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Electrical System on Ship-A review

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Abstract— *A ship is like a city floats on water with all amenities and facilities available to any operational set-up on land. Just like any conventional city, the ship also requires the basic amenities to sustain life on board, the important among them being power or electricity. Electricity on ships is generated by an alternator or generator. Just like other mechanical systems, electrical systems must also be checked at regular intervals of time. Marine engineers and electrical officers on ships must know their mechanical systems and all electrical equipment attached to them extremely well. Periodic maintenance is the key element to the efficient and smooth running of all electrical systems on ships.*

Keywords— Marine, Electrical power, Maintenance.

I. INTRODUCTION

A ship is equivalent to a floating city that enjoys almost all privileges available to any operational set-up on land. Just like any conventional city, the ship also requires the basic amenities to sustain life on board, the chief among them being power or electricity. Electricity on ships is generated by an alternator or generator. Shipboard power is generated when a prime mover and alternator works together. For this purpose, an alternating current generator is used on board. The generator works on the principle that as a magnetic field rotating around a conductor varies, a current is induced in the conductor.

II. POWER GENERATION ON SHIPS

The generator consists of a stationary set of conductors, wound in coils of iron core also known as the stator. A rotating magnet known as rotor turns inside this stator, producing a magnetic field, which cuts across the conductor and generates an induced EMF or electro-magnetic force as the mechanical input causes the rotor to turn. The magnetic field is generated by induction (in a brushless alternator) and by a rotor winding energized by DC current through slip rings and brushes. Few points that are to be noted about power generated on board ships AC, 3-phase power is preferred over DC as it gives more power for the same size - 3-phase is preferred over single phase as it draws more power and in the event of failure of one.

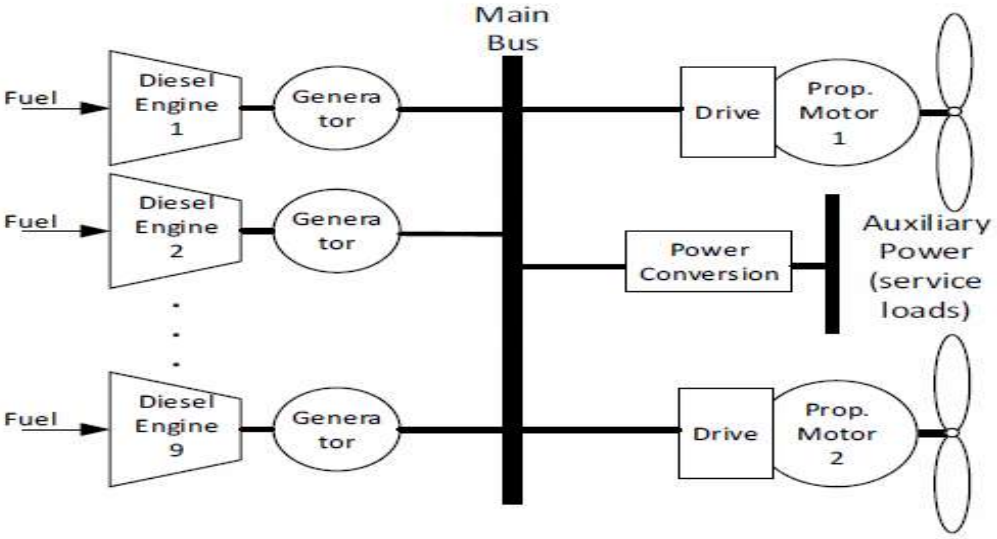

Fig.1. Integrated diesel electric power grid

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III. POWER DISTRIBUTION ON SHIPS

The ship's power distribution system consists of different components for distribution and safe operation of the system. The main components of this system are:

- Ship's generator - consists of prime mover and alternator
- Main switchboard - a metal enclosure taking power from the diesel generator and supplying it to different machinery systems
- Bus bars - acts as power carrier and allows transfer of load from one point to another
- Circuit breakers - act as a switch, and in unsafe conditions can be tripped to avoid breakdown and accidents

 Fuses- safety devices for machinery

 Transformers- to step up or step-down the voltage. When supply is to be given to the lighting system, a step down transformer is used in the distribution system In a power distribution system, the voltage t which the ship is a critical system works is usually 440v. However, there are some large installations wherein the voltage is as high as 6600v.

Power on ships is supplied through circuit breakers to large auxiliary machinery at high voltage. For smaller supply fuse and miniature circuit breakers are used.

The power distribution system, consisting of three wires, can be neutrally insulated or earthed. Insulated system is more preferred as compare to earthed system, as during earth fault essential machinery such as steering gear can be lost.

IV. EMERGENCY POWER SUPPLY

In case of failure of the ship's main power generation system, an emergency power system or a standby system is used. The emergency power supply ensures that the essential machinery systems continue to operate the ship.

Batteries or an emergency generator or even both can supply emergency power on ships.

Ratings of the emergency power supply should be such that it is able to support all essential systems such as:

1. Steering gear system
2. Emergency bilge and fire pumps
3. Watertight doors
4. Firefighting system
5. Ship's navigation lights and emergency lights
6. Communication and alarm systems

V. CONCLUSION

The evolution of the development of marine vessels, from the earliest introduction of electricity in commercial vessels with the SS Columbia in the 1880 to the new era of the all-electric ship marked by the Ampere ferry, has been presented in this paper. The use of electricity in marine vessels which started far from the idea of an electric power system on board, has however spurred the developments of electric propulsion systems, and the concept of the integrated power system. As new needs arose (raising cost of fuels and need for improved fuel efficiency) and new inventions emerged, electricity moved from illumination to propulsion systems and energy storage, gradually shaping the emergence of an electric power grid within the marine vessel. The evolution of the marine vessel electrical power system, in this way shaped also the evolution of several electrical technologies, that were customized for use in vessels. And the move appears likely to continue as the Ampere example shows, towards fully electric ships with compact electric components, far from the solution but not from the idea of the first experiment of DC electric boat by

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von Jakobi. More than 150 years after this first experiment, and through a trajectory of diverse technological developments, the concept of fully electrically driven ships seems to not have gone forgotten.

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