Chapter 1
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Emergency Generator Usage on Landing Craft Tank: A Brief Review

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ABSTRACT

The Landing Craft Tank (LCT) is a type of attack landing craft for waterfront vessel tanks. Generally, LCT 415 Gross Tonnage (GT) ships are not equipped with emergency generators. Only ships with more than 500 GT are required to have an emergency generator package, according to Indonesia Classification Bureau or Biro Klasifikasi Indonesia (BKI) rules. However, in order to achieve a higher level of safety, the LCT 415 GT is outfitted with an emergency generator package installation. This generator serves as an electric power source for the ship's compass when it is turned off. The goal of this research is to learn about the LCT 415 GT's electrical power requirements in order to identify the required emergency generator package specifications and to provide an overview of the generator's placement on the main deck. Emergency generator packages are organised to improve ship safety, crew safety, and cargo safety. LCT 415 GT ships required a total power of 29,9408 kW in an emergency. When extreme weather conditions occur, the basic package of emergency generator set selection is based on total emergency power in accordance with BKI regulations, as well as the generator safety engine package set.

Keywords: BKI regulation; emergency generator package set; LCT 415 GT.

1. INTRODUCTION

A generator is an auxiliary machine that supplies all of the ship's electrical needs. A generator set is a machine that can convert heat energy (the result of combustion) into mechanical energy (motion). The energy source is solar (low rate oil) [1-5]. High pressured air is used to burn the oil. Diesel machines generate electricity by using diesel power motion, which is based on a generator. A ship's generator set serves as the primary power source for electrical devices such as lamps, navigation equipment, pumps, and so on [6-11]. Black out

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condition in ship appeared when complete failure of electrical power brings the ship into a standstill. Main source of electrical fails to be operated. If this happens, emergency generator is needed to supply electrical power to vital equipments of the ship. One of the most basic tasks for ship power system design is electrical load analysis, which is used to determine the required installed capacity of on-board power generators [12-14]. According to BKI regulation Vol. IV Section 3, a ship with 500 GT is required to install emergency generator for emergency condition. Actually, LCT 415 GT is not required to install emergency generator set. Yet it is allowed for safety reason. System in emergency generator has to be set automatically active to avoid long blackout to occur.

2. LITERATURE STUDY

2.1 Engine Combustion System

Based on classification, it is divided into four, they are:

Based on utility: The engine is categorized based on where it is used, like for ship propulsion and as assisting tool for the ship, for generator, compressor and pump in industry. On international scale engine combustion system to generate power will be adapted for high level automotive industry producer, traction and maritime engine.

Based on speed: This classification isgenerally used due to its tocranshaft axis rotation at its base that determines weight and size of engine related to the output.

Based on design: Engine can be sub classified with related to its design feature that is:

a. **Work cycle:** four-strokes or two-strokes
b. **Piston:** action/piston connection
c. **Cylinder:** The way the air is put into cylinder (on ambientor high pressure)

The way the air is put into cylinder (either in ambient or or high pressure)

Based on size: Classification based on size is is related to many factors like cylinder dimension, cylinder number, speed and average of effective pressure.

2.2 Work Cycle

The combustion can be by self igniting or by indirectly. Ignition compression and engine sparks can be arranged in one of those two cycles. In diagram. this can be explained in Figs. 1, 2; along with appropriate indicator diagram depicting what is occuring in engine cylinder in every cycle. In four strokes, fuel ignition happens in every other crank shaft axis revolution engine that this cycle works from its fuel during one stroke in four strokes (Fig. 2). Strokes work in once every

two cycles. On the other hand two stroke engine has excellent motion in every crank shaft axis rotation (Fig. 2). Yet two stroke engine generally is lighter and smaller than four stroke engine with same output.

Because two stroke engine has twice power, so four stroke engine produces twice power as well down stroke two stroke engine combines power & exhaustion of steam. During port intake and exhaust is cleaned by piston, fresh air and burnt gas is mixed. Not all gas is totally burnt, that prevent bigger fresh air to be inducted into cylinder. That's why stroke load produced has fewer pushing power.

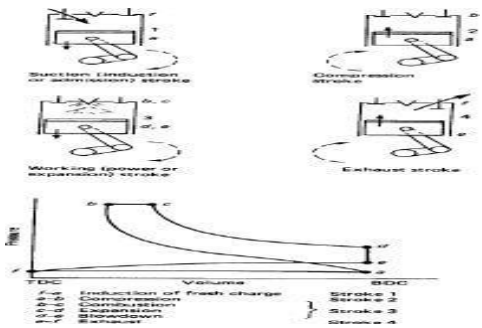

Fig. 1. Four-stroke cycles

In four stroke engine almost all burnt gas will be forced to exit burning area by upward moving piston. This will make almost air-fuel mixture fulled to enter cylinder due to piston stoke, because piston stroke is specialized for mixture induction. Therefore, power stroke produces relatively more power than two-cycle counterpart.

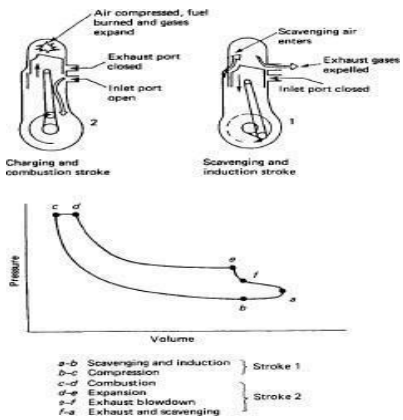

Fig. 2. Two-stroke cycles

2.3 Generator

Generator is electrical device that converts motive power (mechanical energy) into electrical energy by applying magnetic induction principle. Type of generators are AC generator and DC generator.

Generator AC: Magnetic induction principle is a conductor that is moved in magnetic field so that it cuts magnetic flux to create voltage. This condition generates electricity in cycle: +0 -0 (AC) or called alternator. It is a device to convert mechanical energy into electrical energy with magnetic field induction as intermediary. Basic principle of ACgenerator is Faraday Law stating that if circuits conductor is in alternating magnetic field, electricity movement will reforme d. AC Electricity is generated from electromagnetic induction, a wire close to permanent magnetic pole rotating at its axis so electrical voltage at the edge of the circuitwill appear shown by Volt meter, Volt meter indicator will moveright to left showing positive or negative polarity. This changing energy occurs due to changing magnetic field in coil (location of voltage in generator. Field coil in AC generator is at its rotor coil jacket coil is at stator. Shown in folowing picture.

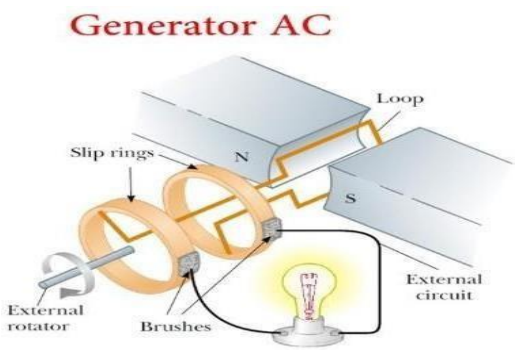

Fig. 3. Generator AC with rotor to produce electrical voltage

Generator of one axis with diesel motor, usually uses alternator to generate power. This Generator has high capacity, its magnetic field is rotating because it is located at rotor. Next is construction of AC generator:

1. Stator frame
2. Stator
3. Rotor
4. Sliding ring
5. Strengthening generator

Poles will generate rotating magnetic field. This Generator is called internal pole generator, shown in Fig. 4.

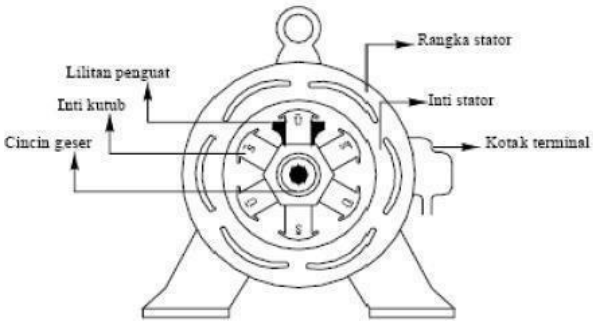

Fig. 4. Construction of magnetic pole generator

DC Generator: DC Generator is a mechanical energy converting device that is rotation to be direct current electrical energy. Mechanical energy is used to rotate coil in magnetic field. Usually ship using AC generator or called alternator shown in following picture.

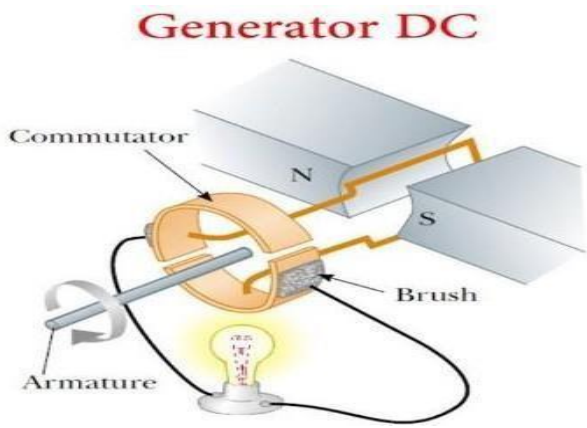

Fig. 5. DC generator with rotor to generate voltage and coil as electrical conductor

2.4 Similarities and Differences of AC and DC Generators

Both have basic construction that is conductor to produce voltage and part that produces magnetic field. Every generator has rotor and dan stator to represent both. Rotor is rotating and stator is static. In DC generator rotor generates voltage, while in AC generator AC generator both, rotor and stator generates voltage.

AC generator with rotor to generate voltage, construction is almost similar with DC generator, but produced voltage is not in direct with comutator but to slip ring and electric current is flowing to stator This type of Generator usually is used for not so big electrical supply. For AC generator to produce voltage, current is flowing to rotor until rotating field occurs in rotor. Advantage of this system is produced voltage can be combined with electrical load and also to reduce short circuit due to not using slip ring or or charcoal brush as conductor because both are difficult for isolation.

2.5 Generator Set

Generator set is to convert mechanical energy to electrical energy, therefore generator rotor needs to be rotated. Mechanical energy source can be water turbine, steam turbine motor diesel. Integration of enerator and its mechanical energy is called generator set

Black out / Emergency condition in ship: Black Out is when electrical supply is interrupted due to oversupply, under supply or telectrical current is too high or too big, for example main genset and controlling system a panel are damaged, short circuit happens, etc.

2.6 Regulation of Biro Klasifikasi Indonesia (BKI)/ Indonesian Classification Bureau

Biro Klasifikasi Indonesia (BKI) is national classification agent that is to make classification of commercial ship and foreign ship operating regularly in Inonesia. BKI was established to setup technical standard in ship's design and costruction and maritime survey related to floating facility including ship and off shore facility. BKI conducts classification based on engine hull construction and electrical installation in order to evaluate ship's ability to sail/operate.

3. RESEARCH METHODOLOGY

The research use descriptive method based on:

3.1 Data Gathering

By requesting data to ship owner of Trijaya Bravo 415 GT.

3.2 Data Analysis

Acquired Data is used as reference to conduct ship design literature study. Then data will be processed in Excel to obtain electrical load calculation for LCT 415 GT. This Data is used to choose appropriate generator package set.

Testing was conducted in Computer laboratory of Faculty of Marine Technology, Darma Persada University from March until July 2020.

4. RESULT AND DISCUSSION

4.1 Data of Ship

Data for final assignment is gathered from owner of the ship:

1. Ship Name: LCT. TRIJAYA BRAVO
2. Ship Type : Ships for the Carriage of Craft tank
3. Length Over All : 56,15 M
4. Length Water Line : 52,00 M
5. Length Between P. : 50,50 M
6. Breadth Moulded : 9,40 M
7. Depth Moulded : 2,85 M
8. Gross Tonage : 415 Ton
9. Main Generator : 2 Units gensets operated, AC 380V/220V, 3Ph, 50Hz 4 Wire 100 Kw, 125KVA, 190A

Result of load need calculation analysis in emergency condition:

Table 1. Load need in emergency condition

No.	Equipment	Load (kw)	Number	Total Load Brand (kw)	Type
1	Radio equipment	0,5	1	0.500 JRC	JSS-2500
2	Giro compass and pilot	0,05	1	0.050 JRC	APLHATRON Marine
3	Echo Sounder	0,3	1	0.300 Furono	LS 6100
4	General Alarm	0,05	1	0.050 Aqua larm	
5	Integrated Communication	0,06	1	0.060 JRC	Aplha connect 48
6	Radar	4	1	4.000 JMA	JMA-1032
7	AIS and motor horn	0,05	1	0.050 JRC	JHS-183
	Navigation Devices			**5.010**	
1	Mast Head Light	0,04	1	0.040 WISKA	AS-760-WH-24-PB
2	Acnhor Light	0,01	1	0.010 EVAL	
3	Port Sidde Light (red)	0,0008	1	0.008 OSCULATI	
4	Stern Light	0,13	1	0.130 WISKA	DAS-760-WH-230/230-PB
5	Star Board Side Light (green)	0,025	1	0.025 VETUS	SB55VN
6	Morse Light	0,01	1	0.010 PERKO	

No.	Equipment	Load (kw)		Number	Total Load Brand (kw)	Type
7	Search Light	1	1	1.000	HALOGEN	PSHR-1K
8	Emergency Lightning	0,048	20	0.960	KHJ	Ex-KSF481200
	Navigation Lightning			2.175		
9	Fire and smoke detector	0,0035	10	0.035	Squashni	
10	Fire alarm system	0,37	1	0.370	Minerva	
	Alarm & Detector			0.405		
11	Exhaust Blower Fan	1,5	2	3.000	Hi-Sea	CWL-180G
12	Supply Blower Fan	2,2	2	4.400	Hi-Sea	CWL-200G
	Ventilation Engine Room			7.400		
13	Exhaust Blower Fan	0,06	1	0.060	Hi-Sea	CWL-100D
14	Supply Blower Fan	0,09	1	0.090	Hi-Sea	CWL-100G
	Ventilation For Galley			0.150		
15	Exhaust Blower Fan	0,12	1	0.120	Hi-Sea	CWL-160D
16	Supply Blower Fan	0,37	1	0.370	Hi-Sea	CWL-180D
	Ventilation Steering Room			0.500		
17	Transfer Fuel Pump	1,5	1	1.500	Azcue	CA-80/7A
18	Oily Water Separator	0,8	1	0.800	RWP-VEOLIA	0.1
19	Public Utility & Fire Pump	4	3	12.000	Azcue	CA-50/5A
	Pump			14.300		
Total					**29.940 kW**	

4.2 Choosing of Emergency Generator Set

Emergency generator set is assisting device to convert mechanical energy into electrical energy in emergency condition. Basic consideration to choose emergency generator set is because total voltage of ship needed during emergency based on BKI Volume IV Section is 3 29,940 kW Power Supply Installation, total voltage needed of LCT 415 GT during emergency is 29,940 kW. Perkins emergency generator set has specification voltage of 30 kW in 3-phase system. This indicates that this generator to be emergency generator package set for ship LCT 415 GT. This machine has casing to ensure safety of generator machine in extreme weather. Below is specification of Perkins generator package set.

Fig. 6. Perkins emergency generator set

Table 2. Perkins specification of emergency generator set

Engine Maker		**Perkins**
Model		1103A-33G
Engine Speed	RPM	1800
Engine Power	kWm	36.5
Output at rated rpm	HP	48.9
Cooling		Radiator Cooled
Aspiration		Natural
Total Displaceme nt	Liter	3.3
No. of Cylinders andBuild		3-inline
Bore and Stroke	mm x mm	105 x 127
Compressi on Ratio		19 : 25 : 1
Governor		Mechanical
Fuel	Full Load	8.6

Engine Maker		**Perkins**
Consumption(L/hr)	75% Load	6.6
	50% Load	4.9
Fuel Tank Capacity (Non-UL)	Liter	130 Open / 180 SAE
Oil Capacity	Liter	8.3
Coolant Capacity	Liter	10.2
Radiator Cooling Air	m^3/min	70

4.3 General Arrangement

General arrangement is planning of room/space based on its function and equipment facility. For example cargo space, accomodation room, machine room, etc. Besides, this planning covers location of room and its access. Accoding to Ship Design and Construction, it is divided into four:

a. Decision of main room location.
b. Decision of its boundary.
c. Decision to choose exact equipment.
d. Decision of its access.

Based on acquired data, LCT 415 GT has design of general arrangement shown in Fig. 7. This design represents ship prior to using generator set.

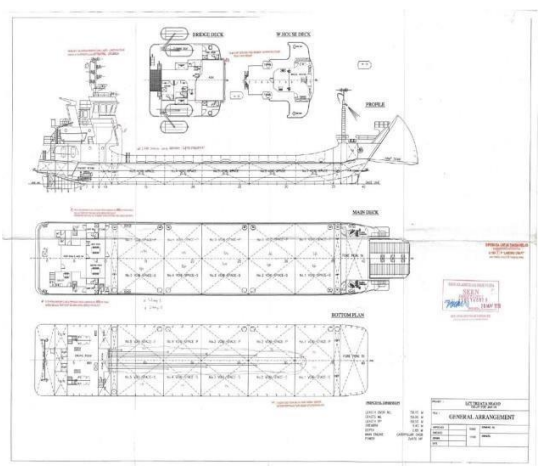

Fig. 7. General rearrangement of LCT. 415 GT
Source: P.T. Indoliziz Marine

Based on planning, generator package set will be put in main deck. Main deck is open area for easy access to operate generator in emergency condition. Below is modification of generator arrangement of LCT 415 GT after the installment of generator package set.

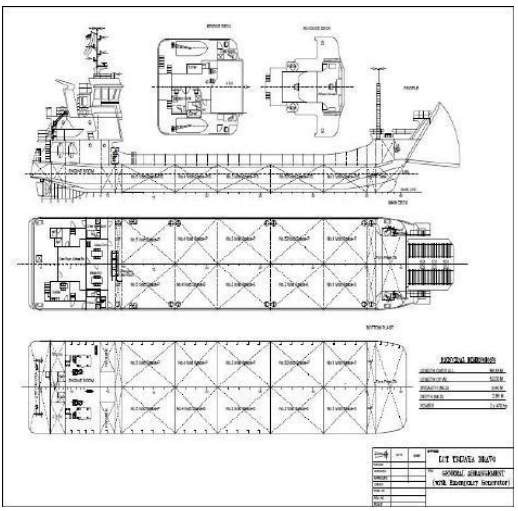

Fig. 8. Modification of general arrangement of LCT. 415 GT
Source: PT Indoliziz Marine

5. CONCLUSION

Ship of LCT 415 GT needs total emergency power of 29,940 kW. There is modification ofLCT 415 one line diagram due to emergency generator package set installment. Reason of emergency generator package set is based on total emergency power according to BKI regulation and the safety of generator engine package set in extreme weather. Emergency generator package set for tshi p LCT 415 GT is put at open deck that is in line with BKI regulation so it can be accessed if there is fire or other incident.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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