

Some examples of ASTM standards:

ASTM D-5642
Referenced documents
inside this standard
ASTM D-149
ASTM D-1676
ASTM D-1711

ASTM D-3455
Referenced documents
inside this standard
ASTM D-877
ASTM D-924
ASTM D-971
ASTM D-974
ASTM D-1500
ASTM D-2413
ASTM D-3487

ASTM D-882
ASTM D-149
ASTM D-2305
ASTM D-732

Some examples of IEEE standards:

IEEE Std. 1043
IEC Std. 60343

Some examples of UL standards:

UL 1446
UL 749

Sealed Tube Testing: The Reference Documents

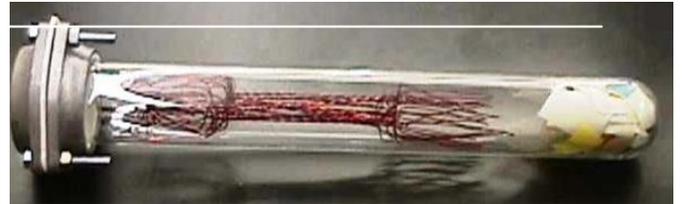
1. **UL 1446:** Standard for Safety Systems of Insulating Materials **Section 14** Sealed Tube Testing; and
2. **ASTM D 5642:** Standard Test Method for Sealed Tube Chemical Compatibility Test.

One of the most common tests for compatibility is described in UL 1446 and is known as the Sealed Tube Test. The sealed tube test is a base level evaluation; it evaluates the interaction between volatile components which out-gas from any material in the group placed into the tube interacting with the magnet wire insulation of the Electrical Insulation System (EIS).

The sealed tube test is evaluating the possible interaction of materials or components which a manufacturer of end-products wishes to use with an EIS. Compatibility is important because incompatibility leads to shortened life of the end product. By performing a sealed tube test, companies can determine if the materials they want to use in the assembly of an end product will adversely affect the EIS. This would be effective for a company that produces electrical drills and finds a polymer that would reduce construction costs, and wants to know if it can be used safely in their current design.

Sealed Tube Testing is an efficient way to predict what could occur to a product after prolonged use and material degradation without putting any consumers at risk.

The name “Sealed Tube” comes from the reference to the apparatus used when conducting the test. The test apparatus is a Tube that will be Sealed. The most common tube apparatus is the tube assembly shown.



The standard Sealed Tube Vessel loaded with twisted pairs of copper wire and electrical insulation materials

Component Compatibility Testing: Theory and Practice

Component Compatibility Testing (CCT) is unlike many other tests to evaluate electrical insulators or groups of insulators. The primary difference is in time. Whereas an EID will run an average of 5,000 hours, and even longer depending on the failure rate of specimens, CCT programs run a specific length. Thermal Aging runs only two weeks.

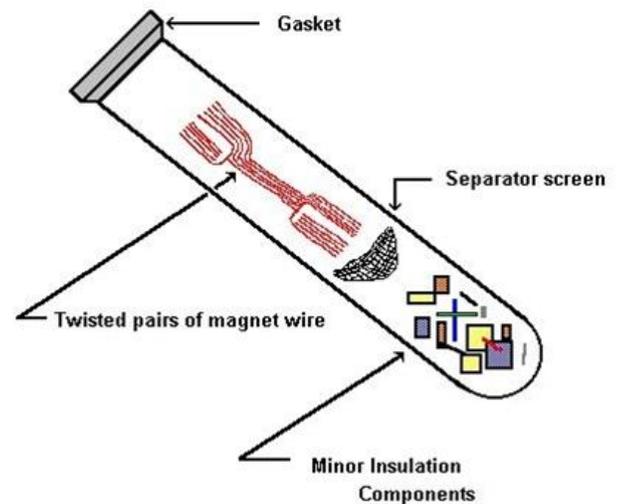
So, unlike the lengthy evaluation of an EIS, CCT programs can take very little time. With the thousands of materials in our EIM Inventory – from suppliers large and small from around the world – some CCT programs can run as quickly as 3-4 weeks from initial contact to the publication of the Final Report. And with all Final Reports being submitted electronically, you get your results even quicker.

To follow are several of the key points to understand with CCT programs.

- There are always at least two tubes tested:
- The first tube (control) consists of only the components actually contained in the original EIS. These are known to be good and serve as a reference point.

- The second tube (candidate) consists of the original components plus a group of alternate materials. It is these materials which are being evaluated.
- The tubes are then aged for two weeks at 25 degrees Celsius above the system rating.
- During this time, the materials in the tubes outgas volatiles which have the potential to damage the magnet wire.
- After the aging is complete, the magnet wire which was used in the original system is tested dielectrically to determine if the gasses were damaging.
- If the dielectric strength of the candidate tube is 50% or greater than that of the control, the list of materials is considered compatible and can be used as minor insulation.

LAYOUT OF A SEALED TUBE



CCT Test Points of Interest:

- Tests designed to provide manufacturers ability to gain as much information about materials and their interactions before assembly begins, saving both time and money.
- Component Compatibility Testing allows Electrical System manufacturers to make changes to already existing systems without the need of full thermal aging.
- Sealed Tube Tests are demonstrated to be repeatable.
- The aging at two weeks allows sufficient time for chemicals to outgas from the minor insulation components.
- Materials which might produce chemical reactions potentially harmful to the magnet wire that would not occur during normal operation of the unit should be included into the test only if needed.

Other Compatibility tests

ASTM D-3455 – Oil and Refrigerant Compatibility Testing

The oil and refrigerant compatibility tests are designed to identify any potential problems between the materials used in the construction of the transformer, or compressor, and the oil and/or refrigerant. The insulating oil used in transformers is an integral part of its operation, and therefore its performance is of the utmost importance. The testing of insulating oil and refrigerant in A/C compressors are both critical to operation.

This is done by placing materials in the original design in a sealed vessel with the oil and/or refrigerant. This is thermally aged. After aging process is complete, tests are conducted on the oil and materials to evaluate any undesired effects on the electrical insulation materials or, more importantly, to the insulating oil.

IEEE 1043- Environmental Compatibility

Testing is performed on wound insulated coils that are submerged in different solutions and then energized for extended periods of time. The test can be conducted in water, salt water or in solutions with either an acidic or basic PH depending on what is appropriate for each application. These tests evaluate whether the insulation and processing methods used for the coils can hold up to the harsh environments that the end products can be subjected to, for example, submerged water pump.

UL 749- Soap and Detergent Compatibility

This test is used to evaluate adverse effects that long term exposure of dish soap and laundry detergents may have on a dishwasher or washing machine. The materials are exposed to concentrations of the desired detergents and then aged for a specific time frame. The materials are then tested for different properties, which can include tensile strength, dielectric strength and extractable.

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