

AUXILIARY SYSTEMS:

a. **System and Machinery Controls.** Mainly 4 different types of Machinery control systems are being used onboard PN ships / vessels. Details of the same are as follows:

(1) **RLC (Relay Logic Control).** This is the oldest control system being used involving relay logic. However, same is being upgraded on case to case basis.

(2) **ELC (Electronic Logic Control).** This system involves a number of nonprogrammable PCBs. Same can be considered for upgradation on case to case basis.

(3) **Microprocessor Based System.** This system involves programmable PCBs. It is easy to handle, presence of software and COTS components makes troubleshooting easier.

(4) **PLC (Programmable Logic Control).** It is one of the most advanced systems being used in PN. It is considerably compact sized as compared to earlier described systems. Same PLC can be used for different systems with amendment in program. Option to develop a standardized PLC based control system for its machinery control can be considered.

b. **Converters / Transformers.** Various types of AC to DC and DC to AC converters are used onboard different vessels. These generally range from 440 V AC to 24, 28, 50 V DC. Similarly, a number of step up & step down transformers are being used by PN ranging from 440 V to 220 and 115 Volts. In addition, Motor Generators ranging from 50/60 Hz to 400 Hz of varying capacities are also being utilized.

c. **Motors.** A variety of AC and DC motors are being used. In AC motors, mainly induction motors are used which range from ½ HP to 75 HP of 440 V 50 / 60 Hz. Some squirrel cage motors are also being used. These motors drive various pumps, compressors and capstans etc.

d. **Non Magnetic Motors.** Ships are fitted with non-magnetic 88 KW, 440 V motors with variable frequency (5-17 Hz). It is essential that these should have non-magnetic characteristics.

e. **Auxiliary Power Units (APU).** Auxiliary Power Motors are used for propelling the vessels in case of emergencies (bring home device). The power rating of the unit is 325 HP with 440 Volts AC, 60 Hz; developing a thrust of approx over 13000 lbs. The starting current of the unit is 3400 Amps with 540 Amps running current.

f. **Power Generation (Generators).** Various kinds/types of generators are being used in PN inventory ranging from 1 MW to 50 KW producing 11KV-220V in 50 Hz and 60 Hz range. These vary mainly from brushless generators to regular brushed generators.

g. **Pumps.** A large variety of positive displacement and continue flow pumps of various types like centrifugal, close / open impeller, axial flow, reciprocating, gear / lube, rotating plunger and screw type pumps etc are being used. Flow rate of these pumps range from 0.1 GPM to 550 GPM with pressure ranging from 10 PSI to 800 PSI utilizing sea water, fresh / feed water, fuel and lube oil as pumping media.

h. **RO Plants.** RO plants are being used for fulfilling fresh and feed water requirements of various sea going and shore units. Onboard plants range up-to 7000 GPD with raw water intake designed for 48000 TDS. On shore requirement varies from 250 GPD to 250,000 GPD with intake designed for both sub soil and sea water.

j. **Air Compressors.** In order to fulfil requirement of compressed air for various purposes, a large range of compressors is being used. These compressors mainly include reciprocating, centrifugal and screw type ranging from 120 PSI to 4000 PSI. In addition, compressed air is also being used for breathing purposes fulfilling the required standard for human consumption.

k. **HVAC Systems.** A vast variety of HVAC systems for both sea going platforms as well as on shore units are being used. These plants comprise of hermetic, semi hermetic and classical reciprocating compressors with direct and in-direct expansion utilizing screw, scroll and seal rotary compressors etc. The plants range from 1.5 tons to over 200 tons capacity of varying operating principles i.e. absorption cycle, compression cycle etc. However, keeping in view the changing trends in local market, it is intended to replace the existing plants with Variable Refrigerant Flow / Volume (VRF/V) plants.

l. **Batteries.** A large number of batteries for various purposes are being used. Apart from classical batteries for vehicles, UPS and DC voltage back up, batteries are also used for propulsion system onboard submarines. These propulsion batteries comprise 320 Q type cells divided into two groups of 160 cells each and installed in two separate compartments. It has total life equal to charge/discharge of 1.8 Million AH or 5 years whichever is earlier. The "lead-acid" electro-chemical group consists of oval tubular positive plates and flat negative plates. The cell is specially designed to ensure the best possible use of power for slow and rapid discharging and a low release of hydrogen in both open-circuit and floating configuration. General technical description of the cells is as follows:

(1) Overall height: 1 140 + 0- 6 mm

- (2) Height under the cover: 1 066 + 2 mm
- (3) Width: 360 + 1 mm
- (4) Length: 450 + 1 mm
- (5) Weight: 528 Kg