Gas Appliance Safety

Compliance – NRTLS and Certification Guidance

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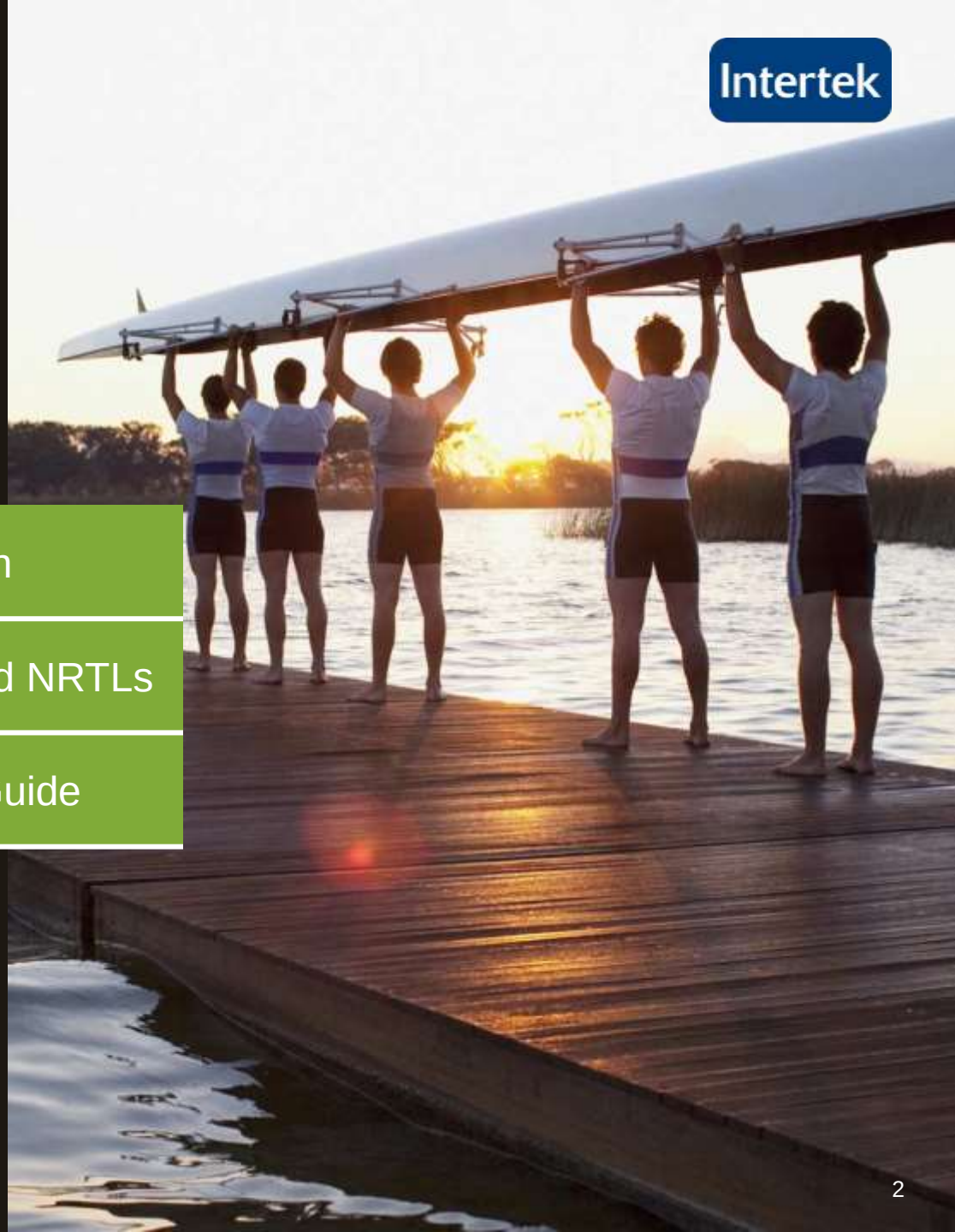
Agenda



01 Importance of Certification

02 History of Certification and NRTLs

03 Successful Certification Guide

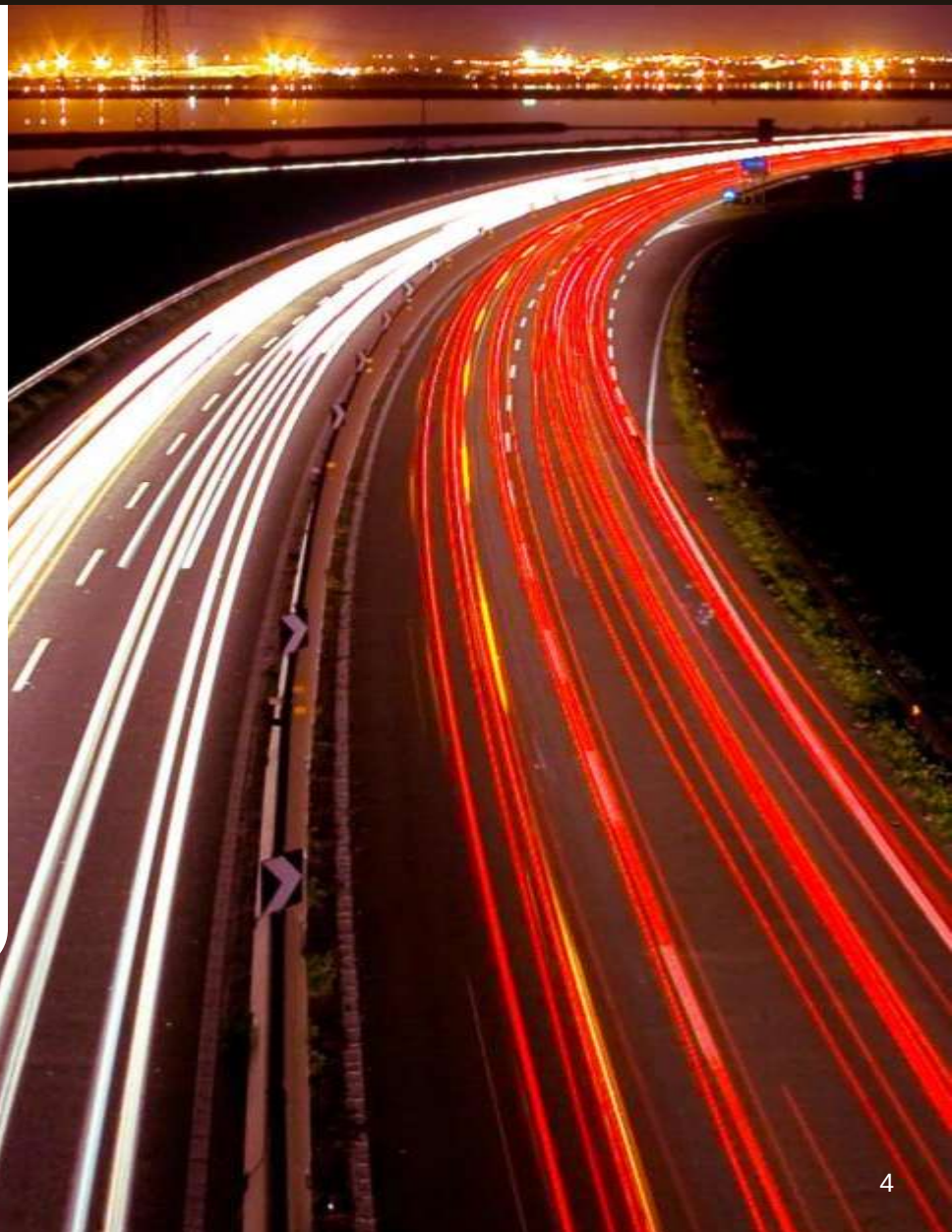
01

Why is Product Safety Certification Important?

Safety in a Fast Paced Market

Keeping up with the pace of the world presents new challenges everyday, but as Engineers we must always put the safety, welfare, and health of the public first.

This is our moral and ethical responsibility as leaders in our Industries.

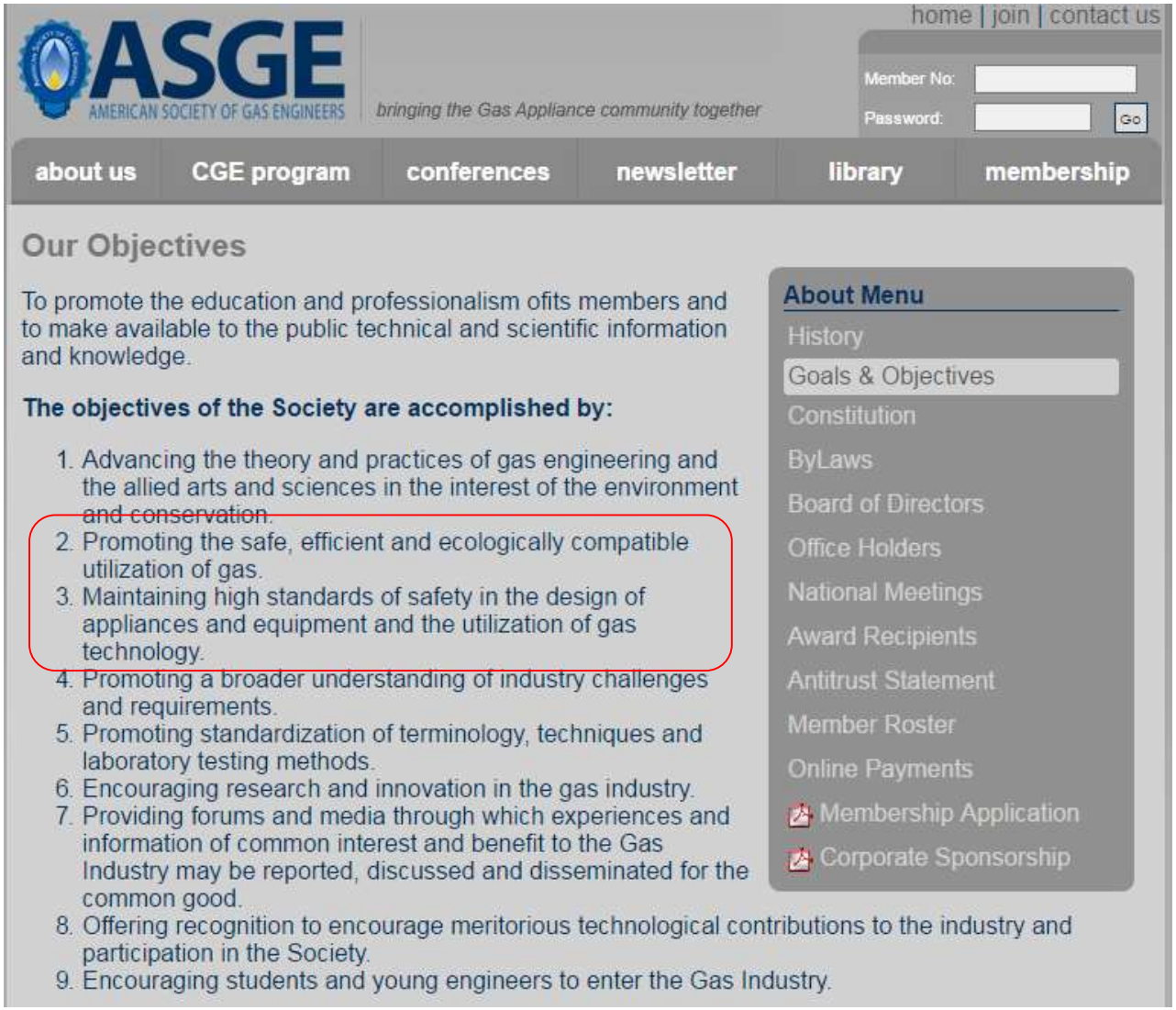


Words of Inspiration

"A good scientist is a person with original ideas. A good engineer is a person who makes a design that works with as few original ideas as possible. There are no prima donnas in engineering. - Freeman Dyson

"Safety First today: It may be too late tomorrow"

"Engineering is the practice of safe and economic application of the scientific laws governing the forces and materials of nature by means of organization, design and construction, for the general benefit of mankind." - S.E. Lindsay



http://www.asge-national.org/About/Objectives

National Society of Professional Engineers – Code of Ethics

Preamble

Engineering is an important and learned profession. As members of this profession, engineers are expected to exhibit the highest standards of honesty and integrity. Engineering has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct.

I. Fundamental Canons

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

http://www.nspe.org/resources/ethics/code-ethics

National Society of Professional Engineers – Code of Ethics

II. Rules of Practice

1. Engineers shall hold paramount the safety, health, and welfare of the public.
    a. If engineers' judgment is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate.
    b. Engineers shall approve only those engineering documents that are in conformity with applicable standards.
    c. Engineers shall not reveal facts, data, or information without the prior consent of the client or employer except as authorized or required by law or this Code.
    d. Engineers shall not permit the use of their name or associate in business ventures with any person or firm that they believe is engaged in fraudulent or dishonest enterprise.
    e. Engineers shall not aid or abet the unlawful practice of engineering by a person or firm.
    f. Engineers having knowledge of any alleged violation of this Code shall report thereon to appropriate professional bodies and, when relevant, also to public authorities, and cooperate with the proper authorities in furnishing such information or assistance as may be required.

http://www.nspe.org/resources/ethics/code-ethics

Water Heater Rocket

Consumer Reports – Appliance Fires

From a March, 2012 Consumer Reports article:

Appliance fires pose a safety concern

"The Consumer Product Safety Commission, using estimates from 2006 through 2008, says that major appliances caused more than 150,000 residential fires each year, resulting in 3,670 injuries, 150 deaths, and $547 million dollars in property damage."

http://www.consumerreports.org/cro/magazine/2012/03/appliance-fires-is-your-home-safe/index.htm

Microwave – Component fire while not in use

Dishwasher – Control board fire

Consumer Reports – Appliance Fires

"when Consumer Reports conducted an in-depth analysis of federal fire data, we found that only about half of appliance fires could be blamed on human mistakes, such as unattended cooking, or natural causes such as storms or animals."

"More than 15 million appliance units have been recalled in the past five years for defects that could cause a fire, according to our analysis of CPSC records, with 1,942 incidents reported."

"When we analyzed data from the National Fire Incident Reporting System (NFIRS) from 2002 through 2009, the latest available, we found more than 69,000 fires in which an appliance was the primary cause."

CPSC – NEISS Query

Consumer Product Safety Commission – 2015 Reported Injuries

Gas Appliance	Injuries Reported	NEISS Product Code
Furnace	27	0310
Gas Range or Oven	72	0279
BBQ Grill	74	3248
Water Heater	21	0118

National Electronic Injury Surveillance System

- Query from 1/1/2015 to 12/31/2015
- Covers all reported injuries related to these common household appliances.
  - Smoke Inhalation, Burns, Carbon Monoxide Exposure

http://www.cpsc.gov/cgibin/NEISSQuery/home.aspx

Boiler Bomb

Self Declared Vs 3rd Party Certification Testing

2015 IFIA Survey Results:

Effectiveness of Consumer Product Safety Comparing Self Declaration System to 3rd Party Testing Certifications

Survey covered testing of products purchased on the open EU market from 2012 – 2014.

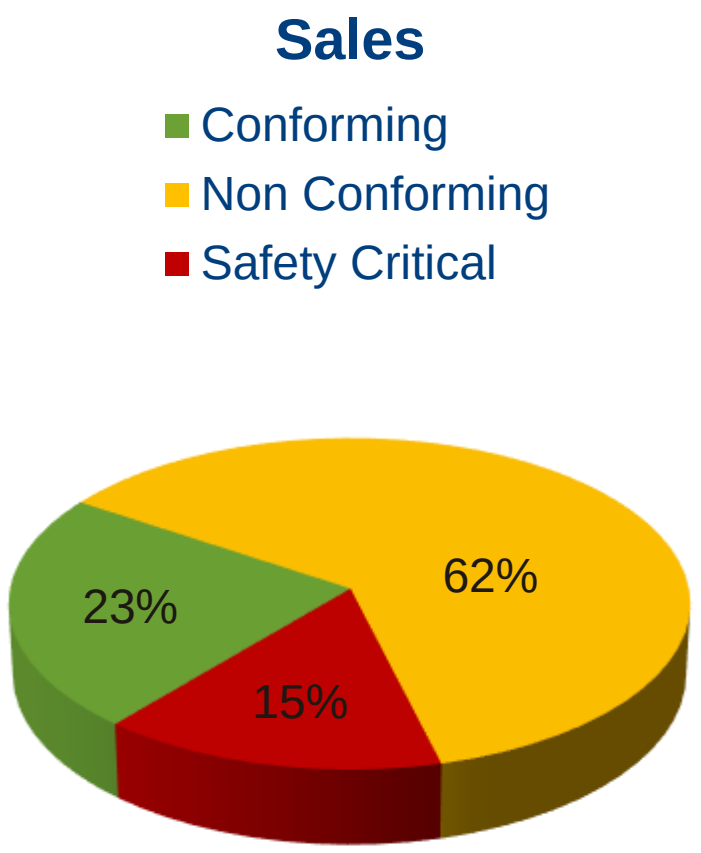
Self Declared products were compared against products purchased in EU, USA, and Canada that were certified by an independent third party.

Product Categories Surveyed:
Electric Fans
Toasters, Heating Devices
Luminaires
Chargers for IT products
Room Heaters
Hair Dryers and Curlers
Irons
Small Power Tools

Self Declared Vs 3rd Party Certification Testing

Of the 319 samples submitted, 77% were NOT in compliance with EU standards and regulations

There were 48 instances of *safety-critical* failures (i.e. high risk of **fire**, **permanent injury**, etc) which were/are being reported to the local authorities (1 out of every 7 products)



Hoverboards

Birmingham, AL - News 13

May 20, 2016

“Authorities said this was the second incident of this type in the last two weeks.”

http://www.wvtm13.com/news/tuscaloosa-fire-and-rescue-responds-to-a-hoverboard-fire/39643972

Boston Globe May 9, 2016

“The fire broke out around 9 p.m. on the third floor of 406 Hanover St. It was extinguished quickly, but not before it displaced up to 10 people and caused an estimated $100,000 in damage.”

https://www.bostonglobe.com/metro/2016/05/09/north-end-hoverboard-fire-was-city-first-officials-say/ZSPJ9jrzAqMc4xZyHxBzoI/story.html

Hoverboards - Certification

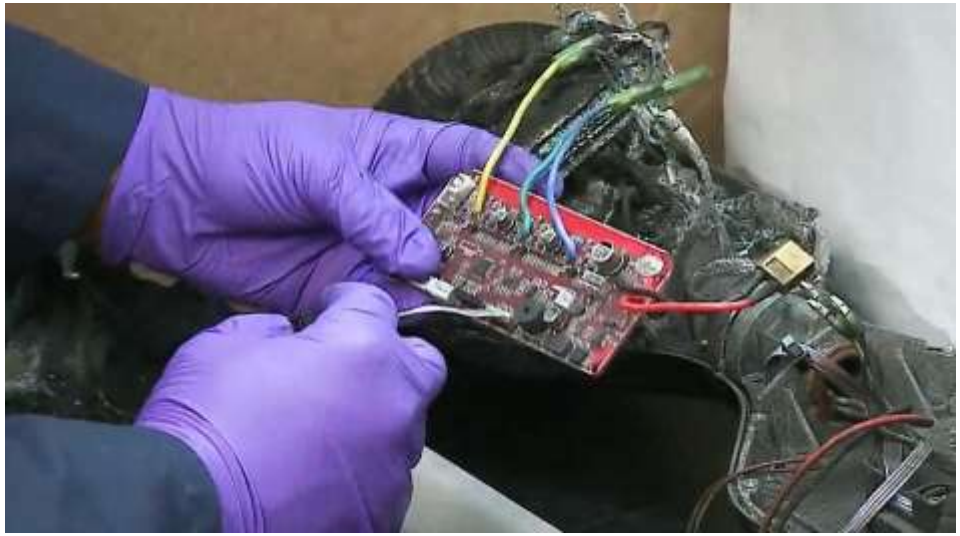
Innovation outpaced safety testing

CPSC determines no hoverboard on the market can be deemed safe

Industry and 3rd party testing experts combine knowledge and Standard UL 2272 is created

CPSC gives notice to retailers of standard requirements that must be followed

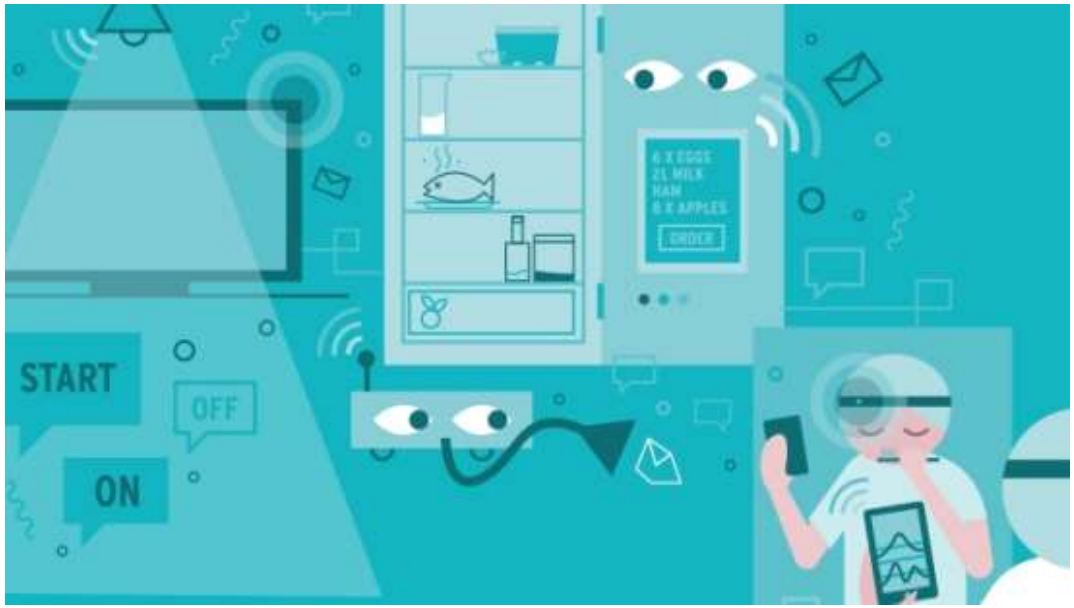
3 Months later the first hoverboard is certified after passing safety requirements for electrical systems of self-balancing scooters.



http://mashable.com/2016/02/19/hoverboards-unsafe/#q_IBx09jWaqX

Keeping up with Innovation

- Adapting test standards to include Smart-Enabled controls on gas appliances
  - Changes are being discussed and standards updated in the ANSI/CSA and UL technical committees
- Essential to ensure external communication to controls do not create hazardous situations
- Electromagnetic Compatibility and Immunity
- Additional endurance and safety circuit tests are needed for power devices



02

North America Product Safety Compliance and Certification

OSHA – NRTL

Standards Council of Canada

Nationally Recognized Testing Laboratories

NRTLs are private sector, third-party organizations recognized by OSHA to provide product certification services to the requirements of construction and industry test standards.

Test standards are issued by U.S. standards organizations such as the American National Standards Institute (ANSI).

Each NRTL has an approved scope of recognized test standards to which they can certify compliance.

Each NRTL has their own unique registered mark of certification which designates compliance with product safety standards.

Nationally Recognized Testing Laboratories

What is the role of a Nationally Recognized Testing Laboratory (NRTL)?

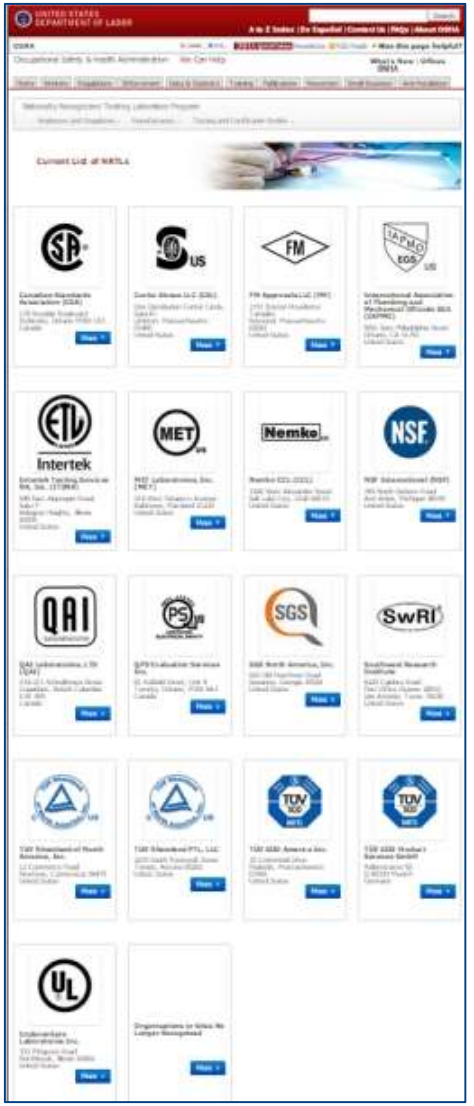
- OSHA seeks to prevent accidents through assuring the safety of products used by US workers. NRTLs are private sector organizations that are recognized by OSHA to perform this safety assurance.
- OSHA recognizes testing organization's capabilities to test and certify specific types of products for safety.

History of the NRTL Program

- When first adopted, OSHA regulations gave two examples of approval organizations: Underwriters Laboratories (UL) and Factory Mutual Research Corporation (FMRC).
- In 1983, OSHA was ordered by a court to remove the specific references to UL and FMRC in a successful lawsuit brought by a private lab.
- In 1988, OSHA revised its regulations to remove the references, and established the NRTL Program to recognize other organizations.
- The first NRTL was recognized in May 1989 followed by 2 more the same year. Currently there are 17 recognized NRTLs.

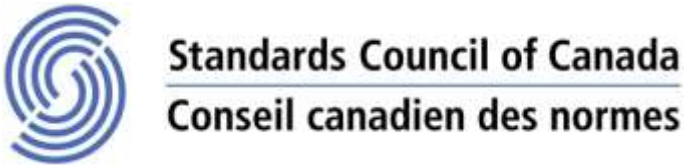
Who are the NRTLs? (All 17 of them)

https://www.osha.gov/dts/otpca/nrtl/



Standards Council of Canada

- SCC is an internationally recognized accreditation program for product certification.
- SCC Accreditation is recognized throughout Canada



- 1970 the SCC is created
- 1980 first certification organization accredited by SCC
- 1981 two test laboratories are accredited by SCC

Certification Body Requirements

- Certification Bodies must conform to ISO/IEC 17065 – Requirements for bodies certifying products, processes and services
- Additionally they must conform to the specific requirements of:
  - OSHA's NRTL recognition program requirements
  - SCC accreditation program requirements

- Test Agencies submitting evaluation and test reports to Certification Bodies must conform to ISO/IEC 17025 – General requirements for the competence of testing and calibration laboratories

Certification Mark

- Identifies that a product conforms to standards of safety to meet:
  - Federal, State, and Local Codes
  - Installations inspected by Authorities Having Jurisdiction (AHJ)
  - Retailers requirements as determined by regulation of a governing agency such as the CPSC, or as self imposed requirement of the retailer to mitigate risk

Intertek

Excerpt from the United States National Electrical Code (NEC)

NEC, Section 90.7. Examination of Equipment for Safety

For specific items of equipment and materials referred to in this Code, examinations for safety made under standard conditions will provide a basis for approval where the record is made generally available through promulgation **by organizations properly equipped and qualified for experimental testing, inspections of the run of goods at factories, and service-value determination through field inspections.**

This avoids the necessity for repetition of examinations by different examiners, frequently with inadequate facilities for such work, and the confusion that would result from conflicting reports as to the suitability of devices and materials examined for a given purpose. It is the intent of this Code that factory-installed internal wiring or the construction of equipment need not be inspected at the time of installation of the equipment, except to detect alterations or damage, **if the equipment has been listed by a qualified electrical testing laboratory that is recognized as having the facilities described above and that requires suitability for installation in accordance with this Code.**

03

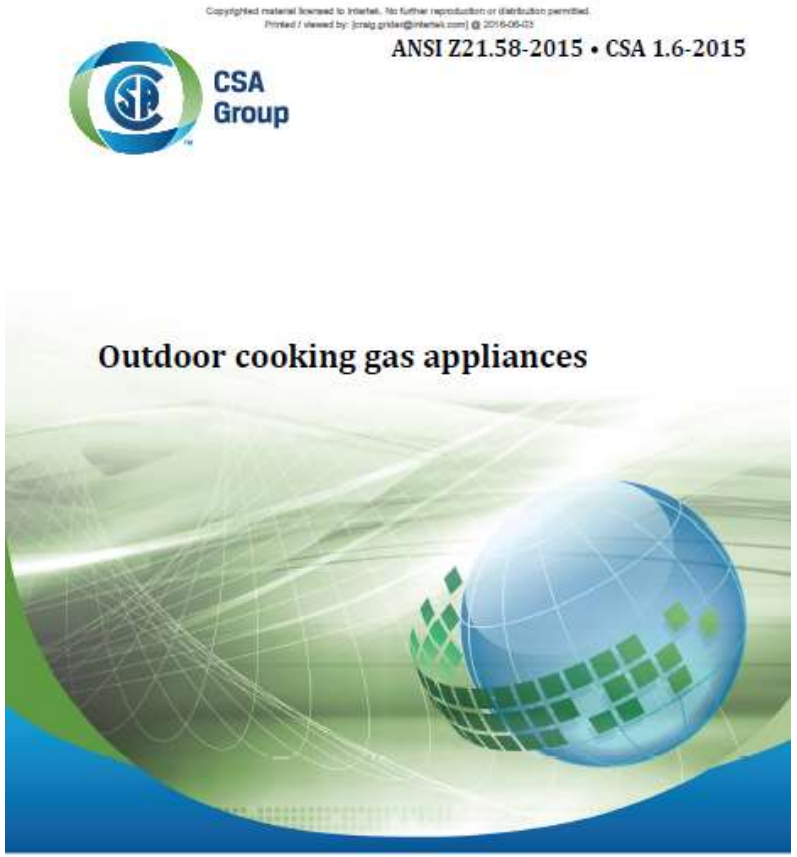
Guide to Successful Certification

What is your Market?

- Seems routine, but knowing your target market and the region's regulations and requirements before starting the certification process is important to prevent headaches later.
- Know the differences between the U.S. and Canada Electrical and Fuel Gas codes.
- Some jurisdictions within Canada require certification to High Altitude requirements – CGA 2.17
- Do you need full product certification or is this a limited production run or one time installation?

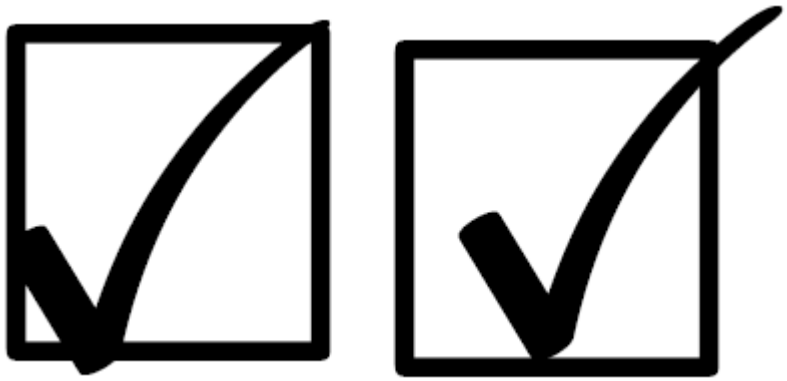
Copy of the Test Standard

- Make sure you have a copy of the latest test standard(s) to which your product will be certified.
- Contact your certification body to determine the standards applicable to your product that are required to grant certification.
- Having the latest edition and revision is important when you're discussing construction or test requirements with your 3rd party test agency or certification body.



Test in House

- Recommend doing your own checks in house before requesting 3rd party testing and certification.
- This added check can save you from additional testing and lost time.
- Perform a review of the construction to the standard requirements.
  - Make sure your components conform to the correct component standard referenced by the product standard.
- Conduct all the tests possible in your facility.



Example Component Check – Referenced Standard

Verifying the component standard referenced by the product standard is critical.

Example:

Boilers for industrial and commercial use can require certification to multiple product standards if they have a range of models with different capabilities (Hot Water, Low Pressure Steam, High Pressure Steam).

If a boiler is tested and certified under ANSI Z21.13, the reference standard for a conversion burner rated 400,000 BTU/hr or less is ANSI Z21.17.

However, if a boiler is tested and certified per UL 795 the burner reference standard is UL 295.

> Note: Regardless of input rate, boilers evaluated under UL 795 have to meet the requirements of burners rated above 400,000 BTU/hr (per current clause 26.1.1)

Prepare Documentation

1.	Models
2.	BTU Rating
3.	Fuel Types
4.	Engineering Design Documentation
5.	Burner and Ignition Types
6.	Product Ratings and Dimensions
7.	Component Certification and Alternates

Models

- The easiest approach to presenting a family or series of models to a certification body is to create a Matrix listing the models with their unique specifications and ratings.
- If your marketing and sales has already created a brochure of the product line that includes optional features and specifications, provide this with your request for certification.
- When a family of models is presented, the certification body and test agency must select a representative model that covers worst case test scenarios.
  - Examples: Highest Input Rate, Highest Rated Temperature, Highest Power Rating
- Other factors are considered as well with model selection for testing and in most cases only limited testing is needed on additional models.
  - Different Combustion Chamber, Alternate Controls, Dimensional Changes that Effect Construction or Performance

Ratings

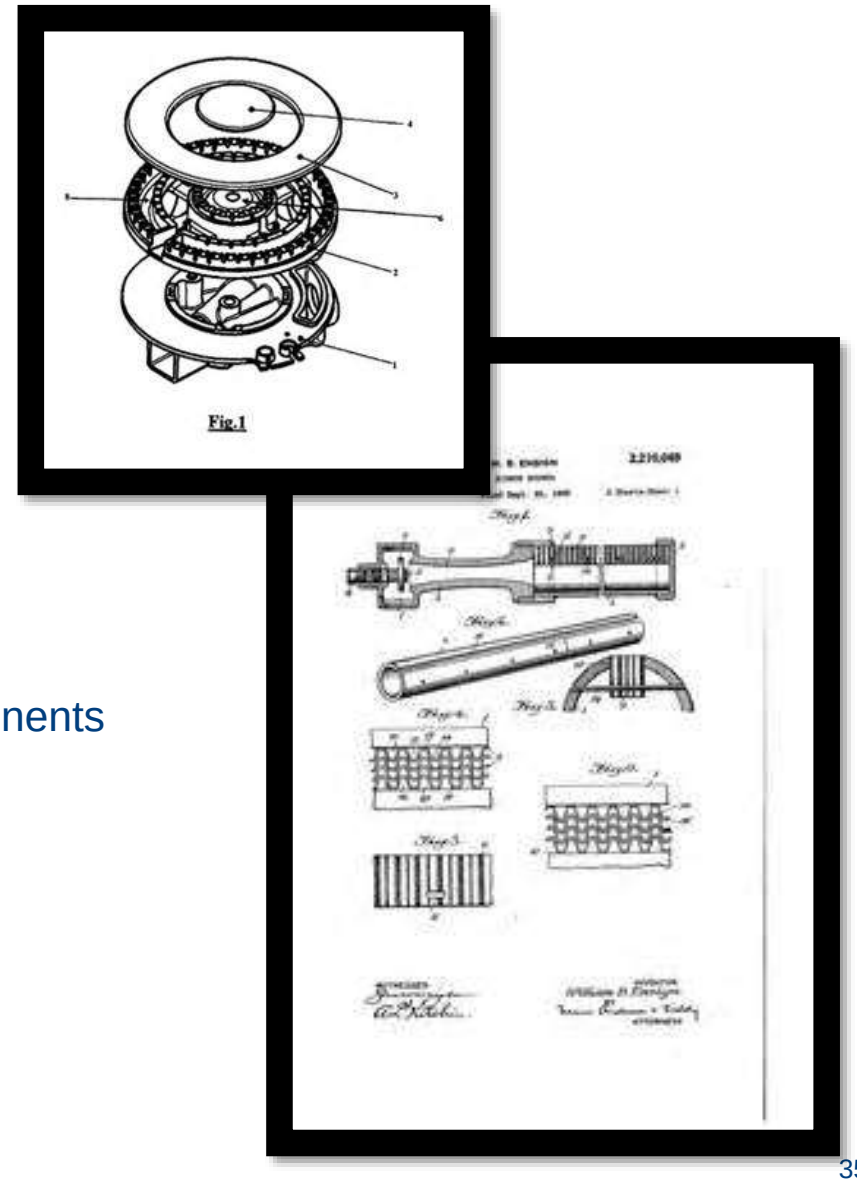
The input rates, rated gas pressures, and fuel types determine the standard(s) and tests required.

Typically full standard testing of a representative model is done with natural gas and only limited testing is required for additional gas types.

- Provide BTU input ratings of your models for each gas fuel type.
  - For two stage or modulating burner systems indicate the min and max BTU/hr rates.
- For each combination of BTU rating and gas type, provide the rated manifold pressure, inlet pressure range, and orifice size

Engineering Design Documentation

- Brochure or Product Marketing Literature
- Schematics
  - Full assembly
  - Burner assembly
  - Heat exchangers
  - Gas train
  - Combustion chamber
  - Frame and Cabinet
  - Flue/Vent
  - Wiring Diagrams
- Bill of Materials with noted Alternate Components
- Installation and Operating Manual
- Gas Conversion Kits
  - NG to LP
  - High Altitude



Burner Style and Ignition Type

Where possible the Certification Body and Test Agency should try to test one burner system that is representative of a product model series.

- This can be done when the largest burner system is tested and the smaller systems are of the same burner type and dimensions.
  - Example: Test a 4 burner model to cover the same product design available in a 3 burner and 2 burner system.
- Burner Type and design must remain the same throughout the model family, any deviations will require limited or full testing of the burner. Burner types are defined by the test standards.
  - Example: Atmospheric, Induced Draft, Forced Draft, Power Burner
- Dimensional variations in burners of a model series must be reviewed by the Cert Body and Test Agency to determine if additional testing is required. Such as Combustion and BOCs.

Burner Style and Ignition Type

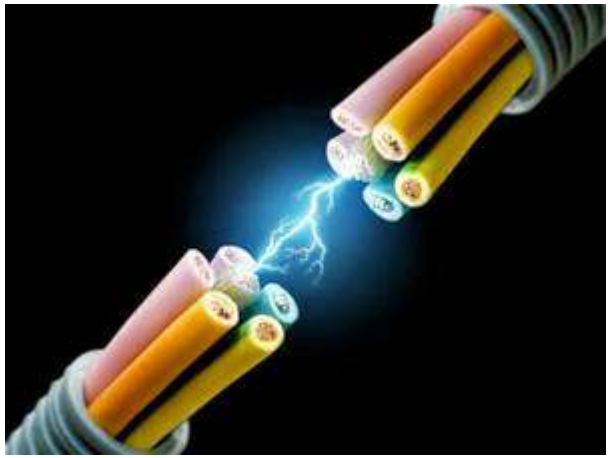
If your product model series comes with optional or alternate ignition types, each ignition source must be tested to the applicable BOCs (Burner Operating Characteristics) of the test standard.

- Automatic, Direct, and Manual Ignition System
- Pilot
- Hot Surface
- Spark
- Piezo

Other Product Ratings

Other product ratings to prepare and provide to your Certification Body are:

- Electrical details are evaluated to the product test standard, applicable electric component standard, NFPA codes, and Canada electric codes.
  - Voltage
  - Amperage



- Dimensions and Weight
  - Important to the test lab so they can confirm they can pick up the test sample and fit it through the lab doors ☺.

Square Peg, Round Hole

Prepare technical details for critical components.

- Critical Components are components which directly impact the performance of the product or act as a safety control monitor of the product.
- A Component is most likely defined as critical if:
  - It is supplied with voltage greater than 30V
  - It is a burner or motor
  - Controls the burner or motor
    (Thermostat, Ignition System, Contactor, Relay)
  - Shuts down the product in the event of an unsafe condition
- Details to provide for each critical component:
  - Listing or Recognition information (Certification Mark)
  - Specification/Ratings: Electrical, Temperature, Material Composition

Prepare technical details for critical components.

- Note any unlisted/unrecognized component and call it to the attention of the certification body so they can prepare a test plan specific to that component for use in your product.
- Call out Alternate Components
- Alternate Thermostats, Burner Controls, Flame Sense Devices (FSD), Temperature and Flame Roll Out Limits may require additional limited testing in the product dependent on component specifications and product design.

Test Sample Preparation

Once the models have been determined which will require construction evaluation and testing prepare these model samples for 3rd Party Testing by performing the “in house” checks mentioned earlier.

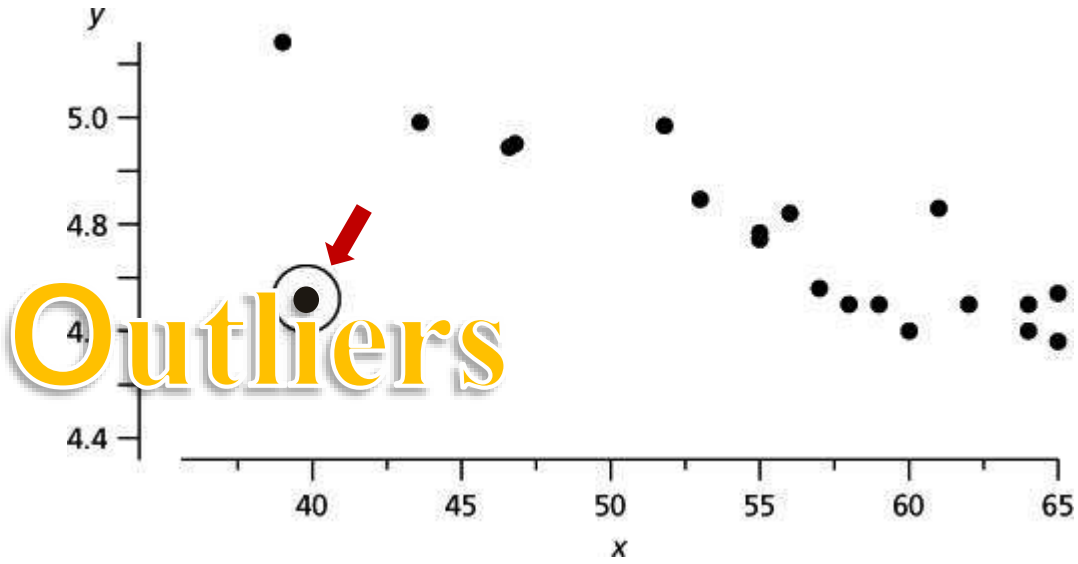
Test samples must be representative of production.

Never send a prototype model to a 3rd Party Test Agency for Certification unless you are 100% sure it is representative of the final production models.

Case in Point:

Prototype commercial oven is received by the test agency. Agency Engineer notices that the ribbon burner is black steel threaded pipe with rough machined edges and holes. Calls it to the attention of the product manufacturer and they respond that the final production will be a seamless weld, stainless steel burner . This won’t work, the gas train and burner must be the same as final production before burner, BOC, and combustion tests can be performed. Otherwise you’ll end up having to test twice.

Note on Outliers



Occasionally outliers come up in 3rd party certification testing where a product may meet the word for word requirements of a product test standard, but it doesn't meet the intent of the standard.

As accredited certification test agencies, we have the authority to overrule a test standard if we identify a safety risk in a product assembly or component.

In such cases other product standards are typically referenced which have testing that covers the identified safety risk.

If you are prepared, certification can be an easy process.

Use the recommendations in this guide and you will cut down on certification delays, costly retests, and get your product to market faster.

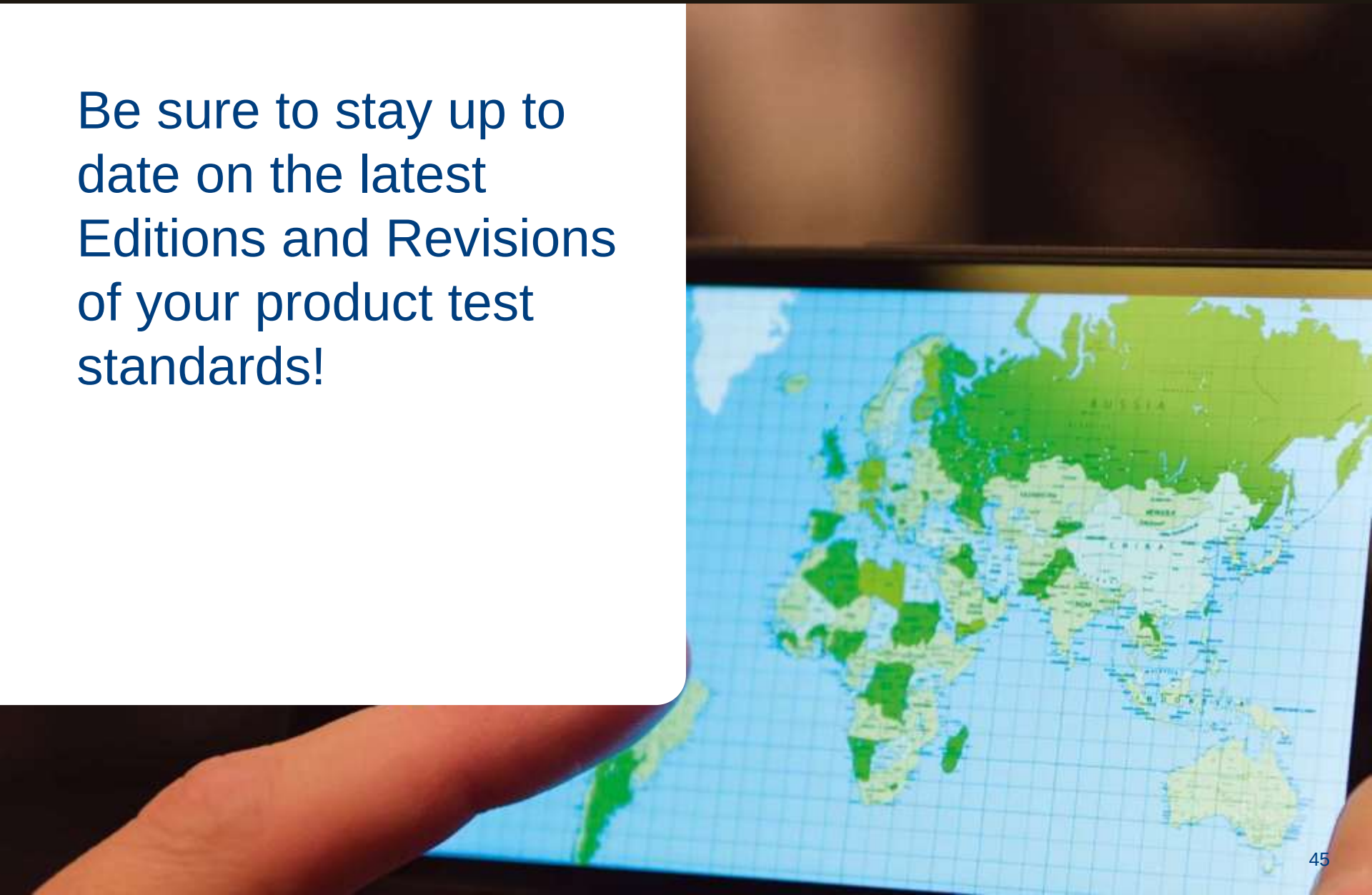
- Get a copy of the standard and test in house first if possible
- Prepare all your documentation to prevent unforeseen test requirements
- Reach out to your certification body any time you have a question about preparing a new or updated product for certification. They have experts on staff to help you with the process.

Added Safety Measures

We urge manufacturers to go above and beyond the requirements of the safety standards.

- Higher Cycle Testing on Components
- Life Cycle Testing
- FMEA
- Audit your Vendors/Suppliers routinely

Be sure to stay up to date on the latest Editions and Revisions of your product test standards!



04

Questions?