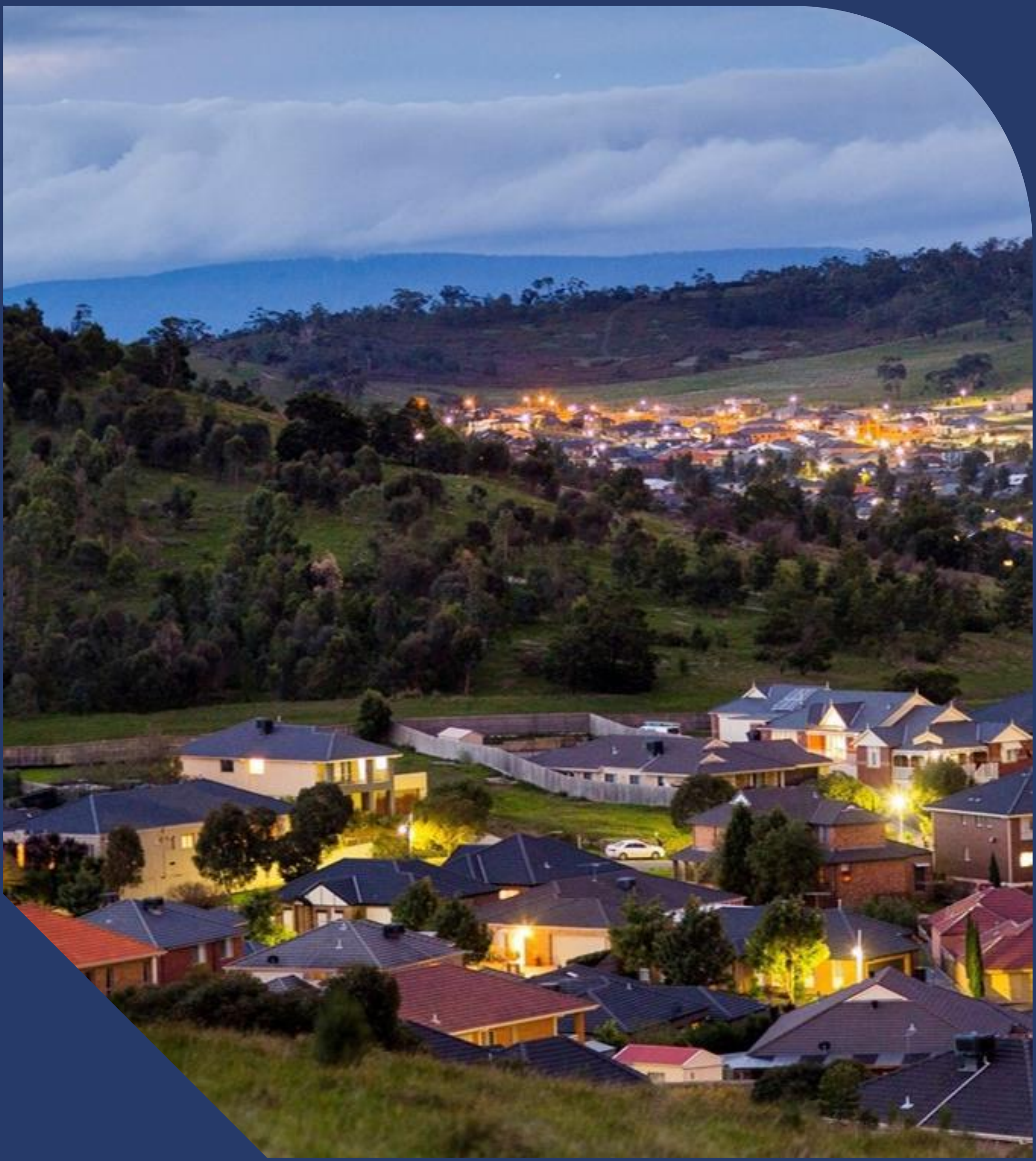
AusNet

Surge Arrestors in Zone Substations

AMS – Electricity Distribution Network



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1. Executive Summary

This document is part of the suite of Asset Management Strategies relating to the AusNet electricity distribution network. The purpose of this strategy is to outline the inspection, maintenance, replacement and monitoring activities identified for economic life cycle management of zone substation surge arresters.

Approximately 95% of surge arresters are of the gapless metal oxide type which is the newest technology in the fleet of assets. The remaining population compromises older porcelain-housed silicon carbide units.

Proactive management of surge arrestor inspection, condition monitoring and replacement practice is required to ensure that stakeholder expectations of cost, safety, reliability and environmental performance are met.

The summary of proposed asset strategies is listed below.

1.1. Asset Strategies

1.1.1. New Assets

- Continue to purchase gapless polymer housed metal oxide surge arresters

1.1.2. Inspection

- Continue with routine visual inspection and annual thermo-vision scans

1.1.3. Spares

- Maintain strategic spares holding of surge arresters for all voltage classes in service

1.1.4. Replacement

- Proactively replace porcelain-housed silicon carbide and first-generation porcelain housed metal oxide surge arresters

2. Abbreviations and definitions

TERM	DEFINITION
SIC	Silicon Carbide
MO	Metal Oxide
Pof	Probability of failure
Cof	Consequence of failure

3. Introduction

3.1. Purpose

The purpose of this document is to outline the inspection, maintenance, replacement and monitoring activities identified for economic life cycle management of surge arresters installed in zone substations in AusNet's electricity distribution network. This document is intended to be used to inform asset management decisions and communicate the basis for activities.

In addition, this document forms part of our Asset Management System for compliance with relevant standards and regulatory requirements. It is intended to demonstrate responsible and prudent asset management practices by outlining economically justified outcomes.

3.2. Scope

Included in this strategy is all surge arresters located within AusNet's electricity distribution zone substations that operate at 66 kV, 22 kV, 11 kV and 6.6 kV.

Excluded from this strategy are line surge arresters, for details on this asset refer to AMS-20 -67.

3.3. Asset Management Objectives

The high-level asset management objectives are outlined in *AMS 01-01 Asset Management System Overview*.

The electricity distribution network objectives are stated in *AMS 20-01 Electricity Distribution Network Asset Management Strategy*.

4. Asset Description

4.1. Function

The AusNet electricity distribution network is located in the highest lightning impact areas in the state of Victoria. Surge arresters are used to protect key items of electrical plant within zone substations that are susceptible to internal failure following transient lightning over-voltages or over-voltage surges created by network switching.

Surge arresters are installed between each active phase and the electrical earth grid at 66 kV line entries, on each side of power transformers, at cable ends and on 22 kV, 11 kV and 6.6 kV feeder exits from zone substations.

4.2. Population

Population Considerations

The population profile for surge arresters is crucial for effective lifecycle management. This profile includes detailed data on the quantity, types, locations, and specifications of these assets within the electrical distribution network. A comprehensive understanding of the population profile allows asset managers to:

- **Identify critical assets:** Determine which surge arresters are essential for maintaining the integrity and reliability of the network. For example, surge arresters protecting key transformers at a zone substation are deemed essential and may require more frequent inspections to ensure protection of key assets.
- **Allocate resources efficiently:** Plan and allocate maintenance resources effectively by knowing the exact number and location of assets. For instance, knowing that a certain region has a high concentration of older porcelain-housed silicon carbide surge arresters can help in scheduling replacement activities more efficiently.
- **Risk management:** Assess and manage risks associated with different assets. For example, if the population profile indicates that certain surge arresters are located in high lightning strike areas, additional protective measures can be implemented in those areas.
- **Optimise maintenance schedules:** Develop optimised maintenance schedules based on the distribution and condition of assets. For instance, surge arresters that protect critical equipment in a zone substation might be scheduled for more frequent inspections.
- **Enhance reliability and safety:** Ensure that all components, including high voltage and medium voltage surge arresters, meet the required standards for reliability and safety. For example, if the profile reveals that certain older surge arresters have outdated technology that no longer meets safety or technical standards, these can be prioritised for replacement.
- **Support strategic planning:** Inform long-term strategic planning and investment decisions. Surge arresters are critical piece of asset that are used to protect key electrical assets against lightening and overvoltage surges, hence they can be appropriately located during future network design, example: indoor, GIS , underground network environments.

Geographic impact areas

The AusNet electrical distribution network covers a significant portion of Victoria, including Melbourne's northern and eastern suburbs, and extends across eastern and north-eastern Victoria. This region encompasses a diverse range of geographic locations, each with specific environmental impacts on surge arresters. Understanding these impacts is essential for effective asset management within the AusNet electrical distribution network.

Notable examples include:

- **High Wind Areas:** High wind areas, particularly in elevated regions and open plains, subject surge arresters to significant mechanical stress and fatigue. Example: The structural integrity of surge arresters in the elevated regions of the Dandenong Ranges must be robust to withstand high wind speeds, ensuring they remain securely in place and do not fail under stress.
- **Corrosive Areas:** Coastal areas and industrial regions where salt and pollutants are prevalent can cause corrosion of surge arresters, especially those with metallic components. Example: Regular inspections are crucial to understand whether they are in a condition to operate effectively.
- **Bushfire Areas:** Bushfire-prone areas, common in many parts of Victoria, pose a risk of fire damage to surge arresters. Example: Fire-resistant materials and strategic vegetation management around installations are essential for reducing this risk.
- **Flood-Prone Areas:** Areas prone to flooding can impact the performance and integrity of surge arresters. Example: Proper waterproofing and elevation are essential to protect these assets.
- **Seismic Zones:** Though less common, areas with potential seismic activity may require surge arresters to be constructed with flexibility and resilience to absorb and dissipate seismic forces, reducing the risk of structural failure. Example: In areas near fault lines, surge arresters may need to incorporate seismic-resistant features to ensure stability during earth tremors.

Population by Type

Gapped Silicon Carbide Surge Arresters

- **Summary Explanation of Form and Function:** Gapped silicon carbide surge arresters consist of silicon carbide (SiC) blocks with air gaps between them, housed in a porcelain casing. They are designed to protect electrical equipment by conducting high voltage surges to ground.
- **Purpose within the Asset Class:** These surge arresters protect key electrical plant within the zone substation from transient over-voltages.
- **Purpose within the Network Design:** Strategically placed at critical points such as transformer terminals, feeder exits, and line entries to mitigate the risk of over-voltage damage.
- **Process Function:** Air gaps break down during high voltage surges, allowing SiC blocks to conduct the surge current to ground.
- **Historical Application:** Widely used from the 1970s onwards, these have been gradually phased out in favour of more advanced technologies.

Gapless Metal Oxide Surge Arresters

- **Summary Explanation of Form and Function:** Composed of zinc oxide (ZnO) blocks without any gaps, typically housed in polymeric or porcelain casings (in older designs), with highly non-linear resistance profiles.
- **Purpose within the Asset Class:** Provide robust and reliable protection against transient over-voltages.
- **Purpose within the Network Design:** Deployed throughout the network to safeguard infrastructure from over-voltage conditions.
- **Process Function:** Non-linear resistance decreases sharply during a voltage surge, allowing the surge current to pass through and be safely dissipated into the ground.
- **Historical Application:** Introduced in the 1980s, these represent a significant technological advancement. Early models had porcelain housings, but modern versions predominantly use polymeric housings.

Population Profile

AusNet has a total of 1520 surge arresters installed in its zone substations (ZSS). There are mainly two types of surge arresters installed in ZSS's, namely gapped silicon carbide and gapless metal oxide type which is the newest technology. Silicon Carbide type surge arresters are all porcelain housed whereas gapless metal oxide surge arresters predominantly have polymeric housings. However, a small population of gap less metal oxide surge arresters manufactured in the 1980s have porcelain housings.

The population of surge arresters by service voltage and technology type is given in Figure 1. Only 4.9% of the surge arrester population consist of old silicon carbide technology which are now reaching end of life.

The population of surge arresters by technology type and housing is shown in Figure 2. Only 8.6% of the surge arrester population consist of porcelain housing which are old and have a mixture of silicon carbide and metal oxide technology.

Figure 1: Population of surge arresters by service voltage and technology type

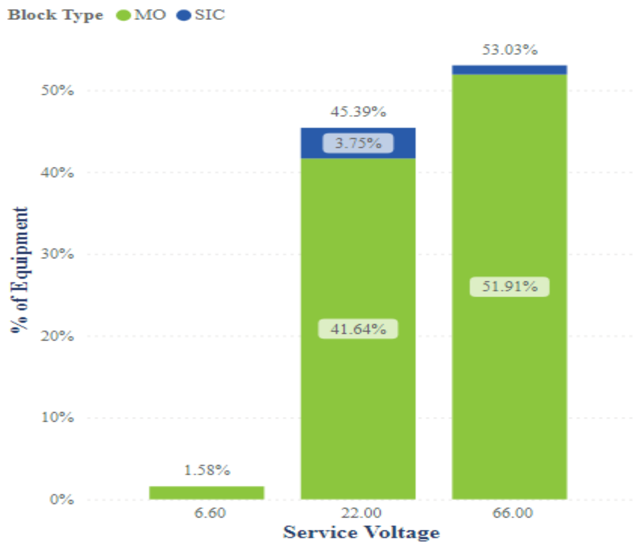


Figure 2: Population of surge arresters by technology and housing type

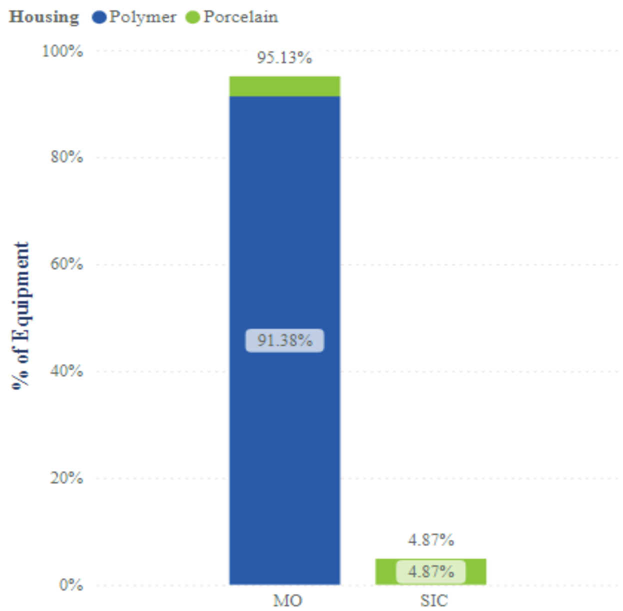
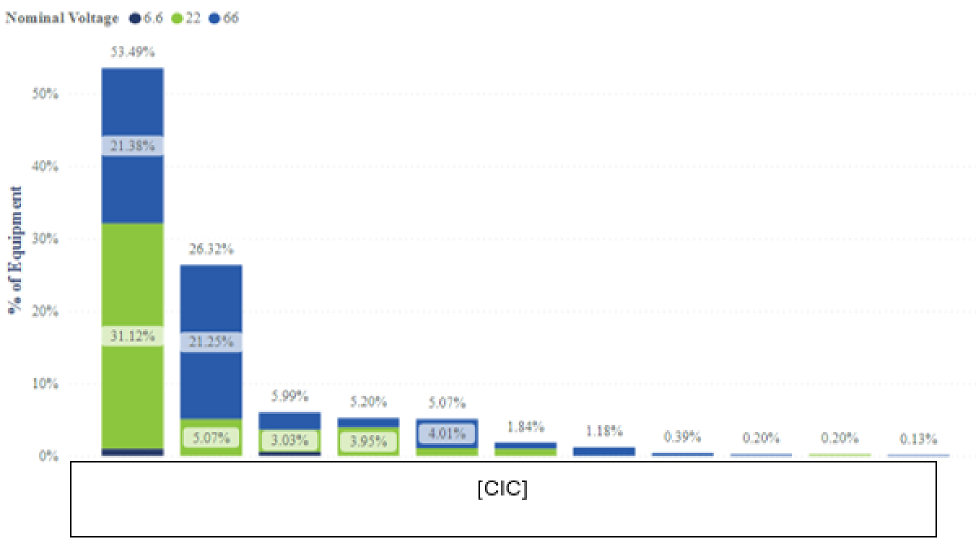


Figure 3 below provides the surge arresters by manufacturer. [CIC] (53.5%) and [CIC] (26.3%) have the highest population of surge arresters in zone substations.

Figure 3: Population of surge arresters by Manufacturer & Voltage



4.3. Age

Age Considerations

Understanding the age profile of surge arresters is essential for effective asset management and lifecycle planning. Knowing the age distribution of these assets helps in predicting their remaining useful life and planning maintenance, upgrades, or replacements accordingly. Key age driven considerations are listed below.

Gapped Silicon Carbide Surge Arresters

- **Average Age:** Typically, these surge arresters are older than the rest of the population, having an average age of 54.1 years.
- **Strategic Considerations:** Older gapped silicon carbide surge arresters are prone to insulation degradation and mechanical wear. The age of these assets can lead to common issues such as moisture ingress, corrosion, and reduced performance.
- It is important to consider regular condition assessments and prioritised replacements.
- Technology used is outdated and their technical performance is lower compared to modern metal oxide surge arresters
- Strategic planning may include:
    - Monitoring for signs of wear and corrosion.
    - Proactive replacement programs to replace old silicon carbide surge arresters during other station augmentation projects.
    - Regularly updating the asset database to reflect condition and age-related data.

Gapless Metal Oxide Surge Arresters (Porcelain Housing)

- **Average Age:** These surge arresters, typically introduced in the 1980s, have an average age of 43.7 years.
- **Strategic Considerations:** While many porcelain-housed metal oxide surge arresters perform satisfactorily, they are at risk of insulation breakdown and mechanical fragility due to their age.
- Strategic planning may include:
    - Implementing regular visual inspections and electrical tests to detect early signs of failure.
    - Planning for phased replacements of older units to maintain network reliability.
    - Evaluating the performance of existing porcelain-housed arresters to identify those most at risk and prioritise their replacement.

Gapless Metal Oxide Surge Arresters (Polymeric Housing)

- **Average Age:** These are relatively newer assets, with an average age of 10.7 years.
- **Strategic Considerations:** Despite being newer, polymeric-housed metal oxide surge arresters are susceptible to UV degradation and moisture ingress.
- Strategic planning may include:
    - Ensuring regular UV protection measures, such as protective coatings.
    - Conducting periodic inspections to check for signs of brittleness or water ingress.
    - Maintaining an up-to-date inventory and condition records to plan timely maintenance and replacements.

Age Profile

The average service age of all station surge arrester population is 14.0 years. Average age of surge arresters is shown in Figure 4.

Figure 4: Average age of surge arresters

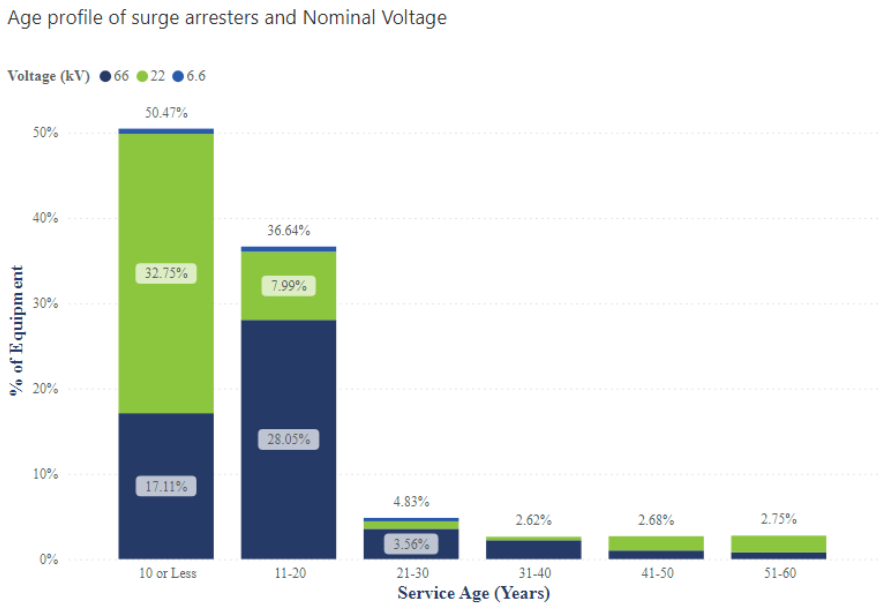
Average service age of Surge Arrester by Voltage an...

Found_Nominal_Volatge	Average of Age	% Population
6.60	13.50	1.58%
SDIV	13.50	1.58%
MO	13.50	1.58%
22.00	12.25	45.39%
SDIV	12.25	45.39%
MO	8.56	41.64%
SIC	53.23	3.75%
66.00	15.62	53.03%
SDIV	15.62	53.03%
MO	14.72	51.91%
SIC	57.29	1.12%
Total	14.06	100.00%

The average age of 6.6 kV and 22kV surge arresters is 13.5 and 12.3 years. This is mainly due to the implementation of a proactive surge arrester replacement program under the two previous regulatory period programs.

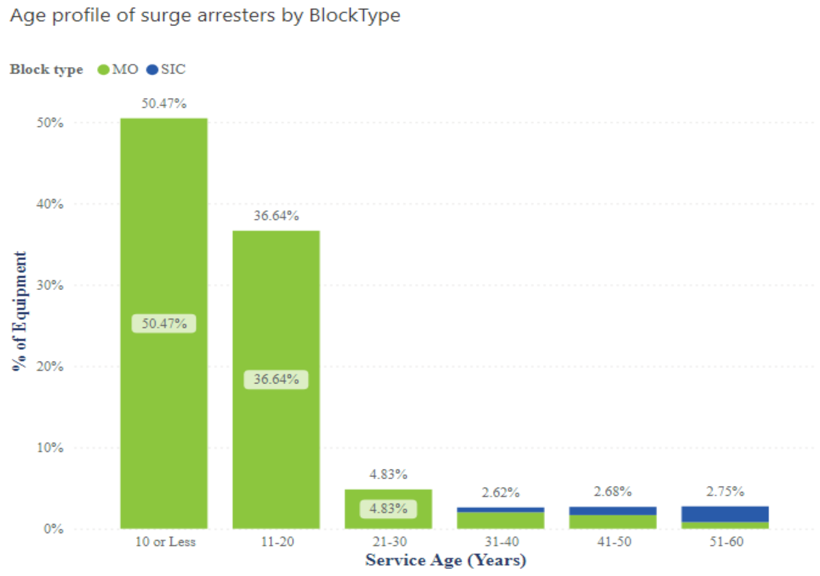
The service age profile of zone substation surge arresters is shown in Figure 5 by service voltage.

Figure 5: Age profile of surge arresters by Service Voltage



Surge Arrester population by technology type is shown in Figure 6.

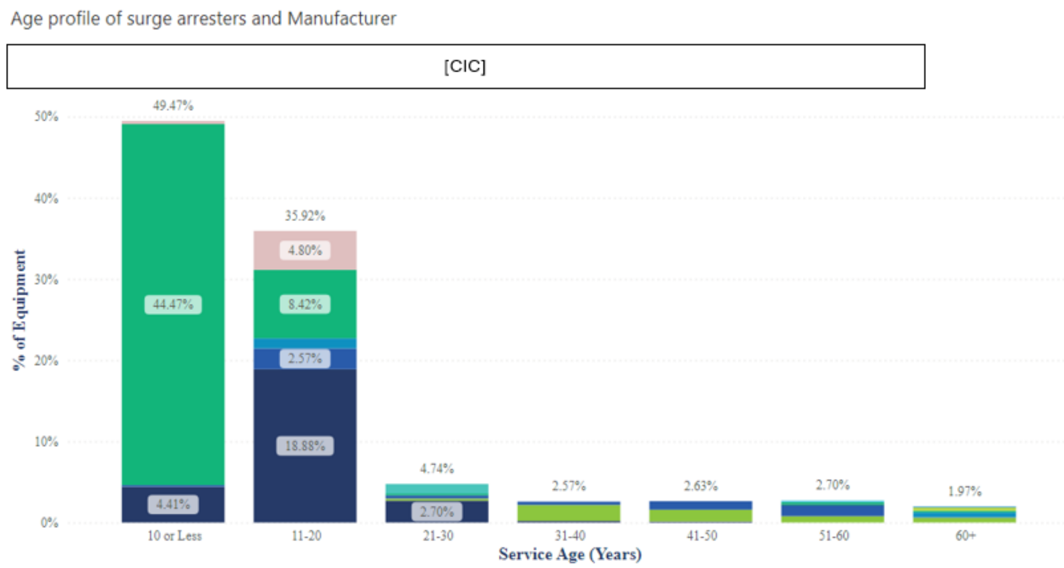
Figure 6: Surge Arrester population by technology type



It can be observed that metal oxide type surge arresters are relatively new compared to a smaller population of silicon carbide type arresters in service (which were introduced in the 1970s). Older metal oxide type such as [CIC] type had porcelain housing compared to the newer versions which have polymeric housings. Older porcelain housed metal oxide surge arresters are still in service and their performance had been satisfactory, and no failures reported so far. But average age has increased since no targeted replacements were carried out in the past.

Figures 7 shows the age profile of surge arresters by manufacturer. [CIC] and [CIC] manufacturer models are the key modern metal oxide type polymer housed surge arresters in service in Zone substations which are less than 20-30 yrs of age.

Figure 7: Age profile of surge arresters by Manufacturer



5. Risk

AusNet maintains a risk management system designed in accordance with AS ISO 31000 Risk Management – Guidelines to ensure risks are effectively managed to provide greater certainty for the owners, employees, customers, suppliers, and the communities in which we operate.

The risk of each asset is calculated as the multiplication of probably of failure (PoF) of the asset and the consequence of failure (CoF). The risk is then extrapolated into the future accounting for forecast changes in PoF and CoF.

In the distribution network, AusNet aims to maintain risk. Risk treatments required to achieve this over time include replacement, refurbishment, and maintenance activities, and are developed based on current risk and extrapolated risk.

The overall approach to quantified asset risk management is detailed in AMS -01-09. Section 5.1, 5.2 and 5.3 of this document describe the considerations and methodologies to determine PoF, Cof, and risk treatments that are unique to Surge Arresters.

5.1. Probability of failure

An asset is deemed to have failed when it does not meet the functional requirements for which it was acquired. Both quantitative and qualitative analysis is used to assess the condition of the asset to determine the probability of failure and to estimate the remaining useful life. AMS 01-09 describes the detailed methodology used to calculate and derive the probability of a failure considering four key factors: asset life, asset utilization, location and physical condition.

5.1.1. Failure Causes

Station surge arresters are used to protect key items of electrical plant within the zone substation against lightning or overvoltage surges. They rarely fail in service under normal operating network conditions but can fail under abnormal lightning or voltage surges.

In most cases, a station surge arrester fails to meet this functional requirement due to gradual insulation degradation of is internal components eventually causing dielectric breakdown rendering it incapable of withstanding the designed lightning or over voltages.

Factors such as ageing of surge arrester blocks, moisture ingress and thermal runaway from surge duty are typical causes of failure usually the case of older gapped silicon carbide type surge arresters.

5.1.2. Failure Modes

Application of Failure Modes

Understanding failure modes is an important tool that supports measuring the criticality of assets, especially when assessing the risk of potential failures and their potential impact on the overall system. By identifying and analysing the various ways in which an asset can fail (including the root causes and mechanisms of failure), asset managers can better predict and mitigate risks. This understanding allows for a more accurate assessment of the probability of failure (PoF) and the consequence of failure (CoF), which is a core aspect of how AusNet approaches determining asset criticality.

Failure Modes by Asset Type

As noted above, assessing failure modes and utilising the detailed information about each mode plays a crucial role in various aspects of Asset Management Planning. Understanding failure modes enhances the effectiveness of risk management efforts and ensures the optimal performance and reliability of assets within the electrical distribution network. Some notable failure modes for surge arresters are detailed below.

Gapped Silicon Carbide Surge Arresters (Porcelain Housing)

- **Insulation Degradation:** The insulation material can degrade over time due to thermal aging and environmental exposure, leading to reduced effectiveness. Historical Application: Moisture ingress can cause internal components to corrode and fail.
- **Thermal Overload:** Excessive current flow can cause overheating, leading to thermal degradation. Historical Application: Sustained high current can cause overheating and failure.
- **Mechanical Fragility:** Porcelain housings are fragile and susceptible to mechanical damage. Historical Application: Handling and installation may cause damage to the porcelain housing.
- **Environmental Degradation:** Exposure to harsh environments can lead to corrosion of metal components. Historical Application: Coastal areas can accelerate the corrosion of metal parts, leading to corrosion, moisture ingress and premature failure.
- **Moisture Ingress:** Water or moisture can penetrate the unit, leading to corrosion of internal components. Historical Application: In high humidity areas, moisture ingress can corrode the internal components due to ageing surge arrester seals.

Gapless Metal Oxide Surge Arresters (Porcelain Housing)

- **Insulation Breakdown:** The porcelain housing can become compromised, reducing effectiveness. Historical Application: Older porcelain housings may develop cracks, leading to insulation breakdown.
- **Thermal Overload:** Excessive current flow can cause overheating, leading to thermal degradation. Historical Application: Sustained high current can cause overheating and failure.
- **Mechanical Fragility:** Porcelain housings are fragile and susceptible to mechanical damage. Historical Application: Handling and installation may cause damage to the porcelain housing.
- **Environmental Degradation:** Exposure to harsh environments can lead to corrosion of metal components. Historical Application: Coastal areas can accelerate the corrosion of metal parts, leading to corrosion, moisture ingress and premature failure.
- **Moisture Ingress:** Water or moisture can penetrate the unit, leading to corrosion of internal components. Historical Application: In high humidity areas, moisture ingress can corrode the internal components due to ageing surge arrester seals.

Gapless Metal Oxide Surge Arresters (Polymeric Housing)

- **UV Degradation:** Prolonged exposure to sunlight can degrade the polymeric housing. Historical Application: UV radiation can cause the housing to become brittle and crack.
- **Thermal Overload:** Excessive current flow can cause overheating, leading to thermal degradation. Historical Application: Sustained high current can cause overheating and failure.
- **Component Fatigue:** Repeated voltage surges can cause fatigue in the components. Historical Application: Regular exposure to surges can wear out internal components.
- **Moisture Ingress:** Water or moisture can enter the unit, leading to corrosion and degradation of the internal components. Historical Application: Moisture ingress can lead to internal corrosion and reduced performance due to poor manufacture.

5.1.3. Probability of Failure Assessments

As per the methods of calculation described in section 3 of AMS 01-09, the conditional PoF for station surge arresters is derived from health index based on asset life, asset utilisation, location and asset physical condition based on observed condition.

5.2. Consequence

Failure of a surge arrester has the potential of resulting in failure to supply customers with energy. This could lead to time-consuming unplanned works needed to be performed for network switching, clearing the faulty surge arrester and restoration. There is also a possibility the failed asset injures an employee as a result of explosive failure in the case of porcelain housed arresters.

Following key consequences of surge arrester failure effects have been considered viewed through three lenses.

1. Safety impact; and
2. Environment impact; and
3. Community impact due to outages (unserved energy).

The detailed methodology of the consequence assessment is described in AMS 01-09.

5.3. Risk Treatment

Risk treatments are required to maintain risk by targeting reduction of PoF or CoF depending on the nature of the risk. Treatment measures include asset replacement, asset refurbishment, inspections, testing or system redesign, and are achieved through capital projects or operational expenditure. Risk treatment options are described in the section on 'Risk Treatment' in AMS 01-09.

Capital replacement is a major component of asset risk management. The prerequisites for replacing assets:

- replacement of an asset will result in a material risk reduction
- risks can't be feasibly managed through maintenance or refurbishment
- monetised risk exceeds the replacement cost – ie replacement is economic.

6. Performance

6.1. Performance Analysis

In the context of asset management for surge arresters, assessing asset performance is a vital tool for effective lifecycle management. Performance information provides a comprehensive understanding of how these assets behave under various conditions, enabling asset managers to make informed decisions that enhance the reliability, safety, and efficiency of the electrical distribution network.

Performance data helps identify trends and patterns in asset behaviour, which are crucial for making strategic decisions regarding maintenance, upgrades, and replacements. Understanding how assets perform over time allows for proactive management, reducing the risk of unexpected failures. The assessment employed by AusNet involves analysing failure trends and any significant impacts resulting from failure, which provides valuable insights into the health and reliability of the assets.

6.1.1. Performance Profile

Surge Arresters are inspected at the intervals for maintenance of their associated Transformer or Circuit Breaker or line entry equipment. Surge arresters are not maintainable and very minimal corrective action can be performed on them and replacement with modern metal oxide type is the only option on defect or failure.

Surge arresters generally reach end of life when the voltage-impedance characteristics deteriorate beyond acceptable limits or when corrosion or deterioration of seals allows moisture to ingress into the unit. Under a previous surge arrester replacement program, 91% of the ZSS surge arresters were replaced during the period 2009-2017 and hence only a small portion of poor condition silicon carbide surge arresters currently in service.

There were no known surge arrester failures during the period 2020 -2024 mainly due to implementation of zone substation surge arrester replacement programs undertaken. However, there is a small population of gapped silicon carbide 22kV and 66kV surge arresters of make [CIC], [CIC], [CIC], [CIC] in 22kV feeder exits and 66kV line entries and bus bars. These surge arrester types are porcelain housed and build to old technology which had a past history of catastrophic failures due to corrosion, seal failure, moisture ingress and insulation failure.

6.1.2. Major Failures

No major failures reported in the current period except for several 22kV silicon carbide type old surge arrester failures on feeder exits due to external flashover to earth.

7. Related Matters

7.1. Regulatory Framework

7.1.1. Compliance Factors

There are no relevant compliance considerations for station surge arresters involved.

Regulatory and Legislative Reference

Effectively managing compliance obligations specific to legislation and policies is a core element of Asset Class Planning and supports the sustainable operation and management of Network Assets. Ensuring adherence to relevant laws, policies and codes helps prevent legal and regulatory breaches, which can lead to significant penalties, operational disruptions, and reputational damage.

Refer to Section 9 for detailed guidance notes and references, supplied to support the assessment of this factor and the ways it impacts and influences the management of this Asset Class.

Technical Standards and Procedures

Effectively managing compliance with technical standards and operational procedures is an important element of Asset Class Planning. Adhering to these standards ensures that the assets are designed, constructed, maintained, and operated in a manner that meets industry best practices, enhances safety, and ensures reliability. Compliance with technical standards helps prevent asset failures, reduces risks, and ensures interoperability within the electrical distribution network. For example, ensuring that all components of various asset types are installed and maintained according to Australian Standards can prevent unplanned failure and operational faults, enhancing network reliability.

Refer to Station Design Manual for detailed guidance notes and references, supplied to support the assessment of this factor and the ways it impacts and influences the management of this Asset Class.

7.2. External Factors

7.2.1. Technical Factors

Not applicable.

7.2.2. Environmental Factors

Environmental Management

Not applicable.

7.2.3. Stakeholder/ Social Factors

Not applicable.

7.3. Internal Factors

7.3.1. Training and Competency Factors

Not applicable.

7.3.2. Resource Management Factors

Resource Management is a core element of asset class planning for Network Assets. Proper oversight ensures that the management of AusNet's resource bases meets stringent quality and performance standards, which is essential for preventing asset failures, managing risks, and maintaining compliance with regulatory requirements. Effective resource management contributes to cost efficiency via activities such as leveraging the expertise of specialised in-house skills and contractors while avoiding hidden costs associated with inefficiencies and non-compliance.

There are three critical sub-categories of consideration for this factor. These sub-categories are:

- Resourcing strategies
- Outsourcing
- Supply Chain Management[i]

7.3.3. Economic Factors

Economic factors significantly influence the lifecycle management of network assets, impacting financial stability, investment decisions, and overall network performance. Major contracts being tendered, such as those for infrastructure development, maintenance, and technology upgrades, can materially affect asset management. These contracts involve substantial investments, requiring rigorous management to align with long-term asset goals, mitigate risks, and control costs. Effective contract management ensures that service providers deliver value, supporting the network's reliability and performance while maintaining financial health.

Material developments and significant commercial agreements also play pivotal roles in the economic landscape of asset management. Developments like new regulatory requirements or technological advancements can alter network needs, necessitating strategic adjustments in asset management. Commercial agreements, including customer service agreements, dictate service levels, performance metrics, and penalties, impacting operational priorities. Regular reviews of these agreements ensure adaptability to changing economic conditions, customer expectations, and regulatory landscapes. Additionally, planned renewal programmes and changes to asset types and purchasing strategies must be evaluated for their financial impact to ensure efficient resource allocation. By addressing these economic factors, AusNet can manage financial risks, optimise investments, and support robust lifecycle models, aligning financial planning with operational goals and regulatory requirements.

7.3.4. Safety Factors

Safety is a paramount concern in the management of electricity distribution network assets, as outlined in **ESMS 20-01**. Effective asset management planning and activities are crucial for protecting employees, contractors, the public, and the environment from potential hazards associated with electrical infrastructure. Ensuring adherence to safety regulations and standards through diligent asset management helps prevent accidents, minimise risks, and maintain the integrity of the network.

Targeted asset management activities include conducting regular safety audits and risk assessments, maintaining a robust Bushfire Mitigation Plan, continuously improving asset inspection and maintenance programmes, providing ongoing safety training and competency assessments, regularly reviewing and updating emergency response plans, engaging with the community to raise awareness about electrical safety, and adopting new technologies and practices to enhance network safety. By integrating these safety-focused activities into asset management planning, AusNet can effectively minimise safety risks "as far as practicable," as outlined in the Electricity Safety Act 1998 and reflected in ESMS 20-01.

7.4. Future Developments

7.4.1. Technology and Innovation Factors

Effectively managing the process of tracking future technology developments and innovations is a core element of asset class planning. Staying informed about technological advancements ensures that asset management practices remain up-to-date, efficient, and competitive. Innovations can lead to improved materials, better monitoring systems, and enhanced maintenance techniques that increase the reliability, safety, and longevity of critical infrastructure. For example, advancements in diagnostic tools for detecting early signs of wear and the development of advanced materials for asset components can significantly enhance their performance and maintenance. For technology and innovation, this is a process that looks to existing technologies, processes, or practices that have been proven in the market and have already been taken to market.

7.4.2. Research and Development Factors

Effectively managing the process of investing in research and development (R&D) and seeking funds for R&D activities is a core element of asset class planning. R&D investment ensures that the organisation stays at the forefront of technological advancements, develops innovative solutions to emerging challenges, and enhances the reliability, safety, and efficiency of its assets. For example, developing new materials with improved structural properties for buildings or advanced monitoring systems for environmental systems can significantly extend their lifespan and reduce maintenance costs. Research and development is the process of researching and investing in an idea, process, practice, or technology that has not been realised in the market yet; it is a step before tracking innovation and technology because the investment to build and take the item to market still needs to be proven and undertaken.

7.4.3. Continuous Improvement

Continuous Improvement (CIP) is a critical process in the overall application of asset management, particularly for managing Distribution Assets. CIP ensures that asset management practices remain effective, efficient, and adaptive to changing conditions and emerging challenges. By consistently seeking ways to enhance processes, technologies, and strategies, organisations can maintain high levels of performance, reliability, and safety. For example, regularly updating maintenance protocols for buildings, environmental systems, and security fences based on feedback and new insights can prevent issues before they become major problems, thereby extending the lifespan of critical infrastructure.

Best practice asset management promotes a culture of continuous improvement, encouraging organisations to regularly evaluate their asset management systems, identify areas for enhancement, and implement changes. This iterative process involves monitoring performance, analysing data, and applying lessons learned to refine practices. By focusing on CIP, organisations can ensure that their asset management activities remain dynamic, resilient, and aligned with best practices and strategic objectives. This approach not only enhances the overall efficiency and effectiveness of asset management but also supports long-term sustainability and success. CIP differs from technology and innovation as well as R&D because it involves the ongoing enhancement of existing processes and practices based on real-world feedback and performance data, rather than the development and introduction of new technologies or the exploration of unproven ideas.

8. Asset Strategies

8.1. New Assets

New Asset Considerations

A strategic asset strategy for the introduction of new assets provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the aspects of asset upgrades or changes, detailing the conditions under which new assets may be introduced into the network. This is not a like-for-like replacement but rather a strategic change or upgrade to a different type of asset to enhance reliability, improve efficiency, and incorporate advanced technologies. It serves as a roadmap that is ideal to follow if possible, guiding the decision-making process for integrating new assets into the AusNet network.

Targeted Activities (New Asset Strategies)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Continue to purchase gapless polymer housed metal oxide surge arresters

8.2. Inspections and Monitoring

A strategic plan for inspections and monitoring provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the ideal framework and objectives for conducting inspections and monitoring activities, such as enhancing reliability, improving efficiency, and incorporating advanced technologies. It serves as a roadmap that is ideal to follow if possible, guiding the decision-making process for establishing comprehensive inspection and monitoring protocols within the AusNet network.

Targeted Activities (Inspection and Monitoring Strategies)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Continue with routine visual inspection and annual thermo-vision scans

8.3. Maintenance Planning

A strategic plan for maintenance provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the ideal framework and objectives for conducting maintenance activities, such as enhancing reliability, improving efficiency, and incorporating advanced technologies. It serves as a roadmap that guides the decision-making process for establishing comprehensive maintenance protocols within the AusNet network. This involves creating a structured approach to regular maintenance activities to ensure optimal performance and longevity.

8.4. Renewals Planning

A strategic asset strategy for renewals and replacements provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the aspects of asset refurbishments or like-for-like replacements, detailing the conditions under which existing assets may be renewed or replaced within the network. This process ensures continued reliability and efficiency, manages obsolescence, and maintains adequate spares. It serves as a roadmap that is ideal to follow if possible, guiding the decision-making process for renewing or replacing assets within the AusNet network.

Targeted Activities (Renewal Strategies)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Carry out Proactive and reactive replacement of porcelain housed silicon carbide and first-generation porcelain housed MO surge arresters
02	Maintain strategic spares holding of surge arresters for all voltage classes in service

8.5. Decommissioning

A strategic asset strategy for decommissioning provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the aspects of safely and efficiently removing assets from service, detailing the conditions under which decommissioning may occur. It ensures that the process is conducted in a way that minimises disruption, manages environmental impacts, and complies with regulatory requirements. It serves as a roadmap that is ideal to follow if possible, guiding the decision-making process for decommissioning assets from within the AusNet network.

9. Legislative References

NO.	REGULATOR	REFERENCE
1	WorkSafe Victoria	Occupational Health and Safety Act 2004
2		

10. Resource References

NO.	TITLE	DOCUMENT TITLE
1	QMS 20-04	Documented information Control
2	AMS 01-09	Asset Risk Assessment Overview
3	AS ISO 31000	Risk Management – Guidelines
4	AMS 01-01	Asset Management System Overview
5	AMS 20-01	Electricity Distribution Network Asset Management Strategy
6	PGI 02-01-04	Summary of Maintenance Intervals – Distribution Plant Guidance and Information
7	SDM	Station Design Manual

11. Schedule of revisions

ISSUE	DATE	AUTHOR	DETAILS OF CHANGE	APPROVED BY
1	03/07/08	NB	Initial draft	
2	15/07/08	NB, DP	Included RCM analysis	
3	19/08/08	GL	Updated with comments from SD, GL and DP	
4	20/03/09	NB, GL	Review and update	G T
5	30/09/09	DP & NB	ARMs review of RCMCost models	G Towns
6	18/11/09	Nilima Bapat Stuart Dick	Editorial changes and consistency checks	G Towns
7	10/02/15	P Seneviratne D Platt D Meade	Review and update	J Bridge
8	18/06/19	N. Boteju	Review and update	P Ascione
9	22/01/24	N. Boteju	Review and update	

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