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Finding Safe Harbor for Electronic Sounding Devices

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Just about any mariner knows the power and appeal of the open air and salty sea. It's a phenomenon that goes back long before mankind even dreamed of mechanical flight. Yet, despite his long-term affinity for things nautical, today's boater is far more reliant upon modern electronics than his predecessors ever were.

The trend has created many opportunities for electronic equipment manufacturers and designers of sounding devices including speakers, alarms and microphones. Common enough among land-dwelling instruments and hand held devices, these components offer high performance, high quality audible characteristics for many of the same purposes for which they've been used before; engine heat indicators, oil pressure, fuel monitors, communications, navigation systems, depth finders, and more. Yet, wherever these parts are used in marine environments, engineers and maintenance personnel need to be mindful of the harsh environments and conditions in which these devices must function. This article provides an inside look at some of the considerations affecting the more common device types.

Alarms

Many alarm devices in the industry fail in time which results in costly replacements or retrofit. The bulk of the problems originate at the connection design. In the typical setup for an alarm, the positive terminal of the device is "wired" to the battery and the negative terminal is linked to a sensor or a switch used to activate the alarm when required. Water deposition on the switch or sensor can activate the alarm and create a false indication. Full immersion of the alarm can also lead to corrosion on the sound diaphragm.

In the first case, if the switch or sensors are not sealed, water deposits can cause a leakage current to flow and activate the alarm unnecessarily. If sealing the sensor or switch is not possible, other methods have to be taken to prevent the false alarm. Some alarms are designed to prevent it and incorporate characteristics that prevent this occurrence.

The second case is more severe. Typical diaphragms of piezoelectric alarms are made from either brass or stainless steel. When the alarm is immersed in the water, a conductive path is formed and DC current will flow through the water to the diaphragm. This direct current will cause a **galvanic corrosion** in the diaphragm that will allow the water to penetrate the alarm and damage the electronic components. To circumvent this issue, some manufacturers have painted the diaphragm in order to isolate it. This is a very dangerous method. Any fault in the coating or UV damage will concentrate the current to that location and will cause rapid failure in the diaphragm. Even stainless steel will not hold up to galvanic corrosion. Brass diaphragms would not survive long in a chlorine environment like swimming-pools.

Special attention should be given to the construction materials of the alarms. The plastic case should be made with plastic that resists water, oil, and chemicals. Nylon should not be used since it will absorb humidity. To seal the alarm hermetically epoxy should be used for encapsulation. Silicon potting will absorb humidity and can affect the electronic component performance and it will not withstand oil. The recommended termination is wire leads spliced and sealed with glue filled heat shrink tubing.

The alarm sound port should have a single hole and be directed downward to allow water to drain from the alarm after immersion. Any water in the sound chamber will reduce the output sound level or in some cases prevent the alarm from producing any sound.

To the modern mariner, the difference from one alarm to the next may be difficult to spot since most replacement parts look virtually alike. The trick to the game is in the specifications and the price. The lowest cost piezoelectric alarms may be among the lesser grade devices, particularly if they are not hermetically sealed, or encapsulated in an isolation epoxy to prevent water from penetrating the alarm from either direction.

Typical Devices for Marine Applications

The **CE-CX212BWIR** or the **CE-C80WIR** from Challenge Electronics covers all the previous described problems. These components contain a stainless steel diaphragm and are hermetically sealed from all directions. They also feature an isolation circuit to prevent galvanic corrosion and false alarms. They are audibly powerful with continuous tone (operating from 5 to 15 Vdc). Output sound is about 103 ± 3 dB (A) at 24 inches (61 cm). They are panel mounted with 18 AWG wire leads. These alarms, as well as the entire CE series alarms also meet the most recent requirements for environmental compliance and are lead free RoHS compliant.

When specifying a sounding device, design engineers need to factor in the desired volume as well as the type of sound. A primary consideration is to make sure that the alarm can be heard above environment noise, and at the same time not blend with the engine noise. Alarms can produce a variety of tones, continuous, intermittent, chime, warble, or siren tones. Therefore, when specifying a continuous tone alarm, make sure that the sound does not blend in with environmental noises and thus be ignored. Even an intermittent tone at some interrupted rates may get lost within the acoustic noises generated by engines. Challenge Electronics provides a wide range of standard and custom alarms. Most of the standard alarms may be customized to include the isolation and false alarm features. They are all hermetically sealed, RoHS compliant, and are ISO9001 and QS9000 certified.

Tones and Tech

Continuous tone alarms produce a steady sound The **CE-CU515BS** continuous tone, panel mounted alarm is ultra loud in volume, operating from 5 to 15 Vdc. Output sound is 107 ±3 dB (A) at 24 inches (61 cm).

The intermittent tone can be modified to reflect the urgency of the alarm by changing the interruption rate from a slow rate to a fast rate. The **CE-BX515ASS**, for example, is a panel-mounted alarm that delivers an extra loud intermittent tone, 1 pulse per second, while operating from 5 to 15 Vdc. Output sound is about 103 ± 3 dB (A) at 24 inches (61 cm).

A chime tone delivery is a more pleasant sound, with the volume decaying exponentially. Typical applications for chime tones include indicators used within the cabin of a large pleasure craft or liner. The **CE-HM530ASS** is a panel-mounted alarm with a medium loud chime tone, 1 pulse per second, operating from 5 to 30 Vdc. Output sound is approximately 95 ± 3 dB (A) at 24 inches (61 cm).

A warble tone is designed to be more attention-getting, creating a sound that alternates between two distinguished frequencies. The **CE-WM530ASS** is a panel-mounted alarm with a medium loud warble tone, alternating at 1 Hz. operating from 5 to 30 Vdc. Output sound is about 97 ± 3 dB (A) at 24 inches (61 cm).

A siren tone creates a sweeping sound between a low and high frequency, producing very loud sounds that are commonly utilized for noisy environments. The **CE-US515BS** is a panel-mounted alarm with an ultra loud siren tone, 6 sweeps per second, operating from 5 to 15 Vdc. Output sound is about 108 ± 3 dB (A) at 24 inches (61 cm).

In addition, there are dual function alarms that combine two different sounds in one unit, thus minimizing the cost of the alarm. For example, in a dual function unit, there might be intermittent and continuous tones, chime and continuous tones, and warble and continuous tones. Another hard-to-find feature is a volume control to attenuate the sound level in special environments. The **CE-EV** offers a unique volume control rotor that can be mounted by the manufacturer or customer to attenuate the sound output level up to 20 dB from its loudest output.

Speakers

It is recommended that mylar speakers be used in marine applications. Paper speakers will be damaged by any water splash on it and will not tolerate the bouncing and vibrations on the boats. The Challenge Electronics **CLS50RA1B2B,** is a 50 mm diameter Round Speaker, with sealed black Mylar Cone, ABS 757 Plastic Frame, Hard Rubber seal, 8 ohms impedance, 0.5 W (1.0 W) Power rating (max.), 320 Hz. Resonant Frequency (Fo), with a rang to 5,000 Hz. 86 ± 3 dB Sound Output Level (Average of SPL values at 800, 1,000, 1,200 & 1,500 Hz. It is terminated with Blade Tabs, Brass Sn plated for wire leads soldering and weighs just 45 grams.

For more information about hermetically sealed, marine-grade alarms, contact sales department at **Challenge Electronics 1-800-722-8197** or visit the company on line at www.challengeelectronics.com <http://www.challengeelectronics.com/>

Ely Zofan is the Director of Engineering for Challenge Electronics. He has more than 30 years of experience with the design and manufacturing of piezoelectric alarms. He is responsible for all aspects of design and quality of piezoelectric alarms and transducers as well as assisting customers with their sound devices needs (microphones, speakers, buzzers, piezoelectric alarms and transducers). Zofan can be reached at 800-722-8197 Ext. 1009 or ***ezofan@challelec.com*** or ***sales@challelec.com***

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