

All Electrical Conduits Are Not Created Equal

All electrical, industrial cable protection systems and conduits are not created equal. For the past several decades, most industries within the US market have been dominated by the use of PVC jacketed metallic conduits (otherwise known as Liquid Tight) as a standard for cable protection applications. PVC jacketed Liquid Tight conduits are still widely used even though new emerging technologies (highly engineered & modified polyamide systems) far out-perform PVC jacketed metallic conduits in all aspects.

Conversely, the European market has not used PVC jacketed metallic conduits since the 1980's. Almost every industry in Europe has taken advantage of the latest in cable protection technology which is known as highly engineered & specially modified polyamide systems. The most compelling advantages of the use of these highly engineered polyamide conduits and fittings are the drastically reduced assembly times, high impact resistance and flexibility associated with the products.

In a recent study done by John Hunt, Manufacturing Engineering Manager at Mercury Electronics in Seven Valleys, PA, it has been determined that the assembly of Polyamide conduits will reduce assembly times to one fifth the time it takes to assemble PVC Jacketed metallic conduits. The cost reductions with this type of labor savings speak for themselves.

In addition, Mr. Hunt determined that Polyamide conduits are more impact resistant than PVC jacketed metallic conduits by running a forklift over both engineered Polyamide PA6 conduit and PVC jacketed metallic conduit. The results were that the PVC jacketed metal (Liquid-Tight) conduit crushed under the pressure of the forklift and due to sharp edges from the metallic system it crushed and pierced the insulation of the internal conductors. Conversely, the engineered Polyamide PA6 material withstood the pressure of the forklift with no damage done to the conduit or the conductors within.

Although Polyamide cable protection technology is the standard in conduits and fittings within the worldwide rail, transit, hybrid vehicle, and wind industries, it is still not widely known as compared to the dated yet heavily standardized PVC jacketed metallic (Liquid Tight) conduits and fittings. The reason for this is simply that the Polyamide cable protection systems are relatively new to the North American market and the majority of electrical and mechanical engineers throughout the United States and Canada are not educated to the superior technical advantages of the technology. The following are examples of the distinct advantages of Polyamide conduits and fittings over PVC jacketed metallic conduits and fittings.

Assembly Time

As John Hunt, Manufacturing Engineering Manager at Mercury Electronics determined in his recent time study, Polyamide conduits and fittings vs. PVC jacketed metallic conduit (Liquid Tight), Polyamide cable protection products take one fifth the time to assembly as compared to PVC jacketed metallic conduits. The cutting procedures for PVC jacketed metallic conduits requires either a hack saw or a ban saw which take approximately one to two minutes per cut and leave you with sharp jagged edges which must be de-burred. Polyamide conduits, on the other hand, are literally cut to length in seconds with a simple cutting tool and require no de-burring procedures and produce no sharp edges that may cut hands or conductors. Polyamide connectors are terminated within seconds and, depending on the manufacturer, require no tooling of any kind to make the connection. PVC jacketed metallic connectors take approximately two to three minutes per connector to properly terminate. In the case of highly engineered Polyamide cable protection systems, a higher quality product in the long run costs much less.

Multiple Recipes, Multiple Applications.

Polyamide is a very high-performance polymer which is derivative of nylon for which there are numerous recipes created for a myriad of applications. A few examples of the superior performance characteristics of Polyamide cable protection are as follows:

Impact Resistance

One of the most common misconceptions about Polyamide cable protection technology is the belief that a specialized nylon derivative such as Polyamide (plastic to those unfamiliar with the properties of the polymer) cannot be as impact resistant as metallic conduits. As previously stated in this article, actual performance studies done in the field indicate that a highly engineered and modified PA6 Polyamide, commonly available with impact resistant additives, far out-perform any metallic conduits available on the worldwide market in terms of impact and crush resistance. Take a hammer to a PA6 high-impact Polyamide conduit on a cement shop floor and be prepared for the hammer to bounce back with significant force and no damage done to the conduit or the internal conductors. Using the same hammer test with the most commonly specified PVC jacketed metallic (liquid tight) conduit results in crushed conduit, crushed internal conductors and system failure.

Flexibility

One of the most basic concepts behind the development of Polyamide cable protection technology is that of extreme flexibility. The majority of all robotic dress pack manufacturers prefer the use of Polyamide conduits and fittings based on its ratings of up to several million reversed bending cycles. All Polyamide conduits are much more flexible than PVC jacketed metallic (liquid tight) or just the most basic metallic conduits (if you over-flex PVC jacketed metallic systems the internal metal core will come apart and tear through the PVC jacketing rendering the conduit useless). This extreme flexibility makes the use and assembly of Polyamide cable protection much more convenient where space, aesthetics, bend radii and motion are essential to the application. In addition, Polyamide conduits remain flexible regardless of extreme temperature variances and time in the field.

Corrosion Resistance / Ingress Protection.

Another of the core concepts behind the development and implementation of Polyamide cable protection systems is that of longevity and mechanical integrity in environmentally challenging applications. PA6 and PA12 Polyamide conduits have proven to remain corrosion proof for over 40 years in outdoor applications. By comparison, PVC jacketed metallic conduits will eventually rust, corrode and fail within a few years in the field. PVC jacketed conduits also attract rodents which chew through the PVC jacketing and cause system failures when the intruding vermin's stray into and try to mark their territories. Due to the molecular structure of Polyamide systems, and the lack of desire by rodents to chew on the polyamide material, this is a non-issue with the highly engineered polyamide system.

Weight

Considering the fact that fuel costs have increased significantly worldwide, especially in Europe, an additional core concept in the development and implementation of Polyamide cable protection technology has to do with the light weight of the product. Polyamide cable protection systems are used almost exclusively in the worldwide rail and transit industry because of the comparatively light weight of the Polyamide conduits and fittings vs. PVC jacketed metallic (liquid tight) conduits. Considering the significant amount of cable protection necessary in commuter and light rail cars, Polyamide cable protection's light weight has a considerable impact on fuel savings in rail, transit, hybrid truck, bus and commercial vehicle operations.

Chemical Resistance

There are a variety of Polyamide mixtures available for use in a very broad spectrum of applications. One of the best examples of this is the chemical resistance of the Polyamide cable protection system. From standard polyamide 6 & 12 to polypropylene (PP) with highly caustic chemical resistance properties and polyurethane (PU) with good abrasion and microbe resistance properties for use in clean room applications to petro-chemical and waste-water treatment facilities, there is a Polyamide product available to meet the challenges of harsh chemical environments.

UV Resistance

Polyamide conduits and fittings were quickly adopted in the European and North American solar industries based on the exceptionally high degree of UV protection provided by this special polymer. One of the largest solar farms in the world, located in Saudi Arabia, utilized Polyamide exclusively in the construction of the project and many of North America's solar installers are quickly becoming aware of the advanced UV resistant characteristics of the Polyamide cable protection system. PVC jacketed metallic conduits, by comparison, will not withstand the prolonged exposure for many years in the sun and will crack, corrode, rust and fail even under the most ideal environmental conditions.

Specialty Products

One product which is a mainstay in the rail and transportation industry is the specially engineered PA6 with low smoke and low toxicity characteristics. These flame resistance properties meet several ASTM and SMP specifications for flammability, smoke emission and smoke toxicity. There are also several products with unique characteristics such as shielding for protecting against EMI / RFI interference, high temperature conduits for use in applications rated up to 350°C continuous and oversized jumbo conduits up to 4" in diameter.

Summary

Once again, there is a Polyamide product for every possible cable protection application. When comparing the relatively new Polyamide conduit technology to the more dated, more historically well-known PVC jacketed metallic (Liquid-Tight) conduits, Polyamide has very few limitations. Not only will mechanical and manufacturing engineers save very significant time and cost in the assembly and termination of Polyamide cable protection systems, the product is more rugged than steel, more environmentally secure, much more flexible and light-weight, and more impact resistant than the standard liquid tight conduits so widely used in the North American market.