

of the sensing system alarm. A de-watering capability is required when the vessel is on the surface. A hand operated pump may be sufficient for this purpose.

CHAPTER 7. ELECTRICAL INSTALLATION

A. General. In general, the electrical systems must meet the requirements of 46 CFR Subchapter T, Part 183 and Subchapter J - Electrical Engineering, Parts 110 - 113 as appropriate depending on whether the vessel will be certificated as a Subchapter T or Subchapter H vessel. System redundancy must be considered and addressed.

B. Cable. All cable, on the low pressure side, of the hull, must meet one of the following fire test standards: IEEE VW-1, IEEE 1202, or IEC 332-3 Category A. The fire test standard used to qualify the cable must be identified. In addition, because of the confined area of the submersible, any amount of smoke may be extremely asphyxiating, irritating to the eyes, and could cause panic or disorientation among the passengers. For this reason, all power and lighting cable must be low smoke, low/zero halogen cables. Types LSX or LSE cable manufactured to IEEE Standard 45 (Draft, October 20, 1992), meeting the appropriate flame tests are acceptable. All enclosures of cable, on the high pressure side, must be Nation Electrical Manufacturers Association (NEMA) rated 70 or greater, or equivalent. Signal and communication cables must meet the requirements of 46 CFR 111.60.

[Note: Limited runs of water-blocked submarine cable connecting external electrical equipment to internal junction boxes or power supplies may be acceptable, and will be reviewed on a case by case basis by the Marine Safety Center.]

C. Emergency Power.

1. An emergency power source and controls must be provided for emergency lighting, emergency recovery systems, emergency life support systems, and underwater communications systems. It must be independent of the main power source and must be sized to supply all connected loads for at least twice the maximum intended duration of an operational dive. At the end of this period the voltage of the battery must not be less than 88 per cent of the nominal battery voltage.

2. Emergency lighting must be automatically activated upon loss of the main power source. Pilot controls should be illuminated by the emergency lighting system. Emergency lights may have a means to turn them off to conserve power, but such means should not be accessible to the passengers.

3. There must be a means to indicate low potential on the emergency batteries

D. Batteries and Battery Charging.

1. All batteries must be protected from salt water contamination, yet remain accessible for regular servicing.

2. Batteries may be installed within the vessel hull if suitable precautions are made to protect the passenger compartment from outgassing and other associated hazards. Battery compartment isolation and sealing, monitoring of hydrogen and chlorine gas levels, catalytic conversion of gas emissions, and automatic bilge pumping are precautions that should be considered. Battery compartments must be made gas tight during normal passenger operations.

3. Battery charging procedures and equipment must be addressed from the standpoint of hydrogen generation and sources of ignition. Battery charging should be accomplished only while the submersible is at the surface, and no passengers are on board. Adequate ventilation must be provided during charging operations. The ventilation system must exhaust outside the submersible to the weather. Portable venting arrangements would be adequate.

CHAPTER 8. VESSEL CONTROL

A. Ballast Systems. Ballast systems must be designed to enable the vessel to be sufficiently stable on the surface and have adequate freeboard for the safe transfer of passengers to and from the vessel in the