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Study of Electrical System Analysis of the Cadet Dorm Building of the West Sumatra Snailing Polytechnic

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Abstract: The quality of electrical installations is highly dependent on the implementation and application of electrical installation standards, namely PUIL 2011 (General Requirements for Electrical Installations) and other supporting regulations. The implementation is to ensure the safety of humans, tools, and buildings, as well as the main requirement for electrical installations to be carried out safely, reliably, and environmentally friendly. So it is necessary to conduct an evaluation of the electrical system to ensure the safety, reliability, and efficiency of the system are in accordance with electrical installation standards. In the cadet dormitory building, there are several rooms that function as bedrooms, living rooms, pantries, warehouses, and toilets with an electrical system consisting of power outlets, lighting installations, and air conditioning. Based on the results of the study, the total installed load of LVMDP is 104,134 Watts using a 3-phase 250A MCCB with a cable size of 4x240 mm2 NYFGbY. The 1st floor AC panel has a total load of 27,360 Watts using a 3-phase 80A MCCB using a cable of 4x35 mm2 NYY. Lighting Panel & Socket on the 1st floor total load of 9,762 Watts using 3 phase 40A MCB using 4x16 mm2 NYY cable. AC Panel on the 2nd floor total load of 27,360 Watts using 3 phase 80A MCCB using 4x35 mm2 NYY cable. Lighting Panel & Socket on the 2nd floor total load of 5,473 Watts using 3 phase 20A MCB using 4x4 mm2 NYY cable. AC Panel on the 3rd floor total load of 27,360 Watts using 3 phase 80A MCCB using 4x35 mm2 NYY cable. Lighting Panel & Socket on the 3rd floor total load of 6,819 Watts using 3 phase 32A MCB using 4x6 mm2 NYY cable.

Keyword: Electrical System, NYFGbY, NYY, MCCB, MCB.

INTRODUCTION

The West Sumatra Maritime Polytechnic is one of the Civil Service Universities within the Transportation Human Resources Development Agency under the supervision and responsibility of the Ministry of Transportation, tasked with preparing transportation human resources through education and training by implementing a dormitory program for all cadets. In carrying out these duties, the West Sumatra Maritime Polytechnic is supported by good infrastructure, one of which is the cadet dormitory building.

The Cadet Dormitory Building is a place to build character such as ethics, discipline, honesty, responsibility, commitment to caring for others and is also a place for implementation in social life. The existence of the building is very important to provide security, peace and a feeling of comfort for all residents in the dormitory environment so that the learning and teaching process can run well and produce competent graduates. Of course, the dormitory building requires a large amount of electricity to support activities in the dormitory environment properly, so a quality electrical installation is needed.

The quality of electrical installations is highly dependent on the implementation and enforcement of electrical installation standards, namely PUIL 2011 (General Requirements for Electrical Installations) and other supporting regulations. These standards are intended to ensure the safety of people, equipment, and buildings, and are essential for ensuring safe, reliable, and environmentally friendly installations. Therefore, an evaluation of the electrical system is necessary to ensure that the system's safety, reliability, and efficiency meet electrical installation standards.

Based on these considerations, the author chose the research title "Analysis Study of the Electrical System of the Cadet Dormitory Building at the West Sumatra Maritime Polytechnic." With this analysis study, the author will be able to obtain an overview of the feasibility of the installed electrical system.

METHOD

The type of research conducted is quantitative descriptive. Data collection was carried out by calculating room sizes, recording layouts, the number and location of lights and air conditioners, recording loads, circuit breakers (CBs), and cable cross-sections on each electrical panel, and specific loads to describe the analysis of the electrical system in the cadet dormitory building.

The location of this research was conducted at the cadet dormitory building of the West Sumatra Maritime Polytechnic, located at Jl. Syekh Burhanuddin No. 1, Korong Tiram, Ulakan Tapakis District, Padang Pariaman Regency.

Data Processing Techniques.

After collecting the data, the author then calculated the lighting intensity (illumination) in the room, calculated the AC capacity (BTUH), calculated the load, and calculated the protection value and cable cross-section on each electrical panel and special load in the cadet dormitory building to obtain results which will be compared with electrical installation standards.

After the calculation is carried out by entering the data into the formula, the results obtained from the calculation will be compared with the data in the field and after that an analysis will be carried out so that it will be known whether the electrical installation in the cadet dormitory building complies with electrical installation standards.

After conducting the analysis, the author can draw conclusions and evaluate the research results. If the results are inconsistent, the author will provide suggestions and recommendations for the Sumbawa Maritime Polytechnic campus.

RESULTS AND DISCUSSION

Data

The dormitory building has 3 floors, each floor has several rooms with different sizes, as well as several types of lights, AC, loads, circuit breakers, and cable cross-sectional areas as shown in the following table.

Table 1 Room Size Data

Floor	Room	Size (m)	Area (m2)
One	Bedroom 1	9 x 7	63
	Bedroom 2	9 x 7	63
	Bedroom 3	18 x 7	126
	Bedroom 4	18 x 7	126
	Living Room 1	9 x 7	63
	Living Room 2	9 x 7	63
	Toilet 1	9.1 x 4.5	40.95
	Toilet 2	9.1 x 4.5	40.95
	Toilet 3	6.6 x 4.5	29.7
	Warehouse 1	2.5 x 3	7.5
	Warehouse 2	3 x 3	9
	Warehouse 3	3.6 x 3	10.8
	Warehouse 4	2.1 x 4.5	9.45
	Panel Room	2.1 x 4.5	9.45
	Terrace 1	2.1 x 2.1	4.41
	Terrace 2	2.1 x 2.1	4.41
	Pantry	2.5 x 3	7.5
	Corridor 1	2 x 26	52
	Corridor 2	2 x 26	52
	Corridor 3	2 x 26	52
	Corridor 4	2 x 26	52
	Warehouse Corridor	1.5 x 9.1	13.65
Two	Bedroom 1	18 x 7	126
	Bedroom 2	18 x 7	126
	Bedroom 3	18 x 7	126
	Bedroom 4	18 x 7	126
	Toilet 1	9.1 x 4.5	40.95
	Toilet 2	9.1 x 4.5	40.95
	Toilet 3	6.6 x 4.5	29.7
	Warehouse 1	2.5 x 3	7.5
	Warehouse 2	3 x 3	9
	Warehouse 3	3.6 x 3	10.8
	Warehouse 4	2.1 x 4.5	9.45
	Panel Room	2.1 x 4.5	9.45
	Pantry	2.5 x 3	7.5
	Corridor 1	2 x 26	52
	Corridor 2	2 x 26	52
	Corridor 3	2 x 26	52
	Corridor 4	2 x 26	52
	Warehouse Corridor	1.5 x 9.1	13.65
Three	Bedroom 1	18 x 7	126
	Bedroom 2	18 x 7	126
	Bedroom 3	18 x 7	126
	Bedroom 4	18 x 7	126
	Toilet 1	9.1 x 4.5	40.95
	Toilet 2	9.1 x 4.5	40.95
	Toilet 3	6.6 x 4.5	29.7
	Warehouse 1	2.5 x 3	7.5
	Warehouse 2	3 x 3	9
	Warehouse 3	3.6 x 3	10.8
	Warehouse 4	2.1 x 4.5	9.45
	Panel Room	2.1 x 4.5	9.45
	Pantry	2.5 x 3	7.5
	Corridor 1	2 x 26	52
	Corridor 2	2 x 26	52
	Corridor 3	2 x 26	52
	Corridor 4	2 x 26	52

Floor	Room	Size (m)	Area (m2)
	Warehouse Corridor	1.5 x 9.1	13.65

Table 2 Lighting Data for Each Room

Floor	Room	Amount	Type	Luminous Flux (Lumen)
One	Bedroom 1	6	DL 18 Watt (Philips)	2000
	Bedroom 2	6	DL 18 Watt (Philips)	2000
	Bedroom 3	12	DL 18 Watt (Philips)	2000
	Bedroom 4	12	DL 18 Watt (Philips)	2000
	Living Room 1	6	TL 2 x 36 Watt (Philips)	5000
	Living Room 2	6	TL 2 x 36 Watt (Philips)	5000
	Toilet 1	17	DL 11 Watt (Philips)	1,200
	Toilet 2	17	DL 11 Watt (Philips)	1,200
	Toilet 3	12	DL 11 Watt (Philips)	1,200
	Warehouse 1	1	DL 18 Watt (Philips)	2000
	Warehouse 2	1	DL 18 Watt (Philips)	2000
	Warehouse 3	1	DL 18 Watt (Philips)	2000
	Warehouse 4	1	TL 1 x 36 Watt (Philips)	2500
	Panel Room	1	TL 1 x 36 Watt (Philips)	2500
	Terrace 1	1	DL 18 Watt (Philips)	2000
	Terrace 2	1	DL 18 Watt (Philips)	2000
	Pantry	1	DL 18 Watt (Philips)	2000
	Corridor 1	7	DL 18 Watt (Philips)	2000
	Corridor 2	7	DL 18 Watt (Philips)	2000
	Corridor 3	7	DL 18 Watt (Philips)	2000
	Corridor 4	7	DL 18 Watt (Philips)	2000
	Warehouse Corridor	2	DL 18 Watt (Philips)	2000
Two	Bedroom 1	12	DL 18 Watt (Philips)	2000
	Bedroom 2	12	DL 18 Watt (Philips)	2000
	Bedroom 3	12	DL 18 Watt (Philips)	2000
	Bedroom 4	12	DL 18 Watt (Philips)	2000
	Toilet 1	17	DL 11 Watt (Philips)	1200
	Toilet 2	17	DL 11 Watt (Philips)	1200
	Toilet 3	12	DL 11 Watt (Philips)	1200
	Warehouse 1	1	DL 18 Watt (Philips)	2000
	Warehouse 2	1	DL 18 Watt (Philips)	2000
	Warehouse 3	1	DL 18 Watt (Philips)	2000
	Warehouse 4	1	TL 1 x 36 Watt (Philips)	2500
	Panel Room	1	TL 1 x 36 Watt (Philips)	2500
	Pantry	1	DL 18 Watt (Philips)	2000
	Corridor 1	7	DL 18 Watt (Philips)	2000
	Corridor 2	7	DL 18 Watt (Philips)	2000
	Corridor 3	7	DL 18 Watt (Philips)	2000
	Corridor 4	7	DL 18 Watt (Philips)	2000
	Warehouse Corridor	2	DL 18 Watt (Philips)	2000
Three	Bedroom 1	12	DL 18 Watt (Philips)	2000
	Bedroom 2	12	DL 18 Watt (Philips)	2000
	Bedroom 3	12	DL 18 Watt (Philips)	2000
	Bedroom 4	12	DL 18 Watt (Philips)	2000
	Toilet 1	17	DL 11 Watt (Philips)	1200
	Toilet 2	17	DL 11 Watt (Philips)	1200
	Toilet 3	12	DL 11 Watt (Philips)	1200
	Warehouse 1	1	DL 18 Watt (Philips)	2000
	Warehouse 2	1	DL 18 Watt (Philips)	2000
	Warehouse 3	1	DL 18 Watt (Philips)	2000
	Warehouse 4	1	TL 1 x 36 Watt (Philips)	2500

Floor	Room	Amount	Type	Luminous Flux (Lumen)
	Panel Room	1	TL 1 x 36 Watt (Philips)	2500
	Pantry	1	DL 18 Watt (Philips)	2000
	Corridor 1	7	DL 18 Watt (Philips)	2000
	Corridor 2	7	DL 18 Watt (Philips)	2000
	Corridor 3	7	DL 18 Watt (Philips)	2000
	Corridor 4	7	DL 18 Watt (Philips)	2000
	Warehouse Corridor	2	DL 18 Watt (Philips)	2000

Table 3 AC Data for Each Room

Floor	Room	Number of AC	Type of AC	AC Capacity (HP)
One	Bedroom 1	2	Split AC	2
	Bedroom 2	2	Split AC	2
	Bedroom 3	4	Split AC	2
	Bedroom 4	4	Split AC	2
	Living Room 1	2	Split AC	2
	Living Room 2	2	Split AC	2
Two	Bedroom 1	4	Split AC	2
	Bedroom 2	4	Split AC	2
	Bedroom 3	4	Split AC	2
	Bedroom 4	4	Split AC	2
Three	Bedroom 1	4	Split AC	2
	Bedroom 2	4	Split AC	2
	Bedroom 3	4	Split AC	2
	Bedroom 4	4	Split AC	2

Table 4 Load Data for Each Electrical Panel

Panel Name	Unit Name	Power/Unit (W)	Number of Units	Total Power (W)
Floor 1 AC Panel	2 Pk Split AC	1,710	16	27,360
Lighting Panel & Sockets Floor 1	DL 18 Watt Lamp	18	74	1,332
	11 Watt DL Lamp	11	46	506
	2 x 36 Watt TL Lamps	72	12	864
	1 x 36 Watt TL Lamp	36	8	288
	Transfer Pump	1,100	3	3,300
	1 x 8 Watt EXIT Lamp	8	4	32
	Exhaust Fan	16	12	192
	Electric socket	85	37	3.145
Total AC Panel Load on Floor 1				27,360
Total Load of Lighting Panels & Sockets on Floor 1				9,659
Subtotal Load of Floor 1				37,019
2nd Floor AC Panel	2 Pk Split AC	1,710	16	27,360
Lighting Panel & Sockets 2nd Floor	DL 18 Watt Lamp	18	86	1,548
	11 Watt DL Lamp	11	47	517
	1 x 36 Watt TL Lamp	36	8	288
	Exhaust Fan	16	12	192
	Electric socket	85	33	2,805
Total AC Panel Load on Floor 2				27,360
Total Load of Lighting Panels & Sockets on Floor 2				5,350
Subtotal Load of Floor 2				32,710
3rd Floor AC Panel	2 Pk Split AC	1,710	16	27,360
Lighting Panel & Sockets Floor 3	DL 18 Watt Lamp	18	86	1,548
	11 Watt DL Lamp	11	47	517
	1 x 36 Watt TL Lamp	36	12	432
	Booster Pump	550	3	1,650

	1 x 8 Watt EXIT Lamp	8	4	32
	Exhaust Fan	16	12	192
	Electric socket	85	33	2,805
Total AC Panel Load on Floor 3				27,360
Total Load of Lighting Panels & Sockets on Floor 3				7,176
Subtotal Load of Floor 3				34,536
Total Load of Floors 1 + 2 + 3				**104,265**

Table 5 Circuit Breaker Data and Cable Cross-Section for Each Electrical Panel

Panel Name	CB Type & Rating (A)	Cable Type & Size (mm2)
Floor 1 AC Panel	MCCB 3P 80A	NYY 4x35 mm2
Lighting Panel & Sockets Floor 1	MCB 3P 40A	NYY 4x16 mm2
2nd Floor AC Panel	MCCB 3P 80A	NYY 4x35 mm2
Lighting Panel & Sockets 2nd Floor	MCB 3P 20A	NYY 4x4 mm2
3rd Floor AC Panel	MCCB 3P 80A	NYY 4x35 mm2
Lighting Panel & Sockets Floor 3	MCB 3P 32A	NYY 4x6 mm2
Main Panel	MCCB 3P 250A	NYFGBY 4x240 mm2
Transfer Pump	MCB 1P 16A	NYY 3x4mm2
Booster Pump	MCB 1P 6 A	NYY 3x4mm2

Analysis

Comparison of Lighting Intensity.

Based on the results of the lighting intensity calculations in each room that have been carried out, a comparison is obtained with the following table:.

Table 6 Comparison of Lighting Intensity

Floor	Room	Area (m2)	Illumination (lux)		Note
			Calculation	Standard	
One	Bedroom 1	63	152.3	120 - 250	In accordance
	Bedroom 2	63	152.3	120 - 250	In accordance
	Bedroom 3	126	152.3	120 - 250	In accordance
	Bedroom 4	126	152.3	120 - 250	In accordance
	Living Room 1	63	380.9	120 - 250	It is not in accordance with
	Living Room 2	63	380.9	120 - 250	It is not in accordance with
	Toilet 1	40.95	398.5	250	It is not in accordance with
	Toilet 2	40.95	398.5	250	It is not in accordance with
	Toilet 3	29.7	387.8	250	It is not in accordance with
	Warehouse 1	7.5	213.3	100	It is not in accordance with
	Warehouse 2	9	177.7	100	It is not in accordance with
	Warehouse 3	10.8	148.1	100	In accordance
	Warehouse 4	9.45	211.64	100	It is not in accordance with
	Panel Room	9.45	211.64	120 - 250	In accordance
	Terrace 1	4.41	362.8	60	It is not in accordance with
	Terrace 2	4.41	362.8	60	It is not in accordance with
	Pantry	7.5	213.3	250	It is not in accordance with

Floor	Room	Area (m2)	Illumination (lux)		Note
			Calculation	Standard	
	Corridor 1	52	215.3	100	It is not in accordance with
	Corridor 2	52	215.3	100	It is not in accordance with
	Corridor 3	52	215.3	100	It is not in accordance with
	Corridor 4	52	215.3	100	It is not in accordance with
	Warehouse Corridor	13.65	234.4	100	It is not in accordance with
Two	Bedroom 1	126	152.3	120 - 250	In accordance
	Bedroom 2	126	152.3	120 - 250	In accordance
	Bedroom 3	126	152.3	120 - 250	In accordance
	Bedroom 4	126	152.3	120 - 250	In accordance
	Toilet 1	40.95	398.5	250	It is not in accordance with
	Toilet 2	40.95	398.5	250	It is not in accordance with
	Toilet 3	29.7	420.2	250	It is not in accordance with
	Warehouse 1	7.5	213.3	100	It is not in accordance with
	Warehouse 2	9	177.7	100	It is not in accordance with
	Warehouse 3	10.8	148.1	100	In accordance
	Warehouse 4	9.45	211.64	100	It is not in accordance with
	Panel Room	9.45	211.64	120 - 250	In accordance
	Pantry	7.5	213.3	250	It is not in accordance with
	Corridor 1	52	215.3	100	It is not in accordance with
	Corridor 2	52	215.3	100	It is not in accordance with
	Corridor 3	52	215.3	100	It is not in accordance with
	Corridor 4	52	215.3	100	It is not in accordance with
	Warehouse Corridor	13.65	234.4	100	It is not in accordance with
Three	Bedroom 1	126	152.3	120 - 250	In accordance
	Bedroom 2	126	152.3	120 - 250	In accordance
	Bedroom 3	126	152.3	120 - 250	In accordance
	Bedroom 4	126	152.3	120 - 250	In accordance
	Toilet 1	40.95	398.5	250	It is not in accordance with
	Toilet 2	40.95	398.5	250	It is not in accordance with
	Toilet 3	29.7	420.2	250	It is not in accordance with
	Warehouse 1	7.5	213.3	100	It is not in accordance with
	Warehouse 2	9	177.7	100	It is not in accordance with
	Warehouse 3	10.8	148.1	100	In accordance
	Warehouse 4	9.45	211.64	100	It is not in accordance with

Floor	Room	Area (m2)	Illumination (lux)		Note
			Calculation	Standard	
	Panel Room	9.45	211.64	120 - 250	In accordance
	Pantry	7.5	213.3	250	It is not in accordance with
	Corridor 1	52	215.3	100	It is not in accordance with
	Corridor 2	52	215.3	100	It is not in accordance with
	Corridor 3	52	215.3	100	It is not in accordance with
	Corridor 4	52	215.3	100	It is not in accordance with
	Warehouse Corridor	13.65	234.4	100	It is not in accordance with

Table 6 shows the comparison of calculated lighting intensity with installed lighting intensity. The following analysis is obtained from these results:

The lighting intensity in living rooms 1 and 2 can be adjusted to the number of 1 x 36 Watt TL lamps as many as 6 lamps with a lighting intensity value of 190.47 lux so as not to cause wastage of electrical energy with the following calculation.

Known: 1 x 36 Watt TL lamp

N : 6

Φ : 2500

η : 0.8

A : 63

$E=(N \times \phi \times \eta)/A= = 190.4$ lux$(6 \times 2500 \times 0{,}8)/63$

The lighting intensity on terraces 1 and 2 can be adjusted to the number of 5.5 Watt DL lamps, namely 1 lamp with a lighting intensity value of 87.1 lux so as not to cause wastage of electrical energy with the following calculation.

It is known that the DL lamp is 5.5 watts.

N : 1

Φ : 600

η : 0.8

A : 4,41

$E=(N \times \phi \times \eta)/A= = 87.1$ lux$(1 \times 600 \times 0{,}8)/4{,}41$

The lighting intensity in toilets 1 and 2 on each floor can be adjusted to the number of DL 8 Watt lamps as many as 17 lamps with a lighting intensity value of 299.19 lux so as not to cause wastage of electrical energy with the following calculation.

It is known that the DL lamp is 8 watts.

N : 17

Φ : 900

η : 0.8

A : 40,95

$E=(N \times \phi \times \eta)/A= = 299.19$ lux$(17 \times 900 \times 0{,}8)/40{,}95$

The lighting intensity in toilet 3 on each floor can be adjusted to the number of DL 8 Watt lamps as many as 12 lamps with a lighting intensity value of 290.9 lux so as not to cause wastage of electrical energy with the following calculation.

It is known that the DL lamp is 8 watts.

N : 12

Φ : 900

η : 0.8

A : 29,7
E=(N × ϕ × η)/A= = 290.9 lux(12 ×900 ×0,8)/29,7

The lighting intensity in warehouse 1 on each floor can be adjusted to the number of 11 Watt DL lamps with a lighting intensity value of 128 lux so as not to cause wastage of electrical energy with the following calculation.

It is known that the DL lamp is 18 watts.
N : 1
Φ : 1200
η : 0.8
A : 7,5
E=(N × ϕ × η)/A= = 128 lux(1 ×1200 ×0,8)/7,5

The lighting intensity in warehouse 2 on each floor can be adjusted to the number of 11 Watt DL lamps with a lighting intensity value of 106.6 lux so as not to cause wastage of electrical energy with the following calculation.

It is known that the DL lamp is 11 watts.
N : 1
Φ : 1200
η : 0.8
A : 9
E=(N × ϕ × η)/A= = 106.6 lux(1 ×1200 ×0,8)/9

The lighting intensity in warehouse 4 on each floor can be adjusted to the number of 1 x 14 Watt TL lamps, namely 1 lamp with a lighting intensity value of 114.28 lux so as not to cause wastage of electrical energy with the following calculation.

Known: 1 x 14 Watt TL lamp
N : 1
Φ : 1350
η : 0.8
A : 9,45
E=(N × ϕ × η)/A= = 114.28 lux(1 ×1350 ×0,8)/9,45

The lighting intensity in the pantry on each floor can be adjusted to the number of 11 Watt DL lamps, namely 2 lamps with a lighting intensity value of 256 lux so as not to cause wastage of electrical energy with the following calculation.

It is known that the DL lamp is 11 watts.
N : 2
Φ : 1200
η : 0.8
A : 7,5
E=(N × ϕ × η)/A= = 256 lux(1 ×1200 ×0,8)/7,5

The lighting intensity in corridors 1, 2, 3 and 4 can be adjusted to the number of DL 18 Watt lamps as many as 4 lamps with a lighting intensity value of 123.07 lux so as not to cause wastage of electrical energy with the following calculation.

It is known that the DL lamp is 11 watts.
N : 7
Φ : 1200
η : 0.8
A : 52
E=(N × ϕ × η)/A= = 129.23 lux(7 ×1200 ×0,8)/52

The lighting intensity in the warehouse corridor can be adjusted to the number of 8 Watt DL lamps as many as 2 lamps with a lighting intensity value of 105.49 lux so as not to cause wastage of electrical energy with the following calculation.

It is known that the DL lamp is 8 watts.
N : 2
Φ : 900
η : 0.8
A : 13,65
E=(N × ϕ × η)/A= = 105.49 lux(2 ×900 ×0,8)/13,65

The intensity measurements in the bedroom, warehouse 3 and electrical panel room are in accordance with the calculation results and in accordance with standards.

Air Conditioning Comparison.

Based on the results of the air conditioning calculations for each room that have been carried out, a comparison is obtained with the following table:.

Table 7 Comparison of Air Conditioning

Floor	Room	Area (m2)	AC (PK)	AC Quantity	BTUH		Note
					Calculation	Installed	
One	Bedroom 1	63	2	2	31,500	36,000	It is not in accordance with
	Bedroom 2	63	2	2	31,500	36,000	It is not in accordance with
	Bedroom 3	126	2	4	63,000	72,000	It is not in accordance with
	Bedroom 4	126	2	4	63,000	72,000	It is not in accordance with
	Living Room 1	63	2	2	31,500	36,000	It is not in accordance with
	Living Room 2	63	2	2	31,500	36,000	It is not in accordance with
Two	Bedroom 1	126	2	4	63,000	72,000	It is not in accordance with
	Bedroom 2	126	2	4	63,000	72,000	It is not in accordance with
	Bedroom 3	126	2	4	63,000	72,000	It is not in accordance with
	Bedroom 4	126	2	4	63,000	72,000	It is not in accordance with
Three	Bedroom 1	126	2	4	63,000	72,000	It is not in accordance with
	Bedroom 2	126	2	4	63,000	72,000	It is not in accordance with
	Bedroom 3	126	2	4	63,000	72,000	It is not in accordance

Floor	Room	Area (m2)	AC (PK)	AC Quantity	BTUH		Note
					Calculation	Installed	
							with
	Bedroom 4	126	2	4	63,000	72,000	It is not in accordance with

Table 7 shows the comparison of the calculated air conditioning unit dimensions with the installed air conditioning unit dimensions. The following analysis is obtained:

1. The AC capacity in bedrooms 1 and 2 and the living room on the 1st floor can be adjusted to a 2.5 PK AC (1 unit) and a 3/4 PK AC (1 unit) with a BTUH value of 31,000 so as not to cause wastage of electrical energy.
2. The AC capacity in bedrooms 3 and 4 on the 1st floor can be adjusted to 2 PK ACs (3 units) and 1 PK AC (1 unit) with a BTUH value of 63,000 so as not to cause wastage of electrical energy.
3. The AC capacity in the bedrooms on each floor 2 and 3 can be adjusted to 2 PK AC (3 units) and 1 PK AC (1 unit) with a BTUH value of 63,000 so as not to cause wastage of electrical energy.

Comparison of Electrical System Protection Values.

Based on the results of the calculation of the electrical system protection value on each electrical panel and the special load that has been carried out, a comparison is obtained with the following table:

Table 8 Comparison of Protection Values

Panel Name	Power (W)	In (A)	Ir (A)	Protection Value (A)		Note
				Calculation	Installed	
Floor 1 AC Panel	27,360	48.90	61.12	63	80	It is not in accordance with
Lighting Panel & Sockets Floor 1	9,659	17.26	21.5	25	40	It is not in accordance with
2nd Floor AC Panel	27,360	48.90	61.12	63	80	It is not in accordance with
Lighting Panel & Sockets 2nd Floor	5,350	9.56	12.22	16	20	It is not in accordance with
3rd Floor AC Panel	27,360	48.90	61.12	63	80	It is not in accordance with
Lighting Panel & Sockets Floor 3	6,819	12.82	16.02	20	32	It is not in accordance with
Main Panel	104,134	186.13	214.04	250	250	In accordance
Floor 1 Transfer Pump	1,100	5.88	14.7	16	16	In accordance
3rd Floor Booster Pump	550	2.94	7.35	10	6	It is not in accordance with

Table 8 shows the comparison of the calculated protection values with those installed. The following analysis is obtained from these results:

1. The protection value on the AC panels on Floors 1, 2, and 3 differs between the calculated and installed protection values. According to the calculation results, a 3P 63A protection should be used because the calculated result is 61.12A, but the installed protection value is larger, namely 3P 80A. Therefore, it is recommended to lower the protection value to 63A because if there is an excess current, the MCCB can function properly as a safety device for electrical equipment.
2. The protection value on the lighting panel & the first floor sockets there is a difference between the calculated protection size and the installed one. According to the calculation results should be able to use a 3P 25A protection because the calculated result is 21.5A but the installed protection value is greater at 3P 40A. Therefore, it is recommended to lower the protection value to 3P 25A because if there is an excess current MCB can function properly as a safety device for electrical equipment.
3. The protection value on the lighting panel & power outlet on the 2nd floor is different between the calculated protection value and the installed one. According to the calculation results, a 3P 16A protection should be used because the calculated result is 12.22A, but the installed protection value is larger, namely 3P 20A. Therefore, it is recommended to lower the protection value to 3P 16A because if there is an excess current, the MCB can function properly as a safety device for electrical equipment.
4. The protection value on the lighting panel & socket on the 3rd floor is different between the calculated protection value and the installed one. According to the calculation results, a 3P 20A protection should be used because the calculated result is 16.02A, but the installed protection value is larger, namely 3P 32A. Therefore, it is recommended to lower the protection value to 3P 20A because if there is an excess current, the MCB can function properly as a safety device for electrical equipment.
5. The booster pump's protection value differs from the calculated value. The calculated value should be 1P 10A, as the calculated value is 7.35A, but the installed value is smaller, at 1P 6A. Therefore, it is recommended to increase the protection value to 1P 10A so that the MCB can function properly as a safety device for electrical equipment.
6. The protection values on the other panels are consistent with the calculations and meet applicable standards. Therefore, they are guaranteed to be safe.

Comparison of Electrical System Cable Cross Sections.

Based on the results of the cable cross-section calculations on each electrical panel and the specific loads that have been carried out, a comparison is obtained with the following table:.

Table 9 Comparison of Cable Cross-Sections

Panel Name	Power (W)	In (A)	Ir (A)	Cable Cross Section		Note
				Calculation	Installed	
Floor 1 AC Panel	27,360	48.90	61.12	NYY 4x16 mm2	NYY 4x35 mm2	It is not in accordance with
Lighting Panel & Sockets Floor 1	9,762	17.44	21.8	NYY 4x4 mm2	NYY 4x16 mm2	It is not in accordance with
2nd Floor AC Panel	27,360	48.90	61.12	NYY 4x16 mm2	NYY 4x35 mm2	It is not in accordance with
Lighting Panel & Sockets 2nd Floor	5,473	9.78	12.22	NYY 4x2.5 mm2	NYY 4x4 mm2	It is not in accordance with
3rd Floor AC	27,360	48.90	61.12	NYY 4x16 mm2	NYY 4x35	It is not in

Panel Name	Power (W)	In (A)	Ir (A)	Cable Cross Section		Note
				Calculation	Installed	
Panel					mm2	accordance with
Lighting Panel & Sockets Floor 3	6,819	12.18	15.22	NYY 4x2.5 mm2	NYY 4x6 mm2	It is not in accordance with
Main Panel	104,134	186.13	232.66	NYFGbY 4x120 mm2	NYFGbY 4x240 mm2	It is not in accordance with
Floor 1 Transfer Pump	1,100	5.88	14.7	NYY 3x2.5 mm2	NYY 3x4 mm2	It is not in accordance with
3rd Floor Booster Pump	390	2.08	5.2	NYY 3x1.5 mm2	NYY 3x4 mm2	It is not in accordance with

Table 9 shows a comparison of the cable cross-sections for each electrical panel, transfer pump, and booster pump in the cadet dormitory building. The data shows that the installed cable cross-sections are larger than the calculated values

CONCLUSION

1. The lighting intensity in the bedroom and electrical panel room met standards, although there were differences in the living room, terrace, toilet, storage room, and corridor. The pantry, on the other hand, had a lower light intensity than the standard.
2. In the living room and bedroom with a room area of 63 m2, 2 units of 2PK AC (36,000 BTUH) are installed, having a BTUH value greater than the calculation (31,500 BTUH). Meanwhile, in the bedroom with a room area of 126 m2, 4 units of 2PK AC (72,000 BTUH) are installed, having a BTUH value greater than the calculation (63,000 BTUH).
3. The total power on the AC panels on floors 1, 2 and 3 is 27,360 Watts using 3-phase electricity with an 80 A MCCB and 4x35 mm2 NYY cable.
4. The total power on the lighting panel & power outlets on the 1st floor is 9,762 Watts using 3-phase electricity with a 40 A MCB and 4x16 mm2 NYY cable.
5. The total power on the lighting panel & power outlets on the 2nd floor is 5,473 Watts using 3-phase electricity with a 20 A MCB and 4x4 mm2 NYY cable.
6. The total power on the lighting panel & power outlets on the 3rd floor is 6,819 Watts using 3-phase electricity with a 32 A MCB and 4x6 mm2 NYY cable.
7. The total power on the MDP panel is 104,134 Watts using 3-phase electricity with a 250 A MCCB and 4x240 mm2 NYFGbY cable.

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