STATEMENT OF TECHNICAL REQUIREMENTS FOR BATTERY MONITORING SYSTEM (BMS)

1. **Functionality**. The submarine is equipped with two identical batteries of lead-acid accumulators that are the normal and safe sources of electric power for feeding the propulsion system and the auxiliary machinery of the submarine through the direct current network. Each battery is located in a specific compartment and consists of 180 elements equipped with an electrolyte agitation system and an internal cooling system. Each battery is connected to a battery switchboard. The direct current is produced by the batteries and distributed via the battery switchboards.

2. **Battery Characteristics Monitored**. Voltage, Current, Ah discharged, Ah charged and capacity.

3. **Functional Requirements.** The BMS allows the information to be available at any time on the state of the batteries (voltage, current, charge state, residual autonomy, etc.), as well as, on the elements they are made up (voltage, temperature and electrolyte level in 100% of the elements in local mode and also transmitted to the IPMS).The BMS is able to detect failures and to provide the operator with indications of faults and incidents with respect to the state of the battery elements.

4. **Components.** The battery monitoring system consists of the following units:

(a) **Hardware Units** consisting of :-

(i) Processing and Monitoring Unit (PMU).

(ii) Data Concentrator Units, forward and aft (DCO).

(iii) Remote Sensing Unit (RSU).

(iv) Portable configuration PC or laptop, for local surveillance, serves to support the Human Machine Interface (HMI) for local control.

(v) 10 fibre optical cable jumps per submarine to by pass the sensors damaged.

(vi) Cables with connector to joint the first and last RSU of each loop with the respective DCO.

(b) **Software Units**.

(i) BMS server program, resident in the PC BMS. It implements the functions of sensing, data processing and response to requests made from the client program (HMI).

(ii) BMS Client Program, for making surveillance possible from the emergency PC in Local Mode with aim of linking with the PMU and not doing any battery monitoring operations.