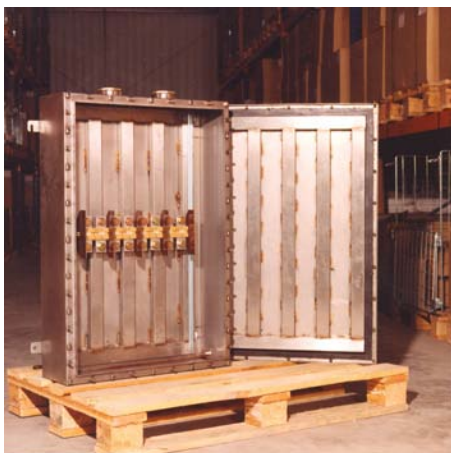


Submersible Enclosures

By definition, a submersible enclosure is one which provides complete protection to live or moving parts within the enclosure. Such protection being against the ingress of dust (or other contaminants) as well as protection against the ingress of water.

There are two distinct IP rating for submersible enclosures. These are:

IPX7 - submersion in one metre of water for 30 minutes, and IPX8 - submersion depth and duration to be agreed between manufacturer and client. The degree of protection provided is normally specified to a maximum depth for a pre-determined duration and defined frequency of duration for example "up to 20 metres for 72 hours – weekly". IEC 529 - BS 5345 Part 1 relates to IP 68.



ABTECH designed their first submersible terminal box over 15 years ago. The IP Rating standard in use at the time was BS5490:1977.

This, like its modern replacement BS EN 60529:1992, lists both the test method for ingress protection and the acceptance criteria.

In general, the acceptance criteria for water penetration is that the amount of water entering the enclosure, if any, shall be insufficient to interfere with the safety and operation of the equipment inside. However, if the operating requirements include indefinite submersion the only realistic amount of water that can be tolerated is none.

The difficulty in detecting small quantities of water is that water may be present as a vapour, and therefore invisible. In time limited tests water may enter an enclosure in quantities small enough to increase the humidity inside the box, but this would not be apparent using a visual check since it would be invisible. A more objective measurement technique is required.

With the assistance of the University of Sheffield, ABTECH devised a method of detecting very small quantities of water. Two identical enclosures are required, one as a test box and one as a control. A conditioning room is set up in a location with constant humidity. The room must then be equipped with a calibrated high resolution analytical balance. Each box is left open in the same part of the conditioning room, close to the balance for 24 hours to ensure that they are both at the same temperature and both contain air at the same relative humidity. Using the balance one sachet of desiccant is weighed and quickly inserted into each box. The boxes are immediately closed and the lids secured. The weight of the desiccant in each box is recorded. The test box is then subject to the test as agreed with the client or as stated in the current British or international standard. The control box is left in the conditioning room.

When the test is completed the test box is thoroughly dried on the outside and left for several hours, preferably overnight, in a dry place outside of the conditioning room. This ensures that any extraneous water on the outside of the box has evaporated. The test box is then returned to the conditioning room. Both boxes are opened and quickly the desiccant is weighed again. The results are recorded. If no water has entered the test box the increase in weight of each sachet of desiccant will be the same. This is because they have both absorbed all the moisture in the air that was trapped inside the boxes. If any water has entered the test box the desiccant from that box will show a greater increase in weight. It should be noted, however, that it is only possible to measure the amount of water vapour absorbed by the desiccant within the accuracy limits of the balance.

ABTECH have devoted much development effort to the concept of submersible enclosures. Small enclosures are eminently suitable for submersible applications. They are relatively stiff and have little surface area for water pressure to act upon.

For shallow depths (less than 1m) submersion is generally achievable using standard off the shelf enclosures e.g. the ABTECH ZAG, BPG and SX ranges of enclosures.



However, boxes soon become large enough to require reinforcement. A box of only 300mm cube in 10 metres of water will experience over a tonne of pressure on each of its six sides. The actual forces that will be experienced need to be calculated and reinforcement needs to be added whilst leaving as much internal volume as possible free for components, even if that means using external reinforcement.

Added to this is the problem of preventing the cover sealing edges from cutting through the gasket, and reinforced boxes can be very heavy so it may also be necessary to include lifting eyes.

Manufacturing must be of the highest quality. It is essential to ensure high quality welding on fabricated boxes, correctly specified for both the static and dynamic loading they may have to withstand. Water under pressure will find the tiniest pin hole and will leak into the box until the air pressure inside is equal to the water pressure outside.

Once the necessary calculations have been completed then rigorous testing must be endured to ensure that the design meets the pre-agreed requirements of enclosure submersion.

Where submersion over elongated periods of time are to be catered for then consideration must also be given to enclosure material.

By far the most flexible material available for submersible applications is marine grade 316L stainless steel.



With non-submersible applications, cable entry is usually through a proprietary cable gland which itself will normally qualify for an IP rating similar to that of the enclosure to which it is applied. However, due to the greater pressures present with submersible enclosures, cable entry is normally achieved through welded stainless steel hubs suitably positioned to receive incoming multi-core cables.

As with all enclosure applications reliance is placed on the equipment installer to ensure that proper engineering practices are adhered to in order to ensure that the siting and installation of ABTECH Submersible Enclosures is within agreed conditions.

ABTECH have designed submersible boxes for use in a wide variety of applications ranging from prestige projects such as the underwater lighting in Trafalgar Square to severe applications on the legs of unmanned offshore installations.

If you have a submersible box application, the ABTECH technical staff will be happy to advise.

SX Range 1

BPG Range 2

BPGA Range 3

ZAG Range 4

High Voltage 5

Fire Rated 6

ZP Range 7

Others 8

Technical 9