

During product safety testing, a wide range of characteristics are evaluated. Source: TUV Rheinland



THE BASICS OF APPLIANCE SAFETY TESTING

Many appliances are tested for safety but few manufacturers know exactly what the regulations are or what happens to appliances during testing. The picture grows more complex as companies consider accessing markets overseas. This article offers straightforward answers to frequently asked questions about testing requirements for appliances and reminds engineers to design with compliance in mind.

To Each Appliance Its Own Standard

There is no single standard defining testing requirements for household appliances in the U.S.; instead, there are different, non-harmonized standards for each type of equipment. For some examples, see Table 1.

There is also little harmonization of standards between the UL standards in the U.S. and

the International Electrotechnical Commission (IEC) standards for the international market. Europe and some other countries use, with minor modifications, IEC 60335-1 “Household and Similar Electrical Appliances – Safety” as a base standard. While part 1 of the standard covers general requirements, various sections of part 2 contain particular requirements that affirm, augment or modify part 1 and addresses exact hazards inherent to a specific type of product.

Standard Originators & Test Labs

In the United States, standards development organizations, such as the American National Standards Institute (ANSI), develop consensus-based standards which are then used by official third-party laboratories to test and certify products. In the U.S., the government agency responsible for establishing the criteria for the recogni-

Design with compliance in mind

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QUALITY & STANDARDS

Standards for International Markets	Products	Standards for the U.S. Market
IEC 60335-2-23	Hair dryers, hair curlers	UL 859 Household Electric Personal Grooming Appliances
IEC 60335-2-8	Hair clippers, shavers	UL 1028 Hair Clipping and Shaving Appliances
IEC 60335-2-2	Vacuums	UL 1017 Vacuum Cleaners, Blower Cleaners, and Household Floor Finishing Machines
IEC 60335-2-10	Floor cleaner, scrubber, polisher	
IEC 60335-2-14	Food processors, grinders, slicing machines, knife sharpeners, centrifugal juicers and alike	UL 982 for Motor-Operated Household Food Preparing Machines

Table 1. Source: TUV Rheinland

tion of laboratories is the Occupational Safety & Health Administration (OSHA). This agency has developed the Nationally Recognized Testing Laboratory (NRTL) Program. In this program, OSHA recognizes laboratories and certification agencies, authorizing them to evaluate, certify or list equipment as conforming to product safety standards used in the American workplace.

Similar to the U.S., in Canada standards are developed by organizations like the Canadian Standards Association (CSA). These standards development organizations are accredited by the Standards Council of Canada (SCC). The SCC coordinates standards work in Canada ensuring the country's input on regulatory issues in international standards organizations.

When looking for a recognized laboratory in the U.S., visit OSHA's website for the complete list: www.osha.gov/dts/otpca/nrtl/; when looking for an accredited lab in Canada, go to www.scc.ca/en/accreditation/inspection-bodies/directory-of-accredited-clients.

Inside a Lab

Accredited product safety testing laboratories employ technicians and engineers trained to test appliances per appropriate standards providing an adequate level of safety. Labs are equipped with various probes, meters, surge-inducing equipment, loads, and specialty gear to evaluate polymeric materials for the risk of fire, environmental chambers to simulate humid and/or extreme temperatures, and dust and water apparatus to simulate severe environmental conditions.

During product safety testing, a wide range of characteristics are evaluated. In a typical investigation, the physical construction

of the product is evaluated initially and then supporting documentation is reviewed. The documentation requirements for household appliances include labels, schematics, drawings, manuals, certification documents for components and warning statements.

To ensure compliance to the standards, the physical construction of the product is evaluated. The critical components are reviewed, confirming that their specifications are adequate. The suitability of wire routing and the integrity of the earth bond to various parts are determined. The adequacy of the insulation is conducted by measuring the physical spacing between components and critical paths called creepage and clearance distances, and thickness through solid insulation.

Appliances are exposed to moisture and other extreme environmental conditions like dust and water to determine if they degrade the product's integrity. Even something as innocuous as a label must be checked. The label must be robust enough to ensure that it will not fall off or become illegible if exposed to common cleaning agents, and the information on it should be accurate.

After a documentation review and construction evaluation, products are then tested under normal operating conditions and under foreseeable, abnormal conditions such as single component failures and overloads. Appliances are tested to ensure that they do not pose a risk of electric shock, fire, mechanical or other hazards. Testing may include, but is not limited to: power consumption, ground continuity, dielectric withstand, insulation resistance, touch current, capacitor discharge, temperature, stability and impact, abnormal and fault conditions.

Additional Considerations

Manufacturers of household appliances that would like their products sold by large-format retailers, such as Target or Walmart, should check if they need to comply with any additional requirements. In addition to the third-party product safety certifications, the retailers may require specific shipment inspections or performance testing on products before they are released for shipment (these requirements go beyond safety and EMC testing).

Mind the Design

When designing a product, engineers need to separate hazardous parts from the enclosure or other touchable parts to make sure that the product under normal and abnormal operating conditions does not create an electric shock or a fire hazard. Proper application-rated and third-party approved components should be used at all times.

While the product is still in development, the manufacturer should decide if the company will target international markets. Identifying technical specifications in the design phase will help ensure that the product's features will match the requirements of the target country. Design engineers would do well to read the standards for the target countries so that their products comply with the requirements—from specifying correct cable sizes for internal and external connections to choosing correct safety-related components.

It is important to find out in advance the estimated lead time of the international certification process—it is often several months long—so that the product's launch schedule

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can be defined based on that information. Regulatory certification lead times are often overlooked when product launch schedules are set up.

Working With the Lab

When the target market is determined, the manufacturer needs to find a lab accredited for the certification scheme in question. The lab should have an ISO 17025 accreditation to demonstrate its competence in testing, and should have accreditations necessary for the specific countries where the appliance will be sold.

To get a quote, the manufacturer will need to answer the following questions for the lab: Where is the product to be sold? Who will use the product? Does the product have batteries or rely on software or electronic protection? What are the exact environmental conditions and the application of the product? Who will operate or service the product?

These questions will help the lab determine applicable standards as, for example, a treadmill can be considered a medical or a household product, depending upon the intended use.

It typically takes a few days for a lab to

get back to a client with a quote. The time needed to test an appliance will be dependent on the product. Complex appliances where multiple disciplines are involved could take several weeks. A simple product such as a blender or heater with no electronic protection would likely be tested within a week, with additional time required to prepare test reports and technical files.

To start a testing assignment, the lab project coordinator reaches out to the client immediately after the project is opened. Items required to start testing include fully functional test sample(s), labeling (or its artwork), schematics, mechanical drawings, manuals and other safety-related instructions, and a component list with proper safety approvals for safety-critical components.

The number of testing samples depends on the product itself, the number of tests for abnormal conditions and expected damage to the equipment during these tests. In many cases, if EMC and safety testing needs to be done in parallel, the manufacturer would need to provide at least two or three samples.

Manufacturers would be wise to seek out a knowledgeable laboratory early in the product

development cycle. While certification agencies must remain completely impartial and have no power over how the product performs under test, conducting a pre-compliance construction review and evaluation will point out any weak areas of a product. This review will help lessen the chances of a noncompliant product when the certification testing is conducted, thus saving time and money.

Getting It Done

A competent compliance partner can help appliance manufacturers by assisting with core testing, providing the requirements upfront, and, in case a company is going to an international market, by leveraging the lab's own agreements for report acceptance with the foreign certification bodies. Companies should remember that various test laboratories have different agreements and accreditations. A trusted partner can save significant research time and provide the added value of project management, particularly if the list of target countries is substantial. ■

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Precisely Right.

About TÜV Rheinland

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