15 High-rise buildings**

Emergency and standby power shall be provided in high-rise buildings in accordance with Sections 403.4.8 and 403.4.9.

**2702.2.16 Underground buildings**

Emergency and standby power shall be provided in underground buildings in accordance with Sections 405.8 and 405.9.

**2702.2.17 Group I-3 occupancies**

Emergency power shall be provided for doors in Group I-3 occupancies in accordance with Section 408.4.2.

**2702.2.18 Airport traffic control towers**

Standby power shall be provided in airport traffic control towers in accordance with Section 412.3.4.

### 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.

## 1.6 Special Occupancy Requirements

NEC Chapter 5, Article 500, was analyzed and due to the nature of the Engineering Center program and use, no special occupancy requirements apply.

## 1.7 Priority Assessment Table

In the following table, six categories are rated as high, medium, or low importance for the impact that they will have on the electrical design of the Engineering Center. These importance ratings are relative and reflect on opinions of the electrical design for the building based on the program of the project and the importance of this building as the new center for the schools of Engineering and Computer Science on Oakland University's campus.

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

## 1.8 Optional Back-up Power Loads

Optional back-up power may be necessary for loads that aid in lighting exit paths for life system safety, elevators for safety reasons, data rooms to ensure safety of all data, and some HVAC systems for the comfort of occupants as well as protecting the building from events such as freezing pipes.

## 1.9 Low Voltage + Communications Systems

Potential low-voltage and communications systems that are applicable to the Engineering Center's program of spaces, and use to the occupants of the space, are outlined below:

**Telephone** | The offices as well as the labs within the building, should have access to telephone usage.

**Fire Alarms** | Fire alarms are required by code; the IBC text pertaining to the Engineering Center are copied below.

### **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.

A minimum of 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 waterflow detection devices. Where other sections of this code allow elimination of fire alarm boxes due to sprinklers, a single fire alarm box shall be installed.

### **907.3 Fire safety functions**

Automatic fire detectors utilized for the purpose of performing fire safety functions shall be connected to the building's fire alarm control unit where a fire alarm system is required by Section 907.2. Detectors shall, upon actuation, perform the intended function and activate the alarm notification appliances or activate a visible and audible supervisory signal at a constantly attended location. In buildings not equipped with a fire alarm system, the automatic fire detector shall be powered by normal electrical service and, upon actuation, perform the intended function. The detectors shall be located in accordance with NFPA 72.

### **907.4 Initiating devices**

Where manual or automatic alarm initiation is required as part of a fire alarm system, the initiating devices shall be installed in accordance with Sections 907.4.1 through 907.4.3.1.

### **907.5 Occupant notification systems**

A fire alarm system shall annunciate at the fire alarm control unit and shall initiate occupant notification upon activation, in accordance with Sections 907.5.1 through 907.5.2.3.4. Where a fire alarm system is required by another section of this code, it shall be activated by:

1. Automatic fire detectors.
2. *Automatic sprinkler system* waterflow devices.
3. Manual fire alarm boxes.
4. Automatic fire-extinguishing systems.

**CATV/CCTV** | Cable for the use of television will most likely be of use in the public spaces of the building as well as some of the offices or meeting areas. Cables for video surveillance will also be utilized.

**Intercom** | This may be useful, or it may not in the actual building. The reasons that this system may be used can probably be mitigated with telephone use within the building.

**Access Control** | Being on a campus, it is likely that at some times, such as late nights, it would be beneficial to have some sort of card-access system in place to keep those that do not belong on the premises out.

**Video Surveillance** | For similar reasons to the access control, it would be likely that a system of video surveillance be in place for campus safety.



## 1.10 Electrical Equipment Space Requirements

The major electrical equipment that will require a large amount of floor space will include the following: Emergency power generators, utility transformer outside and step-down transformers inside, distribution electrical panels, and switchboards.

## 2.0 Part 2 | Understand and Describe the Electrical Systems as Currently Designed

### 2.1 Connected Building Loads

The actual connected building load is outlined in the table below by going through each panel to find the loads by category. The categories that the loads fall under are lighting, power, receptacle, mechanical, and specialty equipment, which entails all other loads, mentioned in the panel schedules. The total kVA for each category are added up and then the total connected kVA for the building is shown. Then, using demand factors of 0.8 for lighting, 0.3 for power, 1.0 for receptacles, 0.6 for mechanical equipment, and 0.6 for specialty equipment, the demand load is estimated.

Note | The receptacle demand factor varied between panels so an approximation of 1.0 was used due to the majority being 1.0 or near 1.0. This means that the demand shown here is not exactly the actual demand load for the building.

Actual Connected Building Load by Panel VA					
Panel	Lighting	Power	Receptacle	Mechanical	Specialty Equipment
H11	7015				
H13	12616				
H21	8987				
H23	13973				
H31	13770				
H41	13971				
H51	17552				
L11A	501	6446	14100	1656	
L11B		1500	16020		
L13A		25697	4900	11123	
L13B		8702	6480		
L21A		499	15080		
L21B		4800	7420	3680	
L21C		4812	21175		
L185			11000		
L23A		600	6960	7360	
L23B		22195			

L31A		1603	24560		
L31B		3840	14300		
L31C		4330	19432		
L41A		4688	18240		
L41B		3736	12320		8640
L170			6120	1840	
L51A		1705	27600		
L51B		6556	4220		8640
L179		5000	18312		
L178			28860		
L182			14220	1840	
L186			17160	3670	
L264		7360	10800		
L358		720	9900		
L360		1440	10260		
L364		4140	5940		
L370		21800	4680		
L450		23840	7420	1840	
L452		2520	3240		4320
L454		2520	3780		4320
L455		720	4680		
L460		3600	5580		4320
L461		1440	9900		
L466		720	20880		
L468		1440	9660		
L470		3240	6360		
L550			15300		
L554			28440		
L556		720	4140		4320
L557		1440	7920		
L562			22860		
L566		720	13860		
L570			16500		
L61		9225	6480	4935	
H13LS	5750				
H23LS	4968				
H31LS	2367				
H51LS	6041				
L13LR	70	13979	3300	4508	
L23LR		6963	180	4508	

L41LR		2503			
L61LR		8256	360	11648	
L189SB			10680	1996	
L365ASB			15720	6448	
L565ASB			15600	1788	
L165SB			10140	3328	
Totals	107,581	226,015	593,039	72,168	34,560
				<b>Total kVA</b>	<b>1,033.36</b>

Actual Demand Building Load VA					
Load Type	Lighting	Power	Receptacle	Mechanical	Specialty Equipment
Total VA	107,581	226,015	593,039	72,168	34,560
Demand Factor	0.8	0.3	*1.0	0.6	0.6
Demand	86,064.8	67,804.5	593,039	43,300.8	20,736
				<b>Total kVA</b>	<b>810.95</b>

## 2.2 Actual Utility Company Rate Schedule

The assumed utility company, DTE was a correct assumption though the service type is actually D8 not D6.2. The SmithGroupJJR utility rate analysis is shown below according to DTE rates.

<b>Electricity Rate</b>				
Service Type: DTE - D8				
	KW	Power \$/KW	Distribution \$/KW	Total \$/KW
	4,000	\$14.34	\$3.14	\$17.48
	1,184	\$8.86	\$3.14	\$12.00
	<b>Potential Demand Savings \$/KW:</b>			<b>\$12.00</b>
	KWH	Power \$/KWH	Distribution \$/KWH	Total \$/KWH
On-Peak	2,705,360	\$0.0500	\$0.0067	\$0.0567
Off-Peak Discount		\$0.0030		2.40%
Off-Peak				\$0.0537
	<b>Potential Savings \$/KWH:</b>			<b>\$0.0547</b>
off-peak – from 7 p.m. to 11 a.m.			16 hours	\$0.0537
on-peak – from 11 a.m to 7 p.m.			8 hours	\$0.0567
	<b>Power Factor Penalty:</b>			<b>\$0.00</b>

## 2.3 Building Utilization Voltage

The actual primary building utilization voltage is 480Y/277V, 3-phase, 4 wire, 60 hertz. The following voltages are used for the specified tasks.

**Lighting** | 277V primarily though a few 120V

**Receptacles** | 120V

**Mechanical Equipment** | 208V or 240V

## 2.4 Emergency Power System

A natural gas generator and two turbogenerators power the emergency power system. The natural gas generator is located on the top roof in a sound attenuating, weather-rated enclosure and provides power to a 225A 480Y/277V, 3PH panel. This generator powers the fire pump controller with a wye-delta starter and integral automatic transfer switch. The two turbogenerators provide 480Y/277V, 3PH power to all of the equipment under the life safety and legally required panels (designated by LS and LR in the panels above). These panels include power to the emergency lighting, elevators, stair pressure fans, lab and atrium exhaust fans, sump pumps, the atrium coiling doors, and the other loads on the legally required panels.

## 2.5 Special Occupancy Requirements

There are no special occupancy requirements that could be found according to NEC article 500.

## 2.6 Special Equipment

Chapter 6 of the NEC 2011 code outlines special equipment for buildings. The following special equipment in chapter 6 apply to the Engineering Center building:

### **Article 620** | Elevators, Dumbwaiters, Escalators, Moving Walks, Platform Lifts, and Stairway Chairlifts

Vehicle lift in SAE lab, 30A 208V, 1PH

Wheelchair Lift in room 116 200 seat classroom, 30A 120V, 3PH

3 Elevators

### **Article 625** | Electrical Vehicle Charging System

Multiple charging stations in SAE lab

### **Article 640** | Audio Signal Processing, Amplification, and Reproduction Equipment

Audio Systems throughout

**Article 645** | Information Technology Equipment

**Article 690** | Solar Photovoltaic (PV) Systems

PV system on the roof of the building

**Article 695** | Fire Pumps

## 2.7 Electrical Equipment Ratings

The electrical equipment for the power distribution of the Engineering Center was studied from the electrical construction documents and is summarized below.

### Main Service Equipment + Transformer |

#### Primary Power Transformers |

**TR-A2** | 1500/1991/2700 kVA (AA/AA/FA) 13.2kV – 480Y/277V 3PH, 4W

**TR-B2** | 1500/1991/2700 kVA (AA/AA/FA) 13.2kV – 480Y/277V 3PH, 4W

**Substation Rating** | 4000A, 480Y/277V, 3PH, 4W, 100% Neutral 100K AIC

Utility power enters the building at the ground level into a secondary unit substation, which contains two 15kV fused load interrupter break switches (PS-A2 + PS-B2) for the two primary service transformers. All of the electrical rooms are fed from feeders located in this room. The substation room 160 is shown in the figure below.

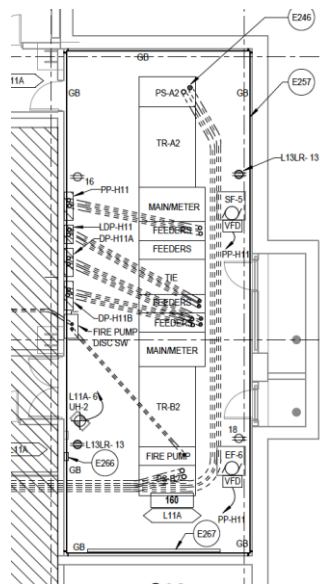


Figure 2 | Substation RM 160

## **Distribution Equipment + Step-Down Transformers |**

**DP-H11A** | Dist. Panel 800A, 480Y/277V, 3PH, 4W, 100% Neutral, 65K AIC

**DP-H11B** | Dist. Panel 800A, 480Y/277V, 3PH, 4W, 100% Neutral, 65K AIC

**LDP-H11** | Dist. Panel 400A, 480Y/277V, 3PH, 4W, 100% Neutral, 65K AIC

**PP-H11** | Dist. Panel 800A, 480Y/277V, 3PH, 4W, 100% Neutral, 65K AIC

**DP-H13** | Dist. Panel 800A, 208Y/120V, 3PH, 4W, 200% Neutral, 22K AIC

**PP-H13** | Dist. Panel 400A, 480Y/277V, 3PH, 4W, 100% Neutral, 42K AIC

**DP-H21** | Dist. Panel 400A, 208Y/120V, 3PH, 4W, 200% Neutral, 22K AIC

**DP-H31** | Dist. Panel 600A, 208Y/120V, 3PH, 4W, 200% Neutral, 22K AIC

**DP-H41** | Dist. Panel 800A, 208Y/120V, 3PH, 4W, 200% Neutral, 22K AIC

**DP-H51** | Dist. Panel 800A, 208Y/120V, 3PH, 4W, 200% Neutral, 22K AIC

**DP-LR** | Dist. Panel 400A, 480Y/277V, 3PH, 4W, 200% Neutral, 42K AIC

**DP-LS** | Dist. Panel 200A, 480Y/277V, 3PH, 4W, 100% Neutral, 42K AIC

**DP-SB** | Dist. Panel 300A, 208Y/120V, 3PH, 4W, 200% Neutral, 22K AIC

**T-11** | Ceiling mounted XFMR 45 kVA K-13 480Y/277V – 208Y/120V 3PH, 4W

**T-13A** | Floor mounted XFMR 225 kVA K-13 480Y/277V – 208Y/120V 3PH, 4W

**T-13B** | Ceiling mounted XFMR 30 kVA K-13 480Y/277V – 208Y/120V 3PH, 4W

**T-21** | Floor mounted XFMR 112.5 kVA K-13 480Y/277V – 208Y/120V 3PH, 4W

**T-31** | Floor mounted XFMR 150 kVA K-13 480Y/277V – 208Y/120V 3PH, 4W

**T-41** | Floor mounted XFMR 225 kVA K-13 480Y/277V – 208Y/120V 3PH, 4W

**T-51** | Floor mounted XFMR 225 kVA K-13 480Y/277V – 208Y/120V 3PH, 4W

**T-61A** | Ceiling mounted XFMR 30 kVA K-13 480Y/277V – 208Y/120V 3PH, 4W

**T-61B** | Floor mounted XFMR 75 kVA K-13 480Y/277V – 208Y/120V 3PH, 4W

Each of these step-down transformers is located in designated electrical rooms on each level of the building. These transformers provide power to the receptacle and mechanical equipment panels on each level of the building. A typical electrical room is shown below which includes one or two transformers and multiple

panelboards including distribution panels and branch panels. The electrical room shown, RM 265C is on the second level and contains one step-down transformer, one distribution panel, and five branch panels.

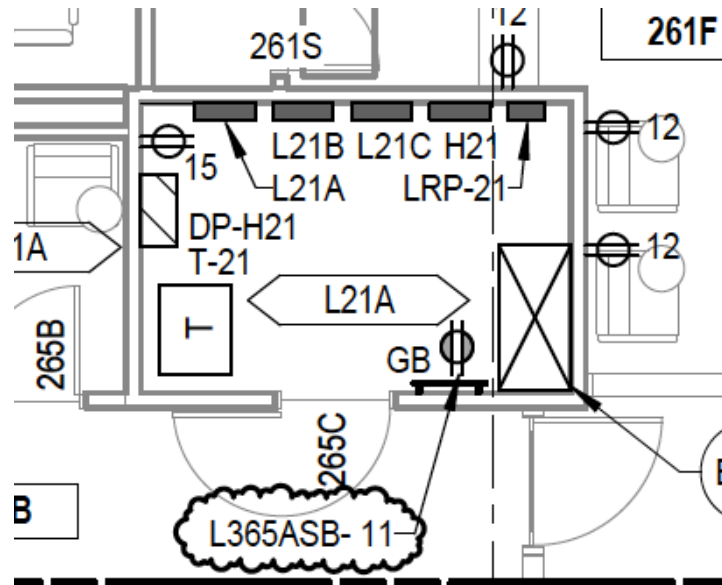


Figure 3 | Electrical RM 265C

### Branch Panelboards |

There are 63 wall-mounted branch panelboards in the Engineering Center located in the 8 designated electrical rooms throughout the building. They range in ratings and are summarized in the table below.

Branch Panelboard Ratings

Panels	Voltage	Phases	Wires	AIC Rating	Mains Type	Bus Rating	MCB Rating
H11, H13, H21, H23, H31, H41, H51,	480Y/277	3	4	14,000	MCB	100 A	100 A
L11A	208Y/120	3	4	10,000	MCB	225 A	100 A
L11B, L13A, L51A	208Y/120	3	4	10,000	MLO	225 A	-
L13B, L21A, L21B, L21C, L31A, L31B, L31C, L41A, L41B, L51B, L61LR	208Y/120	3	4	10,000	MLO	100 A	-
L185, L23A, L23B, L170, L182, L186, L264, L358, L360, L364, L452, L454, L455, L460, L461, L466, L468, L470, L550, L554, L556, L557, L562, L566, L61, L13LR, L189SB, L365ASB, L565ASB	208Y/120	3	4	10,000	MCB	100 A	100 A
L178, L179, L370, L450	208Y/120	3	4	10,000	MCB	225 A	225 A
L570	208Y/120	3	4	10,000	MCB	225 A	200 A
H13LS, H23LS, H31LS, H51LS,	480Y/277	3	4	14,000	MCB	100 A	60 A
L23LR, L41LR, L165SB	208Y/120	3	4	10,000	MCB	100 A	60 A

**Main Risers + Feeders |**

The utility service is brought into the building's substation through (2) 350 AWG/kcmil copper 3-1/C cables. The feeders from the substation transformers are (2) size 600 AWG/kcmil Copper 4 – 1/C+G THHN or (2) 400 AWG/kcmil Copper 3 – 1/C+G THHN cables in PVC. Other mains from step-down transformers to branch panels are (1 or 2) size 600 AWG/kcmil Copper 4 – 1/C+G THHN and (2) size 350 AWG/kcmil Copper 4 – 1/C+G THHN.



## **Conductors |**

The primary conductor for the building is copper however aluminum conductors are to be used for feeders in circuits with overcurrent protective devices 100A and greater according to a side note on the construction documents.

## **Conduit |**

All conduit is to be PVC or rigid as indicated throughout the project and sized in accordance with the NEC.

5" underground conduits for telecommunications service

5" underground conduits for primary power

2" conduit for power

1 ¼" conduit for telecommunications

1" conduit to each elevator controller for pre-transfer signal

2" for grounding conductors

¾" conduit to fiber optic interface module in room 165

¾" conduit to lighting controllers in all of the larger classrooms

¾" conduit to access control panel

## **Faceplate Type |**

Throughout the project, common faceplates are used for duplex and quadruplex receptacles. The material and grade could not be found out in construction documents.

## **Motor Starters |**

Motor starting types are based on 460V, 3PH, full voltage non-reversing unless the motor size is 75HP or greater in which case, the motor starting type is based on 460V, 3PH, part winding reduced voltage starting.

## **UPS Systems (Uninterrupted Power Supply) |**

There do not appear to be any UPS systems specified within the Engineering Center construction documents.

## 2.8 Low Voltage + Communication Systems

**Telephone** | Not explicitly shown in plans, but the telecommunications company Convergent Technologies has added telecom outlets in most of the main spaces in their separate documents.

**Fire Alarms** | The building is completely equipped with smoke detectors, fire alarm sirens, and fire alarm strobe lights to announce the possibility of a fire.

**CATV/CCTV** | CCTV cables provided for the video surveillance of the building.

**Intercom** | Does not seem to be used.

**Access Control** | Required by the campus and provided by specification of Convergent Technologies.

**Video Surveillance** | Same as access control.

## 2.9 Electrical + Telecommunications Floor Space

The spaces designated for electrical or telecommunications uses are outlined in the table below showing the square footage allotted per floor for electrical and telecommunications related uses. The total square footage used for either electrical or telecommunications use is 3,119 ft<sup>2</sup> out of 136,653 ft<sup>2</sup> or 2.28% of the building.

Electrical + Telecommunications Floor Space

Floor	Elevator Control (sf)	A/V Room (sf)	Electrical Room (sf)	Telecommunications (sf)
Level 1	74	101	1482 (includes substation)	397
Level 2		12	185	92
Level 3			95	92
Level 4			86	89
Level 5			86	89
Penthouse			239	
<b>Totals</b>	<b>74</b>	<b>113</b>	<b>2173</b>	<b>759</b>

## 2.10 Energy Reduction Methods

Oakland University, with SmithGroupJJR, is aiming for LEED gold status for the new Engineering Center. To achieve this, the lighting power density was designed 30% below ASHRAE 90.1 guidelines, a PV system on the roof was added to the design for on-site renewable energy and will achieve 1 or 2 points towards LEED, and controllability of lighting systems was added. Unfortunately, overall the electrical design does not impact the LEED certification that substantially. According to SmithGroupJJR documentation, due to lack of funding during construction, the PV system was taken out of the design. The projected LEED credits that are expected are 52 with an additional 13 possible and will have to wait until the project is inspected. It is still possible that the project will end up with a LEED gold rating.

### 2.11 Single Line + Riser Diagram

The single line diagrams (including the emergency power one line diagrams) and riser diagram can be found in the appendix of this report.

## 3.0 Part 3 | Evaluate Designed Systems Against Criteria

### 3.1 Estimated vs. Actual Building Loads

Below is a table comparing the preliminary connected and demand load calculations to the actual loads. As seen, the actual load totals are considerably lower than those calculated using generalizations from the NEC and mechanical rules-of-thumb. This is to be expected since the code is certainly oversimplifying design, as well as overdesigning for safety reasons, and this building is attempting to be LEED gold certified. It can also be seen that there are large differences in the preliminary and actual loads for each of the categories. This can be justified as SmithGroupJJR probably has designated certain power and mechanical loads on the panels as receptacle loads as well as attempting to use as little lighting load as possible with the use of LED lighting fixtures. Also, since a preliminary demand factor was not found for mechanical loads, the preliminary load was much greater than the actual.

Building Load Comparison (VA)						
	Preliminary			Actual		
	Connected	DF	Demand	Connected	DF	Demand
Lighting	409,959	1.0	409,959	107,581	0.8	86,064.8
Receptacle	136,653	First 10,000 VA = 1 Remainder (126,653) = 0.5	73,326.5	593,039	*1.0	593,039
Mech. / Spec Eq / Power	956,571	*1.0	956,571	332,743	0.6 / 0.6 / 0.3	131,841.3
Totals (kVA)	<b>1,503.18</b>		<b>1,439.86</b>	<b>1,033.36</b>		<b>810.95</b>

### 3.2 Utility Rate Schedule

The utility rate schedule that the building is actually using is different from the one that was found but is more appropriate. That being said, there is a power plant on campus and some of the building power will most likely be supplemented by this power leading to some energy savings for Oakland University.

### 3.3 Building Utilization Voltage

The building utilization voltages expected matched up exactly with the voltages used in the design of the Engineering Center. Because of this, there are no recommendations that seem viable here.

### 3.4 Electrical Equipment

The current design of the building has a distribution plan and electrical room locations that seem appropriate for the building use and the criteria that were deemed important. The electrical rooms seem to be in strategic locations to provide power to all of the areas of the building with the least amount of voltage drop and least amount of wires used. Having the individual step-down transformers on each floor also seems logical to save on conduit and conductor costs. When looking at the material chosen for the wiring in the building, which is primarily, copper, there is the possibility for cost savings in choosing aluminum wiring as long as it does not detract from the reliability of the system.

### 3.5 Emergency Power System

The emergency power system currently includes two turbogenerators on the penthouse level as well as a natural gas generator. After looking through the documentation and the one-line diagrams it is slightly uncertain why the generator is needed as well as the two turbogenerators. To save on initial cost, as well as natural gas cost throughout the lifetime of the building, it may be possible to take the natural gas generator out of the design and supplement the power that it was providing with power from the two turbogenerators. This would simplify the design and would not implicate a large change in space appropriation on the penthouse level of the building.

### 3.6 Optional Back-up Power

Although recommended in the last section that the natural gas generator be taken out of the design, there may be a better cost to performance solution to back-up power and emergency power to the use of the generator and two turbogenerators. This has not been looked into, but could be a possibility.

### 3.7 Energy Reduction Strategy Suggestions

Since there were insufficient funds for a PV system, it may be interesting to try to implement some PV panels to analyze how much energy saving is possible there. With daylight harvesting, photosensor use in conjunction with light dimming and shade control could be an electricity savings as well as a mechanical energy savings.

## 4.0 References

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

"Chapter 27- Electrical." International Code Council. International Building Code 2012. Web. 14 Oct. 2014. [http://publicecodes.cyberregs.com/icod/ibc/2012/icod\\_ibc\\_2012\\_27\\_section.htm](http://publicecodes.cyberregs.com/icod/ibc/2012/icod_ibc_2012_27_section.htm).

*NEC: 2011*. (2011 ed.). (2010). Quincy, Mass.: National Fire Protection Association.

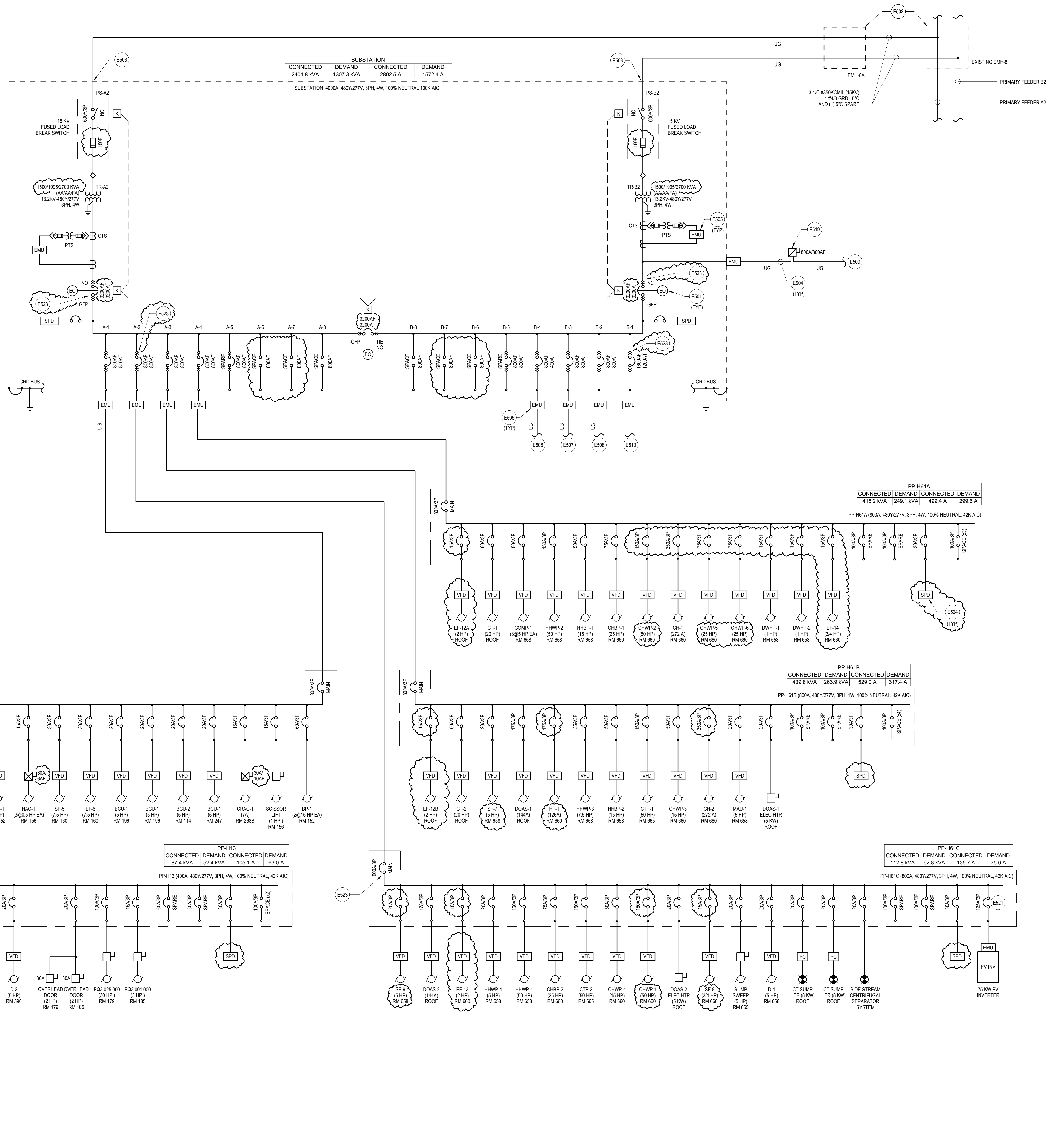
## 5.0 Appendices

5.1 Panel Schedules + Emergency Panel Schedules

5.2 One-Line Diagrams + Emergency One-Line Diagram

5.3 Riser Diagram

5.4 Electrical Equipment Schedules



SUBSTATION			
CONNECTED	DEMAND	CONNECTED	DEMAND
2404.8 kVA	1307.3 kVA	2892.5 A	1572.4 A

SUBSTATION 4000A, 480Y/277V, 3PH, 4W, 100% NEUTRAL, 100K AIC

PP-H61A			
CONNECTED	DEMAND	CONNECTED	DEMAND
415.2 kVA	249.1 kVA	499.4 A	299.6 A

PP-H61B			
CONNECTED	DEMAND	CONNECTED	DEMAND
438.8 kVA	263.9 kVA	529.0 A	317.4 A

PP-H61C			
CONNECTED	DEMAND	CONNECTED	DEMAND
112.8 kVA	52.8 kVA	135.7 A	75.6 A

PP-H11			
CONNECTED	DEMAND	CONNECTED	DEMAND
219.1 kVA	119.0 kVA	263.6 A	143.2 A

PP-H13			
CONNECTED	DEMAND	CONNECTED	DEMAND
87.4 kVA	52.4 kVA	105.1 A	63.0 A

### SHEET NOTES

- REFER TO SHEET E02 FOR ELECTRICAL FEEDER/BRANCH CIRCUIT, MOTOR CIRCUIT AND TRANSFORMER CIRCUIT SIZING SCHEDULES. CIRCUITS SHALL BE SIZED BASED ON OVERCURRENT PROTECTION DEVICE RATING.
- ALL DISTRIBUTION PANELBOARDS (DP) SHALL BE 90" HIGH.
- ALL DISTRIBUTION PANELBOARDS (DP) AND POWER PANELBOARDS (PP) SHALL HAVE FULLY RATED, FULL LENGTH BUS SUCH THAT THERE IS NO REDUCTION IN THE CAPACITY OF THE BUS. PANELBOARDS SHALL BE READY TO ACCEPT FUTURE CIRCUIT BREAKERS.
- THE FAULT CURRENT INDICATED SHOWS THE DESIGN INTENT. PROVIDE COMPLETE FAULT CURRENT ANALYSIS PER SPECIFICATIONS SECTION 260500.
- CONTACT CONSTRUCTION MANAGER AND OWNER THREE WEEKS PRIOR TO ANY REQUIRED POWER SHUTDOWNS.
- PROVIDE 200% RATED NEUTRAL CONDUCTOR FOR ALL 208Y/120V RECEPTACLE PANELBOARDS ("L" PANELS). REFER TO FEEDER AND BRANCH CIRCUIT SIZING SCHEDULE FOR NON-LINEAR LOADS ON SHEET E02.
- PROVIDE SURGE PROTECTION DEVICE FOR ALL 208Y/120V RECEPTACLE PANELBOARDS ("L" PANELS).
- PROVIDE K-RATED TRANSFORMERS FOR TRANSFORMERS SUPPLYING DISTRIBUTION PANELBOARDS SERVING 208Y/120V RECEPTACLE PANELBOARDS ("L" PANELS). REFER TO TRANSFORMER CIRCUIT SIZING SCHEDULE FOR NON-LINEAR LOADS ON SHEET E02.
- A PERMANENT PLAQUE OR DIRECTORY DENOTING ALL ELECTRIC POWER SOURCES ON OR IN PREMISES SHALL BE INSTALLED AT EACH SERVICE EQUIPMENT LOCATION AND AT ALL LOCATIONS OF ALL ELECTRIC POWER PRODUCTION SOURCES CAPABLE OR BEING INTERCONNECTED.

### KEYED NOTES

- INDICATES OVERCURRENT PROTECTION DEVICE IS ELECTRICALY OPERATED.
- REFER TO ELECTRICAL SITE PLAN FOR EXACT MANHOLE LOCATIONS.
- ALL 15KV FEEDERS MUST ENTER AND EXIT THROUGH BOTTOM OF GEAR.
- ROUTE FIRE PUMP SUPPLY CONDUCTORS UNDERNEATH THE BUILDING, ENCASE IN A MINIMUM OF TWO INCHES OF CONCRETE.
- REFER TO SPECIFICATIONS FOR TYPE OF METER.
- TO LDP-H11 LOCATED IN ROOM 160. REFER TO SHEET E5.1.2 FOR CONTINUATION.
- TO DP-H11A LOCATED IN ROOM 160. REFER TO SHEET E5.1.2 FOR CONTINUATION.
- TO DP-H11B LOCATED IN ROOM 160. REFER TO SHEET E5.1.2 FOR CONTINUATION.
- TO FIRE PUMP CONTROLLER LOCATED IN ROOM 162. REFER TO SHEET E5.1.3 FOR CONTINUATION AND FEEDER SIZE.
- TO SWBD-EMER LOCATED IN ROOM 658. REFER TO SHEET E5.1.3 FOR CONTINUATION.
- FIRE PUMP DISCONNECT SWITCH SHALL BE SUITABLE FOR USE AS SERVICE EQUIPMENT, CAPABLE OF BEING LOCKED ON, FACTORY-PAINTED RED AND CLEARLY LABELED PER THE NEC.
- CIRCUIT BREAKER SHALL BE SUITABLE FOR BACKFEED OPERATION. LOCATE BREAKER ON PANELBOARD BUS AT OPPOSITE END FROM MAIN BREAKER.
- CIRCUIT BREAKER SHALL BE SUITABLE FOR BACKFEED OPERATION.
- MOUNT INSIDE PANELBOARD.

STATE OF MICHIGAN  
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FACILITIES AND BUSINESS SERVICES ADMINISTRATION  
DESIGN AND CONSTRUCTION DIVISION  
ROBERT C. HALL, III, P.E., NCARB DIRECTOR

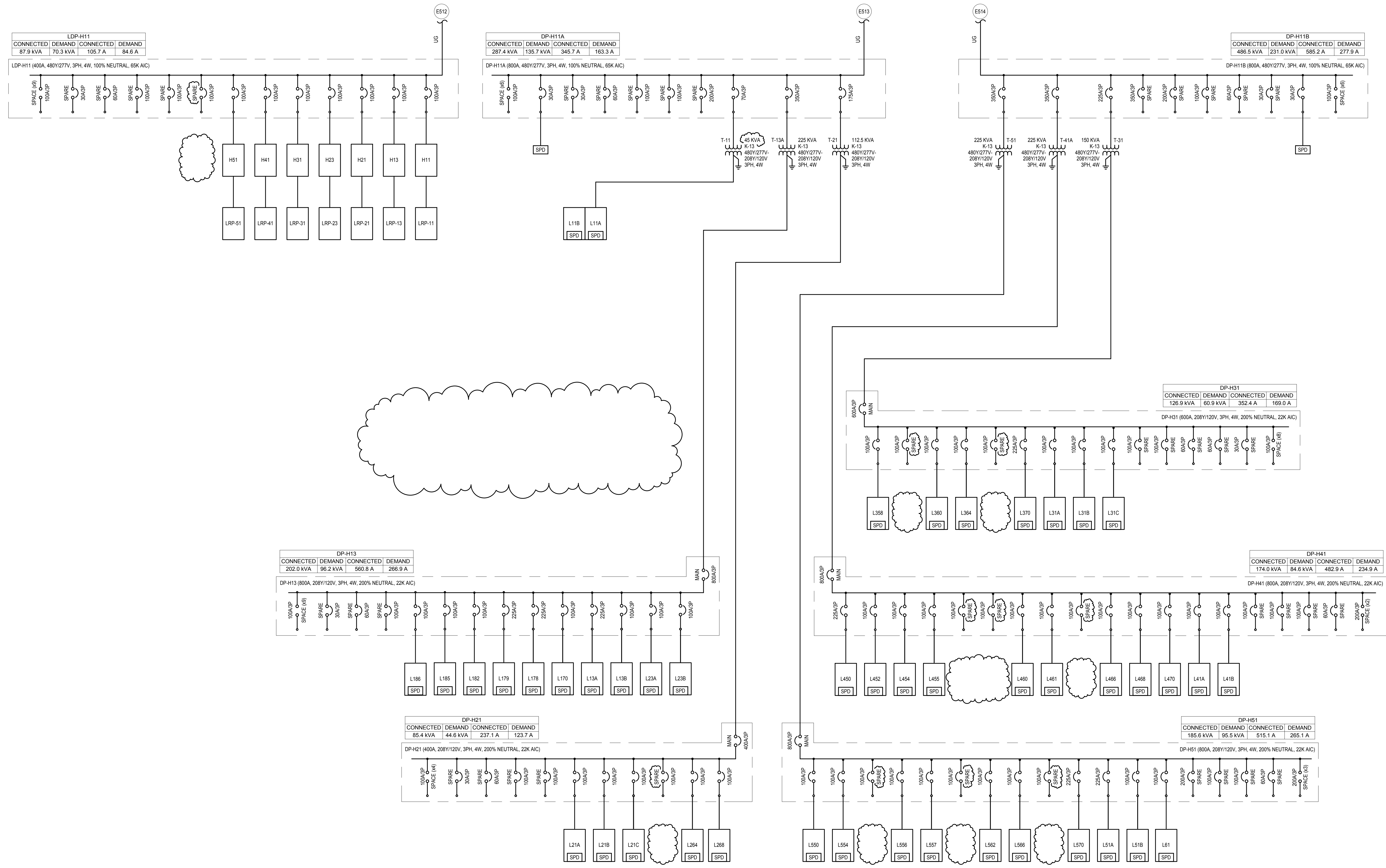
**OAKLAND UNIVERSITY**

**SMITHGROUP JJR**  
ENGINEERING CENTER  
ELECTRICAL ONE-LINE DIAGRAM

SHEET NO.	IDENTIFICATION NO.	ISSUED FOR	DATE	DESIGNED	MPP	ISSUED FOR	
						PRELIMINARY	CONSTRUCTION
E5.1.1	FILE NO. 33211155.DWG	2007/12	2007/12	DRAWN	KIM	ISSUE 1	2007/12
	FIRE SAFETY NO. XXXX-XX	2007/12	2007/12	CHECKED	MUM	ISSUE 4	2007/12
	OU PROJECT NO. 70484	2007/12	2007/12	APPROVED	MUM	ISSUE 5	2007/12
	SG PROJECT NO. 22645-000	2007/12	2007/12			ISSUE 6	2007/12
							ISSUE 9

SHEET NOTES

A REFER TO SHEET NOTES ON SHEET E5.1.1.



KEYED NOTES

- E512 TO SUBSTATION FEEDER BREAKER B4. REFER TO SHEET E5.1.1 FOR CONTINUATION.
- E513 TO SUBSTATION FEEDER BREAKER B3. REFER TO SHEET E5.1.1 FOR CONTINUATION.
- E514 TO SUBSTATION FEEDER BREAKER B2. REFER TO SHEET E5.1.1 FOR CONTINUATION.

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SMITHGROUP JJR

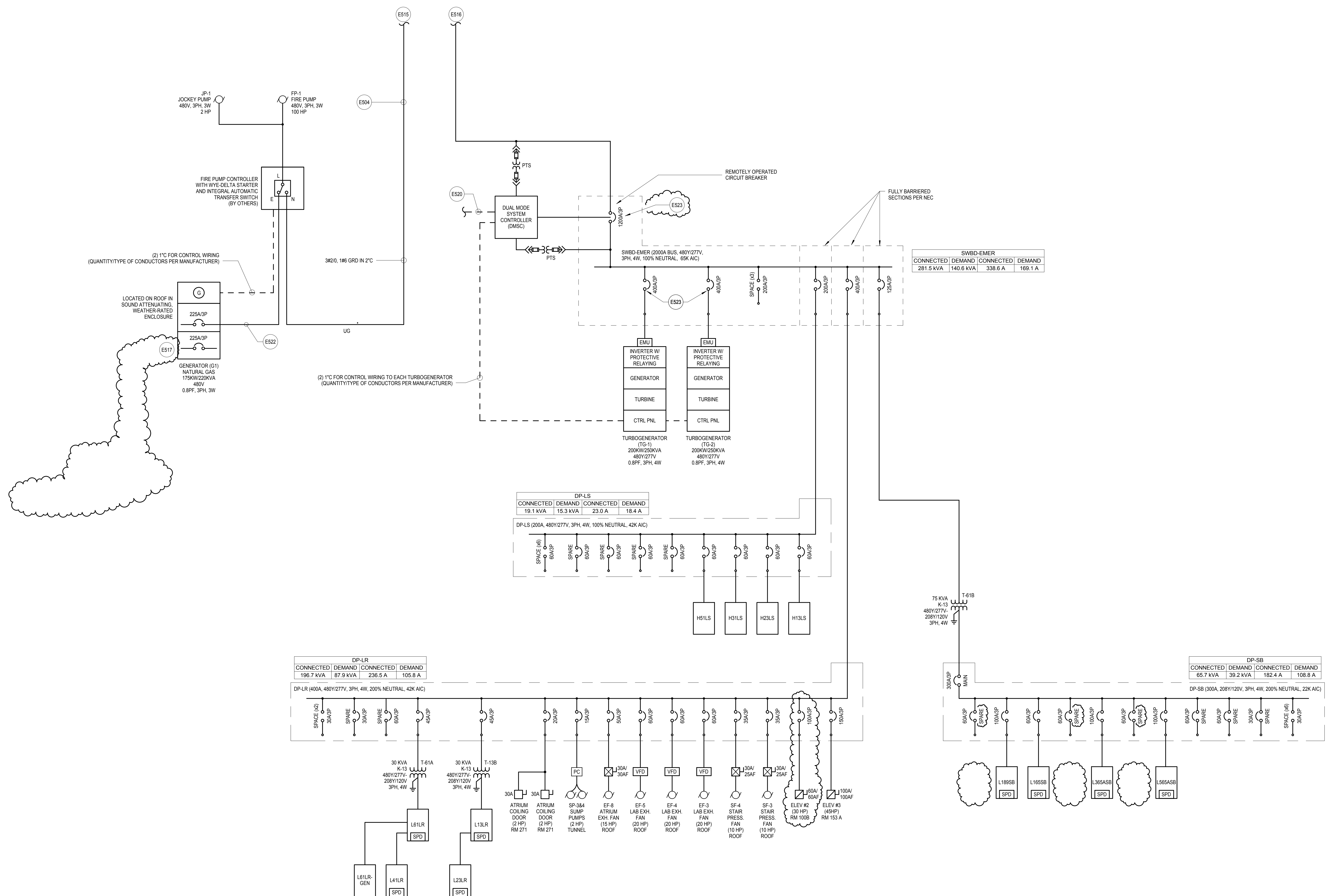
ENGINEERING CENTER  
ELECTRICAL ONE-LINE DIAGRAM

SHEET NO.	IDENTIFICATION NO.	ISSUED FOR	DATE	DESIGNED	MPN	ISSUED FOR
	FILE NO. 33211155-RE3	PRELIMINARY		DRAWN	KIM	2002/12
E5.1.2	FIRE SAFETY NO. XXXX-XX	CONSTRUCTION		CHECKED	MUM	14/07/12
	OU PROJECT NO. 70484	FINAL RECORD		APPROVED	MUM	20/03/13
	SG PROJECT NO. 22645-000					



SHEET NOTES

A. REFER TO SHEET NOTES ON SHEET ES.1.1.



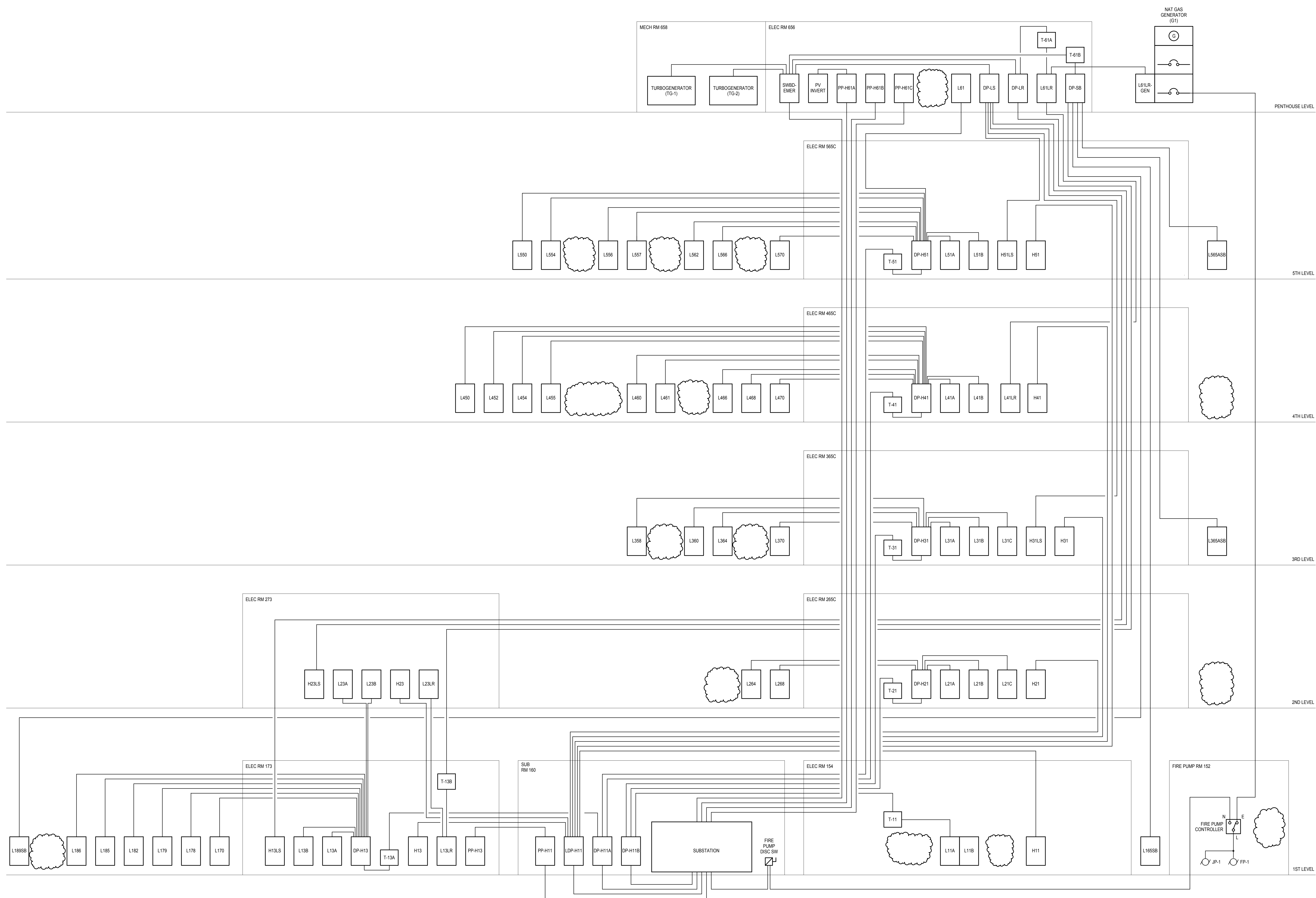
KEYED NOTES

- E504 ROUTE FIRE PUMP SUPPLY CONDUCTORS UNDERNEATH THE BUILDING. ENCASE IN A MINIMUM OF TWO INCHES OF CONCRETE.
- E515 TO SUBSTATION FEEDER BREAKER #1 LOCATED IN ROOM 160. REFER TO SHEET ES.1.1 FOR CONTINUATION.
- E516 TO SUBSTATION FEEDER BREAKER #1 LOCATED IN ROOM 160. REFER TO SHEET ES.1.1 FOR CONTINUATION.
- E517 SPARE BREAKER FOR PORTABLE LOAD BANK. PROVIDE 1" CONDUIT TO EACH ELEVATOR CONTROLLER FOR PRE-TRANSFER SIGNAL (QUANTITY/TYPE OF CONDUCTORS PER MANUFACTURER).
- E522 ROUTE FEEDER THROUGH VERTICAL SHAFT. PROVIDE 2-HOUR FIRE WRAP FOR PORTIONS OF FEEDER NOT INSIDE SHAFT SPACE.
- E523 CIRCUIT BREAKER SHALL BE SUITABLE FOR BACKED OPERATION.

SHEET NOTES

A. REFER TO SHEET NOTES ON SHEET ES.1.1.

KEYED NOTES



Panelboard: H11

Location: ELEC 154
Supply From: LDP-H11
Mounting: Surface
Enclosure: Type 1

Volts: 480Y/277
Phases: 3
Wires: 4

A.I.C. Rating: 14,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Includes load classification and panel totals.

Panelboard: H13

Location: ELEC 173
Supply From: LDP-H11
Mounting: Surface
Enclosure: Type 1

Volts: 480Y/277
Phases: 3
Wires: 4

A.I.C. Rating: 14,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Includes load classification and panel totals.

Panelboard: H21

Location: ELEC 265C
Supply From: LDP-H11
Mounting: Surface
Enclosure: Type 1

Volts: 480Y/277
Phases: 3
Wires: 4

A.I.C. Rating: 14,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Includes load classification and panel totals.

Panelboard: H23

Location: ELEC 273
Supply From: LDP-H11
Mounting: Surface
Enclosure: Type 1

Volts: 480Y/277
Phases: 3
Wires: 4

A.I.C. Rating: 14,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Includes load classification and panel totals.

Panelboard: H31

Location: ELEC 365C
Supply From: LDP-H11
Mounting: Surface
Enclosure: Type 1

Volts: 480Y/277
Phases: 3
Wires: 4

A.I.C. Rating: 14,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Includes load classification and panel totals.

Panelboard: H41

Location: ELEC 465C
Supply From: LDP-H11
Mounting: Surface
Enclosure: Type 1

Volts: 480Y/277
Phases: 3
Wires: 4

A.I.C. Rating: 14,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Includes load classification and panel totals.

Panelboard: H51

Location: ELEC 565C
Supply From: LDP-H11
Mounting: Surface
Enclosure: Type 1

Volts: 480Y/277
Phases: 3
Wires: 4

A.I.C. Rating: 14,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Includes load classification and panel totals.



**Panelboard: L189SB**

Location: BDF 189  
Supply From: DP-SB  
Mounting: Surface  
Enclosure: Type 1

Volts: 208Y/120  
Phases: 3  
Wires: 4

A.I.C. Rating: 10,000  
Mains Type: MCB  
Bus Rating: 100 A  
MCB Rating: 100 A

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	Receptacle BDF 189	20 A	1	800 VA	540 VA			1	20 A	Receptacle BDF 189
3	Receptacle BDF 189	30 A	1		2000	2000		1	30 A	Receptacle BDF 189
5										
7	ACCU-6, PTAC-6	20 A	2	499 VA	499 VA			2	20 A	ACCU-5,PTAC-5
9	Receptacle TCOMM 187	20 A	1		800 VA	540 VA		1	20 A	Receptacle TCOMM 187
11	Receptacle TCOMM 187	30 A	1					1	30 A	Receptacle TCOMM 187
13	Spare	20 A	1	0 VA	0 VA			1	20 A	Spare
15	Spare	20 A	1		0 VA	0 VA		1	20 A	Spare
17	Spare	20 A	1					1	20 A	Spare
19	Spare	20 A	1	0 VA	0 VA			1	20 A	Spare
21	Spare	20 A	1		0 VA	0 VA		1	20 A	Spare
23	Space	--	--					--	--	Space
25	Space	--	--	0 VA	0 VA			--	--	Space
27	Space	--	--		0 VA	0 VA		--	--	Space
29	Space	--	--					--	--	Space
				<b>Total Load:</b>	2338 VA	5340 VA			4998 VA	
				<b>Total Amps:</b>	19 A	48 A			45 A	
Load Classification		Connected Load	Demand Factor	Estimated Demand		Panel Totals				
Receptacle		10680 VA	96.82%	10340 VA		Total Conn. Load: 12676 VA				
Mechanical Equipment		1996 VA	60.00%	1198 VA		Total Est. Demand: 11538 VA				
						Total Conn.: 35 A				
						Total Est. Demand: 32 A				
<b>Notes:</b>										

**Panelboard: L365ASB**

Location: TCOMM 365A  
Supply From: DP-SB  
Mounting: Surface  
Enclosure: Type 1

Volts: 208Y/120  
Phases: 3  
Wires: 4

A.I.C. Rating: 10,000  
Mains Type: MCB  
Bus Rating: 100 A  
MCB Rating: 100 A

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	Receptacle TCOMM 365A	20 A	1	1080	540 VA			1	20 A	Receptacle TCOMM 365A
3	Receptacle TCOMM 365A	30 A	1		2000	2000		1	30 A	Receptacle TCOMM 365A
5	Receptacle ELEC 365C	20 A	1			180 VA	2000	1	30 A	Receptacle TCOMM 365A
7	ACCU-9,PTAC-9	20 A	2	1560	1664			2	20 A	ACCU-8,PTAC-8
9					1560	1664				
11	Receptacle ELEC 265C	20 A	1			180 VA	540 VA	1	20 A	Receptacle TCOMM 265A
13	Receptacle TCOMM 265A	20 A	1	1200	2000			1	30 A	Receptacle TCOMM 265A
15	Receptacle TCOMM 265A	30 A	1		2000	2000		1	30 A	Receptacle TCOMM 265A
17	Spare	20 A	1			0 VA	0 VA	1	20 A	Spare
19	Spare	20 A	1	0 VA	0 VA			1	20 A	Spare
21	Spare	20 A	1		0 VA	0 VA		1	20 A	Spare
23	Spare	20 A	1		0 VA	0 VA		1	20 A	Spare
25	Space	--	--	0 VA	0 VA			--	--	Space
27	Space	--	--		0 VA	0 VA		--	--	Space
29	Space	--	--			0 VA	0 VA	--	--	Space
				<b>Total Load:</b>	8044 VA	11224 VA			2900 VA	
				<b>Total Amps:</b>	74 A	100 A			24 A	
Load Classification		Connected Load	Demand Factor	Estimated Demand		Panel Totals				
Receptacle		15720 VA	81.81%	12860 VA		Total Conn. Load: 22168 VA				
Mechanical Equipment		6448 VA	60.00%	3869 VA		Total Est. Demand: 16729 VA				
						Total Conn.: 62 A				
						Total Est. Demand: 46 A				
<b>Notes:</b>										

**Panelboard: L565ASB**

Location: TCOMM 565A  
Supply From: DP-SB  
Mounting: Surface  
Enclosure: Type 1

Volts: 208Y/120  
Phases: 3  
Wires: 4

A.I.C. Rating: 10,000  
Mains Type: MCB  
Bus Rating: 100 A  
MCB Rating: 100 A

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	Receptacle TCOMM 565A	20 A	1	540 VA	1080			1	20 A	Receptacle TCOMM 565A
3	Receptacle TCOMM 565A	30 A	1		2000	2000		1	30 A	Receptacle TCOMM 565A
5	Receptacle ELEC 565C	20 A	1			180 VA	2000	1	30 A	Receptacle TCOMM 565A
7	Spare	20 A	1	0 VA	447 VA			1	20 A	ACCU-11,PTAC-11
9	Spare	20 A	1		0 VA	447 VA		2	20 A	
11	Spare	20 A	1			0 VA	0 VA	1	20 A	Spare
13	Receptacle TCOMM 465A	20 A	1	540 VA	1080			1	20 A	Receptacle TCOMM 465A
15	Receptacle TCOMM 465A	30 A	1		2000	2000		1	30 A	Receptacle TCOMM 465A
17	Receptacle ELEC 465C	20 A	1			180 VA	2000	1	30 A	Receptacle TCOMM 465A
19								1	20 A	Spare
21	ACCU-10,PTAC-10	20 A	2	447 VA	0 VA			1	20 A	Spare
23	Spare	20 A	1		447 VA	0 VA		1	20 A	Spare
25	Spare	20 A	1	0 VA	0 VA			1	20 A	Spare
27	Space	--	--		0 VA	0 VA		--	--	Space
29	Space	--	--			0 VA	0 VA	--	--	Space
				<b>Total Load:</b>	4134 VA	8894 VA			4360 VA	
				<b>Total Amps:</b>	34 A	74 A			37 A	
Load Classification		Connected Load	Demand Factor	Estimated Demand		Panel Totals				
Receptacle		15600 VA	82.05%	12800 VA		Total Conn. Load: 17388 VA				
Mechanical Equipment		1788 VA	60.00%	1073 VA		Total Est. Demand: 13873 VA				
						Total Conn.: 48 A				
						Total Est. Demand: 39 A				
<b>Notes:</b>										

**Panelboard: L165SB**

Location: TCOMM/ BDF ROOM 165  
Supply From: DP-SB  
Mounting: Surface  
Enclosure: Type 1

Volts: 208Y/120  
Phases: 3  
Wires: 4

A.I.C. Rating: 10,000  
Mains Type: MCB  
Bus Rating: 100 A  
MCB Rating: 60 A

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	Receptacle TCOMM/ BDF ROOM 165	20 A	1	800 VA	540 VA			1	20 A	Receptacle TCOMM/ BDF ROOM 165
3					1664	800 VA		1	20 A	Receptacle TCOMM/ BDF ROOM 165
5	ACCU-7,PTAC-7	20 A	2			1664	2000	1	20 A	Receptacle TCOMM/ BDF ROOM 165
7	Receptacle TCOMM/ BDF ROOM 165	20 A	1	2000	2000			1	20 A	Receptacle TCOMM/ BDF ROOM 165
9	Receptacle TCOMM/ BDF ROOM 165	20 A	1			2000	0 VA	1	20 A	Spare
11	Spare	20 A	1				0 VA	1	20 A	Spare
				<b>Total Load:</b>	5340 VA	4464 VA			3664 VA	
				<b>Total Amps:</b>	46 A	38 A			31 A	
Load Classification		Connected Load	Demand Factor	Estimated Demand		Panel Totals				
Receptacle		10140 VA	99.31%	10070 VA		Total Conn. Load: 13468 VA				
Mechanical Equipment		3328 VA	60.00%	1997 VA		Total Est. Demand: 12067 VA				
						Total Conn.: 37 A				
						Total Est. Demand: 33 A				
<b>Notes:</b>										



Panelboard: L11A

Location: ELEC 154
Supply From:
Mounting: Surface
Enclosure: Type 1
Volts: 208Y/120
Phases: 3
Wires: 4
A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 225 A
MCB Rating: -

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various electrical loads and their specifications.

Summary table with columns: Load Classification, Connected Load, Demand Factor, Estimated Demand, Panel Totals. Includes totals for Power, Receptacle, and Mechanical Equipment.

Notes:

Panelboard: L11B

Location: ELEC 154
Supply From:
Mounting: Surface
Enclosure: Type 1
Volts: 208Y/120
Phases: 3
Wires: 4
A.I.C. Rating: 10,000
Mains Type: MLO
Bus Rating: 225 A
MCB Rating: -

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various electrical loads and their specifications.

Summary table with columns: Load Classification, Connected Load, Demand Factor, Estimated Demand, Panel Totals. Includes totals for Power and Receptacle.

Notes:

Panelboard: L13A

Location: ELEC 173
Supply From: DP-H13
Mounting: Surface
Enclosure: Type 1
Volts: 208Y/120
Phases: 3
Wires: 4
A.I.C. Rating: 10,000
Mains Type: MLO
Bus Rating: 225 A
MCB Rating: -

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various electrical loads and their specifications.

Summary table with columns: Load Classification, Connected Load, Demand Factor, Estimated Demand, Panel Totals. Includes totals for Lighting, Power, Receptacle, and Mechanical Equipment.

Notes:

Panelboard: L13B

Location: ELEC 173
Supply From: DP-H13
Mounting: Surface
Enclosure: Type 1
Volts: 208Y/120
Phases: 3
Wires: 4
A.I.C. Rating: 10,000
Mains Type: MLO
Bus Rating: 225 A
MCB Rating: -

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various electrical loads and their specifications.

Summary table with columns: Load Classification, Connected Load, Demand Factor, Estimated Demand, Panel Totals. Includes totals for Power and Receptacle.

Notes:

Panelboard: L21B

Location: ELEC 265C
Supply From: DP-H21
Mounting: Surface
Enclosure: Type 1
Volts: 208Y/120
Phases: 3
Wires: 4
A.I.C. Rating: 10,000
Mains Type: MLO
Bus Rating: 100 A
MCB Rating: -

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various electrical loads and their specifications.

Summary table with columns: Load Classification, Connected Load, Demand Factor, Estimated Demand, Panel Totals. Includes totals for Power, Receptacle, and Mechanical Equipment.

Notes:

Panelboard: L21C

Location: ELEC 265C
Supply From: DP-H21
Mounting: Surface
Enclosure: Type 1
Volts: 208Y/120
Phases: 3
Wires: 4
A.I.C. Rating: 10,000
Mains Type: MLO
Bus Rating: 100 A
MCB Rating: -

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various electrical loads and their specifications.

Summary table with columns: Load Classification, Connected Load, Demand Factor, Estimated Demand, Panel Totals. Includes totals for Power and Receptacle.

Notes:

Panelboard: L21A

Location: ELEC 265C
Supply From: DP-H21
Mounting: Surface
Enclosure: Type 1
Volts: 208Y/120
Phases: 3
Wires: 4
A.I.C. Rating: 10,000
Mains Type: MLO
Bus Rating: 100 A
MCB Rating: -

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various electrical loads and their specifications.

Summary table with columns: Load Classification, Connected Load, Demand Factor, Estimated Demand, Panel Totals. Includes totals for Power and Receptacle.

Notes:

Panelboard: L185

Location: SHOP/SAE STORAGE 185
Supply From: DP-H13
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various electrical loads like Vertical Contour Saw, Receptacle SHOP/SAE STORAGE 185, etc.

Summary table with columns: Load Classification, Connected Load, Demand Factor, Estimated Demand, Panel Totals. Includes Total Conn. Load, Total Est. Demand, and Total Conn. Amps.

Notes:

Panelboard: L23A

Location: ELEC 273
Supply From: DP-H13
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various electrical loads like Spare, Receptacle OUTDOOR TERRACE, etc.

Summary table with columns: Load Classification, Connected Load, Demand Factor, Estimated Demand, Panel Totals. Includes Total Conn. Load, Total Est. Demand, and Total Conn. Amps.

Notes:

Panelboard: L23B

Location: ELEC 273
Supply From: DP-H13
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various electrical loads like FAN FILTER, Receptacle 50 SEAT CLASSROOM, etc.

Summary table with columns: Load Classification, Connected Load, Demand Factor, Estimated Demand, Panel Totals. Includes Total Conn. Load, Total Est. Demand, and Total Conn. Amps.

Notes:

Panelboard: L31A

Location: ELEC 365C
Supply From: DP-H31
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MLO
Bus Rating: 100 A
MCB Rating: -

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various electrical loads like Receptacle Room 348, 346, 344, 342, 340, 338, etc.

Summary table with columns: Load Classification, Connected Load, Demand Factor, Estimated Demand, Panel Totals. Includes Total Conn. Load, Total Est. Demand, and Total Conn. Amps.

Notes:

Panelboard: L31B

Location: ELEC 365C
Supply From: DP-H31
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MLO
Bus Rating: 100 A
MCB Rating: -

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various electrical loads like Receptacle Room 301K, 316, 318, 314, 312, etc.

Summary table with columns: Load Classification, Connected Load, Demand Factor, Estimated Demand, Panel Totals. Includes Total Conn. Load, Total Est. Demand, and Total Conn. Amps.

Notes:

Panelboard: L31C

Location: ELEC 365C
Supply From: DP-H31
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MLO
Bus Rating: 100 A
MCB Rating: -

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various electrical loads like Receptacle FACULTY LOUNGE/COPY 321, etc.

Summary table with columns: Load Classification, Connected Load, Demand Factor, Estimated Demand, Panel Totals. Includes Total Conn. Load, Total Est. Demand, and Total Conn. Amps.

Notes:

Panelboard: L41A. Location: ELEC 465C. Supply From: DP-H41. Mounting: Surface. Enclosure: Type 1. Volts: 208Y120. Phases: 3. Wires: 4. A.I.C. Rating: 10,000. Mains Type: MLO. Bus Rating: 100 A. MCB Rating: -.

Panelboard: L41B. Location: ELEC 465C. Supply From: DP-H41. Mounting: Surface. Enclosure: Type 1. Volts: 208Y120. Phases: 3. Wires: 4. A.I.C. Rating: 10,000. Mains Type: MLO. Bus Rating: 100 A. MCB Rating: -.

Panelboard: L170. Location: SOPHOMORE DESIGN LAB 170. Supply From: DP-H13. Mounting: Surface. Enclosure: Type 1. Volts: 208Y120. Phases: 3. Wires: 4. A.I.C. Rating: 10,000. Mains Type: MCB. Bus Rating: 100 A. MCB Rating: 100 A.

Panelboard: L51A. Location: ELEC 565C. Supply From: DP-H51. Mounting: Surface. Enclosure: Type 1. Volts: 208Y120. Phases: 3. Wires: 4. A.I.C. Rating: 10,000. Mains Type: MLO. Bus Rating: 225 A. MCB Rating: -.

Panelboard: L51B. Location: ELEC 565C. Supply From: DP-H51. Mounting: Surface. Enclosure: Type 1. Volts: 208Y120. Phases: 3. Wires: 4. A.I.C. Rating: 10,000. Mains Type: MLO. Bus Rating: 100 A. MCB Rating: -.

Panelboard: L179. Location: MACHINE SHOP 179. Supply From: DP-H13. Mounting: Surface. Enclosure: Type 1. Volts: 208Y120. Phases: 3. Wires: 4. A.I.C. Rating: 10,000. Mains Type: MCB. Bus Rating: 225 A. MCB Rating: 225 A.

Panelboard: L178. Location: SENIOR PROJECT LAB 178. Supply From: DP-H13. Mounting: Surface. Enclosure: Type 1. Volts: 208Y120. Phases: 3. Wires: 4. A.I.C. Rating: 10,000. Mains Type: MCB. Bus Rating: 225 A. MCB Rating: 225 A.

Panelboard: L182. Location: MECHATRONICS 182. Supply From: DP-H13. Mounting: Surface. Enclosure: Type 1. Volts: 208Y120. Phases: 3. Wires: 4. A.I.C. Rating: 10,000. Mains Type: MCB. Bus Rating: 100 A. MCB Rating: 100 A.

Panelboard: L186. Location: SAE 186. Supply From: DP-H13. Mounting: Surface. Enclosure: Type 1. Volts: 208Y120. Phases: 3. Wires: 4. A.I.C. Rating: 10,000. Mains Type: MCB. Bus Rating: 100 A. MCB Rating: 100 A.

STATE OF MICHIGAN DEPARTMENT OF TECHNOLOGY, MANAGEMENT AND BUDGET FACILITIES AND BUSINESS SERVICES ADMINISTRATION ROBERT C. HALL, R.A., NCARB DIRECTOR. OAKLAND UNIVERSITY SMITHGROUP JIR ENGINEERING CENTER PANEL SCHEDULES. ISSUED FOR: DESIGN, BIDDING, CONSTRUCTION, FINAL RECORD. SHEET NO. E8-4. IDENTIFICATION NO. FILE NO. 200715-0001-0001.0001. FIRE SAFETY NO. XXXXX. OUI PROJECT NO. 70484. I&S PROJECT NO. 22646-000.

Panelboard: L264

Location: CHARACTERIZATION LAB 264
Supply From: DP-H21
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various receptacle and power circuits for Characterization Lab 264.

Load Classification table showing Connected Load, Demand Factor, Estimated Demand, and Panel Totals for Panelboard L264.

Notes:

Panelboard: L360

Location: FLUIDS LAB 360
Supply From: DP-H31
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various receptacle and power circuits for Fluids Lab 360.

Load Classification table showing Connected Load, Demand Factor, Estimated Demand, and Panel Totals for Panelboard L360.

Notes:

Panelboard: L370

Location: ENERGY LAB 370
Supply From: DP-H31
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 225 A
MCB Rating: 225 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various receptacle and power circuits for Energy Lab 370.

Load Classification table showing Connected Load, Demand Factor, Estimated Demand, and Panel Totals for Panelboard L370.

Notes:

Panelboard: L358

Location: THERMO LAB 358
Supply From: DP-H31
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various receptacle and power circuits for Thermo Lab 358.

Load Classification table showing Connected Load, Demand Factor, Estimated Demand, and Panel Totals for Panelboard L358.

Notes:

Panelboard: L364

Location: BIO ENGINEERING DRY LAB
Supply From: DP-H31
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various receptacle and power circuits for Bio Engineering Dry Lab.

Load Classification table showing Connected Load, Demand Factor, Estimated Demand, and Panel Totals for Panelboard L364.

Notes:

Panelboard: L450

Location: POWER & MACHINES LAB 450
Supply From: DP-H41
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 225 A
MCB Rating: 225 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various receptacle and power circuits for Power & Machines Lab 450.

Load Classification table showing Connected Load, Demand Factor, Estimated Demand, and Panel Totals for Panelboard L450.

Notes:





Panelboard: L452

Location: GENERIC RESEARCH LAB 452
Supply From: DP-H41
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with 15 columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists 41 circuits including receptacles and spares for various labs.

Total Load: 3420 VA, 29 A
Total Amps: 29 A

Load Classification table with columns: Connected Load, Demand Factor, Estimated Demand, Panel Totals. Shows total connected load of 3420 VA and total estimated demand of 28 A.

Notes:

Panelboard: L454

Location: GENERIC RESEARCH LAB 454
Supply From: DP-H41
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with 15 columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists 41 circuits including receptacles and spares for various labs.

Total Load: 5040 VA, 43 A
Total Amps: 43 A

Load Classification table with columns: Connected Load, Demand Factor, Estimated Demand, Panel Totals. Shows total connected load of 5040 VA and total estimated demand of 20 A.

Notes:

Panelboard: L455

Location: ELECTRONICS CLASS LAB 455
Supply From: DP-H41
Mounting: FLUSH
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with 15 columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists 42 circuits including receptacles and spares for electronics labs.

Total Load: 2520 VA, 21 A
Total Amps: 21 A

Load Classification table with columns: Connected Load, Demand Factor, Estimated Demand, Panel Totals. Shows total connected load of 4680 VA and total estimated demand of 14 A.

Notes:

Panelboard: L460

Location: STATICS & DYNAMICS 460
Supply From: DP-H41
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with 15 columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists 42 circuits including receptacles and spares for statics and dynamics labs.

Total Load: 5580 VA, 47 A
Total Amps: 47 A

Load Classification table with columns: Connected Load, Demand Factor, Estimated Demand, Panel Totals. Shows total connected load of 5580 VA and total estimated demand of 37 A.

Notes:

Panelboard: L466

Location: CAD/CATIA LAB 466
Supply From: DP-H41
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with 15 columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists 42 circuits including receptacles and spares for CAD/CATIA labs.

Total Load: 9000 VA, 75 A
Total Amps: 75 A

Load Classification table with columns: Connected Load, Demand Factor, Estimated Demand, Panel Totals. Shows total connected load of 20880 VA and total estimated demand of 43 A.

Notes:

Panelboard: L461

Location: ADVANCED CAD SIMULATION
Supply From: DP-H41
Mounting: FLUSH
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Mains Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with 15 columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists 42 circuits including receptacles and spares for advanced CAD simulation labs.

Total Load: 4320 VA, 39 A
Total Amps: 39 A

Load Classification table with columns: Connected Load, Demand Factor, Estimated Demand, Panel Totals. Shows total connected load of 9900 VA and total estimated demand of 29 A.

Notes:



**Panelboard: L468**

Location: MATERIALS LAB 468  
Supply From: DP-H41  
Mounting: Surface  
Enclosure: Type 1

Volts: 208Y/120  
Phases: 3  
Wires: 4

A.I.C. Rating: 10,000  
Main Type: MCB  
Bus Rating: 100 A  
MCB Rating: 100 A

CKT	Circuit Description	Tripp	Poles	A	B	C	Poles	Tripp	Circuit Description	CKT		
1	Receptacle MATERIALS LAB 468	20 A	1	720 VA	720 VA		1	20 A	Receptacle MATERIALS LAB 468	2		
3	Receptacle MATERIALS LAB 468	20 A	1		720 VA	720 VA		1	20 A	Receptacle MATERIALS LAB 468	4	
5	Receptacle MATERIALS LAB 468	20 A	1			900 VA	900 VA	1	20 A	Receptacle MATERIALS LAB 468	6	
7	Receptacle MATERIALS LAB 468	20 A	1	900 VA	720 VA			1	20 A	Receptacle MATERIALS LAB 468	8	
9	Receptacle MATERIALS LAB 468	20 A	2		300 VA	300 VA		2	20 A	Receptacle MATERIALS LAB 468	10	
11						300 VA	300 VA				12	
13	Receptacle MATERIALS LAB 468	20 A	2	300 VA	300 VA			2	20 A	Receptacle MATERIALS LAB 468	14	
15											16	
17	Receptacle MATERIALS LAB 468	20 A	2	300 VA	180 VA			1	20 A	Receptacle MATERIALS LAB 468	18	
19								1	20 A	Receptacle MATERIALS LAB 468	20	
21	Power MATERIALS LAB 468	20 A	1		180 VA	180 VA		1	20 A	Power MATERIALS LAB 468	22	
23	Power MATERIALS LAB 468	20 A	1			180 VA	180 VA		1	20 A	Power MATERIALS LAB 468	24
25	Power MATERIALS LAB 468	20 A	1	180 VA	180 VA			1	20 A	Power MATERIALS LAB 468	26	
27	Power MATERIALS LAB 468	20 A	1		180 VA	180 VA		1	20 A	Power MATERIALS LAB 468	28	
29	Spare	20 A	1			0 VA	0 VA		1	20 A	Spare	30
31	Spare	20 A	1	0 VA	0 VA				1	20 A	Spare	32
33	Spare	20 A	1		0 VA	0 VA			1	20 A	Spare	34
35	Spare	20 A	1			0 VA	0 VA		1	20 A	Spare	36
37	Spare	20 A	1	0 VA	0 VA				1	20 A	Spare	38
39	Spare	20 A	1		0 VA	0 VA			1	20 A	Spare	40
41	Spare	20 A	1			0 VA	0 VA		1	20 A	Spare	42

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
Power	1440 VA	30.00%	432 VA	
Receptacle	9660 VA	100.00%	9660 VA	
				Total Conn. Load: 11100 VA
				Total Est. Demand: 10092 VA
				Total Conn.: 31 A
				Total Est. Demand: 28 A

Notes:

**Panelboard: L470**

Location: TRIBOLOGY LAB 470  
Supply From: DP-H41  
Mounting: Surface  
Enclosure: Type 1

Volts: 208Y/120  
Phases: 3  
Wires: 4

A.I.C. Rating: 10,000  
Main Type: MCB  
Bus Rating: 100 A  
MCB Rating: 100 A

CKT	Circuit Description	Tripp	Poles	A	B	C	Poles	Tripp	Circuit Description	CKT			
1	Receptacle TRIBOLOGY LAB 470	20 A	1	900 VA	900 VA		1	20 A	Receptacle TRIBOLOGY LAB 470	2			
3	Receptacle TRIBOLOGY LAB 470	20 A	2		300 VA	300 VA		2	20 A	Receptacle TRIBOLOGY LAB 470	4		
5						300 VA	300 VA				6		
7	Power TRIBOLOGY LAB 470	20 A	1	1800	900 VA			1	20 A	Receptacle TRIBOLOGY LAB 470	8		
9	Receptacle TRIBOLOGY LAB 470	20 A	1		900 VA	300 VA		2	20 A	Receptacle TRIBOLOGY LAB 470	10		
11						300 VA	300 VA				12		
13	Receptacle TRIBOLOGY LAB 470	20 A	2	300 VA	180 VA			1	20 A	Receptacle TRIBOLOGY LAB 470	14		
15	Receptacle TRIBOLOGY LAB 470	20 A	1		180 VA	180 VA		1	20 A	Power TRIBOLOGY LAB 470	16		
17	Power TRIBOLOGY LAB 470	20 A	1			180 VA	180 VA		1	20 A	Power TRIBOLOGY LAB 470	18	
19	Power TRIBOLOGY LAB 470	20 A	1	180 VA	180 VA			1	20 A	Power TRIBOLOGY LAB 470	20		
21	Power TRIBOLOGY LAB 470	20 A	1		180 VA	180 VA		1	20 A	Power TRIBOLOGY LAB 470	22		
23	Power TRIBOLOGY LAB 470	20 A	1			180 VA	0 VA		1	20 A	Spare	24	
25	Spare	20 A	1	0 VA	0 VA				1	20 A	Spare	26	
27	Spare	20 A	1		0 VA	0 VA			1	20 A	Spare	28	
29	Spare	20 A	1		0 VA	0 VA		0 VA	0 VA	1	20 A	Spare	30
31	Spare	20 A	1	0 VA	0 VA				1	20 A	Spare	32	
33	Spare	20 A	1		0 VA	0 VA			1	20 A	Spare	34	
35	Spare	20 A	1			0 VA	0 VA		1	20 A	Spare	36	
37	Spare	20 A	1	0 VA	0 VA				1	20 A	Spare	38	
39	Spare	20 A	1		0 VA	0 VA			1	20 A	Spare	40	
41	Spare	20 A	1			0 VA	0 VA		1	20 A	Spare	42	

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
Power	3240 VA	30.00%	972 VA	
Receptacle	6360 VA	100.00%	6360 VA	
				Total Conn. Load: 9600 VA
				Total Est. Demand: 7332 VA
				Total Conn.: 27 A
				Total Est. Demand: 20 A

Notes:

**Panelboard: L550**

Location: COMPUTING LAB 550  
Supply From: DP-H51  
Mounting: Surface  
Enclosure: Type 1

Volts: 208Y/120  
Phases: 3  
Wires: 4

A.I.C. Rating: 10,000  
Main Type: MCB  
Bus Rating: 100 A  
MCB Rating: 100 A

CKT	Circuit Description	Tripp	Poles	A	B	C	Poles	Tripp	Circuit Description	CKT			
1	Receptacle COMPUTING LAB 550	20 A	1	180 VA	720 VA			1	20 A	Receptacle COMPUTING LAB 550	2		
3	Receptacle COMPUTING LAB 550	20 A	1		1440	720 VA		1	20 A	Receptacle COMPUTING LAB 550	4		
5	Receptacle COMPUTING LAB 550	20 A	1			1440	720 VA		1	20 A	Receptacle COMPUTING LAB 550	6	
7	Receptacle COMPUTING LAB 550	20 A	1	1440	720 VA			1	20 A	Receptacle COMPUTING LAB 550	8		
9	Receptacle COMPUTING LAB 550	20 A	1		1440	540 VA		1	20 A	Receptacle COMPUTING LAB 550	10		
11	Receptacle COMPUTING LAB 550	20 A	1			1440	1440		1	20 A	Receptacle COMPUTING LAB 550	12	
13	Receptacle COMPUTING LAB 550	20 A	1	1440	1440			1	20 A	Receptacle COMPUTING LAB 550	14		
15	Receptacle COMPUTING LAB 550	20 A	1		180 VA	0 VA			1	20 A	Spare	16	
17	Spare	20 A	1			0 VA	0 VA		1	20 A	Spare	18	
19	Spare	20 A	1	0 VA	0 VA				1	20 A	Spare	20	
21	Spare	20 A	1		0 VA	0 VA			1	20 A	Spare	22	
23	Spare	20 A	1			0 VA	0 VA		1	20 A	Spare	24	
25	Spare	20 A	1		0 VA	0 VA			1	20 A	Spare	26	
27	Spare	20 A	1		0 VA	0 VA			1	20 A	Spare	28	
29	Spare	20 A	1		0 VA	0 VA		0 VA	0 VA	1	20 A	Spare	30
31	Spare	20 A	1		0 VA	0 VA			1	20 A	Spare	32	
33	Spare	20 A	1		0 VA	0 VA			1	20 A	Spare	34	
35	Spare	20 A	1			0 VA	0 VA		1	20 A	Spare	36	
37	Spare	20 A	1	0 VA	0 VA				1	20 A	Spare	38	
39	Spare	20 A	1		0 VA	0 VA			1	20 A	Spare	40	
41	Spare	20 A	1			0 VA	0 VA		1	20 A	Spare	42	

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
Power	15300 VA		12650 VA	
Receptacle	15300 VA	82.68%	12650 VA	
				Total Conn. Load: 15300 VA
				Total Est. Demand: 12650 VA
				Total Conn.: 42 A
				Total Est. Demand: 35 A

Notes:

**Panelboard: L554**

Location: NETWORKING & SECURITY  
Supply From: DP-H51  
Mounting: Surface  
Enclosure: Type 1

Volts: 208Y/120  
Phases: 3  
Wires: 4

A.I.C. Rating: 10,000  
Main Type: MCB  
Bus Rating: 100 A  
MCB Rating: 100 A

CKT	Circuit Description	Tripp	Poles	A	B	C	Poles	Tripp	Circuit Description	CKT		
1	Receptacle NETWORKING & SECURITY LAB 554	20 A	1	540 VA	720 VA			1	20 A	Receptacle NETWORKING & SECURITY LAB 554	2	
3	Receptacle NETWORKING & SECURITY LAB 554	20 A	1		1440	720 VA		1	20 A	Receptacle NETWORKING & SECURITY LAB 554	4	
5	Receptacle NETWORKING & SECURITY LAB 554	20 A	1			1440	720 VA		1	20 A	Receptacle NETWORKING & SECURITY LAB 554	6
7	Receptacle NETWORKING & SECURITY LAB 554	20 A	1	1440	720 VA			1	20 A	Receptacle NETWORKING & SECURITY LAB 554	8	
9	Receptacle NETWORKING & SECURITY LAB 554	20 A	1		1440	720 VA		1	20 A	Receptacle NETWORKING & SECURITY LAB 554	10	
11	Receptacle NETWORKING & SECURITY LAB 554	20 A	1			1440	180 VA		1	20 A	Receptacle NETWORKING & SECURITY LAB 554	12
13	Receptacle NETWORKING & SECURITY LAB 554	20 A	1	180 VA	180 VA			1	20 A	Receptacle NETWORKING & SECURITY LAB 554	14	
15	Receptacle NETWORKING & SECURITY LAB 554	20 A	1		1440	180 VA		1	20 A	Receptacle NETWORKING & SECURITY LAB 554	16	
17	Receptacle NETWORKING & SECURITY LAB 554	20 A	1		1440	300 VA		1	20 A	Receptacle Room 555	18	
19	Receptacle NETWORKING & SECURITY LAB 554	20 A	1	1440	300 VA			1	20 A	Receptacle	20	
21	Receptacle NETWORKING & SECURITY LAB 554	20 A	1		1440	1440		1	20 A	Receptacle COMPUTING LAB 555	22	
23	Receptacle NETWORKING & SECURITY LAB 554	20 A	1			1440	1440		1	20 A	Receptacle COMPUTING LAB 555	24
25	Receptacle NETWORKING & SECURITY LAB 554	20 A	1	720 VA	1440			1	20 A	Receptacle NETWORKING & SECURITY LAB 554	26	
27	Receptacle COMPUTING LAB 555	20 A	1		720 VA	1440		1	20 A	Receptacle COMPUTING LAB 555	28	
29	Receptacle COMPUTING LAB 555	20 A	1		180 VA	180 VA		1	20 A	Receptacle COMPUTING LAB 555	30	
31	Receptacle COMPUTING LAB 555	20 A	1	360 VA	0 VA			0 A	Spare		32	
33	Spare	0 A	1		0 VA	0 VA			1	0 A	Spare	34
35	Spare	0 A	1			0 VA	0 VA		1	0 A	Spare	36
37	Spare	0 A	1	0 VA	0 VA				1	0 A	Spare	38
39	Spare	0 A	1		0 VA	0 VA			1	0 A	Spare	40
41	Spare	0 A	1			0 VA	0 VA		1	0 A	Spare	42

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
Receptacle	28440 VA	67.58%	19220 VA	
				Total Conn. Load: 28440 VA
				Total Est. Demand: 19220 VA
				Total Conn.: 79 A
				Total Est. Demand: 53 A

Notes:

**Panelboard: L557**

Location: HCI VISUAL COMPUTING LAB  
Supply From: DP-H51  
Mounting: Surface  
Enclosure: Type 1

Volts: 208Y/120  
Phases: 3  
Wires: 4

A.I.C. Rating: 10,000  
Main Type: MCB  
Bus Rating: 100 A  
MCB Rating: 100 A

CKT	Circuit Description	Tripp	Poles	A	B	C	Poles	Tripp	Circuit Description	CKT		
1	Receptacle HCI VISUAL COMPUTING LAB 557	20 A	1	720 VA	720 VA			1	20 A	Receptacle HCI VISUAL COMPUTING LAB 557	2	
3	Receptacle HCI VISUAL COMPUTING LAB 557	20 A	1		720 VA	540 VA		1	20 A	Receptacle HCI VISUAL COMPUTING LAB 557	4	
5	Receptacle HCI VISUAL COMPUTING LAB 557	20 A	1			720 VA	720 VA		1	20 A	Receptacle HCI VISUAL COMPUTING LAB 557	6
7	Receptacle HCI VISUAL COMPUTING LAB 557	20 A	2	300 VA	180 VA			1	20 A	Receptacle	8	
9						300 VA	300 VA				10	
11	Receptacle HCI VISUAL COMPUTING LAB 557											

Panelboard: L566

Location: COMPUTING LAB 566
Supply From: DP-H51
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Main Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various receptacle and power loads for Computing Lab 566.

Total Load: 4680 VA, 39 A
Total Amps: 39 A

Load Classification table with columns: Connected Load, Demand Factor, Estimated Demand, Panel Totals. Shows total connected load of 13860 VA and estimated demand of 34 A.

Notes:

Panelboard: L570

Location: SHARF COMPUTER
Supply From: DP-H51
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Main Type: MCB
Bus Rating: 225 A
MCB Rating: 200 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists SHARF computer integrated and manifold loads for Lab 570.

Total Load: 5940 VA, 50 A
Total Amps: 50 A

Load Classification table with columns: Connected Load, Demand Factor, Estimated Demand, Panel Totals. Shows total connected load of 16500 VA and estimated demand of 37 A.

Notes:

Panelboard: L61

Location: ELEC 656
Supply From: DP-H51
Mounting: Surface
Enclosure: Type 1

Volts: 208Y/120
Phases: 3
Wires: 4

A.I.C. Rating: 10,000
Main Type: MCB
Bus Rating: 100 A
MCB Rating: 100 A

Table with columns: CKT, Circuit Description, Trip, Poles, A, B, C, Poles, Trip, Circuit Description, CKT. Lists various lighting, power, and mechanical equipment loads for Elec 656.

Total Load: 7762 VA, 66 A
Total Amps: 66 A

Load Classification table with columns: Connected Load, Demand Factor, Estimated Demand, Panel Totals. Shows total connected load of 9225 VA and estimated demand of 34 A.

Notes:





### Panelboard: H13LS

Location: ELEC 173  
Supply From: DP-LS  
Mounting: Surface  
Enclosure: Type 1  
Volts: 480Y/277  
Phases: 3  
Wires: 4  
A.I.C. Rating: 14,000  
Mains Type: MCB  
Bus Rating: 100 A  
MCB Rating: 60 A

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	
1	Lighting ELEVATOR CONTROL ROOM 150	20 A	1	2210	295 VA			1	20 A	Lighting CORRIDOR 193	2
3	Lighting PRE-FUNCTION 196	20 A	1		757 VA	962 VA		1	20 A	Lighting ELEC 173	4
5	Lighting	20 A	1					1	20 A	Lighting CORRIDOR 1197-1	6
7	Lighting Room 731	20 A	1	192 VA	64 VA			1	20 A	Lighting ELEV. 153A	8
9	Spare	20 A	1		0 VA	96 VA		1	20 A	Lighting ELEV. 100A	10
11	Spare	20 A	1			0 VA	0 VA	1	20 A	Spare	12
13	Spare	20 A	1	0 VA	0 VA			1	20 A	Spare	14
15	Spare	20 A	1		0 VA	0 VA		1	20 A	Spare	16
17	Spare	20 A	1			0 VA	0 VA	1	20 A	Spare	18
19	Spare	--	--	0 VA	0 VA			--	--	Space	20
21	Spare	--	--		0 VA	0 VA		--	--	Space	22
23	Spare	--	--			0 VA	0 VA	--	--	Space	24
25	Spare	--	--	0 VA	0 VA			--	--	Space	26
27	Spare	--	--		0 VA	0 VA		--	--	Space	28
29	Spare	--	--			0 VA	0 VA	--	--	Space	30
				Total Load:	2761 VA	1815 VA		1174 VA			
				Total Amps:	10 A	7 A		4 A			
<b>Load Classification</b>		<b>Connected Load</b>	<b>Demand Factor</b>	<b>Estimated Demand</b>	<b>Panel Totals</b>						
Lighting		5750 VA	80.00%	4600 VA	Total Conn. Load: 5750 VA						
					Total Est. Demand: 4600 VA						
					Total Conn.: 7 A						
					Total Est. Demand: 6 A						
<b>Notes:</b>											

### Panelboard: H23LS

Location: ELEC 273  
Supply From: DP-LS  
Mounting: Surface  
Enclosure: Type 1  
Volts: 480Y/277  
Phases: 3  
Wires: 4  
A.I.C. Rating: 14,000  
Mains Type: MCB  
Bus Rating: 100 A  
MCB Rating: 60 A

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	
1	Lighting	20 A	1	92 VA	702 VA			1	20 A	Lighting VESTIBULE 247	2
3	Lighting WAITING 255	20 A	1		719 VA	0 VA		1	20 A	Spare	4
5	Lighting Room 287, 212, 261X, 179F, 102-2, 297,	20 A	1			3455	0 VA	1	20 A	Spare	6
7	Spare	20 A	1	0 VA	0 VA			1	20 A	Spare	8
9	Spare	20 A	1		0 VA	0 VA		1	20 A	Spare	10
11	Spare	20 A	1			0 VA	0 VA	1	20 A	Spare	12
13	Spare	20 A	1	0 VA	0 VA			1	20 A	Spare	14
15	Spare	20 A	1		0 VA	0 VA		--	--	Space	16
17	Spare	--	--			0 VA	0 VA	--	--	Space	18
19	Spare	--	--	0 VA	0 VA			--	--	Space	20
21	Spare	--	--		0 VA	0 VA		--	--	Space	22
23	Spare	--	--			0 VA	0 VA	--	--	Space	24
25	Spare	--	--	0 VA	0 VA			--	--	Space	26
27	Spare	--	--		0 VA	0 VA		--	--	Space	28
29	Spare	--	--			0 VA	0 VA	--	--	Space	30
				Total Load:	794 VA	719 VA		3455 VA			
				Total Amps:	3 A	3 A		13 A			
<b>Load Classification</b>		<b>Connected Load</b>	<b>Demand Factor</b>	<b>Estimated Demand</b>	<b>Panel Totals</b>						
Lighting		4968 VA	80.00%	3975 VA	Total Conn. Load: 4968 VA						
					Total Est. Demand: 3975 VA						
					Total Conn.: 6 A						
					Total Est. Demand: 5 A						
<b>Notes:</b>											

### Panelboard: H31LS

Location: ELEC 355C  
Supply From: DP-LS  
Mounting: Surface  
Enclosure: Type 1  
Volts: 480Y/277  
Phases: 3  
Wires: 4  
A.I.C. Rating: 14,000  
Mains Type: MCB  
Bus Rating: 100 A  
MCB Rating: 60 A

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	
1	Lighting	20 A	1	1073	873 VA			1	20 A	Lighting CORRIDOR 393	2
3	Lighting STAIR #3 398	20 A	1		420 VA	0 VA		1	20 A	Spare	4
5	Spare	20 A	1			0 VA	0 VA	1	20 A	Spare	6
7	Spare	20 A	1	0 VA	0 VA			1	20 A	Spare	8
9	Spare	20 A	1		0 VA	0 VA		1	20 A	Spare	10
11	Spare	20 A	1			0 VA	0 VA	1	20 A	Spare	12
13	Spare	20 A	1	0 VA	0 VA			--	--	Space	14
15	Spare	--	--		0 VA	0 VA		--	--	Space	16
17	Spare	--	--			0 VA	0 VA	--	--	Space	18
19	Spare	--	--	0 VA	0 VA			--	--	Space	20
21	Spare	--	--		0 VA	0 VA		--	--	Space	22
23	Spare	--	--			0 VA	0 VA	--	--	Space	24
25	Spare	--	--	0 VA	0 VA			--	--	Space	26
27	Spare	--	--		0 VA	0 VA		--	--	Space	28
29	Spare	--	--			0 VA	0 VA	--	--	Space	30
				Total Load:	1947 VA	420 VA		0 VA			
				Total Amps:	7 A	2 A		0 A			
<b>Load Classification</b>		<b>Connected Load</b>	<b>Demand Factor</b>	<b>Estimated Demand</b>	<b>Panel Totals</b>						
Lighting		2367 VA	80.00%	1893 VA	Total Conn. Load: 2367 VA						
					Total Est. Demand: 1893 VA						
					Total Conn.: 3 A						
					Total Est. Demand: 2 A						
<b>Notes:</b>											

### Panelboard: H51LS

Location: ELEC 565C  
Supply From: DP-LS  
Mounting: Surface  
Enclosure: Type 1  
Volts: 480Y/277  
Phases: 3  
Wires: 4  
A.I.C. Rating: 14,000  
Mains Type: MCB  
Bus Rating: 100 A  
MCB Rating: 60 A

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	
1	Lighting CORRIDOR-2 493-2	20 A	1	1155	658 VA			1	20 A	Lighting MENS 465E	2
3	Lighting RECEPTION 546	20 A	1		1236	623 VA		1	20 A	Lighting MENS 565E	4
5	Lighting STAIR 651	20 A	1			2369	0 VA	1	20 A	Spare	6
7	Spare	20 A	1	0 VA	0 VA			1	20 A	Spare	8
9	Spare	20 A	1		0 VA	0 VA		1	20 A	Spare	10
11	Spare	20 A	1			0 VA	0 VA	1	20 A	Spare	12
13	Spare	20 A	1	0 VA	0 VA			1	20 A	Spare	14
15	Spare	20 A	1		0 VA	0 VA		--	--	Space	16
17	Spare	--	--			0 VA	0 VA	--	--	Space	18
19	Spare	--	--	0 VA	0 VA			--	--	Space	20
21	Spare	--	--		0 VA	0 VA		--	--	Space	22
23	Spare	--	--			0 VA	0 VA	--	--	Space	24
25	Spare	--	--	0 VA	0 VA			--	--	Space	26
27	Spare	--	--		0 VA	0 VA		--	--	Space	28
29	Spare	--	--			0 VA	0 VA	--	--	Space	30
31	Spare	--	--	0 VA	0 VA			--	--	Space	32
33	Spare	--	--		0 VA	0 VA		--	--	Space	34
35	Spare	--	--			0 VA	0 VA	--	--	Space	36
37	Spare	--	--	0 VA	0 VA			--	--	Space	38
39	Spare	--	--		0 VA	0 VA		--	--	Space	40
41	Spare	--	--			0 VA	0 VA	--	--	Space	42
				Total Load:	1814 VA	1859 VA		2369 VA			
				Total Amps:	7 A	7 A		9 A			
<b>Load Classification</b>		<b>Connected Load</b>	<b>Demand Factor</b>	<b>Estimated Demand</b>	<b>Panel Totals</b>						
Lighting		6041 VA	80.00%	4833 VA	Total Conn. Load: 6041 VA						
					Total Est. Demand: 4833 VA						
					Total Conn.: 7 A						
					Total Est. Demand: 6 A						
<b>Notes:</b>											

### Panelboard: L13LR

Location: ELEC 173  
Supply From: T-13R  
Mounting: Surface  
Enclosure: Type 1  
Volts: 208Y/120  
Phases: 3  
Wires: 4  
A.I.C. Rating: 10,000  
Mains Type: MCB  
Bus Rating: 100 A  
MCB Rating: 60 A

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	
1	Receptacle ELEVATOR CONTROL ROOM 100C	20 A	1	360 VA	180 VA			1	20 A	Receptacle ELEC 173	2
3	Power VEST. LOBBY 100	20 A	1		303 VA	180 VA		1	20 A	Receptacle ELEV. 100A	4
5	Power VESTIBULE 101	20 A	1			1440	180 VA	1	20 A	Receptacle ELEV. 100B	6
7	Lighting	20 A	1	70 VA	25 VA			1	20 A	Power FIRE COMMAND ROOM 103	8
9	Power ELEVATOR CONTROL ROOM 150	20 A	1		0 VA	1440		1	20 A	Power VESTIBULE 114	10
11	Power ELEVATOR CONTROL ROOM 100C	20 A	1			0 VA	2 VA	1	20 A	Power CORRIDOR-2 197-2	12
13	Receptacle SUBSTATION 160	20 A	1	360 VA	0 VA			1	20 A	Power ELEVATOR CONTROL ROOM 100C	14
15	Receptacle FIRE PUMP/DOMESTIC WATER 152	20 A	1		180 VA	0 VA		1	20 A	Power ELEVATOR CONTROL ROOM 150	16
17	Receptacle ELEV. 15A	20 A	1			180 VA	0 VA	1	20 A	Power ELEVATOR CONTROL ROOM 100C	18
19	Power ELEVATOR CONTROL ROOM 100C	20 A	1	0 VA	540 VA			1	20 A	Receptacle Room -728, 150	20
21	Receptacle ELEV. 153A (0.5 HP)	20 A	1		180 VA	3 VA		1	20 A	Power TCOMM BDF ROOM 165	22
23	Power	20 A	1			0 VA	500 VA	1	20 A	Power JC 155	24
25	Power	20 A	1	0 VA	180 VA			1	20 A	Receptacle ELEV. 153A	26
27	Power	20 A	1		700 VA	2400		1	20 A	Power 200 SEAT CLASSROOM 116	28
29	Spare	20 A	1			0 VA	0 VA	1	20 A	Power	30
31	Spare	20 A	1	200 VA	4674			--	--	Space	32
33	Receptacle ELEV. 100A (1.5 HP)	20 A	3		200 VA	4025		3	60 A	L23LR	34
35	Spare	20 A	1		200 VA	0 VA		200 VA	2953		36
37	DDC-5 Panel	20 A	1		200 VA	0 VA		1	20 A	Spare	38
39	Spare	20 A	1		0 VA	0 VA		1	20 A	Spare	40
41	Spare	20 A	1			0 VA	3 VA	1	20 A	Power TCOMM 187	42
				Total Load:	6789 VA	9611 VA		5457 VA			
				Total Amps:	58 A	82 A		45 A			
<b>Load Classification</b>		<b>Connected Load</b>	<b>Demand Factor</b>	<b>Estimated Demand</b>	<b>Panel Totals</b>						
Lighting		70 VA	80.00%	56 VA	Total Conn. Load: 21857 VA						
Power		13979 VA	30.00%	4194 VA	Total Conn. Load: 10254 VA						
Receptacle		3300 VA	100.00%	3300 VA	Total Conn.: 61 A						
Mechanical Equipment		4508 VA	60.00%	2705 VA	Total Est. Demand: 28 A						
<b>Notes:</b>											

### Panelboard: L23LR

Location: ELEC 273  
Supply From: L13LR  
Mounting: Surface  
Enclosure: Type 1  
Volts: 208Y/120  
Phases: 3  
Wires: 4  
A.I.C. Rating: 10,000  
Mains Type: MCB  
Bus Rating: 100 A  
MCB Rating: 60 A

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT	
1	Power INFORMAL LEARNING 371	20 A	1	1080	1080			1	20 A	Power OUTDOOR TERRACE_271B	2
3	Power TCOMM 265A	20 A	1		3 VA	6 VA		1	20 A	Power TCOMM 365A	4
5	Power	20 A	1			720 VA	2 VA	1	20 A	Power CORRIDOR 293	6
7	Power ELEV. LOBBY 200	20 A	1	700 VA	3 VA			1	20 A	Power ELEC 273	8
9	Power SHAFT_502	20 A	1		400 VA	2 VA		1	20 A	Power	10
11	Power WAITING 255	20 A	1			200 VA	300 VA	1	20 A	Power	12

**COPPER FEEDER & BRANCH CIRCUIT SIZING SCHEDULE - NONLINEAR LOADS**  
(NOTES 1, 2)

OVERCURRENT DEVICE RATING (AMPERES)	PHASE & NEUTRAL	E.G.	CONDUIT SIZE				NOTE
			4 WIRE (DPL 5.2(N))	5 WIRE (NOTE 7)	6 WIRE (DPL 5.3(N))	E.G.	
15-20	12	12	3/4"	3/4"	3/4"	3/4"	
25-30	10	10	3/4"	3/4"	3/4"		
35-40	8	10	3/4"	1"	1"		
45-50	8(6)	10	3/4"(1")	1"	1"(1 1/4")		
60	8(4)	10	1"(1 1/4")	1"(1 1/4")	1 1/4"		
70	8(4)	8	1"(1 1/4")	1"(1 1/4")	1 1/4"		
80-90	4(2)	8	1 1/4"	1 1/4"(1 1/2")	1 1/4"(1 1/2")		
100	3(2)	8	1 1/4"	1 1/2"	1 1/2"		
110	2(1)	6	1 1/2"	2"	2"		
125	1(1/0)	6	1 1/2"(2")	2"	2"		
150	1/0	6	2"	2"	2"		
175	2/0	6	2"	2"	2 1/2"		
200	3/0	6	2"	2 1/2"	2 1/2"		
225	4/0	4	2 1/2"	2 1/2"	3"		
250	250	4	3"	3"	3"		
300	350	4	3"	3 1/2"	3 1/2"		
350	500	3	3 1/2"	4"	4"		
400	600	3	4"	4"	4"		
450	2-4/0	2-2	2-2 1/2"	2-2 1/2"	2-3"		
500	2-250	2-2	2-3"	2-3"	2-3"		
600	2-350	2-1	2-3"	2-3 1/2"	2-3 1/2"		
700	2-500	2-1/0	2-3 1/2"	2-4"	2-4"		
800	2-600	2-1/0	2-3 1/2"	2-4"	2-4"		
1000	3-400	3-2/0	3-3"	3-3 1/2"	3-3"		
1200	4-350	4-3/0	4-3"	4-3 1/2"	4-3 1/2"		
1600	5-400	5-4/0	5-3"	5-3 1/2"	5-4"		
2000	6-400	6-250	6-3"	6-3 1/2"	6-4"		

**COPPER FEEDER & BRANCH CIRCUIT SIZING SCHEDULE - GENERAL PURPOSE**  
(NOTES 2, 8, 9)

OVERCURRENT DEVICE RATING (AMPERES)	PHASE & NEUTRAL	E.G.	CONDUIT SIZE				NOTE
			2 WIRE	3 WIRE	4 WIRE (DPL 5.3(N))	E.G.	
15-20	12	12	3/4"	3/4"	3/4"	3/4"	
25-30	10	10	3/4"	3/4"	3/4"	3/4"	
35-40	8	10	3/4"	3/4"	3/4"	3/4"	
45-50	8(6)	10	3/4"	3/4"	3/4"(1")	3/4"	
60	8(4)	10	3/4"(1")	3/4"(1")	1"(1 1/4")	1"	
70	8(4)	8	3/4"(1")	3/4"(1")	1"(1 1/4")	1 1/4"	
80-90	4(2)	8	1"	1"(1 1/4")	1 1/4"	1 1/4"	
100	3(2)	8	1"(1 1/4")	1 1/4"	1 1/4"	1 1/4"	
110	2(1)	6	1 1/4"	1 1/4"(1 1/2")	1 1/4"(1 1/2")	1 1/4"(1 1/2")	
125	1(1/0)	6	1 1/4"	1 1/2"	1 1/2"	1 1/2"(2")	
150	1/0	6	1 1/4"	1 1/2"	1 1/2"	1 1/2"(2")	
175	2/0	6	1 1/2"	2"	2"	2"	
200	3/0	6	1 1/2"	2"	2"	2"	
225	4/0	4	2"	2"	2"	2 1/2"	
250	250	4	2"	2 1/2"	2 1/2"	2 1/2"	
300	350	4	2 1/2"	3"	3"	3"	
350	500	3	3"	3"	3"	3 1/2"	
400	600	3	3"	3"	4"	4"	
450	2-4/0	2-2	2-2"	2-2"	2-2 1/2"	2-2 1/2"	
500	2-250	2-2	2-2"	2-2 1/2"	2-2 1/2"	2-2 1/2"	
600	2-350	2-1	2-2 1/2"	2-3"	2-3"	2-3"	
700	2-500	2-1/0	2-3"	2-3"	2-3"	2-3 1/2"	
800	2-600	2-1/0	2-3"	2-3"	2-3"	2-4"	
1000	3-400	3-2/0	3-2 1/2"	3-3"	3-3"	3-3"	
1200	4-350	4-3/0	4-2 1/2"	4-3"	4-3"	4-3"	
1600	5-400	5-4/0	5-2 1/2"	5-3"	5-3"	5-3"	
2000	6-400	6-250	6-2 1/2"	6-3"	6-3"	6-3"	

**ALUMINUM FEEDER & BRANCH CIRCUIT SIZING SCHEDULE - GENERAL PURPOSE**  
(NOTES 2, 8, 9)

OVERCURRENT DEVICE RATING (AMPERES)	PHASE & NEUTRAL	E.G.	CONDUIT SIZE				NOTE
			2 WIRE	3 WIRE	4 WIRE (DPL 5.3(N))	E.G.	
15-20	12	12	3/4"	3/4"	3/4"	3/4"	
25-30	10	10	3/4"	3/4"	3/4"	3/4"	
35-40	8	10	3/4"	3/4"	3/4"	3/4"	
45-50	8(6)	10	3/4"	3/4"	3/4"(1")	3/4"	
60	8(4)	10	3/4"(1")	3/4"(1")	1"(1 1/4")	1"	
70	8(4)	8	3/4"(1")	3/4"(1")	1"(1 1/4")	1 1/4"	
80-90	4(2)	8	1"	1"(1 1/4")	1 1/4"	1 1/4"	
100	3(2)	8	1"(1 1/4")	1 1/4"	1 1/4"	1 1/4"	
110	2(1)	6	1 1/4"	1 1/4"(1 1/2")	1 1/4"(1 1/2")	1 1/4"(1 1/2")	
125	1(1/0)	6	1 1/4"	1 1/2"	1 1/2"	1 1/2"(2")	
150	1/0	6	1 1/4"	1 1/2"	1 1/2"	1 1/2"(2")	
175	2/0	6	1 1/2"	2"	2"	2"	
200	3/0	6	1 1/2"	2"	2"	2"	
225	4/0	4	2"	2"	2"	2 1/2"	
250	250	4	2"	2 1/2"	2 1/2"	2 1/2"	
300	350	4	2 1/2"	3"	3"	3"	
350	500	3	3"	3"	3"	3 1/2"	
400	600	3	3"	3"	4"	4"	
450	2-4/0	2-2	2-2"	2-2"	2-2 1/2"	2-2 1/2"	
500	2-250	2-2	2-2"	2-2 1/2"	2-2 1/2"	2-2 1/2"	
600	2-350	2-1	2-2 1/2"	2-3"	2-3"	2-3"	
700	2-500	2-1/0	2-3"	2-3"	2-3"	2-3 1/2"	
800	2-600	2-1/0	2-3"	2-3"	2-3"	2-4"	
1000	3-400	3-2/0	3-2 1/2"	3-3"	3-3"	3-3"	
1200	4-350	4-3/0	4-2 1/2"	4-3"	4-3"	4-3"	
1600	5-400	5-4/0	5-2 1/2"	5-3"	5-3"	5-3"	
2000	6-400	6-250	6-2 1/2"	6-3"	6-3"	6-3"	

**MOTOR CIRCUIT SIZING SCHEDULE**  
(FOR 208V, 3 PHASE MOTORS NOTES 3, 4, 5)

MOTOR HP	SWITCH/FUSE	CIRCUIT BREAKER	STARTER		CONDUIT & WIRE	
			SIZE/TYPE	PHASE	E.G.	CONDUIT
1/2	30/4A	15A	1	12	12	3/4"
3/4	30/6 25A	15A	1	12	12	3/4"
1	30/6A	15A	1	12	12	3/4"
1 1/2	30/10A	15A	1	12	12	3/4"
2	30/10A	15A	1	12	12	3/4"
3	30/17.5A	20A	1	12	12	3/4"
5	30/25A	35A	1	10	10	3/4"
7 1/2	60/40A	50A	1	10	10	3/4"
10	60/50A	60A	2	8	10	3/4"
15	60/60A	90A	3	6	10	3/4"
20	100/60A	100A	3	4	8	1"
25	100/100A	110A	3	3	8	1"
30	200/125A	125A	4	2	6	1"
40	200/175A	175A	4	1/0	6	1 1/2"
50	200/200A	200A	5	3/0	6	1 1/2"
60	400/250A	250A	5	4/0	4	2"
75	400/300A	300A	5	3/00	4	2"
100	400/400A	400A	6	500	3	2"
125	600/500A	500A	6	2-4/0	2-4	2-2"
150	600/600A	600A	6	2-250	2-4	2-2"
200	-	800A	76	2-400	2-4	2-2 1/2"

**DRAWING NOTES**

- CIRCUIT SIZING SCHEDULES NOTES:**
- BASED ON THHN/THWN, 90°C, 600V, INSULATED, COPPER WIRE APPLIED AT 75°F FOR TERMINATIONS RATED AT 60°C/75°C AND 75°C. FOR TERMINATIONS RATED AT 80°C PROVIDE WIRE AND CONDUIT SIZES INDICATED IN PARENTHESES.
  - BASED ON WIRE OUTSIDE DIAMETERS AND RIGID METALLIC CONDUIT INSIDE DIAMETERS AS PROVIDED IN THE NEC. DO NOT REDUCE CONDUIT SIZE FOR NON-RIGID METALLIC APPLICATION. REFER TO NEC FOR CONDUIT TYPES MORE RESTRICTIVE THAN RIGID METALLIC.
  - BASED ON MOTOR FULL LOAD AMPERES AS PROVIDED BY THE NEC.
  - BASED ON MOTOR RUNNING OVERLOAD PROTECTION PROVIDED BY THERMAL OVERLOAD RELAYS.
  - MOTOR STARTING TYPE BASED ON 480V, 3 PHASE, FULL VOLTAGE NON-REVERSING EXCEPT FOR MOTORS SIZED 75HP OR GREATER WHICH ARE BASED ON 480V, 3 PHASE, PART WINDING REDUCED VOLTAGE STARTING.
  - TRANSFORMER CIRCUITS BASED ON 480V TO 208/120V, 3 PHASE, 4 WIRE DRY TYPE.
  - PROVIDE THREE PHASE WIRES AND ONE DOUBLE AMPACITY NEUTRAL FOR 110 AMPACITY CIRCUITS AND LESS. PROVIDE THREE PHASE WIRES AND TWO NEUTRAL WIRES, SIZES AS INDICATED FOR 125 AMPACITY CIRCUITS AND GREATER.
  - USE ALUMINUM FEEDERS FOR CIRCUITS WITH OVERCURRENT PROTECTIVE DEVICES 100A AND GREATER.
  - BASED ON THHN/THWN, 90°C, 600V, ALUMINUM WIRE APPLIED AT 75°F FOR TERMINATIONS RATED AT 60°C/75°C AND 75°C. FOR TERMINATIONS RATED AT 80°C PROVIDE WIRE AND CONDUIT SIZES INDICATED IN PARENTHESES.

**MOTOR CIRCUIT SIZING SCHEDULE**  
(FOR 480V, 3 PHASE MOTORS NOTES 3, 4, 5)

MOTOR HP	SWITCH/FUSE	CIRCUIT BREAKER	STARTER		CONDUIT & WIRE	
			SIZE/TYPE	PHASE	E.G.	CONDUIT
1/2	30/3A	15A	1	12	12	3/4"
3/4	30/3A	15A	1	12	12	3/4"
1	30/6A	15A	1	12	12	3/4"
1 1/2	30/6A	15A	1	12	12	3/4"
2	30/6A	15A	1	12	12	3/4"
3	30/10A	15A	1	12	12	3/4"
5	30/15A	20A	1	12	12	3/4"
7 1/2	30/20A	30A	1	12	10	3/4"
10	30/25A	35A	1	12	10	3/4"
15	30/30A	50A	2	10	10	3/4"
20	60/40A	60A	2	8	10	3/4"
25	60/50A	75A	2	8	10	1"
30	60/60A	100A	3	6	10	1"
40	100/80A	125A	3	4	8	1 1/2"
50	100/100A	150A	3	3	8	1 1/2"
60	200/125A	175A	4	1	6	1 1/2"
75	200/150A	200A	4	1/0	6	1 1/2"
100	200/200A	225A	4	2/0	6	2"
125	200/200A	225A	5	3/0	6	2"
150	400/250A	300A	5	4/0	4	2 1/2"
200	400/350A	400A	5	350	4	3"

**TRANSFORMER CIRCUIT SIZING SCHEDULE - GENERAL PURPOSE TYPE**  
(NOTE 6)

TRANSF. KVA	PRIMARY CIRCUIT (480V)		SECONDARY CIRCUIT (208/120V)			
	SWITCH/FUSE OR CIRCUIT BREAKER	PRIMARY FEEDER	SWITCH/FUSE OR CIRCUIT BREAKER	SYSTEM/EQUIPMENT BONDING AMPER (GROUND WIRE)	SECONDARY FEEDER	
9	30/20A	20A, 3W	30/30A	#8	30A, 4W	
15	30/25A	25A, 3W	60/60A	#8	60A, 4W	
30	60/45A	45A, 3W	100/100A	#8	100A, 4W	
45	100/70A	70A, 3W	200/175A	#4	175A, 4W	
75	200/125A	125A, 3W	400/300A	#2	300A, 4W	
112 1/2	200/175A	175A, 3W	400/400A	#10	400A, 4W	
150	400/225A	225A, 3W	600/600A	#20	600A, 4W	
225	400/350A	350A, 3W	800/800A	#30	800A, 4W	
300	600/500A	500A, 3W	1200/1000A	#30	1000A, 4W	

**TRANSFORMER CIRCUIT SIZING SCHEDULE - NONLINEAR LOAD TYPE**  
(NOTE 6)

TRANSF. KVA	PRIMARY CIRCUIT (480V)		SECONDARY CIRCUIT (208/120V)			
	SWITCH/FUSE OR CIRCUIT BREAKER	PRIMARY FEEDER	SWITCH/FUSE OR CIRCUIT BREAKER	SYSTEM/EQUIPMENT BONDING AMPER (GROUND WIRE)	SECONDARY FEEDER	
9	30/20A	20A, 3W	30/30A	#8	30A, 5W-NL	
15	30/25A	25A, 3W	60/60A	#8	60A, 5W-NL	
30	60/45A	45A, 3W	100/100A	#8	100A, 5W-NL	
45	100/70A	70A, 3W	200/175A	#4	175A, 5W-NL	
75	200/125A	125A, 3W	400/300A	#2	300A, 5W-NL	
112 1/2	200/175A	175A, 3W	400/400A	#10	400A, 5W-NL	
150	400/225A	225A, 3W	600/600A	#20	600A, 5W-NL	
225	400/350A	350A, 3W	800/800A	#30	800A, 5W-NL	

**480V, THREE PHASE CIRCUIT LENGTH TABLE**

BREAKER AMPACITY (AMPS)	MAX. CIRCUIT LOAD (AMPS)	MAXIMUM LENGTH IN FEET																										
		NO. 12	NO. 10	NO. 8	NO. 6	NO. 4	NO. 2	NO. 1	1/0	2/0	3/0	4/0	250	350	500	2-3/0	2-4/0	2-250	2-350	2-500	3-300	3-400	4-350	4-400	6-400	6-500		
20	16	253	403	642	1019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	24	-	269	428	679	1079	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	32	-	-	321	509	809	1293	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	40	-	-	-	408	648	1034	-	-	-	-																	