Tideland Signal Corp.

featuring Aids to Navigation Products

2.2 Buoys

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Rev	**Description**	**Date**	**By**

A. General

For many years, buoys were predominantly made of steel and relied on volume for buoyancy that was required to support the weight of buoy, AtoN equipment and power system and moorings. There were two basic designs of buoy – skirt shaped and tail tube. The latter were more stable in deeper and more exposed waters and could support the AtoN equipment at greater focal point heights. Steel buoys, however, were maintenance intensive; they had to be taken out of the water for re-painting and their moorings inspected and renewed at regular intervals. On such occasions, opportunity was taken to service the AtoN itself and its associated power system. They also required the use of relatively expensive-to-run specialist vessels to lift the buoys out of the water.

A requirement for buoys that were lighter, easier to handle and required less maintenance resulted in the development of other materials. GRP proved to be too brittle and vulnerable to damage. Elastomer-skinned buoys, foam-filled buoys were introduced in the 1980's but have since been superseded to a great extent, by rotationally moulded, polyethylene buoys that are as robust; require as little maintenance but are less expensive to manufacture. This type of buoy has such reserve of buoyancy that it is possible to over-size its mooring chain, to allow for wear, thereby extending maintenance intervals for moorings.

In a more recent development, the introduction of LED lights in self-contained systems has meant that there is no longer the same requirement to house batteries within a buoy structure and buoy tower sections can be made solid and more resistant to damage when the AtoN load allows the use of a self-contained system.

B. Polyethylene buoys

Maintenance

A buoy made from polyethylene requires no painting. A polyethylene buoy with a 9mm wall thickness and UV-15 protection, guarding it against discolouration, it is expected to have a useful life of up to 20 years and, with corrosion resistant fittings, to require little or no maintenance. Any damage that might be incurred is likely to be cosmetic and easily repaired for the sake of appearance, on site, using a welding kit.

> *A way to reduce manufacturing costs is to use thinner materials and also use a lower cost UV protection that may last for 8 years. A 6mm section and a UV rating of 8 years can reduce the cost by over 35%. In addition, some even paint the polyethylene taking all the advantages away*.

Damage Resistance

Robust in construction and, with its hull section filled with a water repelling material like expanded polystyrene (EPS), a polyethylene buoy is not only highly resistant to collision damage but virtually unsinkable.

> *An alternative is to use "polyurethane foam" but this is a two-pack system. Two chemicals are poured in and react creating foam. This type of foam degrades over time and can also act like a sponge. It is certainly not a "closed cell foam" and cannot be compared to expanded polystyrene. This type of foam costs over 60% less than expanded polystyrene foam.*

Polystyrene beads are poured into each hull quadrant and steam is then injected to expand the polystyrene beads into a solid block of foam. This will NOT allow any appreciable amount of water in and, if damaged, will almost certainly not sink.

Hull Section

Completely Fused

Size

Exceptionally buoyant, such a buoy no longer requires the volume that was essential to keep one made from steel, afloat. The size of a polyethylene buoy depends to some extent on the focal plane height required and, with 2 metres providing a geographical light range of over 5.5 miles when the observer's height of eye is about 2 metres above sea level, a buoy diameter of about 1.5 metres can be sufficient.

At the seaward end of an approach channel or in more open waters, however, a buoy may require a diameter of 2 – 2.5 metres to produce the bulk, to provide sufficient daylight visibility. In addition, water depth; weight of mooring and stability in the prevailing sea conditions may also be factors, calling for the use of the larger diameter buoy.

Operational Features

For use in deep and exposed waters, the larger diameter buoys have counterweights to improve their stability.

For use, primarily, in the shallow areas of harbours and estuaries, the smaller diameter buoys have shallow draft and an "undercarriage" that enables them to sit on the seabed when and if it dries out and on the deck of a buoy tender vessel. They can also have a choice of more than one mooring point to keep them stable and upright in current flows up to 5 knots.

In polyethylene buoys, the stability calculations also take account of the weight of moorings, and manufacturers will specify both a maximum and a minimum-mooring load for each design.

C. Polyethylene Vs Steel

FEATURE	POLYETHYLENE	STEEL
MATERIAL	Floatation sections are formed from a single piece moulding from exceptionally rugged 9.5mm thick polyethylene providing a shock absorbent construction. The hull is filled with closed cell, expanded polystyrene.	Fabricated from steel plates. Potential for splitting during collisions. Often left with buoyancy chamber unfilled due to facilitate repair by welding. Requires toxic anti fouling paint.
PAINTING/COLOURING	Not required during it's service life.	Requires costly annual lifting from water, sand blasting and re-painting.
MARINE GROWTH	Tends to discourage marine growth.	Requires periodic coating with suitable anti-fouling.
PERIPHERAL FENDER	Floatation section itself forms abrasion resistant shock absorbing zone capable of withstanding knocks and collisions. Expanded polystyrene filling **repels** water if it is sliced.	Requires additional rubber fender. Usually sinks after hull cracks. Cannot withstand knocks. Tow pack, polyurethane foam filling acts like a sponge, **absorbs** water.
ROUTINE MAINTENANCE	Can be easily performed with buoy in situ. The battery compartment is accessed via a watertight door in the superstructure. Moorings can either be smaller and less expensive or can be larger than essential, to allow for wear and thereby extend chain maintenance intervals.	Requires annual cleaning and painting in addition to other tasks. Heavy moorings, maximum wear.
LIFTING AND MOORING EYES	Hard wearing stainless steel.	Usually fabricated in mild steel:- subject to wear and corrosion.
ELECTRICAL WIRING	Internal moulded wiring harness. Fully waterproof. Anti-theft.	Cable loom wiring - some cables external. Not Anti-theft.
REPAIR PROCEDURES AFTER COLLISION DAMAGE	Simple plastic patch welding procedure for fast, easy, cosmetic repairs.	Repairs expensive and time consuming, requiring welding and repainting etc.
WEIGHT	Medium weight for ease of deployment and maintenance.	Heavy and often very cumbersome.
ENVIRONMENTALLY FRIENDLY	Yes, also recyclable, no toxic anti-fouling paint.	No. Also uses toxic anti-fouling paint.