Lightning and surge protection – varistors and arrestors

Telecommunications

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Reviews and Amendments

This document should be reviewed every one (1) year by the Group Manager Engineering or amended as appropriate if the nature of operations changes significantly.

Contents

1. Conventions

a) Words or phrases that appear capitalised out of context are defined within the Definitions section of this VRIOG Standard.

b) The word "**Shall**" is to be understood as mandatory.

c) The word "**Should**" is to be understood as non-mandatory i.e. advisory or recommended.

d) Uncontrolled Standards may not be referenced within the VRIOG Standards. These include former PTC Standards, Franchisee Standards, Franchisee Subcontractor Standards and Infrastructure Lessee Standards.

e) Controlled Standards, including Australian Standards and other VRIOG Standards, may be referenced but only if:

- The referenced item cannot be adequately explained with an amount of text that could not reasonably be inserted into the body of the Standard.
- The reader is not referenced to another Controlled Standard necessary for the item to be adequately explained i.e. one document link only.
- The referenced document is a Figure or table and could not reasonably be included in the appendices of the Standard.

f) The format employed in the VRIOG Standards is compatible with Australian Standards, and will be used from this point on.

g) The numbering system for the VRIOG Standards is chronologically sequential from the point of introduction, and is not based on any form of interpretive system.

h) The VRIOG Standards contain engineering information necessary to operate a safe Railway. VRIOG Standards will not contain any information that can be construed as a work instruction, procedure, process or protocol. This information forms the basis of each individual entity's Safety Accreditation Certification, and, as such, is outside the scope of VRIOG Standards.

2. Definitions

Terminology used and/or applied in this Standard is defined as follows:-

Terminology	Definition
ABS	Acrylonitrile-Butadiene-Styrene
Accredited Rail Operator (ARO)	A Rail Infrastructure Manager or Rolling Stock Operator who is accredited under Part 5 of the Rail Safety Act 2006.
Application for Variation of Accreditation	An application to the Safety Director by an Accredited Rail Operator for variation of its accreditation due to the Accredited Rail Operator proposing to make change to or to the manner of carrying out, accredited rail operations that may reasonably be expected:- • To change the nature, character and scope of the accredited rail operations; or • To not be within the competence and capacity for which the Accredited Rail Operator is accredited.
AS	Australian Standard
Purchaser	Person or organization to which the varistors and arrestors are supplied or being supplied. Note: They may not be a direct representative of the ARO.
PVC	Poly(Vinyl) Chloride
Type Approval	Consideration of form, fit and function under specified conditions to approve equipment suitability for use within VRIOG infrastructure. (Refer to VRIOG Standard "Standard for Signalling Design and Documentation" VRIOGS 012.1, Clause 4.2)
VRIOG	The Victorian Rail Industry Operators' Group comprising the following members:- • VicTrack • V/Line Passenger • Metro Trains Melbourne • Yarra Trams • Australian Rail Track Corporation (ARTC) • Public Transport Division of the Department of Transport (PTD)
VRIOGS	Victoria Rail Industry Operators Group Standard

Table 1. Terminology

3. Scope and general

3.1. Scope

This specification provides the minimum acceptance criteria for the design, manufacture and supply of varistors and arrestors for use within Victorian Railway Network.

3.2. Application

Unless otherwise specified all varistors and arrestors shall be Type Approved by the ARO and shall be designed, manufactured and supplied in accordance with this specification.

3.3. Background

The varistor and arrestor shall provide lightning and surge suppression on AC and DC power supply feeders.

3.4. Quality Assurance

The manufacturer shall be accredited to the appropriate Australian Quality Standards or recognised international equivalent if the manufacturer is based overseas.

It is considered that the following are appropriate Australian Quality Standards:-

- AS/ISO 9001 - Quality Management Systems – Requirements
- AS/ISO 9004 - Quality Management Systems – Guidelines for

3.5. Quality Assurance Documentation

Quality assurance documentation shall be in accordance with the requirements of Australian Quality Standard “Quality Management and Quality Assurance Standards” AS/ISO 9000.2 or recognised international equivalent if the manufacturer is based overseas.

3.6. Maintenance Manual

The maintenance manual shall be in accordance with the requirements of VRIOG Standard “Specification for Signalling Supply, Construction and Installation” VRIOGS 012.2, Section 25.

3.7. Advisory Bulletins

The Purchaser shall check and act upon any related manufacturer and ARO issued product bulletins in order to ensure that they are aware of and action any safety related concerns regarding varistors or arrestors.

3.8. Occupational Health and Safety

The manufacturer shall comply with the Victorian “Rail Safety Act 2006”, the “Occupational Health and Safety Act 2004” and the “Occupational Health and Safety Regulations 2007”.

The weight of the equipment shall be considered with regards to the current “Occupational Health and Safety Regulations 2007 & Codes of Practice” with regards to safe handling by persons and with respect to the installation and maintenance requirements.

The manufacturer shall comply with a recognised international equivalent if the manufacturer is based overseas.

4. Operating Conditions

4.1. Environmental Conditions

All Varistors and Arrestors shall be subjected to the conditions specified for Category B4 equipment in specification VRIOGS 012.7.25 “Environmental Conditions”.

4.2. Lightning and Surge Protection

All applications where a varistor or arrestor is used shall comply with TS-ST 038 Lightning and Surge Protection – General Requirements.

5. Design Requirements

5.1. Construction

a. All components shall be securely mounted on a 6mm thick panel.
b. The panel shall be made of either paper-based Phenolic or ABS.
c. All components shall be readily and individually replaceable in case of failure.
d. All material fittings, bolts, nuts, etc. shall be made of nickel plated brass.

5.2. Components

a. All electrical and electronic components used shall be in accordance with the requirements of VRIOG Standard “Electrical and Electronic Components (Rating and Construction Requirements)” VRIOGS 012.7.31.
b. Surface mounting octal socket shall be used to take arrestor “Sankosha” type 3Y20 - 290 GT.
c. The terminals 1-2, 3-4 and 5-6-7-8 shall be bridged if these terminals are not already bridged internally within the socket.
d. The varistor shall be “GE” type V150HE150; “Siemens” type SIOVB32K150 or an approved type equivalent in voltage and power ratings.
e. The electronic components shall have an “in-service” life of 20 years (minimum).
f. Refer to Appendix A for the list of arrestors and varistors for use in Victorian Railway Network.

5.3. Wiring

a. All conductors shall be multi-stranded, with sizes and current ratings in accordance with Australian Standard “Electrical Installation” AS 3000 – 2007.
b. The minimum insulation shall be 0.6kV, V75 grade PVC.
c. All conductors shall be as short and as direct as possible with smooth curves of maximum practical radius.
d. All conductors shall be terminated with suitable crimp lugs either pre-insulated double grip type for smaller conductors, or in the case of larger conductors, non-insulated lugs with a heat shrink sleeve applied after crimping.
e. The heat shrink sleeve shall cover the body of the crimp lug and extend at least 15mm over the conductor insulation.
f. All wiring should be neatly arranged and secured to prevent damage to insulation.
g. Suitable mechanical protection shall be provided when wiring passes through holes or area subjected to abrasion.
h. Internal wiring shall be colour coded or individually numbered.

5.4. Terminals

a. The Earth terminal shall be a M6 and 40mm long nickel plated brass stud provided with 3 washers, 2 nuts and one lock nut for each stud.

5.5. Product Identifications

a. A label shall be permanently affixed in a readily visible position, clearly legible and of a material which will not fade due to weathering over time or repeated handling.

b. The label shall contain at least the following:-

   i. Manufacturer's name

   ii. Manufacturer's unique serial number

   iii. Date of manufacture

c. Input and Output terminals shall be labelled "Line 1", "Line 2", "Equipment 1" and "Equipment 2" respectively.

d. The earth terminal shall be labelled "Signalling Earth".

5.6. Labelling

a. Labelling shall be in accordance with the requirements of VRIOG Standard "General Requirements for Labelling of Signalling Equipment" VRIOGS 012.7.30.

5.7. Finish

a. All parts should be uniform in composition, clean, smooth and free from defects.

b. All parts shall be free from sharp corners and burrs which could cause injury to personnel during normal installation and maintenance procedures.

6. Deliverable Requirements

6.1. Inspections and Tests

a. Each varistor and arrestor shall be subjected to a series of inspections and tests to confirm that it conforms to the requirements stated in this specification.
b. The manufacturer shall carry out all electrical and/or mechanical inspections and tests to verify that varistors and arrestors supplied conform fully to this specification prior to delivery.
c. All these tests shall be carried out at the manufacturer's premises at their cost. The Purchaser reserves the right to witness these tests.
d. All apparatus and instrumentation required for the tests shall be provided by the manufacturer.
e. The inspection and test records shall be retained by the manufacturer for a period not less than the nominated storage life and warranty period of the equipment.

6.2. Certificates

a. The result of the inspection and testing are to be submitted in the form of a signed certificate on the manufacturer's company letterhead.
b. The manufacturer shall provide the completed Certificate of Compliance to the Purchaser with the delivery of the varistors and arrestors.
    - The certificate shall include but not be limited to the following information:-
    - Certification number and Date of certification
    - Customer's name and Contract number
    - Purchase order number
    - Date of manufacture
    - Quantity of delivery
    - Unique serial number for individual product or batch code assigned by the manufacturer
    - Inspection and test results
    - Date of the inspection and testing
    - Statement of compliance that the product meets all the requirements of this specification
    - Name and Signature of the manufacturer's management representative
c. The Purchaser shall have the right to request supporting Quality Assurance documentation to accompany the manufacturer's Certificate of Compliance

7. Warranty

a. The manufacturer shall provide warranty to the Purchaser on all items of equipment supplied.
b. All goods supplied by the manufacturer shall be guaranteed against faulty workmanship and/or materials for a period of 12 months from the date of commissioning of the equipment or 24 months from the date of delivery, whichever is the later.
c. The manufacturer shall replace without expense to the Purchaser any part (or parts) of the equipment found to be not in accordance with this specification throughout this warranty period.
d. The manufacturer shall warrant components bought-in from external suppliers for a warranty period no less than that specified in Section 7(b) of this specification.

8. Maintainability

a. The manufacturer shall provide a recommended maintenance plan for routine preventative maintenance tasks, task frequencies and fault finding of the equipment to the Purchaser.

b. These shall include but not be limited to the following information:-

- Installation and maintenance instructions
- Maintenance periodicities
- Test equipment and specialist tools required to install, adjust, fault find and maintain the equipment.
- Detailed drawings and complete assembly details
- Operational test plan
- A troubleshooting guide (fault indications, their likely cause and suggested solution)
- Details on equipment repair and replacement procedures
- Spare parts list

9. Packaging and Delivery

a. All varistors and arrestors shall be individually and securely packed to avoid mechanical damage.
b. All varistors and arrestors shall be handled in such a manner that the delivery and storage of these units will not materially influence their subsequent in- service performance.
c. The packaging shall be labelled in accordance to VRIOG Standard “General Requirements for Labelling of Signalling Equipment” VRIOGS 012.7.30, Section 4.4.

10. References

The following documents have been used and referenced for the preparation of this standard:-

No.	Ref No.	Title
1.	AS/ISO 9001	Quality Management Systems – Requirements
2.	AS/ISO 9004	Quality Management Systems – Guidelines for Performances
3.	AS/ISO 9000.2	Quality Management and Quality Assurance Standards
4.	AS 3000 - 2007	Electrical Installation (known as the Australian New Zealand Wiring Rules)
5.	VRIOGS 012.1	Standard for Signalling Design and Documentation
5.	VRIOGS 012.2	Specification for Signalling Supply, Construction and Installation
6.	VRIOGS 012.7.9	Lightning and Surge Protection – General Requirements
7.	VRIOGS 012.7.25	Environmental Conditions
8.	VRIOGS 012.7.30	General Requirements for Labelling of Signalling Equipment
9.	VRIOGS 012.7.31	Electrical and Electronic Components (Ratings and Construction Requirements)
10.	-	Rail Safety Act 2006 (Victoria)
11.	-	Occupational Health and Safety Act 2004 (Victoria)
12.	-	Occupational Health and Safety Regulation 2007 (Victoria)

Table 2. References

Appendix A – Earthing Equipment

No.	Description
1.	Arrestor, “Sankosha” type Y08JSZ-350D
2.	Arrestor holder, “Sankosha” type AT
3.	Arrestor, "Sankosha" type 3Y20-290GT
4.	Arrestor,"Sankosha" type 3Y20-700GT
5.	Base, octal to suit non-vital relays & arrestor "Sankosha" GT type, ”Omron" PF083A or equivalent
6.	Panel diverter (DP-240V)
7.	Panel, Varistor/Arrestor (VAP)
8.	Varistor, Siemens SIOV B32K150 or "National" ERZC32EK241 (20KA, for 120V bus)
9.	Varistor, SIOV S20K17(5KA, for 12V bus)
10.	Varistor, SIOV S20K30 (5KA,for 24V bus)
11.	Varistor, SIOV B32K75 (20KA ,for 50V bus)
12.	Varistor, SIOV B60K150 (60KA, for 120V bus)

Table 3. Lightning Protection Equipment