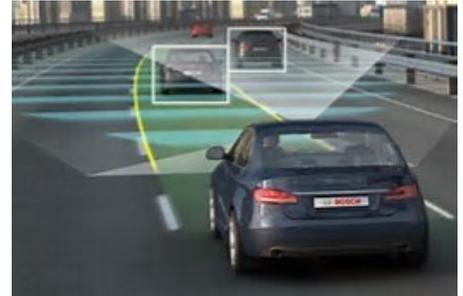


EXRAD[®] Automotive Ethernet Twisted Pairs: The Importance of Heat-Aging Standards for Long Term Reliability

Standards and codes are important in almost every aspect of our lives. The food we eat, the homes we build, and the cars we drive to name a few. For almost any standard in existence, they were created to fix a past, or avoid a future, problem.

Currently, the data and physical requirements for automotive Ethernet are defined by multiple entities: IEEE 802.3 committee, OPEN Alliance committee, SAE J-3117, and ISO 19652-12⁽¹⁾. These standards define many aspects of cable design and performance.

The standards are written to qualify cables for successful operation in an automotive environment, and ensuring the cable can transmit reliable data over the life of the vehicle.



So what does SAE J-3117 and ISO 19652-12 define that predicts future reliability? First, these standards require the single-core components to meet the physical requirements of either SAE J-1658 or ISO-6722-1. This ensures the cable cores are fit for automotive use.

Second, SAE J-3117 and ISO-19642-12 require stringent electrical testing of Ethernet cables. In order to demonstrate the ability to transmit reliable data for the life of the vehicle, the cable must pass a battery of electrical tests (Return Loss, Insertion Loss, Longitudinal Conversion Loss, and Longitudinal Conversion Transmission Loss) at four thermal profiles:

- 1). Un-aged samples, tested at 23°C
- 2). Un-aged samples tested at -40°C
- 3). Samples aged 3,000hrs at their thermal class rating (T1 to T5)
- 4). Samples aged 240hrs at their thermal class rating plus 25°C.

This extensive testing is required because over time exposure to heat will slowly degrade the electrical values of the cable. Eventually the cable will be unable to carry a reliable signal, causing an increase in data errors or outright failure of a sensor or device.

Champlain's EXRAD[®] Ethernet cable materials meet industry standards and maintain the proper electrical properties after this heat exposure.

(1) ISO 19652-12 is currently in draft form. Final publication expected June 2020

EXRAD[®] Automotive Ethernet Twisted Pairs: The Importance of Heat-Aging Standards for Long Term Reliability

Ensuring your cable meets industry standards after heat aging is an important consideration in selecting an appropriate cable.

Heat exposure is cumulative and can have a detrimental effect on data cables. Slightly elevated temperatures for long periods of time can have the same effect as significantly elevated temperatures for short periods of time.



This is proven by the Arrhenius plot equation, which is a logarithm of a reaction rate constant plotted against inverse temperature.⁽²⁾ In summary, for every 10°C of increased heat, the life of the cable insulation material is cut in half. A product that survives 3,000 hours at 100°C, would only be expected to survive 1,500 hours at 110°C, 750 hours at 120°C, and so on.

Automotive Ethernet cables are too important to cut corners with regard to materials or workmanship. The active components relying on the cables might be autonomous driving, driver assist, braking, navigation or other safety systems.

Designing any cable system, whether power or data, needs to take the expected life cycle of the system in to account, and utilize materials which are designed to meet and exceed that service life.

Champlain Cable has 30 years experience manufacturing high-performance Ethernet cables and over 45 years experience with polymer heat-aging. We've been first-to-market with many leading-edge Ethernet and other data-communication products. We currently support multiple global Automotive and Commercial Vehicle OEM's and Tiers with OPEN and other Ethernet cables, and look forward to supporting the Automotive Ethernet market far in to the future.

You can review specifications and learn more about our ingenuity at www.champcable.com



(2) Courtesy Wikipedia.org/wiki/Arrhenius_plot