

Electrical System Planning On Ship 54.18 Tone with Biro Klasifikasi Indonesia (BKI) Standard

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ABSTRACT

Electrical installation systems is the most important system in the ship, Therefore the planning such as the selection of the electrical components to be installed, installation drawings and calculations must be done carefully and refers to the regulation as standard in the construction of a ship. At 54.18 Tone ship project planning is done in a way that the selection of components is technically adapted to the technical standards of the amount of electricity that is allowed. The technical standard uses BKI code. The planning is done well, but the operating system ships were affected by the power source would be optimal. However, it received less attention from the owner of the shipyard that will build a ship.

KEY WORDS: *Electrical Planning, BKI, installation, ship.*

1.0 INTRODUCTION

In the shipping industry and the technology used to support the system operation of the vessel in the classification of construction and system specifications marine use continues to increase, therefore, to ensure the equipment marine use according to the specifications according to standards would require elections when the need to be equipped with certification documents issued by the classification (type approved class) regarding the recognition of the equipment.

PT Biro Klasifikasi Indonesia (Persero) or abbreviated

as BKI is an Indonesian State-Owned Enterprise which is appointed as the only national classification body to carry out the classification of Indonesian and foreign motorized commercial vessels that regularly operate in Indonesia water. The Indonesian Classification Bureau (BKI) is the 4th classification body in Asia after Japan, China and Korea, and is the only national classification body tasked with classifying Indonesian-flagged commercial vessels and foreign flag carriers that regularly operate in Indonesian waters. BKI was formed by applying technical standards in carrying out design, construction and survey marine activities related to floating facilities, including ships and offshore construction. This standard was prepared and issued by BKI as a technical publication. Ships designed and built based on BKI standards will get a Classification Certificate from BKI, where the certificate issuance is carried out after BKI completes the required classification survey.

Electrical installation is a system or circuit required to distribute electric power that will be used to satisfy needs, so the factor of safety equipment, the user and the people around him is important. The installation can be divided into the installation of lighting and installation of electrical power.

The lighting installation is the installations used to provide electric to the lamp or other lighting equipment.

2.0 ELECTRICAL DESIGN

2.1 Ship Characteristic

The general specifications on ships 54.18 are vessel data ranging from the size of the ship, main movers and auxiliary engines and ship crew. There are Engine Room (Engine Room); LOA (Length Over All): 40.00 meters, the overall length of the ship, measured from the stern (rear) to the bow (front) of the ship; B (Breadth Molded): 7.50 meters, the width of the ship; Design Draft: 1.20 meters, the height of the surface of the ship that is submerged in

water which is measured from the bottom of the ship; Play Engine 3x1400 HP; Auxiliary Engine (Generator) = 2x100Kva; Speed Max = 30 Knots; Crews = 24 Personnel. To support the effectiveness of the placement of load equipment in several places on the ship which is one very important element, here is a description of the ship parts 54.18 Tone: Engine Room (Engine Room) and accommodation Room (Accommodation Room) that include Lower deck plan Deck, Navigation deck plan.

DWT (dead weight tonnage) is deadweight tonnage of the amount of weight / weight that can be accommodated by the vessel to make the ship sink to the allowable limit expressed in long tons or tone metrics. The maximum allowable limit is marked with plumose mark on the hull.

Deadweight tonnage is defined as the sum of the weight / weight of the following table:

Table 1: DWT

No.	Item	Full load [ton]
1	Fresh Water	8
2	Daily Tank	5
3	FOT 1	17.4
4	FOT 2	12.2
5	FOT 3	7.2
6	Crew 24 @ 75 kg	1,8
7	Provision 24 @ 20 kg	0,48
8	Cargo 1	0.50
9	Cargo 2	1
10	Bagasi 24 @ 25 kg	0,6
Total DWT		54,18

2.2 Electrical Usage Estimation

To determine the capacity of the generator must know all the load used on the 54.18 Tone vessel listed in the technical specifications of ship equipment including lighting equipment, navigation, communication (lighting & navigation communication), pump capacity (machinery parts) and other good equipment it is to support shipping (Hull Part). Calculating the needs of the generator capacity on 54.18 vessels on several conditions of the ship, namely the on-shore conditions and lean conditions can use equation below.

$$P_{CL} = \sum_{eq} P_{eq} \cdot LF \quad (1)$$

$$P_{IL} = \sum_{eq} P_{eq} \cdot LF \quad (2)$$

Where ; P_{CL} = Continue Load in Watt, P_{IL} = Intermiten Load in Watt, \sum_{eq} = electrical equipment, P_{eq} = usage load LF (Load Factor) = 0.8.

The total load for Lighting, communication, and navigation can be calculated by

$$P_{CL Lnv} = P_{CL1} + P_{CL2} + \sum_{PCL} \quad (3)$$

$$P_{IL Lnv} = P_{IL1} + P_{IL2} + \sum_{pIL} \quad (4)$$

Where, $P_{CL Lnv}$ = Total load in watt for (Continue Load in Lighting & navigation), $P_{IL Lnv}$ = Total for Intermiten Load in Lighting & navigation), \sum_{PCL} = total power P_{CL1} , P_{CL2} and $\sum_{pIL} = P_{IL1}$, P_{IL2} etc.

Machinery Part

$$P_{CL MP} = P_{CL1} + P_{CL2} + \sum_{PCL} \quad (5)$$

$$P_{IL MP} = P_{IL1} + P_{IL2} + \sum_{pIL} \quad (6)$$

Where: $P_{CL MP}$ = Total load for Continue Load at Machinery Part), $P_{IL MP}$ = Total load for Intermiten Load at Machinery Part), $\sum_{PCL} = P_{CL1}$, P_{CL2} etc., and $\sum_{pIL} =$ jumlah daya P_{IL1} , P_{IL2} etc.

Hull Part

$$P_{CL HP} = P_{CL1} + P_{CL2} + \sum_{PCL} \quad (7)$$

$$P_{IL HP} = P_{IL1} + P_{IL2} + \sum_{pIL} \quad (8)$$

Where: $P_{CL HP}$ = Total load for Continue Load at HullPart, $P_{IL HP}$ = Total load for Intermiten Load at Hull Part, $\sum_{PCL} =$ Total power P_{CL1} , P_{CL2} etc., and $\sum_{pIL} =$ total power P_{IL1} , P_{IL2} etc.

Then we sum all equation to calculate the total load in the ship.

$$P_{CL Tot} = P_{CL Lnv} + P_{CL MP} + P_{CL HP} \quad (9)$$

$$P_{IL Tot} = P_{IL Lnv} + P_{IL MP} + P_{IL HP} \quad (10)$$

The Diversity factor at on shore can be calculated by

$$P_{DR,IL} = 0.5 \cdot P_{IL tot} \quad (11)$$

The Diversity factor at off shore can be calculated by

$$P_{DR,IL} = 0.5 \cdot P_{IL tot} \quad (12)$$

The total load at on shore and off shore can be calculated by

$$P_{seagoing} = P_{CL tot} + P_{DR,IL} \quad (13)$$

$$P_{port} = P_{CL tot} + P_{DR,IL} \quad (14)$$

3.3 Distribution Wheelhouse

Single line diagram Distribution Board Wheelhouse shown in figure 3

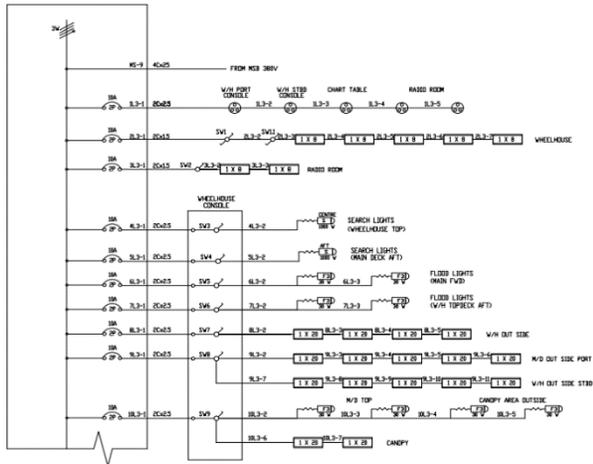


Figure 3: Single line diagram of distribution wheelhouse.

From Figure3 show that the wheel house has two rooms only. There are:

Room 1 consist Platform room (5 pcs *fluorescent light* 220V/18 Watt, 3 pcs *socket electric* 220V and 1 pcs *emergency light* 24V/15 Watt) and room 2 consist Radio room (2 pcs *fluorescent light* 220V/18 Watt, 2 pcs *socket electric* 220V and 1 pcs *emergency light* 24V/15 Watt).

3.4 Main Switch Board (MSB) Panel

Electric power supply from generators, standby generator, and harbor generator distribute through the MSB (Main Switch Board), and distributed to 380V and 220V can be shown Figure 4.

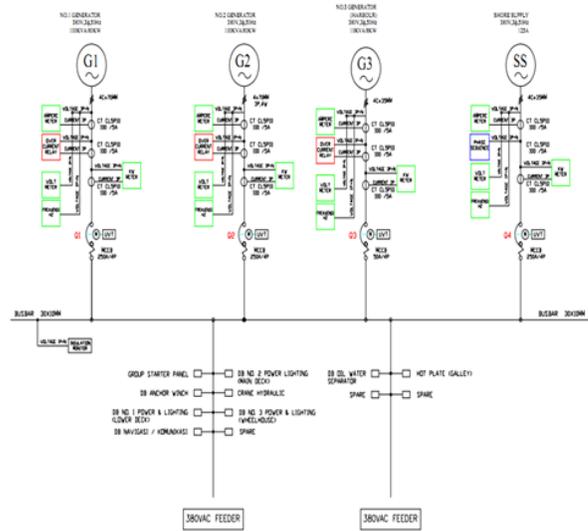


Figure 4: Single line diagram of main Switch Board

4.0 Result and Discussion

First Safety Main Switch Board have specification as Conductor Type XLPE-70 / 259 A; Rating Protection = 250A; Current Load (In) = 126 A; According 259 A > 250 A > 126A From the above calculations can be written with a table as shown below

Table 2: cable and current capacity

NO	DESCRIPTION	PENAMPANG KABEL (mm ²)	KEMAMPUAN HANTAR ARUS (AMPER)	RATING PENGAMAN TERPASANG (AMPER)	ARUS NOMINAL BEBAN (AMPER)
1	Pengaman Utama Main Switch Board (DG)	4C X 70mm ²	259	250	126
2	Distribution Board Lower Deck	4C X 25mm ²	110	50	45.1
3	Distribution Board Main Deck	4C X 25mm ²	110	50	44.44
4	Distribution Board Wheelhouse	4C X 25mm ²	110	50	27.95
5	Distribution Board Navigasi & Komunikasi	4C X 16mm ²	87	30	3.13
6	Distribution Board Crane Hydraulic	4C X 6mm ²	47	30	28.52
7	Distribution Board Anchor Winch	4C X 6mm ²	47	30	20.9
8	Distribution Board Oil Water Separator	4C X 2.5mm ²	28	30	1.77
9	Distribution Board Starter Panel / DB Pump	4C X 2.5mm ²	28	20	17.1
10	General Service Pump	4C X 6mm ²	55	50	45.64
11	Sewage Pump	4C X 1.5mm ²	23	15	12.54
12	Fuel Oil Transfer Pump	4C X 4mm ²	43	20	17.1
13	Seawater Cooling Pump	4C X 4mm ²	43	40	31.38
14	Fire Pump	4C X 4mm ²	43	40	31.38
15	Ballast Pump/Ballast	4C X 2.5mm ²	31	20	17.1
16	Blower Dopur	4C X 2.5mm ²	31	20	17.1
17	Sea Water Hydrophore Pump	4C X 2.5mm ²	31	10	5.7

Measurement of cable insulation resistance is a measurement is performed to determine insulation resistance conductive wires if the conductor is still feasible or not feasible, in accordance with Rule BKI Volume chapter.2 nomer.2.3.4 Insulation resistance measurement should be performed at a voltage of 500V DC.

Table 3: Drop voltage in distribution

NO	DESCRIPTION	VOLTAGE TEST (V)					
		PHASE R & N	PHASE S&N	PHASE T & N	PHASE R&S	PHASE S&T	PHASE T&R
1	GENERATOR.1	219	220	220	379	381	380
2	GENERATOR.2	219	220	220	379	381	380
3	DB LOWER DECK	219	220	220	379	381	380
4	DB MAIN DECK	219	220	220	379	381	380
5	DB WHEELHOUSE	219	220	220	379	381	380
6	DB PUMP /STARTER PANEL	219	220	220	379	381	380
7	DB CRANE	219	220	220	379	381	380

The measurement results of each feeder voltage Distribution Board are shown below

Calculation generator when sailing ship

$$PDR. C. L = \frac{P_{seagoing}}{P_{Gen}} \times 100\%$$

$$PDR. C. L = \frac{66.31 \text{ Kw}}{80 \text{ Kw}} \times 100\%$$

$$PDR. C. L = 82.89\%$$

From the above calculation can be written the table below

Table 4: Characteristic of electrical load in ship



No.	ITEM	Normal Sea Going	In Port	Harbour
a	Lighting and Navigation	3.86	1.50	1.80
	Communication	1.13	3.43	-
b	Machinery Part	18.96	5.20	-
		15.80	29.56	-
c	Hull Part	27.59	0.52	2.51
		14.85	41.92	-
d	Total	50.42	7.22	4.12
		31.78	74.91	-
e	Diversity Factor 0.5 x (d) intermitten	15.89	37.45	-
f	Jumlah beban (d) continue + (e)	66.31	44.68	4.12
g	Genset Capacity (kw)	80.0	80.0	8.0
h	Load Factor $\left(\frac{\%}{100} \right) \times 100\%$	82.89	55.85	51.45

5.0 CONCLUSION

Referring to the analysis and study of final project planning of electrical systems on ships 54.18 tone by standardizing Society Indonesia (BKI), it can be concluded:

Output At the time of sailing ships conditions (at sea going) electric power consumption required by the total load of 66.31 kW, so the value of the generator load factor amounted to 82.89% of the capacity of the generator is used by 80 kW.

At the time the ship docked condition (at in port) power consumption required by the total load of 44.68 kW, so the value of the generator load factor amounted to 55.85% of the capacity of the generator is used by 80 kW.

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