Weekly Whitepaper
Week #67

Is Your IP Rating Repeatable & Reliable?

Ingress Protection Testing

Does Your Product Have An "IP" Rating? Ingress Protection testing involves verifying the level of protection from ingress the product enclosure provides against solid objects and/or water. In the case of solid object ingress, the product's IP rating identifies the size of the object from which the enclosure provides protection, with the highest ratings indicating dust protection. For ingress against water, the product's IP rating identifies the degree of exposure to water - from a light rain, to highly jetted water, to immersion at varying depths. Examples of IP ratings include IP55, IP64, and IP67. The first number represents the protection level against solid objects and the second number represents the level of protection against water. For additional information on IP ratings, see whitepaper #1.

Repeatable & Reliable Testing: A common term used often with respect to certification testing is "repeatable & reliable" = is the testing performed repeatable and are the results reliable?

- Repeatable testing is testing that if performed on two identical products at two different qualified labs, the results will be "repeatable" (comparable). This aspect focuses on the test equipment, laboratory conditions, test methods, and technician training.
- Reliable testing is testing that, if performed on an existing product and then testing is repeated at some later date on a different sample of the same product, the results will be comparable. This aspect focuses on controlling the product construction and consistent response by the product to the effects of product use.
- By understanding the intent, it is obvious why both manufacturers and test labs want to conduct "repeatable and reliable" testing.

IP Type Testing: "Type Testing" by definition is the testing performed on a product to verify compliance with the test standard. When type testing is performed, it is often conducted on only one test sample. That is the case with most IP type testing = IP type testing is usually performed on a single test sample, and it's usually a new test sample to ensure that the enclosure integrity remains as designed and has not been compromised by opening/closing the enclosure for other testing.

IP Test Sample: Because type testing is usually done on the initial design of a product, IP testing is frequently performed on a working prototype or pre-production unit = one that has not been subjected to any other use, misuse, or extensive handling. Is that wise?

IP Rating Reliability: All this leads to the topic of this whitepaper:

a) Can IP testing performed on a single test sample, in many cases a prototype or pre-production unit, be reliably assumed to result in similar results for all production units? And,
b) Can an IP rating established based on testing performed on a "new" product be considered reliable for products that will be used and abused by the consumer or may be subject to degradation of materials over the life of the product? (or at least the warranty period)

Controlling Product Construction: To have a consistent IP rating, we want to control the aspects of the product design that provides the ingress protection. For most safety testing, a US-UL or CAN-CSA certification report does a very good job of controlling the construction in a manner such that the product will continue to comply with the standard. However, that may not be the case with design elements that provide ingress protection.

Ingress protection design can be a very fickle process of test, modify, and retest. In some cases the critical features related to ingress protection are obvious. In other cases, there are many variables that contribute to keeping dust and moisture out. Adhesives and manual assembly are two variables that can be difficult to control without additional measures to verify compliance. Gasket thickness and retaining a consistent pressure along the length of a gasket are things that can become increasingly more difficult to consistently control the larger the product/gasket/seal. Some manufacturers have resorted to production IP testing to ensure that ingress protection integrity is maintained – especially for products that are anticipated to be regularly subjected to dust and moisture by the user.

IP Rating Considerations: It is important that all product manufacturers remain cognizant that their product safety certifications are not an insurance policy, and they certainly do not ensure that your product will live up to the warranty claims. It therefore behooves all product manufacturers to consider if they need to do anything extra to ensure that the products they sell do not fail in the field, during normal use, due to ingress of dust or water.

Insuring IP Rating Repeatability & Reliability: There are a few things that manufacturers can do to help ensure that their IP ratings are repeatable and reliable:

a) Type Testing: Make sure that all IP testing is performed in exact accordance with the standard. If you are using an independent test laboratory, make sure they are ISO17025 accredited for the test standards involved including the finished product safety standard – often times the end product safety standards adds definition to how the IP tests are to be performed for that type of product. For example, did you know that your test water must be properly conditioned for 24 hours before IP testing? If the water isn't being conditioned, the test is not being performed correctly.
b) Type Testing Equipment: Be sure that the test equipment used is accredited per the appropriate IP test standard and was calibrated by an ISO17025 accredited "in-scope" calibration lab (in-scope for IP test equipment). Many IP equipment problems begin with "generic scope" calibration houses not knowing the proper method to calibrate IP test equipment.
c) Production Testing: Periodic IP testing of production product to verify consistency of your IP rating off the production line can be very important depending on the IP rating level, method of production, and number of units produced. The more you have to lose from a field failure, the more you should consider production testing.
d) Product Conditioning: This is a very important consideration. Should you consider performing additional product "conditioning", beyond anything specified in the test standard, before your IP testing? Should you perform drop, shock, vibration, thermal

shock, or other environmental/physical testing prior to IP testing to simulate real world user conditions? How rough is the user with your product before or when it is subjected to dust or moisture and, could that lead to an expensive warranty return problem? Many cell phone makers have learned the hard way to do more than just test new devices. If you make a product in large quantity that has an IP rating, you must consider physical testing before IP testing to help find problems before they lead to a warranty nightmare – especially if the product is handheld and expensive.

Conclusion: There is a lot more to IP testing that many product manufacturers are aware. Assuming that the initial type testing on the product is enough can be a very bad assumption to make. There are several companies who have had extremely large and damaging warranty return problems due to widespread IP failures. In most of those cases, they only tested 1 sample, a brand new sample, and never considered additional conditioning/testing before and during production to protect against warranty claims and damage to company reputation.

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