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A NEMA Ground Fault Personnel Protection Section White Paper—Ground Fault Circuit Interrupter (GFCI) Guidance

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Foreword

This is a NEMA white paper based upon Member support. This publication will be periodically reviewed by the Ground Fault Personnel Protection Section of the NEMA Building Infrastructure Division for any revisions necessary to keep it up to date with advancing technology. Proposed or recommended revisions should be submitted to:

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The National Electrical Manufacturers Association (NEMA) has developed this white paper to offer detailed technical guidance and other information related to application and installation of GFCI protection in accordance with the NFPA 70®, *National Electrical Code*® (*NEC*®).

GFCIs have a long history of saving lives. The *NEC*® introduced the use of GFCIs as a requirement in bathrooms in 1975[1], and over the years, these requirements have expanded. With the publication of the 2023 *NEC*®, GFCI protection is now required in 12 locations throughout the home[2]. The Electrical Safety Foundation (ESFI) asked the question, “What if GFCIs did not exist?” to investigate the number of electrocutions that would have likely occurred without the expansion of GFCI requirements throughout the years[3]. The ESFI found that GFCIs have contributed to an 80% drop in electrocutions, with a 93% drop in consumer product electrocutions (between 1975 and 2020)[3]. Without this expanding protection of GFCIs, there would have been an estimated 603% increase in electrocutions, with an estimated 111% increase in consumer product electrocutions[3]. The U.S. Energy Information Administration has stated that U.S. energy usage increased 114% between 1978 and 2020[3], highlighting the increased potential of in-home contact with water and electricity. This historic data highlights the need for *NEC*® expansion of GFCI usage throughout the home, and how this expansion has saved lives.

In recent years, states have petitioned to remove GFCI protection on dryer and range receptacles. The 2020 *NEC*® introduced this protection in response to multiple children being electrocuted by these appliances. The removal of GFCI protection from dryers and ranges will place home occupants at risk of shock and electrocution. When states do not completely adopt the updated *NEC*® in a timely fashion, they risk the safety of their residents by not requiring this protection everywhere it is needed. Amendments removing this technology could lead to a rise in consumer injuries and death.

Many states and local jurisdictions adopt and enforce GFCI protection requirements of the *NEC*® as published, with no amendments. In some cases, a state or local jurisdiction adopts additional GFCI protection requirements for a specific application or condition of use to improve and enhance the prevention of shock and electrocution beyond the minimum protection requirements in the published code. These states and local jurisdictions clearly recognize the safety benefits that GFCI protection provides to a premises wiring system.

When GFCI protection was first introduced, there were ~600 deaths per year due to consumer product electrocution[4]. This number has decreased, and in 2020 there were reports of 40. This decrease in loss of life can be attributed to a number of improvements in home wiring, including the use of better insulation on conductors, a dedicated grounding wire, and decreasing the use of knob-and-tube wiring. But one of the biggest contributors to saving lives is the use of GFCIs throughout the home.

To determine the number of electrocutions each year, NEMA looked to the Consumer Product Safety Commission's (CPSC) Underlying Cause of Death database [11]. This database contains mortality and population counts for all U.S. counties; each death certificate has a single underlying cause of death identified, and demographic data also is provided. The CPSC also published a report detailing electrocutions associated with consumer products between 2004 and 2013 [9]. The report found that the category responsible for the most electrocutions over the four-year period was “Large Appliances” (31 electrocutions) followed by “Small Appliances” (21 electrocutions). The report also found that, when compared to studies from previous years, a larger number of electrocutions happened while consumers were doing repair work [9].

NEMA sought to compare all of this data to better understand the number of homes that have GFCI protection. To estimate the number of homes protected by GFCIs on a yearly basis, NEMA reviewed data from the census.gov website and the ESFI. Plotting the data from all of these sources shows an increasingly negative correlation between GFCI protection and consumer product electrocutions: