



The Protective Life of Safety Switches

Project Stage 2

Initial Consultations

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Policy Branch

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SAFETY SWITCH RESEARCH PROJECT STAGE 2

The Electrical Safety Office (ESO) is conducting a research project to examine the reliability of safety switches and the physical environmental and engineering factors that may determine the useful life of a safety switch.

Background

Many of Australia's domestic residences are protected by safety switches of various designs that could be several decades old. While reliance on and confidence in, safety switches is generally high, the protective life of safety switches is not known. Safety switches can fail to a state such they will not operate when an electrical fault occurs. This failure state may go undetected indefinitely until tested or otherwise identified. While guidance for Safety Switch reliability is available internationally, little is known of the factors that impact the protective life of safety switches locally.

Past studies published internationally vary in purpose and method and although their findings are generally consistent, their specific findings are variable. The most recent studies report an overall failure rate of safety switches in conditions that might be expected in Queensland, ranging from less than 1% to 11%. Whether or not this reflects Queensland's population of safety switches can not be inferred with certainty. Considering the high reliance on safety switches in most jurisdictions, the question of reliability remains a valid and significant one.

Purpose

The research project was aimed at benchmarking the failure rate of Queensland's safety switch population. It was intended that by researching this general failure rate and identifying the significant influencing factors, control measures for managing the ageing population may be better understood and augmented.

Project stages

Stage 1 of the project was initiated with a review of the international literature for safety switch reliability.

Following the completion of the literature review stage 2 was designed to include an initial consultation and scoping stage, in preparation for stage 3, engaging a research consultant to conduct the research proper.

Project progress

Feedback from key stakeholders and the review of international literature suggested using electrical workers and contractors as key informants to effectively define and measure the factors surrounding the reliability of safety switches. This stage, stage 2, gathered available information and support from industry to inform research design and guide the development of a further broad based intervention.

Initially, the ESO contacted 80 stakeholders with the aim of identifying industry support for the research and available sources of safety switch information including test data. Of the 23 replies, a number of existing data sources was discovered. Support was also gained from the Queensland Public Works Department and a number of contracting firms to record their safety switch tests (manual test button test and time current tests) for a three month period.

Historical Queensland data

Historical records of tests were obtained from a limited sample of Queensland Government owned and maintained safety switches. 9,491 RCDs tested 3 times sequentially (up to 41,891 tests in total including zero and 180 degree tests) in accordance with AS/NZS 3760. Some data cleansing was required for this historical data set.

- Test 1 Push button test - 9,450 tests
- Test 2 Time-current test at zero and 180 degrees – 8,112 x 2 tests
- Test 3 Time-current test at zero and 180 degrees – 8,076 x 2 tests

Overall, 54 units (0.57%) failed, 41 (0.43%) failed their first test of which 11 failed their second test of which 10 failed a third test.

41 RCDs (0.43%) failed their first (push button) test of which 13 then failed their second (time current) test of which 10 then failed a third test. Thirteen (0.14%) passed the first (push button) test but failed their second (time current) test.

In most cases the electrician could not measure or did not record the tripping times for the RCDs which failed.

An analysis of the 32,397 measured tripping times for RCDs which passed test 2 and test 3 was undertaken.

- Test 2, which was conducted after a push-button test, showed tripping times ranging from 1ms to 506ms only three recorded above 300ms. The average tripping times were 28.39ms and 28.08ms respectively for the zero and 180 degrees tests.
- Test 3, which was conducted after a push-button test and after Test 2, showed tripping times ranging from 1ms to 168ms. The average tripping times were 14.90ms and 13.76ms respectively for the zero and 180 degrees tests

These results suggest that tested and maintained safety switches are generally reliable but also reinforces the need for and benefits of regularly testing.

New survey data

To pilot an approach to conducting safety switch reliability research, the ESO equipped volunteer participants with test record booklets and instructions for recording test results and installation details.

Three electrical contractors reported 151 tests of domestic and non domestic installations which are summarised in table 1. Although these results indicate concerning failure rates over the small sample, it is noted that the reliability of testing and data recording may be variable.

Installation type	Number of tests	Failures
Domestic	126	6.35%
Non-domestic	25	16.00%

Table 1 Contractor reported safety switch tests

The Queensland Public Works Department electricians reported 729 tests of domestic and non-domestic installations which are summarised in table 2. This large sample of government owned installation supports an assumption of a generally low failure rate. Together the contractor’s and public works tests indicate a disparity in the failure rate by installation type combined domestic failure rate – 1.8%; combined non-domestic failure rate – 3.8%).

Installation type	Number of tests	Failures
Domestic	491	0.61%
Non-domestic	238	2.52%

Table 2 Public Works reported safety switch tests

These results confirm that confidence in safety switches in Queensland is justifiable generally and comparable to international results. This pilot study modelled an approach which could be taken by the research consultant,

Limitations

Although it was attempted, survey respondents had difficulty in reporting environmental factors which may have influenced failures. Given that there were just 21 failures detected, the ability to identify causal factors is limited. It was also found that relying on industry goodwill to volunteer information about safety switch reliability is problematic. Feedback received suggested that organisations generally found recording test results for this study a burden.

The ESO continues to progress this research project to better understand the implications of increased penetration of, and reliance on, safety switches in our homes and workplaces in Australia.

Stage 3 of this project, a study by a research consultant, will address the findings to date and see whether user response sampling confirms the relatively low rate of safety switch failure, and whether there are readily identifiable factors (such as age or environmental) that contribute to such failures.

Report prepared by:

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