

# Electricity Distribution Code - Review of voltage standards for bushfire mitigation

Draft Decision

22 May 2018

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Essential Services Commission **Electricity Distribution Code - Review of voltage standards for bushfire mitigation**



# Executive Summary

In 2016, the *Electricity Safety (Bushfire Mitigation) Regulations 2013 (Vic)* was amended requiring major electricity companies to increase safety standards on specific components of their networks in order to reduce bushfire risk.<sup>1</sup> This mandated the roll out of powerline bushfire mitigation equipment, known as Rapid Earth Fault Current Limiter (REFCL) technology, across Victoria. REFCLs are intended to be installed at distribution zone substations in areas of high bushfire risk, where high voltage electricity powerlines exist.

To reduce bushfire risk, REFCLs are designed to trigger when an abnormal scenario occurs on the network. For example, when a power line fails and comes into contact with the ground, which could occur during extreme weather events, REFCLs operate to rapidly reduce the potential of an electrical spark occurring at that point. However, the operation of REFCLs will also lead to an increase in voltage levels experienced by the electricity distribution system, which are likely to exceed the limits set out in the Electricity Distribution Code (the code).<sup>2</sup>

In this draft decision, we have proposed amendments to the code to enable REFCLs to operate compliantly. When making decisions, we are guided by our legislative objective to promote the long term interests of Victorian consumers<sup>3</sup> and we had particular regard to the requirements of the *Electricity Safety (Bushfire Mitigation) Regulations 2013 (Vic)*. We also considered the operational issues associated with the implementation of REFCLs and the distribution network.

Our draft decision proposes the following changes to the code:

- Introducing new voltage variation limits that only apply when REFCLs are operating for bushfire risk mitigation. These amendments do not specify phase-to-earth voltage variation limits, but retains the existing phase-to-phase voltage variation limits on the high voltage distribution network.
- Introducing new obligations for distributors to annually publish information on planned REFCL installations.
- Clarifying the conditions of liability for affected parties during REFCL operation, including distributors and high voltage customers.
- Clarifying existing obligations and introducing new definitions to support the operation of REFCLs for bushfire risk mitigation.

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<sup>1</sup> *Electricity Safety (Bushfire Mitigation) Amendment Regulations 2016*

<sup>2</sup> Electricity Distribution Code – December 2015, version 9

<sup>3</sup> *Essential Services Commission Act 2001 (Vic)*, section 8

The commission invites written submissions to the draft decision until 22 June 2018. Stakeholder feedback will be used to inform our final decision expected in August 2018.

# 1. Introduction

The Essential Services Commission (commission) is responsible for licensing electricity distributors in Victoria. As part of our licensing functions under the *Electricity Industry Act 2000 (Vic)*, we set licence conditions for distributors which include the requirement to comply with the Electricity Distribution Code (the code).

The code regulates activities relating to the distribution of electricity so they are undertaken in a safe, efficient and reliable manner. This includes setting standards relating to the quality of supply in our distribution network, including voltage standards. The voltage standards in the code set the limits of voltage levels that can be experienced by the electricity distribution system. These standards apply to all parties connected to the electricity distribution system, which includes distributors and high voltage customers.

In 2016, amended regulations passed by the Victorian government came into effect, mandating the roll out of powerline bushfire mitigation equipment, such as Rapid Earth Fault Current Limiter (REFCL) technology, by certain electricity distributors. REFCLs are pieces of equipment installed on high voltage networks that help reduce bushfires related to electricity asset failures. However, when they are used, REFCLs increase the affected part of the system's voltage levels beyond the limits of the voltage standards in our code.

We are now reviewing the voltage standards in the code to help support the use of REFCLs, and to ensure that REFCLs can be operated compliantly with the code.

## 1.1. Background

In July 2010, the Victorian Bushfires Royal Commission found that certain fires on Black Saturday of 2009 were started by faults with electricity infrastructure. This included the Kilmore East fire which was responsible for 119 of the 173 Black Saturday related fatalities.

To reduce the risk of future bushfires being ignited by faults with electricity infrastructure, the royal commission recommended “other technology that delivers greatly reduced bushfire risk” within its findings.<sup>4</sup>

In response, the government accepted these recommendations and introduced regulatory measures to facilitate their adoption. This included amending the *Electricity Safety (Bushfire Mitigation) Regulations 2013* in May 2016 to mandate the roll out of powerline bushfire mitigation technology in 45 locations. The practical outcome of the regulations is that Victorian electricity

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<sup>4</sup> 2009 Victorian Bushfire Royal Commission, Final Report – Summary, July 2010, pp. 29.

distributors will be required to roll out REFCLs into parts of the 22kV distribution system from 2019 to 2023.

## **1.2. Purpose of the review**

The purpose of this review is to propose changes to the code to enable the operation of bushfire mitigation equipment, such as REFCL technology, to operate on high voltage networks as mandated by the new *Electricity Safety (Bushfire Mitigation) Regulations 2013 (Vic)*.

## **1.3. Process of the review**

In February 2018, we released a project scope for the review. The scope outlined our objectives in considering whether amendments are necessary to the voltage standards so that distributors can operate REFCLs without breaching the code in the context of the bushfire mitigation requirements on Victorian electricity distributors.

Prior to this draft decision, we undertook consultation with stakeholders, which included a workshop on 6 April 2018 attended by 33 people who represented various stakeholders. Stakeholders were invited to present their experiences and provide feedback on key elements related to this draft decision. Our initial consultation involved distributors, high voltage customers or their representatives and retailers. We also consulted with industry bodies, the Australian Energy Regulator and Victorian Government representatives. During this time, we also conducted a review of standards and approaches adopted by other international jurisdictions.

We are seeking feedback from interested stakeholders on the proposed changes to the code set out in this draft decision. Submissions to the commission are due on 22 June 2018. We will consider stakeholder feedback and expect to publish the final decision in August 2018 with the code becoming effective a week after the final decision is made.

## **1.4. Structure of this document**

Our draft decision has the following sections:

- Section 2 explains how the operation of REFCLs interact with the voltage standards of the current code
- Section 3 sets out the changes to the code that are proposed in our draft decision
- Section 4 summarises our draft decision
- Section 5 sets out the next steps, including the process for making a submission in response to our draft decision



## 2. Background

This section provides a background into the voltage standards of the code and briefly explains the operation of REFCL technology. This section also describes how the operation of REFCLs interacts with the existing code.

### 2.1. Voltage standards in the code

The Electricity Distribution Code is a broad and multi-faceted regulatory instrument that we administer. The code broadly regulates activities involving the distribution of electricity by a distributor, technical aspects of the electrical connection of customers and embedded generators to the system, and the transfer of electricity within the distribution systems. The code aims to govern the distribution of electricity to be undertaken in a safe, efficient and reliable manner.

The code also contains technical limits to broadly govern how the distribution system is designed and operated. The code sets out appropriate voltage variation limits for the system to operate within, as follows:

- **Phase-to-earth voltage variation limits.** These limits relate to the voltage levels measured from a single live power line (a phase) relative to the general mass of the ground (the earth), where the ground is considered as having zero voltage.
- **Phase-to-phase voltage variation limits.** These limits relate to the voltage levels measured between any two different live power lines (phases). Of note, this is a measure between the two power lines and not the ground (the earth).

The code also contains other technical parameters and obligations that support the effective operation of the electrical distribution system.

### 2.2. Rapid Earth Fault Current Limiters (REFCLs)

REFCLs are technology that has recently been introduced to Victoria. Though the basic underlying technology has been available around the world for several decades, the incorporation of modern electronics has imparted significant improvements to their capabilities. Furthermore the application of this technology for the purposes of reducing bushfire risk is innovative and a world first. In Victoria, REFCLs are intended to be installed at distribution zone substations in areas of high bushfire risk, where high voltage 'polyphase' electricity lines exist. A polyphase line consists of three electricity lines with each carrying a single phase of electricity.

To reduce bushfire risk, REFCLs are designed to trigger (i.e. responds to a fault) when an abnormal scenario occurs, such as when a power line fails and comes into contact with the ground (known as an 'earth fault'), which may occur during extreme weather events. When triggered, the

REFCL rapidly reduces the amount of abnormal current flowing through the downed line, significantly reducing the potential of an electrical spark igniting a fire.

As a consequence of the REFCL triggering, the phase-to-earth voltage on the remaining two unfaulted polyphase lines simultaneously ‘spikes’ from its normal operating range by up to 90 per cent. The nature of this voltage increase is a natural response of the electricity distribution system. During the time of the voltage spike, REFCLs will continue to test whether the original fault is legitimate. If the REFCL confirms the fault, the REFCL will disconnect power to the affected network to remove the potential for a bushfire. Distributors have advised that the process of determining a fault takes approximately 1 minute.

### 2.2.1. The interaction of REFCL operation with the code

For REFCLs to be commissioned, tested or used to respond to a fault, they are likely to increase voltage levels in that part of the distribution system beyond the allowable range specified in the code. However, the operation of REFCLs does not lead to all voltage limits specified in the code being exceeded. Only the 22kV phase-to-earth voltage variations limits in the code are affected, although we have also considered phase-to-phase voltage variations in this review, as shown in figure 2.1.<sup>5</sup> Distributors and high voltage customers are both required to comply with these voltage standards.

Table 1

STANDARD NOMINAL VOLTAGE VARIATIONS				
Voltage Level in kV	Voltage Range for Time Periods			Impulse Voltage
	Steady State	Less than 1 minute	Less than 10 seconds	
< 1.0	+10% - 6%	+14% - 10%	Phase to Earth +50%-100% Phase to Phase +20%-100%	6 kV peak
1-6.6	± 6 %	± 10%	Phase to Earth +80%-100%	60 kV peak
11	(± 10 %)		Phase to Phase +20%-100%	95 kV peak
22	Rural Areas)			150 kV peak
66	± 10%	± 15%	Phase to Earth +50%-100% Phase to Phase +20%-100%	325 kV peak

Area of code review where REFCL operation interacts with voltage variation limits

Figure 2.1 Extract of voltage variation limits in the Electricity Distribution Code

<sup>5</sup> This is because when a phase-to-earth fault occurs, the operation of REFCLs can actively move the neutral reference of the distributor zone substation transformer such that the two unaffected phase to earth voltages moves towards the phase-to-phase voltage levels.

## 2. Background

As shown in figure 2.1, the code currently allows maximum phase-to-earth voltage to rise up to 80% above the normal phase-to-earth voltage level, for up to 10 seconds.<sup>6</sup> For phase-to-phase voltage this can be 20% above normal phase-to-phase voltage level, for up to 10 seconds.<sup>7</sup>

Where REFCLs are operated, the phase-to-earth voltages in the affected distribution area can rise up to 90% above its normal phase-to-earth voltage levels, and this can be sustained for long periods. Where installed, REFCLs also changes the fundamental operating principles of that portion of electricity distribution system from a solid or restricted earthing system to that of a resonant earthing system. A resonant earthing system will have characteristics like an isolated neutral distribution system, which is designed to operate at phase-to-phase voltage levels.<sup>8</sup> Under an isolated neutral distribution system, phase-to-earth voltage limits become less relevant. Importantly, the phase-to-phase voltage variation limits currently set out in the code are still relevant when REFCLs are in operation.

### **2.2.2. The effect of REFCLs on the distribution system**

REFCLs will be installed at a distribution zone substation supplying the high voltage electricity network (a network having a nominal operating voltage between 1 and 22 kV). Because REFCL operation affect phase-to-earth voltages on the high voltage network, the affected parties include those who own or operate equipment connected to the high voltage network directly linked to where REFCLs are installed.

Equipment connected to the high voltage network during REFCLs operation will be subjected to increased voltages, beyond the existing limits set out in the code. Therefore, distributors and customers connected to the high voltage network may need to conduct technical assessments of their assets to ensure they can operate within these increased voltages variations. Affected assets could consist of distributor assets, customers' electrical installations and electricity retailers' metering equipment.

Most retail electricity customers are connected to the low voltage of the distribution system, and are supplied by distribution transformers that isolate these customers from the increased voltages resulting from REFCLs operation. Therefore most retail electricity customers would not be impacted by these increased voltages.

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<sup>6</sup> Review of international jurisdictions did not identify their regulations setting phase-to-earth voltage limits. The phase-to-earth voltage variation limits in the Victorian Electricity Distribution Code may have been in place since the 1980s. These limits may account for abnormal network conditions that may occur when technology, known as neutral earthing resistors (NERs), are operated. NERs are, however, an older technology with far less technical capability compared to REFCLs.

<sup>7</sup> In general, distribution systems are designed in such a way that the phase-to-phase voltages are higher than phase-to-earth voltages, even though the phase-to-earth voltage appears to have a higher limit.

<sup>8</sup> The Victorian distribution system is primarily designed and operated as a solid or restricted earthing system and not as an isolated neutral system.

## **2. Background**

## 3. Proposed changes

The commission is responsible for setting the licence conditions for electricity distributors, which includes the requirement to comply with the code. These are primarily set out in the *Electricity Industry Act 2000 (Vic)*.

When considering amendments to the code, we consider how it could better achieve the commission's objectives in the *Essential Services Commission Act 2001 (Vic)* or to give effect to relevant government policy.<sup>9</sup> For this review, we also have particular regard for the relevant health, safety, environmental or social legislation that apply to the industry.<sup>10</sup> Stakeholders are invited to provide submissions to our draft decision, as per our charter of consultation.<sup>11</sup>

In making our draft decision, we considered the following questions:

- Should the voltage standards be amended?
- If the code is amended, how should the voltage standards be amended?
- What other amendments to the code are required?

### 3.1. Amending the voltage standards to enable REFCL operation

Our draft decision is to amend the voltage standards of the code. In making our draft decision, we particularly considered other relevant legislation or regulation that applies to the industry. It should be noted that the *Electricity Safety Act 1998 (Vic)* imposes bushfire mitigation requirements on Victorian electricity distributors as well as a 'specified operator', which could include high voltage customers.<sup>12</sup> On 1 May 2016, amendments to the *Electricity Safety (Bushfire Mitigation) Regulations 2013 (Vic)* came into effect, which mandated bushfire mitigation requirements on certain sections of the Victorian distribution network. The current technology available for bushfire mitigation under these requirements is REFCLs.

Amending the code means that the bushfire mitigation equipment intended by these regulations, such as REFCLs, can be operated in compliance with code.

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<sup>9</sup> Electricity Distribution Code, clause 1.7.

<sup>10</sup> *Essential Services Commission Act 2001 (Vic)*, sections 8, 8A. The commission is guided by the legislative objective to promote the long term interests of Victorian consumers with regard to the price, quality and reliability of essential services.

<sup>11</sup> Essential Services Commission, Charter of Consultation and Regulatory Practice, August 2013

<sup>12</sup> *Electricity Safety (Bushfire Mitigation) Regulations 2013 (Vic)*, regulation 6

### 3. Proposed changes

### 3.1.1. The affect of not amending the code

Some stakeholders suggested that the code not be changed. If this were to be the case, the operation of REFCLs would breach the code and under clause 4.2.7 of the code, distributors would be required to compensate any person whose private assets are damaged due to variations outside the limits prescribed in Table 1.

Because high voltage customers privately own and manage their electrical assets directly connected to the network, it is likely that affected high voltage customers will need to upgrade their assets to safeguard against the increased voltages when REFCLs are operating. This could include the hardening of high voltage customer equipment to strengthen against the voltage spikes during REFCL operation, or installing isolation transformers that are configured to withstand voltage spikes.

If the current code was not amended, distributors are obligated to take into account the effect of REFCLs operation on the private assets of high voltage customers. To reduce the risk of liability under clause 4.2.7 of the current code, distributors would likely request for additional funding to protect these assets. However, the Bushfires Royal Commission found, in its final report, that it “considers it inappropriate that electricity consumers bear the entire cost of implementing those recommendations” relating to bushfire mitigation and electrical infrastructure.<sup>13</sup>

High voltage customers are often medium to large businesses and entities that have legislative responsibilities, such as those related to occupational health and safety, associated with owning and operating their high voltage assets. It is expected that these customers will take appropriate action to fulfil these responsibilities, including under the bushfire mitigation regulations. We also recognise that the government is developing a High Voltage Customer Assistance Program (HCAP) that includes assistance measures for affected high voltage customers.

## 3.2. New voltage variation limits during REFCL operation

Our draft decision is to amend version 9 of the code by specifying new voltage variation limits during REFCL operation, or under a REFCL condition. The new voltage variation limits will involve:

- retaining existing phase-to-phase voltage variation limits during a REFCL condition, and
- not specifying any phase-to-earth voltage variation limits during a REFCL condition.

When REFCLs are not operating, both existing phase-to-earth and phase-to-phase voltage variation limits will apply.

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<sup>13</sup> 2009 Victorian Bushfires Royal Commission, Final Report Volume II: Fire Preparation, Response and Recovery, July 2010, pp. 158.

Our draft decision has been made in accordance with the *Electricity Safety (Bushfire Mitigation) Regulations 2013 (Vic)*, and we have also considered the potential operational issues associated with the implementation of REFCLs and the distribution network. The existing phase-to-earth voltage variation limits specify that the system may operate in voltages within +80% to -100% of nominal phase-to-earth voltage for less than 10 seconds. Based on stakeholder feedback, it is likely that the operation of REFCLs will lead to voltages exceeding and rising up to +90% of nominal phase-to-earth voltage for longer than 10 seconds. Removing the phase-to-earth limits will allow REFCLs to operate without breaching the code. Distributors will, however, still be required to operate REFCLs in a way that does not breach the existing phase-to-phase voltage variation limits of the code.

The electrical connection between the distributor and high voltage customer is generally unique to the characteristics and requirements of the high voltage customer and that part of the distribution system. Removing the phase-to-earth variation limits should allow some flexibility in the code to likely facilitate discussions between a customer and a distributor towards an appropriate outcome bespoke to their situation. That is, distributors may likely pursue upgrades to a connection point that allows the effective operation of REFCLs for bushfire mitigation, and high voltage customers may likely pursue solutions appropriate for their needs. Given each connection point between distributors and high voltage customers in Victoria are considered unique, the commission will not be able to determine a phase-to-earth voltage variation limit in the code that is appropriate in all cases.

It should be noted that most existing high voltage customers potentially affected by the REFCLs roll-out are currently in discussions or beginning their engagement with distributors. However, based on stakeholder feedback, we also considered how these changes may affect new high voltage customers seeking a high voltage connection with a distributor. We have proposed other amendments to provide new or existing customers with information regarding REFCLs that are to be deployed or may be planned in the future (refer to section 3.3 of this draft decision).

Some stakeholders also suggested we prescribe new phase-to-earth voltage variation limits in the code. We engaged WSP to undertake a review of the regulations in other countries where REFCLs have been implemented or operated. We found that the regulations in these countries did not specify any phase-to-earth voltage variations, despite the operation of REFCLs on their networks.<sup>14</sup>

Distributors also provided feedback that REFCLs require annual testing of up to 20 minutes. WSP, as part of their review, found that technical standards are not consistent in equipment specification under REFCL conditions. For example, standards for new voltage transformers under REFCL

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<sup>14</sup> However, these countries did regulate phase-to-phase voltage variation limits. The jurisdictions of New Zealand, Ireland, China and Russia were reviewed as part of this research.

### 3. Proposed changes

operating conditions can be specified to withstand up to +90% from nominal phase-to-earth voltage for up to 8 hours. However, standards for new switchgears require testing to withstand up to 50kV, which is +394% from nominal phase to earth voltage, but for one minute. Given these inconsistencies, the commission could not find an appropriate basis to prescribe new limits for the effective operation of REFCLs.

### 3.2.1. How the proposed amendments will apply

Our draft decision is to remove the phase-to-earth voltage variation limits when REFCLs are operating, but we will retain the existing phase-to-phase voltage variation limits under a REFCL condition. However, removing these phase-to-earth voltage limits will be inappropriate for the vast majority of all existing customers of the distribution system who will be receiving supply from areas that are unaffected by REFCLs operation.<sup>15</sup>

Our draft decision is to introduce a new table of voltage variation limits into the code that are only applicable when REFCLs operate. Furthermore, we will retain the phase-to-earth and phase-to-phase voltage variation limits when REFCLs are not operating.

These changes will introduce a new Table 1A to the code, as shown in figure 3.1.

**Figure 3.1 Proposed addition of Table 1A to the code**

4.2.2A The period of time during which the *distributor* is operating a part or parts of the 22kV *distribution system* under the *REFCL condition* the phase to earth voltage variations in clause 4.2.2 shall not apply and the phase to phase voltage variations may occur in that part or parts of the 22kV *distribution system* in accordance with Table 1A.

**Table 1A**

Nominal Phase to Phase Voltage Level in kV	Phase to Phase Voltage Range for Time Periods			
	Steady State	Less than 1 minute	Less than 10 seconds	Impulse Voltage
22	±6 % (±10 % Rural Areas)	±10%	Phase to Phase +20% -100%	150 kV

### 3.2.2. The use of REFCLs for other purposes

Our draft decision has been made in accordance with the bushfire mitigation legislation and regulations. However, we recognise that REFCLs can be operated in different modes, which offer other capabilities beyond the bushfire mitigation requirements. We invite stakeholders to make

<sup>15</sup> REFCLs are installed at specific zone substations, which only affect the areas connected to that substation, including those areas where supply is transferred to a REFCL connected substation from time to time.

## 3. Proposed changes



submissions on whether REFCLs should be permitted to operate for other purposes including reliability, as long as they do not undermine the intent of the *Electricity Safety (Bushfire Mitigation) Regulations 2013 (Vic)*.

### **3.3. Further obligations for a REFCL condition**

We also propose to include further obligations to support the proposed voltage variation limits for the operation of REFCLs, or a REFCL condition (as described in section 3.4). The proposed amendments are related to further obligations that:

- requires distributors to provide public information regarding any intentions or plans to install future REFCLs within their distribution area, and
- clarifies the scope of liability during a REFCL condition.

We propose to expand the existing obligations for distributors when publishing their Distribution Annual Planning Report, which details the network planning for their distribution area. This obligation will be expanded by requiring distributors to include any information about the planning of REFCLs within their distribution area. This provides stakeholders, such as existing or new high voltage customers, with information on the location and potential effect of REFCLs in the future. This should support discussions between high voltage customers and distributors when establishing a new connection, or when future planned REFCLs may affect an existing customer. It should also be noted that this obligation aligns with the electricity distribution price reset process of the AER for distributors. Furthermore, distributors require the acceptance of their plans to use REFCLs for safety purposes by Energy Safe Victoria.

We also propose to clarify the conditions of liability for distributors and parties connected to the electricity distribution system. The obligation will clarify that distributors require including the REFCL condition and to compensate customers when these limits are exceeded. For business customers, such as high voltage customers, they will need to take reasonable measures to safeguard their own equipment during a REFCL condition. It should be noted that these clauses for distributors and business customers are not new as they currently exist in the code.

#### **3.3.1. How the proposed amendments will apply**

Our draft decision is to:

- Insert new clauses 3.5.1(d), 3.5.3B and 3.5.5 to specify the inclusion of information on plans for a potential REFCL condition by a distributor in their Distribution Annual Planning Reports.
- Amend clause 4.2.7 to extend and include REFCL conditions such that should distributors exceed the new voltage variation limits, they are required to compensate customers.
- Amend clause 16 (c) to clarify that business customers must take reasonable measures to safeguard their own assets in the event of a REFCL condition.

### 3. Proposed changes



### 3.4. Consequential amendments to the code

In amending the code for the purposes of the operation of REFCLs, we have proposed a number of other supporting amendments. These amendments are consequential to the proposed voltage standards under a REFCL condition and are an extension of existing obligations, which should not lead to material costs for distributors. It is also standard practice for distributors to conduct prudent asset management in monitoring and recording the performance of any type of technology they operate, including REFCLs. The following table outlines our draft decision on these consequential amendments.

**Table 3.1 Proposed consequential amendments to the code**

Clause	Area	Proposed amendment and reasoning
Clause 4.2.4	Best endeavor obligation	<p>Clause 4.2.4 requires a distributor to use best endeavors to minimise the frequency of voltage variations for periods less than 1 minute. This clause aims to minimise the number of times the distribution system will experience voltage variations.</p> <p>We propose to revise the clause requiring distributors to use best endeavors to minimise the occurrences of a REFCL condition.</p>
Clause 4.2.6	Monitoring and recording requirements	<p>Clause 4.2.6 requires a distributor to monitor and record voltage variations that exceed the prescribed limits at certain locations – at zone substations and the extremity of one feeder supplied from each substation. The clause does not include the variations associated with REFCL operation.</p> <p>We propose to amend the clause to include monitoring and recording of voltage variations at each zone substation with REFCL condition which are outside the limitations specified in Table 1A. Monitoring is required to support the correct operation of clause 4.2.7 compensation.</p>

We also note that a stakeholder raised the topic of negative sequence voltages. Clause 4.6 of the current code requires distributors to manage negative sequence voltages at a certain level. Distributors have confirmed that these levels can be managed when REFCLs are operating and WSP in their review were not aware of this being an issue. We propose not to amend this clause.

#### 3.4.1. Proposed new definitions

To further support the proposed amendments of this draft decision, new and modified definitions are required. We have proposed to amend the code to include the following definitions:

**relevant voltage** means either phase to phase or phase to earth as applicable.

**REFCL or REFCLs** means Rapid Earth Fault Current Limiter or any other technology, which as a minimum satisfies the required capacity as defined by the Electricity Safety (Bushfire Mitigation) Regulations 2013.

### 3. Proposed changes

**REFCL** condition means operating conditions on the 22kV **distribution system** caused by the proper operation of **REFCLs** which results in the neutral reference of the three phase **distribution system** moving to allow the phase to earth voltage to approach a value close to the phase to phase **voltage**. To avoid doubt, the term 'operating conditions on the 22kV **distribution system**' in this definition extends up to but not beyond any device or plant which is functionally equivalent to an isolating transformer.

**voltage** means the root mean square (RMS) of the phase to phase voltage. To avoid doubt this means the electronic force or electric potential between two points that gives rise to the flow of electricity, expressed as the root mean square (RMS) of the peak values (except in the case of impulse voltage).

### **3.5. When the proposed code amendments take effect**

Our draft decision is for the proposed amendments to the code to take effect one week after our final decision in August 2018. This approach promotes certainty to stakeholders, avoids a distributor or customer being in technical breach of the code prior to the commissioning of REFCL technology within a zone substation area.

We propose to amend clause 1.2 that prescribes this.

## 4. Draft decision

In summary, our draft decision is to amend the code primarily for the purposes of enabling the operation of bushfire mitigation equipment proposed by the *Electricity Safety (Bushfire Mitigation) Regulations 2013 (Vic)*, such as REFCLs, to be in compliance with code.

A version of the proposed amended code is available at our website for review.

### Summary of our draft decision

- Amending clause 1.2 to incorporate the code amendment starting date.
- Amending clause 3.5.1 (d) and introducing new clauses 3.5.3B and 3.5.5 to require distributors to include information on future planning of REFCLs installations within a 5-year period in the Distribution Annual Planning Report.
- Amending 4.2.2 and introducing a new clause, clause 4.2.2A, for voltage variations in REFCL condition. The amendment adds a new set of allowable voltage variations (Table 1A) for periods when REFCLs are operating. When REFCLs are not operating, the allowable voltage variations remain the same as per clause 4.2.2 Table 1.
- Amending clause 4.2.4 to require distributors to use their best endeavours to minimise the occurrence of REFCL condition.
- Amending clause 4.2.6 relating to monitoring and recording requirements. The amendment adds a requirement to monitor and record variations that exceed the prescribed limits during REFCL condition.
- Amending clause 4.2.7 relating to compensation obligations. The amendment ensures that compensation applies to variations that exceed the prescribed limits during REFCL condition.
- Amending clause 16(c) relating to liability obligations. The amendment ensures that customers take reasonable measures to safeguard their own equipment during REFCL condition.
- New definitions to clause 19, which includes:

***REFCL and REFCLs***

***REFCL condition***

***Relevant voltage***

- Amending clause 19 to existing definition of **voltage** to remove a possible conflict in the meaning of Phase to Phase voltage, i.e. whether this means RMS or peak values. The definition has been made consistent

## 5. Next steps

### 5.1. Consultation and stakeholder submissions

We invite written submission from stakeholders on our draft decision on the Review of Voltage Standards for Bushfire Mitigation and the proposed amendments. These will inform the development of our final decision.

Please note that the scope of the review is in regard to the code design associated with bushfire mitigation requirements. We are not consulting on any policy matters.

### 5.2. How to make a submission

Please email submissions to [edc.review@esc.vic.gov.au](mailto:edc.review@esc.vic.gov.au). You may also send submissions via fax to 03 9032 1303 or by mail, marked:

Attention: Energy Division  
Essential Services Commission  
Level 37, 2 Lonsdale Street  
Melbourne VIC 3000

#### **Submissions close at 5pm 22 June 2018.**

To promote an open and transparent review process, we will make all submissions publicly available on our website. If there is information that you do not wish to be disclosed publicly on the basis that it is confidential or commercially sensitive, this information should be clearly specified in the submission.<sup>16</sup>

### 5.3. Process for reaching our final decision

Once we have received and considered the comments and input from stakeholders, we expect to issue a final decision around August 2018.

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<sup>16</sup> [www.esc.vic.gov.au/our-submission-policy](http://www.esc.vic.gov.au/our-submission-policy)

# Glossary

Term	Definition
Customer's electrical installation	Any electrical equipment at a customer's site that is connected to, but not part of, a distribution system
Code	Electricity Distribution Code
Commission	Essential Services Commission established by the <i>Essential Services Commission Act 2001</i> (Vic)
Distributor	A person who holds a distribution license under the <i>Electricity Industry Act 2000</i>
ESV	Energy Safe Victoria
Nominal voltage	The voltage level that a distributor must maintain in accordance with clause 4.2.1 of the Electricity Distribution Code
Phase-to-earth voltage	The voltage that exists between a phase conductor and ground in a three phase electrical system
Phase-to-phase voltage	The voltage that exists between any two phases in a three phase electrical system
REFCL	Rapid Earth Fault Current Limiter
Reliability of supply	The measure of the ability of the distribution system to provide supply to customers
Voltage variation	A variation in voltage from the nominal voltage