# Prevent 30% of Fires

## Switchboard Maintenance

**Chris Beh**

**Principal Consultant, Think Consulting**

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think CONSULTING

Any questions or request for additional information in relation to this report can be addressed to:

Chris Beh
+64 21 2783363
Chris.Beh@thinkconsulting.co.nz

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## Abstract

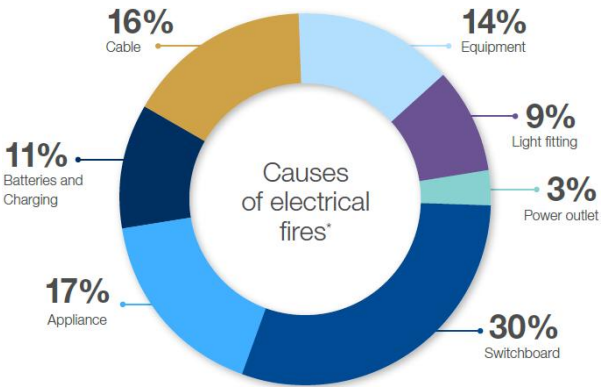
1 in 5 commercial fires are caused by electrical sources, of which 30% of these are due to electrical switchboard failings. However, the maintenance of electrical switchboards is often not prioritised and when undertaken, an issue of scope and frequency is questioned. The guidance is not clear from regulations, standards or authorities and industry practices vary greatly.

This paper outlines the regulations, standards in this area of preventative maintenance and summarises the insurance market requirements and known industry practices, covering both commercial and domestic electrical switchboards.

A suggested scope of works and frequency inspections as part of a preventative maintenance plan for both commercial and domestic electrical switchboards is provided for organisations to consider.


## 1. Context

According to insurer, NZI, electrical switchboards are the main causes of electrical fires from their claims database between 2016 to 2023. 1 in 5 of NZI's significant commercial property damage claims were caused by electrical fires, with 30% of these caused by fires in electrical switchboards[1].




**Summary of NZI's claims database of causes of significant commercial property damage by electrical fires between 2016 to 2023.**

## 2. Electrical Switchboard Preventative Maintenance – Should this be done?

However, between Australia and New Zealand, the maintenance regime of electrical switchboards is not clear, various in industries and sectors and within organisations in each sector. Why is this? Why is there no uniformity? What is the guidance? What is best or better practice?

It is useful to note that there are no legal requirements to conduct electrical periodic verification / assessment inspections in New Zealand and Australia for many industrial and commercial installations and even domestic or residential establishments. The below is an extract from the New

[1] NZI Electrical Safety Guide, nzi.co.nz/content/dam/insurance-brands-nz/nzi/nz/en/documents/nzi/risk-solutions/nzi-electrical-safety-guide.pdf

Zealand Electricity (Safety) Regulations 2010, where periodic assessments are referenced but only in terms of the listed installations –

***Electricity (Safety) Regulations 2010, clause 75 (1), Periodic assessments of certain installations***

*The owners and operators of the following installations must ensure that the installations are periodically assessed as set out below, to determine whether they are electrically safe and otherwise comply with these regulations:*

*(a) low voltage installations in caravan parks: in accordance with AS/NZS 3001, at intervals not exceeding 5 years:*

*(b) low voltage installations in boat marinas: in accordance with AS/NZS 3004.1, at intervals not exceeding 5 years:*

*(c) low voltage installations at demolition and constructions sites: in accordance with AS/NZS 3012:*

*(d) low voltage installations at carnivals and fair grounds: in accordance with AS/NZS 3002, at intervals not exceeding 1 year:*

*(e) low voltage installations, other than domestic installations, in hazardous areas: in accordance with AS/NZS 60079.17:*

*(f) low voltage and extra-low voltage installations intended for use with electrical medical devices situated—*

*(i) in mobile medical facilities: in accordance with NZS 6115:*

*(ii) in any other medical location: AS/NZS 3003.*

AS/NZS 3019:2007 is the standard cited by the Electricity (Safety) Regulations 2010[2], however, the AS/NZS 3019:2022 is the current standard, yet to be cited. Therefore, the standard to work from a 'legal' perspective is AS/NZS 3019:2007. Table 1 summarises the changes between the 2022 revision and 2007. It should also be noted that the standard has been renamed from "*Electrical Installations - Periodic Verification*" in 2007 to "*Electrical Installations - Periodic Assessment*" in the 2022 version of AS/NZS 3019. This terminology is in line with the wording / text in the Electricity (Safety) Regulations 2010 which utilises *"Periodic assessments*" as its descriptor. Therefore, AS/NZS 3019:2007, with reference to AS/NZS 3019:2022, should be used as a guide for the tests that should be conducted for electrical switchboards. The below table summarises the testing scope changes between AS/NZS 3019:2007 & 2022.

**Summary Table – Testing Scope Changes between AS/NZS 3019:2007 & 2022.**

| **Testing Area** | **2007** | **2022** |
|---|---|---|
| Polarity | ✓ | ✓ (renamed "Polarity and correct connection") |
| Polarisation | ✓ | ✓ |
| Insulation resistance | ✓ | ✓ |
| Earth fault loop impedance | ✓ | ✓ |
| Protective device fault rating | ✓ | ✓ |
| RCD check | ✓ ("verification") | ✓ ("assessment") |
| Integrity of switchboard connections | ✓ | ✓ |
| Testing of isolated/separated supply | ✓ | ✓ |
| **Thermography** | ✕ | ✓ *(new)* |

[2] Electricity (Safety) Regulations, Schedule 2, Electrical codes of practice and official standards cited in these regulations, https://www.legislation.govt.nz/regulation/public/2010/0036/latest/DLM2763782.html?search=sw_096be8ed81f3490e_3019_25_se&p=1&sr=2

| Testing Area | 2007 | 2022 |
|---|---|---|
| Switchboard condition | Basic visual | More detailed, dismantling possible |
| NZ “Enhanced Safety” testing | ✕ | ✓ *(new)* |

**Section 3**

Key Changes

- More detail and specificity.
- Improves alignment with *AS/NZS 3000 Electrical installations (Wiring Rules)*.
- Added definitions and protective device labelling checks.

**Section 4**

Key Changes

- Expanded polarity check.
- RCD test clarified as performance check.
- Partial dismantling of switchboards allowed.
- Methodology standardised via *AS/NZS 3017 Electrical installations - Verification inspection and testing*.

**Section 6**

This is a new / additional New Zealand–specific section for enhanced safety evaluation.

**General Differences**

- Reframes the standard as Periodic Assessment.
- Structures inspection levels to be cumulative.
- Upgrades reporting mechanisms and includes suitability-enhancing tools like thermography guidance (*Section 5.8* and *Appendix B Thermography*).

## 3. Frequency of Inspections and Tests

The Electricity (Safety) Regulations 2010 requires electrical installations to be maintained in a safe condition but does not set explicit inspection intervals or frequency for periodic assessments to be undertaken, refer to an extract of the clause below.

***Electricity (Safety) Regulations 2010, clause 40, Safety checks of works***

*(1) Every owner of works must establish and implement a safety checking system that complies with subclause (2) for regularly checking the electrical safety of the works.*

*(2) The safety checking system must—*

*(a) require that the works are checked for compliance with all the requirements of regulations 41 to 46; and*

*(b) provide for periodic checking of the works—*

*(i) at reasonable intervals; and*

*(ii) by a person who is suitably qualified and has the necessary competencies and experience to carry out the check; and*

*(c) require records to be kept of the results of every periodic check.*

The frequency of periodic verification / assessment is outlined in AS/NZS 3019:2007 and AS/NZS 3019:2022 but both standards state that the frequency is dependent on the type of installation, equipment, operation frequency and quality of maintenance and external influences. Refer to clause 2.8 for AS/NZS 3019:2007 and clause 2.9 for AS/NZS 3019:2022 shown below. Both versions are very similar in text but are not specific on the frequency of inspections and tests – cl. 2.8.1 "*the interval may be, for instance, some years (e.g. 4 years)…*". The standards, however, also state that –

1. The periodic verification / assessment report should include advice on the next date or the recommended interval for the next / further verification / assessment.

2. Installations under effective management for preventative maintenance in normal use, periodic verification / assessment may be replaced with an adequate regime of continuous monitoring and maintenance by competent persons, with records kept.

In New Zealand, Worksafe (New Zealand's primary workplace health and safety regulator), refers to the above clause 40 for periodic verification of high voltage electrical installations and for low and extra low voltage electrical installations[3] only state "*Particular electrical installations are required to be periodically assessed to determine whether they are electrically safe and otherwise comply with the regulations*" [4] but no guidance on the actual frequency or interval is provided. For domestic switchboards, Worksafe states the following[5] –

"*Energy Safety recommends that the homeowner carries out visual checks at regular intervals.*"

"*Various manufacturers' instructions suggest a monthly test should be carried out for this type of RCD test.*"

In Australia, it is a strong safety recommendation, for example for all Body Corporates, are advised to complete main switchboard inspections every 2 years as a minimum. Safety switches, located within the main switchboards, for the communal lights and power with safety switches for individual properties located within their individual switchboards. These safety switches should be tested by a licensed electrical contractor to ensure that they are tripping within the required time of 300 milliseconds cutting power to any faulty source. If a safety switch does not trip within the required time, it is deemed faulty and should be replaced immediately. Safety switches must be tested in accordance with AS/NZ 3760:2010, which specifies that inspection and test must be completed every 6 months (push button) and 2 years (operating time test).

The Australian Residential Tenancies Regulations 2021 also states that rental providers must ensure that an electrical safety check of all electrical installations and fittings in the premises (in accordance with Section 4 of AS/NZS 3019 ("Electrical installations — Periodic assessment") is conducted every two years.

[3] **High voltage electrical installations | WorkSafe**

[4] **Inspection and periodic verification | WorkSafe**

[5] **Switchboard installation | WorkSafe**

***AS/NZS 3019:2007***

## 2.8 Frequency of periodic verification

**2.8.1** The frequency of periodic verification of an installation shall be based on the type of installation and equipment, its use and operation, the frequency and quality of maintenance and the external influences to which it is subjected.

NOTE —

(1) The maximum intervals between periodic verifications may be set by legislation.

(2) The interval may be, for instance, some years (e.g. 4 years), with the exception of the following cases where a higher risk may exist and shorter periods may be required:

- (i) Working places or locations where risks of electric shock, fire or explosion exist due to degradation
- (ii) Working places or locations where both high and low voltage installations exist
- (iii) Communal facilities
- (iv) Safety installations (e.g. emergency luminaires).

For domestic dwellings, longer periods (e.g. 10 years) may be appropriate. When occupancy of a domestic dwelling has changed, a verification of the electrical installation is strongly recommended.

(3) The periodic verification report should recommend to the installation owner the recommended interval to the next periodic verification.

**2.8.2** In the case of an installation under an effective management system for preventive maintenance in normal use, periodic verification may be replaced by an adequate regime of continuous monitoring and maintenance of the installation and all its constituent equipment by skilled persons. Appropriate records shall be kept.

***AS/NZS 3019:2022***

## 2.9 Frequency of periodic assessment

The frequency of periodic assessment of an installation shall be based on the type of installation and equipment, its use and operation, the frequency and level of maintenance and the external influences on which it is subjected.

NOTE 1 The maximum intervals between periodic assessments may be set by legislation.

NOTE 2 The interval may be, for instance, some years (e.g. 4 years), with the exception of the following cases where a higher risk exists and shorter periods are required:

(a) Working places or locations where risks of electric shock, fire or explosion exist due to degradation.

(b) Working places or locations where both high and low voltage installations exist.

(c) Communal facilities.

(d) Safety installations (e.g. emergency luminaires).

NOTE 3 For domestic dwellings, longer periods (e.g. 10 years) may be appropriate. When occupancy of a domestic dwelling has changed, an assessment of the electrical installation is recommended.

The periodic assessment report should include advice on the next date for a further assessment.

In the case of an installation under an effective management system for preventive maintenance in normal use, periodic assessment may be replaced with an adequate regime of continuous monitoring and maintenance of the installation and all its constituent equipment by competent persons. Records shall be kept.

## 4. Insurance Market Requirements for Switchboard Maintenance

Most insurers do not have specific requirements for periodic fixed wiring inspections to be undertaken or at least have publicly available guidance for this type of work. However, all/most insurers have a requirement for commercial / industrial type electrical switchboards to have thermal imaging or thermographic surveys undertaken by certified personnel and appropriately reported on. Typically, insurers agree that this should be undertaken on an at least annual basis. Once again, it is noted that many insurers do not have specific requirements on the nature of the thermographic survey or least have publicly available guidance for this type of work. The "informal" nature of most insurer requirements on this area of preventative maintenance may be driven by the fact that many do not have endorsements or warranties for electrical maintenance on their policies.

Only NZI specifically cites AS/NZS 3019:2007 and Form 1 *Certificate of Periodic Verification* and Form 2 *Schedule of Test Results* as recommendations or in some cases for their insureds, as part of their insurance policy endorsements to comply to. NZI also requires thermographic imaging reports in electronic form, with the thermographer details. NZI's guidance on this is contained in their document "*Helping to reduce your electrical risk with Periodic Verification*" and "*Understanding your thermal report*"[6]. It should be noted therefore, NZI's requirements does not accept the Basic Visual Inspection only (Section 3 of AS/NZS 3019:2007) but they require –

- Visual inspection and limited testing with additional thermographic survey reporting (Sections 3 and 4 and clause 5.8 of AS/NZS 3019:2007); or

- Visual inspection and full testing with thermographic survey reporting (Sections 3 and 5 of AS/NZS 3019:2007).

In terms of frequency of inspection, NZI states –

"*The inspection needs to be carried out periodically. The frequency should be no more than annually for buildings constructed of Foamed Plastic Panels or at your recommendation as a registered electrician for all other types of building construction (maximum 4 yearly).*"

Vero Insurance New Zealand (Vero) has formal guidance on periodic verification and thermal imaging and is generally in line with AS/NZS 3019 but written to be agnostic of standard version changes. Their document, "*Periodic Verification*"[7] recommends verification of electrical systems and installations to AS/NZS 3019 and they expect that the Electrical Inspector undertaking the work will provide a certificate confirming –

- What was tested and found.
- Whether there are any limitations on the certificate.
- If any repairs are required.
- When the next periodic verification should take place.

Although not formally stipulated to have Forms 1 and 2 completed, Vero's expectation for a certificate of the works likely means that Forms 1 and 2 or a format similar would be delivered. Their document "*Periodic Verification Tests*"[8] outlines in more detail what each of the three levels of checks and tests are and their expectations.

Vero's guidance on thermal imaging is contained in their document "*Thermal Imaging*"[9] and they

"*At least once a year. Regular checks under load should only be carried out by qualified professionals such as an experienced electrician with the correct training and equipment. Results of the scan*

[6] NZI Understanding your thermal report, nzi.co.nz/content/dam/insurance-brands-nz/nzi/nz/en/documents/nzi/risk-solutions/nzi-understanding-your-thermal-report-guide.pdf

[7] SpecificRisk-Electrical-PeriodicVerification.pdf

[8] SpecificRisk-Electrical-PeriodicVerificationTest.pdf

[9] SpecificRisk-Electrical-InfraredThermography.pdf

*should be fully documented and include a fault identification and action summary. Significant faults should be attended to immediately, other faults should be fixed as advised by an electrician. If any work needs to take place, it also needs to be signed off when completed."*

The below shows Vero's guidance on frequency of electrical fixed wiring inspections –

### How frequently?

Regularity is key, both for verification and maintenance. The frequency boils down to a few factors, including the type of installation and equipment you have, what it's used for, and the environmental conditions for example a. corrosive atmosphere.

- **New installations or systems** – be guided by the manufacturer's recommendations
- **After the first verification** – typically your inspector will make a recommendation based on the results
- **Never completed or many years in between** – a visual inspection with limited testing at minimum

| Indicative timings | Who or why |
|---|---|
| **Every 4 years** | Business premises |
| **Every 10 years** | Domestic dwellings |
| **More frequently** | • Evidence of degradation<br>• Where both high and low voltage installations co-exist<br>• You have safety installations like emergency lights |

## 5. Known Industry Practices

Based on our experience with several organisations from large private, large co-operatives and publicly-listed entities to government organisations, state-owned enterprises and not for profit entities, including organisations in the health sector, as well as discussions with electrical contracting firms, the following was observed across several sectors and industries –

- Annual thermal imaging or thermographic surveys of electrical switchboard is generally conducted (if conducted at all) by registered electricians (undertaken mainly by contracted firms).

- Periodic verification / assessment to AS/NZS 3019:2007 and completion of Form 1 *Certificate of Periodic Verification* and Form 2 *Schedule of Test Results* not commonly performed. Mainly organisations with NZI or some through Vero, as a lead or co-insurer, undertook formal fixed wiring inspections. This was normally conducted annually and for commercial / industrial switchboards (e.g. high voltage, 3-phase, commercial-type). Given the potential number of switchboards to be tested at each site / village, an abbreviated format of Form 2 *Schedule of Test Results* has been observed to be used by large organisations / sites and accepted as part of the Form 1 *Certificate of Periodic Verification*.

Generally, industry information guidance for better practice for fixed wiring inspections and thermal imaging of switchboards vary.

For electrical switchboard fixed wiring inspections, this can be dependent on –

1. Age of the electrical system.
2. Type of installation/environment, usage/occupancy and electrical load / usage – residential (domestic), commercial (office, retail, education, etc), industrial (manufacturing, production facilities, commercial kitchens, commercial laundries - moderate risk environments) and high/higher-risk environments such as west areas, mining, construction, corrosive / harsh environments, hazardous areas (oil, gas, dust, powder), large occupancies (e.g. public entertainment venues), and medical facilities (hospitals, surgeries, etc).
3. Lack of or insufficient electrical safety devices such as ground fault circuit interrupters, residual current devices, etc and electrical surge protection.

Lower risk commercial establishments between 3 to 5 years; moderate risk manufacturing and production environments circa 2 to 3 years depending on conditions; high risk environments 1 to 3 years depending on risk assessments; and medical establishments 1 to 2 years depending on risk assessments.

Residential or domestic environments, depending on age of the electrical systems can be between every 5 to 10 years or sooner if there are renovations or upgrades, or due to change in ownership.

Thermal imaging tends to be annual to every 3 years for commercial and industrial environments.

## 6. Considerations for Electrical Switchboard Fixed Wiring Inspections

As there is no legal requirement to conduct electrical periodic verification / assessment inspections in New Zealand and Australia aside from the specific cases discussed above, it is suggested that the following be considered as part of an organisation's preventative maintenance plan for electrical switchboards.

1. Conduct visual inspection and limited testing with additional thermographic survey reporting (Sections 3 and 4 and clause 5.8 of AS/NZS 3019:2007) including Form 1 *Certificate of Periodic Verification* and Form 2 *Schedule of Test Results* to AS/NZS 3019:2007 with reference to AS/NZS 3019:2022. It is likely that limited testing is appropriate in many cases due to the business / operational disruption risks or life safety risks associated with shutting down or disconnecting systems. Also, this is acceptable from an insurer perspective.

2. If a site has many switchboards to be tested, an abbreviated format of Form 2 *Schedule of Test Results* could be considered.

3. Commercial / industrial electrical switchboards would be of highest priority to be inspected. These would be three-phase, 415V supplies, high amperage (e.g. 63A), building main switchboards, distribution boards, plant and equipment switchboards, etc.

4. Domestic / residential boards, typically operating 230V and 10A, would be a lower priority for testing.

5. Thermal imaging / thermographic surveys of switchboards are commonly used by many organisations to enhance periodic inspections over and above the basic visual inspection requirements as outlined in Section 3 of both AS/NZS 3019:2007 and AS/NZS 3019:2022. Section 5.8 of AS/NZS 3019:2007 and AS/NZS 3019:2022 outline the requirement for thermographic survey of switchboard equipment, which involves the equipment being at normal operating load for at least 30 minutes, and measured and compared to ambient temperature conditions,

checking for excessive rise in temperature. Better industry practice is to conduct this at least annually and is aligned with insurer expectations and requirements for commercial-type boards. Inspections and reporting should be aligned to clause 5.8 and Appendix B of AS/NZS 3019:2022. Use a Category 1 Thermographer (qualified to ISO / AS18436-7) who is a registered and licensed electrician or electrical inspector. The thermal imaging report should include a summary table of exceptions, listing items not tested or included and reasons for their exclusion, with each page featuring both a clear, focussed thermal image of the object of interest, and a key explaining the severity index for reference. The thermal camera should have a resolution of 320 x 240 minimum sensor size and appropriate for electrical inspections.

6. For all commercial / industrial electrical switchboards, conduct visual inspection and limited testing with additional thermographic survey to AS/NZS 3019:2007 with reference to AS/NZS 3019:2022 every 1 to 4 years depending on the age of the electrical systems / facilities. This aligns to general industry practice and Vero's guidance based on 'business premises' which is 4 yearly. Potentially, for older installations of say, 25 years or more, a risk-based assessment should be undertaken to see if higher inspection intervals are required. Noting that annual thermal imaging should be conducted.

7. For domestic / residential-type electrical switchboards, conduct visual inspection and limited testing with additional thermographic survey to AS/NZS 3019:2007 with reference to AS/NZS 3019:2022 every 5 to 10 years. However, inspections would be undertaken after renovations or upgrades or a change in ownership, or if natural movement occurs, or after major events (e.g. flood, storms, earthquake), independent of when the last inspection had been performed.

**Contact us to discuss or to develop your policy, framework, process and procedures and if there are any requirements placed on your industry or by stakeholders such as financers and insurers.**

**Chris.Beh@thinkconsulting.co.nz**

**www.thinkconsulting.co.nz**