Application Note
Considerations for Submerged Optical Cable Applications

Cables used in underwater applications are specialized and typically require more mechanical strength than cables utilized in terrestrial application. Typically these designs include one or more layers of wire armor for strength and mechanical protection for the optical fibers.

The pertinent application requirements are important to evaluate as the operational risk factors and practical service life of the cable will be directly influenced by a number of elements. Some of the most significant considerations include:

1. Intended installation methodology – How will the cable be installed? Some options include:
   a. Placed directly from a boat into the water and sinks on its own to the bottom.
   b. Externally weighted at intervals along the submerged length.
   c. Trenched into the lakebed/riverbed and covered.
   d. Pulled through a pre-installed buried duct.
2. Boat traffic in the vicinity of the cable – Boat anchors and fishing lines/nets are potential hazard to submerged cable if a direct impact or dragging of the cable takes place. The potential for the cable to be snagged/damaged is proportional to the number of boats in the area.
3. Hydrogen induced attenuation – Many sources of Hydrogen are possible in submerged environments. The most common are related to bacterial decomposition of organic material and corrosion of metallic materials. Water depth is also a key factor because the impact of hydrogen induced attenuation in the optical fiber increases with increasing water depth.
4. Currents/Bottom contour – Any current can induce rolling/movement of the cable leading to potential damage. The type and contour of the bottom will either help (protect) or raise the risk potential for damage.
5. Total submerged length – the maximum continuous length of cable in limited. And the maximum length goes down with each increasing layer of wire armor due to reel capacity/weight limitations. Splicing could be required and would increase installation time and cost.

For deep water applications, such as cable for use on offshore oil platforms, a more robust cable design is considered. This cable design incorporates one or more gel-filled stainless steel buffer tubes. This design may be utilized as a stand-alone cable or may be incorporated into a larger cable as a subcomponent of a larger subsea umbilical cable that is 150 mm in diameter or greater. These cables may be deployed in continuous lengths of 30 kilometers or longer. A representative example of this design is below:

AFL's Fiber Optic Component for Umbilical Cable

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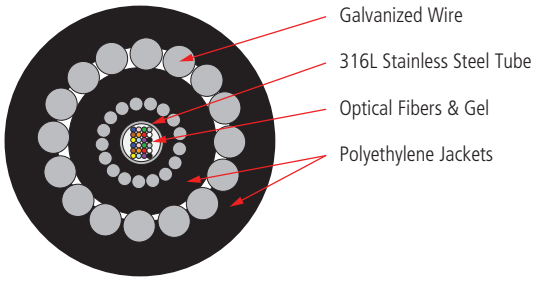
If desired, the umbilical cable design can be strengthened for independent submerged applications by incorporation of additional layer(s) of stranded wire armor to the overall cable design. Each armor layer is typically covered with a durable, weather-resistant thermoplastic jacket material. The number of layers and size of the armor wires will be dictated by the mechanical hazards imposed by the specific application, the project budget limitations, and risk tolerance. A representative example of this design is below:

Double Armored Umbilical – 4xSM, 4x50MM



AFL Double Armored Umbilical Cable

For shallow water applications with limited length requirements, standard terrestrial (land-based) cable designs can be "marinized" for submerged applications with the addition of a layer of stranded wire armor and a durable, weather-resistant thermoplastic jacket material. The optical fibers in this design are contained in one or more thermoplastic buffer tube(s) and the operational depth of this cable should be restricted since these buffer tubes are not hermetic. A representative example of this design is below:

AFL High Strength Steel Wire (HSSW) Armored Fiber Optic Cable

AFL can manufacture a variety of cable constructions for submerged applications. The specific design best suited for each project will be determined by the application requirements. AFL Engineering will tailor the cable design to be project specific as necessary. It should be highlighted that these designs are custom built cables and are not stock items.