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Electrical Planning for Environmental Engineering Building Faculty of Industrial Engineering Andalas University

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***Abstract*— Technological advancement has made electrical energy crucial in daily life and development. Electrical installations in high-rise buildings play a vital role in human safety and fire prevention due to short circuits. This study designs the electrical system for the Environmental Engineering Building at the Faculty of Engineering, Andalas University, covering the single-line diagram, electrical power calculations, lighting needs, power outlets, and other components. The research methods include data collection, needs analysis, electrical system design, component calculation, and cost estimation. The results indicate the need for 200 lighting points, 90 single-phase power outlets, and 2 three-phase outlets. The total power for the lighting panel is 47.82 kW, and for the AC panel, it is 278.8 kW. The total current for the lighting panel is 256 A, and for the AC panel, it is 508.7 A. The design uses NYM and NYY cables as well as 4 MCCBs. A 250 kVA transformer and generator are used, along with 6 grounding points and a lightning arrester.**

***Keywords*—Electrical planning; single-line diagram; electrical power; lighting; power outlet; AC unit; MCCB; transformer; generator**

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I. INTRODUCTION

The rapid advancement of science and technology has made electrical energy an essential energy source for humanity. It is hard to imagine life without electricity, as its usage has permeated every aspect of human life. The importance of electrical energy in daily life and in the development we are currently undertaking demands a reliable and efficient electrical system, both technically and economically, that can effectively meet our needs.[1]

Electrical installations are a crucial component in constructing multi-story buildings to protect the safety of people and animals in the surrounding area, ensuring they are safe from electric shocks. Given the frequent occurrence of fires in buildings—whether homes, markets, or other facilities—often attributed to short circuits or electrical causes, it is critical to address these risks. Many residential or commercial buildings still have electrical installations that neglect the General Electrical Installation Requirements (PUIL) 2000, the Indonesian National Standards (SNI), and ignore modern safety, technological guidelines, and aesthetic considerations. The planning and installation of electrical systems in buildings must comply with the applicable regulations and standards as per PUIL 2000. Multi-story residences generally require substantial electrical energy, and thus, the distribution of this energy must be carefully planned to ensure it meets needs effectively and aligns with the existing regulations..[2]

The construction of the Environmental Engineering Building at the Faculty of Engineering, Andalas University, relies heavily on electrical needs, particularly for lighting installations, power outlets, and other electrical systems to support the building's facilities. Multi-story buildings generally require a greater amount of electrical energy; therefore, the distribution of this energy must be carefully planned to ensure that electrical needs are adequately met. [3]

II. THE MATERIALS AND METHOD

Literatur :

A. Electrical

The mechanical, electrical, and plumbing (MEP) system is an installation that includes electrical wiring, clean water, and wastewater systems designed to provide lighting and manage clean and wastewater in a building. This system is structured to ensure that the building is safe and comfortable for occupants..[4]

B. Low Voltage Electricity Distribution System

The Low Voltage Distribution Network (JTR) is a component of electrical power distribution that connects the distribution transformer to the House Connection (SR), which serves as the endpoint for electricity service to consumers..[5]

C. Power house

A Power House (PH), also known as a generating house, is a space designed for the installation of turbine rotation systems. It is where the elevation of falling water enters through the waterway, flowing into the power house to rotate the turbine, which generates electrical energy.

D. Cubicle

A 20 kV cubicle is a set of electrical equipment installed at a distribution substation, serving functions such as division, interruption, connection, control, and protection of the 20 kV electrical power distribution system.[6].

E. Generator set

A generator is a coil of wire made from copper, consisting of a stationary winding or stator, and it is equipped with a rotating winding or rotor. In its operation, as per the principles of physics, the engine rotates the rotor within the generator, which generates a magnetic field in the coil of the generator. This magnetic field then interacts with the rotor, causing it to spin and ultimately producing an electric current, in accordance with Lorentz's law. [7]

F. Transformator

A transformer is a static electrical machine that operates based on the principle of electromagnetic induction, capable of transforming electrical energy from high voltage to low voltage or vice versa. The voltage ratio between the primary and secondary sides is directly proportional to the ratio of the number of turns in the windings and inversely proportional to the ratio of the currents, with the frequency remaining constant. In distribution systems, transformers are used to step down the transmission voltage of 20 kV to a service voltage of 400/231 volts. [8]

G. LVMDP

The LVMDP (Low Voltage Main Distribution Panel) is a panel used in low voltage electrical distribution systems (typically up to 1000V) in various types of buildings and facilities. This panel plays a central role in controlling, distributing, and protecting the flow of electrical energy from the main source to various circuits or loads within the installation. It ensures that electrical power is efficiently and safely distributed to different parts of the facility while providing essential protection against overloads and short circuits.. [9]

H. Sub Distribution Panel

The Sub Distribution Panel (SDP) is a panel designed to distribute electrical power from higher voltage panels, such as the Low Voltage Main Distribution Panel (LVMDP), to various rooms according to demand. In the SDP, the voltage and current are reduced to smaller levels to ensure optimal and even usage throughout the facility. Typically, the SDP is also equipped with instruments or measuring devices that can read the voltage, current, and electrical power being utilized, allowing for effective monitoring and management of the electrical system..[10]

I. Protection System

MCCB

MCCB stands for Moulded Case Circuit Breaker, which is an active component that can limit the current flowing through it and also serve as a circuit interrupter. There are several capacities of MCCBs used in a panel, including fixed capacity and adjustable capacity. For fixed-capacity MCCBs, they will operate only at the capacity specified on the MCCB nameplate. In contrast, for adjustable-capacity MCCBs, the operational capacity can be set according to the range indicated on the MCCB nameplate..[11]

MCB

Miniature Circuit Breaker (MCB)The MCB features two types of protection: thermal protection and electromagnetic protection**.** The thermal protection is designed to manage overload currents, while the electromagnetic protection handles short circuits. The MCB utilizes a bimetallic strip to prevent overloads during operation. As electricity flows through the circuit, the bimetallic strip absorbs heat, causing it to bend. If the current exceeds a certain limit, the bending of the strip triggers the mechanism to interrupt the circuit, thereby preventing damage due to overheating. In the event of an overload, the thermal trip will activate, disconnecting the circuit to ensure safety.[12]

J. Installation Components

According to SNI 03-6575-2001 on the procedures for designing artificial lighting systems in building structures, determining the minimum lighting and color rendering for each room function. The design of lighting installations requires supporting components so that the installation can function properly and safely. The components needed in the lighting installation system include lamps, fittings, switches, installation pipes, boxes, socket boxes, welding rods, and elbows. [12]

K. Calculating

Electrical Power Calculating

1. **Maximum Electrical Load On Low Voltage Side**

$$Real\ electrical\ power = p \quad (1)$$
$$voltage\ line-to-line = 380\ Volt \quad (2)$$
$$electric\ \ curent\ per\ phase = \frac{Real\ electrical\ power}{voltage\ line-to-line\ x\sqrt{3}} \quad (3)$$

2. **Maximum Electrical Load On Low Medium voltage Side**

$$Real\ electrical\ power = p$$
$$voltage\ line-to-line = 20\ KVolt \quad (4)$$
$$electric\ \ curent\ per\ phase = \frac{Real\ electrical\ power}{voltage\ line-to-line\ x\sqrt{3}}$$

Tranformer power capacity

$$Load = \frac{Installated\ power\ (VA)}{Transformer\ Capcity(VA)} \times 100\% \quad (5)$$

1. **Electrical power required**

$$P = V \times I\ x\ cos\varphi \quad (6)$$

Wich one :

P = electric power (Watt) I = electric curent (Ampere)
V = electric voltage (Volt) cosφ = power factor (cosinus phi)

2. **Transformer power**

$$Ptrafo = \sqrt{3}\ x\ V\ x\ I\ x\ cos\varphi\ x\ 125\% \quad (7)$$

Wich one

V = electric voltage (Volt) cosφ = power factor (cosinus phi)
I = electric curent (Ampere)

3. **Tranformer Capacity**

$$Transformer\ Capacity = \frac{Transformer\ power}{secondary\ side\ electrical\ voltage} \quad (8)$$

Generator Capacity Calculation

The generator capacity is calculated as ± 120% of the electrical power requirement.

$$Generator\ Capacity = Estimated\ Electrical\ Power\ Requirements\ x\ 120\% \quad (9)$$

Calculation Of Cable Cross-Sectional Area

Current Carrying Ability is the maximum current that can be flowed continuously by a conductor in certain circumstances without causing a temperature increase that exceeds a certain value (PUIL 2000, 10). The current carrying capacity and cross-sectional area required depend on the load being connected. According to PUIL 2000 Chapter 5 article 5.5.3.1 that "The final circuit conductor supplying a single motor must not have a KHA of less than 125% of the full load rated current". [1]
Expressed in the following equation:
KHA formula

$$KHA = 125\ \%\ x\ I \quad (10)$$

To calculate the strength of one phase current is

$$I = P\ /\ (V\ x\ Cos\ Phi) \quad (11)$$

To calculate the strength of three phase current is:

$$I = P\ /\ (\sqrt{3}\ x\ E\ x\ Cos\ Phi) \quad (12)$$

Wich one:

I = Strong current flowing (amperes) √3 =1.732
E = Installed voltage (Volts) V= Installed voltage
P = Installed load power (watts) Cos θ= Power factor

Table of KHA of NYA, NYY, NYM cables based on PUIL, how to determine and calculate KHA based on PUIL, KHA correction factors.Tabel KHA Kabel NYM

Calculation of circuit breaker ratings

In determining the value of the security capability of an installation, the formula set out in PUIL can be used..
To calculate the strength of a single phase current, it is

$$I = P / (V\ x\ Cos\ Phi) \quad (13)$$

To calculate the strength of a three phase current, it is:

$$I = P / (\sqrt{3}\ x\ E\ x\ Cos\ Phi) \quad (14)$$

Where :
I = Strong current flowing (ampere)
E = Installed voltage (Volt) V= Installed voltage
P = Installed load power (watt) √**3 =**1.732 Cos θ= Power Factor

Lightning Planning

Determine the need for lights for room lighting

$$N = \frac{E\ x\ A}{\theta\ x\ UF\ x\ LLF} \quad (15)$$

Where :
N = number of light points
E = lighting intensity (Lux)
A = Room Area
θ = lamp lumens
LLF = light looss factor (0,8)
UF = utilization factor (0,65)

III. RESULTS AND DISCUSSION

Number of light point calculation Light used

TABLE I
Lamp Type

Lamp type	Power	Lumens
PHILIPS TL-5 Lampu TL5 28W	56	5400
RC091V LED27S/865 PSU W30L120 G3 MR PCV	28	2700
PHILIPS LED Downlight 59527 Marcasite 125 SQ 12W	12	930
PHILIPS LED DOWNLIGHT ERIDANI DL190B 14W	14	1200

calculation of floor light points 1

$$N = \frac{E\ x\ A}{F\ x\ UF\ x\ LLF}$$

$$N = \frac{300\ x\ 98}{5400\ x\ 0{,}8\ x\ 0{,}79}$$

$$N = 8{,}6$$

So the number of light points in the hydraulics room is 9 lights

TABLE II
Number Of light Point

1st Floor	Room Area M2	Level Iluminasi (lux)	Lumen (F)	Utility Factor (UF)	LLF	Number of light (N)
R. Hydraulics	98	300	5400	0,8	0,79	9
R. Read	98	300	5400	0,8	0,79	9
R. Head of Labor	15	250	2700	0,8	0,79	2
R. Analysis	15	300	2700	0,8	0,79	3
R. Assistant	15	300	2700	0,8	0,79	3
R. Control	23,5	300	5400	0,8	0,79	2
R. Prayer	27,5	200	5400	0,8	0,79	2
Women's Toilet	21	150	930	0,8	0,79	5
Disabled Toilet	4	150	930	0,8	0,79	1
Men's Toilet	21	150	930	0,8	0,79	5
Janitor	4	150	930	0,8	0,79	1
Hall	88	150	1200	0,8	0,79	17
hydraulics warehouse	40	150	2700	0,8	0,79	4

Number Of Contact Srop

The number of contact scrop by the needs and function of the space

TABLE III

Number of Contact Srop

Room	1 phase contact srop	3 phase contact srop
R. Hydraulics	8	2
R. Read	8	0
R. Head of Labor	2	0
R. Analysis	2	0
R. Assistant	2	0
R. Control	3	0
R. Prayer	2	0
Hydraulics Warehouse	4	0
Total	31	2

Power Capacity Calculation

a) *Real power*

$$Power\ (W) = Load\ power\ x\ number\ of\ loads$$
$$power\ (W) = 28\ W\ x\ 8\ lamp$$
$$Power\ = 224\ W$$

The real power installed in group 1 is 224 W

b) *Apparent Power*

$$power\ (VA) = \frac{Power\ (W)}{Power\ Factor}$$
$$Power\ = \frac{224\ W}{0{,}85}$$

$Power = \ 264\ VA$, The apparent power in group 1 is 264 VA

$$Curent(A) = \frac{power\ \ (VA)}{Voltage\ 1\emptyset}$$
$$curent = \frac{264VA}{220\ V}$$

$curent\ = 1{,}2\ A$, The current flowing in group 1 is 1.2 A

TABLE IV
Number of Contact Srop

Group	Location	Fungtion	Number of load	Load Power	Power (W)	Group Power	Power (VA)
1	R. Head of laboratory	Lighting	2	28	56		
1	Analysis Room	Lighting	3	28	84	224,0	264
1	Assistant room	Lighting	3	28	84		
2	Hydraulics Room	Lighting	9	56	504	504,0	593
3	Reading room	Lighting	9	56	504	504,0	593
4	R. prayer	Lighting	2	28	56	182,0	214
4	Tuesdayr	Lighting	9	14	126		
5	Hall	Lighting	8	14	112	112,0	132
6	Hydraulics Warehouse	Lighting	4	28	112	224,0	264
6	R. Control	Lighting	2	56	112		
7	Women's toilet	Lighting	8	12	96	138,0	162
7	Tuesdayr	Lighting	3	14	42		
8	Men's Toilet	Lighting	6	12	72	84,0	99
8	Disabled toilet	Lighting	1	12	12		
9	Hydraulics Room	3 phase KKB	1	12160	12160	12160,0	14306
10	Hydraulics Room	3 phase KKB	1	12160	12160	12160,0	14306
11	Hydraulics Room	KKB	4	200	800	800,0	941
12	Control Room	KKB	3	200	600	600,0	706
13	Assistance room	KKB	2	200	400	800,0	941
13	R. prayer	KKB	2	200	400		
14	Analysis Room	KKB	2	200	400	800,0	941
14	R. head of labor	KKB	2	200	400		
15	Hydraulics Room	KKB	3	200	600	600,0	706
16	Reading room	KKB	4	200	800	800,0	941
17	Reading room	KKB	4	200	800	800,0	941
Total					31492	31492,0	37049

Total capacity power

To calculate the total power capacity, it is done by adding up the total of all the power that was previously calculated

$$power\ Total\ = PP1\ +\ PP2\ + PP3 + P.AC1 + P.AC2 + P.AC3$$

$$power\ total(W) = 31492 + 6676 + 9654 + 16040 + 33795 + 44870$$
$$power\ total = 142527\ W$$
$$power\ total\ (KW) = \frac{142527}{1000}$$
$$power\ total = 142{,}527\ kW$$
$$power\ total\ (kVA) = power\ (kW)\ /power\ faktor\ (0{,}85)$$
$$power\ total\ (kVA) = \frac{142{,}527\ kW}{0{,}85}$$
$$power\ total = 167.678\ kVA$$

TABLE V
Total capacity power

Location	Power (W)	Power (VA)
PP1	31492	37049,412
PP2	6676	7854,1176
PP3	9654	11357,647
P.AC 1	16040	18870,588
P.AC 2	33795	39758,824
P.AC 3	44870	52788,235
Total	142527	167678,82
total (K)	142,527	167,67882

Calculation of cable cross-sectional area

a) Calculate the current flowing

$$Current = \frac{power\ (VA)}{voltage\ 1\emptyset}$$
$$curent = \frac{66\ VA}{220\ V}$$
$$curent = 0{,}3\ A$$

b) Calculation KHA

$$KHA = 115\ \%\ x\ current\ (A)$$
$$KHA = 115\%\ x\ 0{,}3\ A$$
$$KHA = 0{,}35$$

When we get the KHA calculation results of 0.35A, referring to the standard cable table from PLN with the KHA, the cable used is NYM 2x2,5 sqmm

TABLE VI
Cross-sectional area of PP1 cable

Group	Location	Fungtion	cable cross-sectional area	Power (VA)	current (A)	KHA
1	1.1,1.2	Lighting	NYM 2x2,5 sqmm	66	0,3	0,35
1	1.3,1.4,1.5	Lighting	NYM 2x2,5 sqmm	99	0,5	0,52
1	1.4,1.5,1.6	Lighting	NYM 2x2,5 sqmm	99	0,5	0,52
2	2.1-2.9	Lighting	NYM 2x2,5 sqmm	593	2,7	3,10
3	3.1-3.9	Lighting	NYM 2x2,5 sqmm	593	2,7	3,10
4	4.1,4.2	Lighting	NYM 2x2,5 sqmm	66	0,3	0,35
4	4.3-4.11	Lighting	NYM 2x2,5 sqmm	148	0,7	0,77
5	5.1-5.8	Lighting	NYM 2x2,5 sqmm	132	0,6	0,69
6	6.1-6.4	Lighting	NYM 2x2,5 sqmm	132	0,6	0,69
6	6.5,6.6	Lighting	NYM 2x2,5 sqmm	132	0,6	0,69
7	7.1-7.8	Lighting	NYM 2x2,5 sqmm	113	0,5	0,59
7	7.9-7.11	Lighting	NYM 2x2,5 sqmm	49	0,2	0,26
8	8.1-8.6	Lighting	NYM 2x2,5 sqmm	85	0,4	0,44
8	8.7	Lighting	NYM 2x2,5 sqmm	14	0,1	0,07
9	9.1	3 phase KKB	NYY 4x10 sqmm	14305,9	22	25,00
10	10.1	3 phase KKB	NYY 4x10 sqmm	14305,9	22	25,00
11	11.1-11.4	KKB	NYM 3x4 sqmm	941	4,3	4,92
12	12.1-12.3	KKB	NYM 3x2,5 sqmm	706	3,2	3,69
13	13.1,13.2	KKB	NYM 3x2,5 sqmm	471	2,1	2,46
13	13.3,13.4	KKB	NYM 3x2,5 sqmm	471	2,1	2,46
14	14.1,14.2	KKB	NYM 3x2,5 sqmm	471	2,1	2,46

14	14.3,14.4	KKB	NYM 3x2,5 sqmm	471	2,1	2,46
15	15.1-15.3	KKB	NYM 3x2,5 sqmm	706	3,2	3,69
16	16.1-16.4	KKB	NYM 3x4 sqmm	941	4,3	4,92
17	17.1-17.4	KKB	NYM 3x4 sqmm	941	4,3	4,92

Calculation of Busbar cross-sectional area

$KHA = 56{,}8\ x\ 150\%$

$KHA = 85{,}2\ A$

$Total\ KHA\ Panel\ PP1 = 85{,}2A$

So the KHA obtained from the total load connected to the PP1 panel is 85.2A, so the MCCB that will be used is 24sqmm.

TABLE VI
cross-sectional area of busbar PP1

Group	Location	Fungtion	IR	IS	IT	KHA	Busbar Area
1	1.1,1.2	Lighting	0,3				
1	1.3,1.4,1.5	Lighting	0,5				
1	1.4,1.5,1.6	Lighting	0,5				
2	2.1-2.9	Lighting			2,7		
3	3.1-3.9	Lighting			2,7		
4	4.1,4.2	Lighting		0,3			
4	4.3-4.11	Lighting		0,7			
5	5.1-5.8	Lighting		0,6			
6	6.1-6.4	Lighting			0,6		
6	6.5,6.6	Lighting			0,6		
7	7.1-7.8	Lighting			0,5		
7	7.9-7.11	Lighting			0,2		
8	8.1-8.6	Lighting	0,4			85,2	24 sqmm
8	8.7	Lighting	0,1				
9	9.1	3 phase KKB	22	22	22		
10	10.1	3 phase KKB	22	22	22		
11	11.1-11.4	KKB	4,3				
12	12.1-12.3	KKB		3,2			
13	13.1,13.2	KKB		2,1			
13	13.3,13.4	KKB		2,1			
14	14.1,14.2	KKB		2,1			
14	14.3,14.4	KKB		2,1			
15	15.1-15.3	KKB	3,2				
16	16.1-16.4	KKB	4,3				
17	17.1-17.4	KKB			4,3		

Calculation of MCB and MCCB ratings

KHA = curent x 115%

After obtaining the KHA from the installed load, select the MCB that has a rating higher than the calculated KHA.

$I\ mcb = 0{,}3\ x\ 115\%$

$I\ mcb = 0{,}35\ A$

$Total\ I\ mcb\ grup\ 1 = 0{,}35 + 0{,}52 + 0{,}52$

$Total\ I\ mcb = 1{,}39\ A$

So the KHA obtained from the total load connected to group 1 is 1.39A, so the MCB that will be used is 6A.

a) MCCB rating calculation

$rating\ MCCB = I\ MCCB$

$I\ MCCB = The\ total\ current\ flowing\ in\ 1\ phase\ x\ 125\%$

After obtaining the installed load, select the MCCB that has a rating of more than I. The MCCB that has been calculated.

$\text{I MCCB} = 56{,}8\ x\ 125\%$

$\text{I MCCB} = 71\ A$

So the I MCCB obtained from the total load connected to the PP1 panel is 71A, so the MCCB that will be used is 80A .

TABLE VII
Rating MCB dan MCCB PP1

Group	Location	Function	IR	IS	IT	I n x 115%	I MCB	MCB	I MCCB	MCCB
1	1.1,1.2	Lighting	0,3			0,35	1,39		71 A	80A

1	1.3,1.4,1.5	Lighting	0,5			0,52		6A 1∅
1	1.4,1.5,1.6	Lighting	0,5			0,52		
2	2.1-2.9	Lighting			2,7	3,1	3,1	6A 1∅
3	3.1-3.9	Lighting			2,7	3,1	3,1	6A 1∅
4	4.1,4.2	Lighting		0,3		0,35	1,12	6A 1∅
4	4.3-4.11	Lighting		0,7		0,77		
5	5.1-5.8	Lighting		0,6		0,69	0,69	6A 1∅
6	6.1-6.4	Lighting			0,6	0,69	1,38	6A 1∅
6	6.5,6.6	Lighting			0,6	0,69		
7	7.1-7.8	Lighting			0,5	0,59	0,85	6A 1∅
7	7.9-7.11	Lighting			0,2	0,26		
8	8.1-8.6	Lighting	0,4			0,44	0,51	6A 1∅
8	8.7	Lighting	0,1			0,07		
9	9.1	3 phase KKB	22	22	22	25	25	A 1∅
10	10.1	3 phase KKB	22	22	22	25	25	6A 1∅
11	11.1-11.4	KKB	4,3			4,92	4,92	6A 1∅
12	12.1-12.3	KKB		3,2		3,69	3,69	6A 1∅
13	13.1,13.2	KKB		2,1		2,46	4,92	6A 1∅
13	13.3,13.4	KKB		2,1		2,46		
14	14.1,14.2	KKB		2,1		2,46	4,92	6A 1∅
14	14.3,14.4	KKB		2,1		2,46		
15	15.1-15.3	KKB	3,2			3,69	3,69	6A 1∅
16	16.1-16.4	KKB	4,3			4,92	4,92	6A 1∅
17	17.1-17.4	KKB			4,3	4,92	4,92	6A 1∅
Total			56,9	56,8	55,1			

Transformer Capacity Calculation

$$Ptrafo = \frac{installed\ power}{power\ faktor}\ x\ 125\%$$

Where :

Ptransformer = Transformer power (VA)　　Power factor (cosine phi) =0.85

Installed power = 142.6 kW

$$Ptrafo = \frac{142{,}6KW}{0{,}85} x\ 125\%$$

$$Ptrafo = 167{,}8KVA\ x\ 125\%$$

$$ptrafo = 209{,}75\ kVA$$

It was found that the load capacity of the transformer that will be installed is 209.75 kVA, so the transformer that will be used is a transformer that has a capacity of 250 KVA.The reason for taking a transformer that has a capacity of 250 KVA is for the transformer safety system and for future load additions

Calculation of generator capacity

$$Power\ Capacity = Total\ Installed\ Load \times Demand\ Factor \times transformer\ safety\ factor\ (\%)$$

$$power\ capacity = 142{,}6\ x\ 1\ x\ 125\ \%$$

$$Power\ capacity = 178{,}2\ kW$$

$$KVA = 178{,}2\ kW/0{,}85$$

$$power\ capacity = 209{,}75\ KVA$$

If the power capacity of the generator that will be used is 209 kVA, the generator that will be used is a generator that has a capacity of 250kVA..

Power House Design

The transformer used in the powerhouse of the industrial engineering building at Andalas University is a transformer with a capacity of 250 kVA and a generator with a capacity of 250 KVA. The environmental engineering building at Andalas University is a 20KV PLN customer, using a concrete substation.

IV. Conclusion

From the results of calculations and analysis, several conclusions were obtained, including: The total capacity of electrical power required in the environmental engineering building, Faculty of Engineering, Andalas University is equal to the total power in the lighting panels, namely 47.82 kW. The number of light points used in the Andalas University industrial engineering building is 200 light points, on the 1st floor there are 71 light points, on the 2nd floor there are 53 light points, on the 3rd floor there are 64 light points, and on the 4th floor there are 12 light points. The number of sockets in the Andalas University industrial engineering building is 90 1 phase socket points and 2 3 phase socket points, on the 1st floor there are 31 1 phase socket points and 2 3 phase socket points, on the 2nd floor there are 25 points single phase socket, on the 3rd floor there are 30 single phase socket points, and on the 4th floor there are 4 single phase socket points. The average type of cable cross-section used for lighting uses 2x2.5 sqmm NYM cable, for 1-phase sockets uses 3x2.5 sqmm NYM cable, and for 3-phase sockets uses 4x10 sqmm NYY cable. The number of load groups on the panel is 76 groups divided into each phase, PP1 uses 15 6A MCBs and 2 3-phase 25A MCBs. PP2 has 13 groups, uses 13 1-phase 6A MCBs, PP3 has 21 groups, uses 21 6A MCBs , P.AC1 has 8 groups, uses 7 MCB 6 A and 1 MCB 35A 3 phase, P.AC2 has 7 groups, uses 6 MCB 6A 1 phase and 1 MCB 80 A 3 phase, P.AC3 has 10, uses 9 MCB 6A 1 phase and 1 MCB 100A 3 phase. The transformer used in the environmental engineering building at Andalas University is a 250kVA transformer. The generator set used in the environmental engineering building at Andalas University is a generator with a capacity of 250kVA.

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