

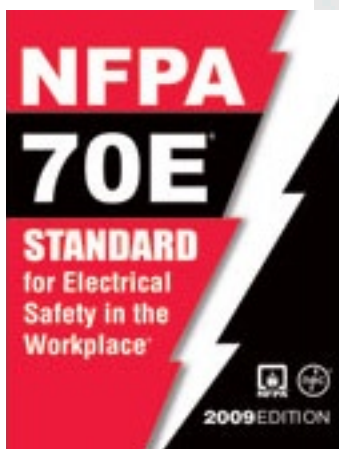
## Key changes to NFPA 70E

### Application Note

by Jim White, Shermco Industries

The 2009 edition of NFPA 70E Standard for Electrical Safety in the Workplace is now taking effect. What's the impact?

1. Overall, the wording and intent is much clearer. Specific hazards of concern are clearly identified and key tables, such as Table 130.7(C)(10) (PPE and Clothing Matrix), have been reformatted to make them easier to use.
2. Rating requirements for electrical test tools are more clearly spelled out. See section 110.9. "Test instruments, equipment, and their accessories shall be rated for circuits and equipment to which they will be connected." Test tool rating for electrical systems 1000 V and below is defined by the ANSI ISA 61010-1 Standard. Visit the link below for an explanation of test tool safety rating categories. Then, check your test tools and make sure they've been independently tested to meet the ISA ratings for your electrical environment.
3. New tasks involving arc-resistant switchgear are being added to Table 130.7(C)(9), and a new section pertaining to arc-resistant switchgear is also added. If the door is properly secured, no flame resistant (FR) clothing or equipment is needed to operate or install/remove (rack) breakers. If the door is open, it would have the same level of risk as traditional switchgear.
4. Infrared thermography has been added as an inspection task for many types of equipment. A reduced level of personal protective equipment (PPE) could be allowed if the thermographer does not remove panel covers, does not break the plane of the equipment, is outside the restricted approach boundary, and if all his/her activities are non-intrusive. Be sure to read all the notes that are included, both in the tables and after, in order to apply these correctly.



The 2009 70E edition now requires that test tools be rated for their electrical environment. Check your tools for ratings and use the chart on page 3 to check your applications.



5. Some Hazard/Risk Categories (HRC) have been changed. Inserting or removing (racking) circuit breakers is now HRC 4, whether the doors are open or closed. This is due to the high probability of the door coming open. Add to this the venting and other openings that are often found in switchgear doors and there is little difference between open or closed. Inserting or removing MCC buckets is also HRC 4 now.
6. In Table 130.7(C)(9), a new equipment category was added for "utilization equipment fed by a branch circuit of the panelboard or switchgear." This applies to equipment such as receptacles, motors and other small devices. In the past there was no guidance for this type of electrical equipment.
7. In an effort to make the Hazard/Risk Category 2\* less confusing, a new row was added to Table 130.7 specifically for it. All PPE and clothing required for HRC 2\* is now in one place.
8. Also in HRC 2\*, a balaclava hood (NOMEX sock hood) and arc-rated face shield combination can be used in place of a full flash hood [Note 11 in Table 130.7(C)(10)].
9. Hazard/Risk Category 1 will now require the use of an arc-rated face shield (4 cal/cm<sup>2</sup> minimum).

Keep in mind that Hazard/Risk Categories really have nothing to do with the occupation; only the electrical hazard of the system or circuit being worked on. A 240 V lighting panel can have a HRC 0 or HRC 1, depending on the task being done. The HRC is dependent on the equipment and the task. The Standard uses HRC as a means to estimate the actual incident energy.

There are many other changes, so purchase a copy of the new 70E edition for your team. Depending on your needs and the needs of your company, some of the other changes could have even more impact than the highlights listed here. The result of these changes, if implemented by companies and their employees, will be a workplace that is considerably safer than before and a standard that is much easier to use.

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Hazard/Risk Category 2\* now requires either a switching hood or a balaclava hood and arc-rated face shield combination.

## PPE guidelines

Hazard/Risk categories are described by the National Fire Protection Association (NFPA) Standard 70E. The higher the electrical environment, the stronger the personal protective equipment (PPE) must be to withstand an arc flash incident.

<p><b>Hazard/Risk Category 1:</b>  <b>&lt; 240 V electrical environments</b>                  (110 V/120 V/208 V/220 V panels, 0 to 50 hsp motors and drives)</p> <p><b>Minimum arc rating for FR clothing:</b>                  16.74 J/cm(2) or 4 cal/cm(2)</p>	<ul style="list-style-type: none"> <li>• Flame-resistant (FR) long-sleeved shirt and/or jacket with sleeves rolled down and front fully buttoned up (FR clothing must fully cover all skin and ignitable clothing)</li> <li>• FR pants</li> <li>• Rubber insulating gloves with leather protectors worn over top</li> <li>• Arc-rated face shield and safety glasses</li> <li>• Hard hat and hearing protection</li> <li>• Leather work boots</li> <li>• No jewelry, keys, or watch</li> <li>• Insulated hand tools</li> </ul>
<p><b>Hazard/Risk Category 2*:</b> 240 V to 600 V electrical environments                  (270/480/600 V electrical panels, MCCs, switchgear, transformers, bus bars, UPS, and lighting; 100+ hsp motors and drives)</p> <p><b>Minimum arc rating for FR clothing:</b>                  33.47 J/cm(2) or 8 cal/cm(2)</p>	<ul style="list-style-type: none"> <li>• FR long sleeved shirt and/or jacket with sleeves rolled down and front fully buttoned up</li> <li>• FR work pants (not denims) or coveralls</li> <li>• Rubber insulating gloves with leather protectors worn over top</li> <li>• Heavy-duty leather work boots</li> <li>• Switching hood or a balaclava hood combined with an arc-rated face shield</li> <li>• Hard hat, hearing protection, and safety glasses</li> <li>• No jewelry, keys, or watch</li> <li>• Insulated hand tools</li> </ul>
<p><b>Hazard/Risk Category 3:</b>  <b>High voltage environments</b>                  (1600 A or higher substations, utility transformers, big facility service entrances)</p> <p><b>Minimum arc rating for FR clothing:</b>                  104.6 J/cm(2) or 25 cal/cm(2)</p>	<ul style="list-style-type: none"> <li>• Full flash suit (jacket, overalls, and hood)</li> <li>• Rubber insulating gloves with leather protectors worn over top</li> <li>• Heavy-duty leather work boots</li> <li>• No jewelry, keys, or watch</li> <li>• Insulated hand tools</li> <li>• Hard hat, hearing protection, and safety glasses</li> </ul>

Reference: NFPA Standard 70E Tables 130.7 (C (9), (C (10), (C(11)).

Note: Category 2\* is a higher risk than Category 2. This chart only lists PPE for 2\*, not for 2. See NFPA 70E Table 130.7 (C)(10) for the specific distinctions between Category 2 and Category 2\*.

## Measurement safety categories

The International Electrotechnical Commission (IEC) Standard 61010 describes performance specifications for low voltage (< 1000 V) test equipment. The higher the category, the higher the power available in that environment and the higher the test tool's ability to withstand transient energy.

Measurement category	In brief	Examples
CAT IV	Three-phase at utility connection, any outdoor conductors	<ul style="list-style-type: none"> <li>• Refers to the "origin of installation", i.e., where low-voltage connection is made to utility power.</li> <li>• Electricity meters, primary overcurrent protection equipment.</li> <li>• Outside and service entrance, service drop from pole to building, run between meter and panel.</li> <li>• Overhead line to detached building, underground line to well pump.</li> </ul>
CAT III	Three-phase distribution, including single-phase commercial lighting	<ul style="list-style-type: none"> <li>• Equipment in fixed installations, such as switchgear and polyphase motors.</li> <li>• Bus and feeder in industrial plants.</li> <li>• Feeders and short branch circuits, distribution panel devices.</li> <li>• Lighting systems in larger buildings.</li> <li>• Appliance outlets with short connections to service entrance.</li> </ul>
CAT II	Single-phase receptacle connected loads	<ul style="list-style-type: none"> <li>• Appliance, portable tools, and other household and similar loads.</li> <li>• Outlet and long branch circuits.                             <ul style="list-style-type: none"> <li>– Outlets at more than 10 meters (30 feet) from CAT III source.</li> <li>– Outlets at more that 20 meters (60 feet) from CAT IV source.</li> </ul> </li> </ul>
CAT I	Electronic	<ul style="list-style-type: none"> <li>• Protected electronic equipment.</li> <li>• Equipment connected to (source) circuits in which measures are taken to limit transient overvoltages to an appropriately low level.</li> <li>• Any high-voltage, low-energy source derived from a high-winding resistance transformer, such as the high-voltage section of a copier.</li> </ul>

Measurement categories. IEC 61010 applies to low-voltage (< 1000 V) test equipment.

## Independent testing

### Independent testing is the key to safety compliance

Look for a symbol and listing number of an independent testing lab such as UL, CSA, TÜV or other recognized testing organization. Beware of wording such as "Designed to meet specification ..." Designers' plans are never a substitute for an actual independent test.

How can you tell if you're getting a genuine CAT III or CAT II meter? Unfortunately, it's not always that easy. It is possible for a manufacturer to self-certify that its meter is CAT II or CAT III **without any independent verification.** The IEC (International Electrotechnical Commission) develops and proposes standards, but it is not responsible for **enforcing** the standards.

Look for the symbol and listing number of an independent testing lab such as UL, CSA, TÜV or other recognized approval agency. That symbol can only be used if the product successfully completed testing to the agency's standard, which is based on national/international standards. UL 3111, for example, is based on IEC 1010. In an imperfect world, that is the closest you can come to ensuring that the multimeter you chose was actually tested for safety.

### What does the CE symbol indicate?

A product is marked CE (Conformité Européenne) to indicate its conformance to certain essential requirements concerning health, safety, environment and consumer protection established by the European Commission and mandated through the use of "directives." There are directives affecting many product types, and products from outside the European Union can not be imported and sold there if they do not comply with applicable directives. Compliance with the directive can be achieved by proving conformance to a relevant technical standard, such as IEC 1010 for low-voltage products. Manufacturers are permitted to **self-certify** that they have met the standards, issue their own Declaration of Conformity, and mark the product "CE." **The CE mark is not, therefore, a guarantee of independent testing.**

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Printed in U.S.A. 5/2009 3399326B A-EN-N

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