

Specification

Electrolysis Mitigation Cubicle Specification

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1 PURPOSE

The purpose of this specification is to specify the minimum requirements of electrolysis mitigation cubicles, which are to be installed within DC traction substations on the Yarra Trams network.

The configuration, ratings and any other project specific equipment details shall be provided by Yarra Trams in the accompanying *Scope of Works* document.

2 SCOPE

The scope of this specification encompasses the design and construction requirements for all new electrolysis mitigation cubicles. This specification does not apply retrospectively to existing electrolysis mitigation cubicles on the Yarra Trams network. However, this specification is applicable if an existing electrolysis mitigation cubicle is being altered, modified or replaced.

This specification applies to any party who is involved in the design or construction of electrolysis mitigation cubicles for Yarra Trams.

3 COMPLIANCE

Any party who is involved in the design or construction of electrolysis mitigation cubicles for Yarra Trams shall fully comply with this specification. Deviation from this specification is only permitted when a deviation or waiver has been formally requested and approved as the per Yarra Trams Deviation from Standards procedure.

The Yarra Trams Engineering Change Management Procedure [CE-021-PR-0020] shall be followed in all circumstances where change is proposed to this specification.

The following definitions apply throughout the specification:

- 'Shall' statements are mandatory in the context of compliance with requirements stipulated in this specification.
- 'Should' statements are considerations in the context of compliance with requirements stipulated in this specification.
- 'Information' statements provide additional content for clarification purposes only and are not requirements in the context of compliance with this specification.
- 'So far as is reasonably practicable' statements must at a minimum result in the provision of a technical risk assessment including proposed list of design controls to demonstrate compliance to this specification.



4 REQUIREMENTS

4.1 Service conditions

4.1.1 Operating conditions

- 4.1.1.1 The electrolysis mitigation cubicle shall be indoor.
- 4.1.1.2 Due to ESV access requirements, the *Designer* shall consult with ESV prior to electrolysis mitigation cubicle installations.
- 4.1.1.3 The operating conditions are defined in Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023] and in Infrastructure – Network Power – Traction Power – Design and Construction [CE-021-ST-0037].

4.1.2 Transport and storage conditions

- 4.1.2.1 The transport and storage conditions are defined in the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023].

4.1.3 Noise

- 4.1.3.1 The permissible noise levels inside and outside the substation are defined in the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023].

4.1.4 Electromagnetic compatibility (EMC)

- 4.1.4.1 The electromagnetic compatibility requirements are defined in the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023] and in Infrastructure – Network Power – Traction Power – Design and Construction [CE-021-ST-0037].

4.2 General requirements

4.2.1 General

- 4.2.1.1 The Electrolysis Mitigation system shall comply with Yarra Trams Standard which shall be defined in the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023] and in Infrastructure – Network Power – Traction Power – Design and Construction [CE-021-ST-0037].
- 4.2.1.2 Electrolysis mitigation system shall be required as part of substation design. The Electrolysis mitigation system shall include Thyristor Drainage Unit, DC power supply, measurement shunt including associated interconnecting cables which shall interface with the DC negative system, rectification system, auxiliary power system and control system.
- 4.2.1.3 The Victorian Electrolysis Committee (VEC) shall determine if electrolysis mitigation equipment is required, on a 'site-by-site' basis. If required, the electrolysis mitigation



equipment shall be tested by the Electrolysis mitigation team which shall ensure the necessary compliance and legislative requirements are met. However, provision shall be made to allow for the electrolysis mitigation cubicle installation if required in the future.

4.2.1.4 The Electrolysis Mitigation Cubicle shall be installed either indoors in the substation switchroom area, or in a safe haven area with secure independent door with locking system.

4.2.1.5 The electrolysis mitigation cubicle shall meet the following requirements, in accordance with the drawings MMN_E0104, H7408 and M3395:

- The cubicle shall be freestanding.
- The cubicle shall be 1200 mm wide, 1000 mm deep and 2200 mm high;
- Access shall be from the front of the cubicle via 2 full height doors with hand operated latches and shall allow sufficient area in front of the cubicle for the setup of test equipment;
- The cubicle is to be self-ventilated and shall have air vents at the top and bottom of each door, with minimum size of 250 mm wide and 200 mm high;
- The cubicle shall have adjustable rails to support the weight of all electrolysis mitigation equipment contained in it (approximately 200 kg);
- The cubicle contains low voltage AC equipment, which shall be earthed to the substation earthing system and be located accordingly within the substation; and
- All specified cables shall be installed into the cubicle and shall be flexible cables (refer to section 4.2.4).

Information: Drawings MMN_E0104 and H7408 can be found on PTV DMS. At the time of writing this specification, M3395 was not on PTV DMS and has therefore been provided in section 5.

4.2.2 Earthing and bonding

4.2.2.1 The earthing and bonding requirements are defined in the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023].

4.2.3 Enclosure

4.2.3.1 The electrolysis mitigation cubicle will be directly earthed to the substation earthing system and be included in the requirements as per the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023]. An earth tag shall be provided at the base of the cubicle.

4.2.4 Equipment interfaces

4.2.4.1 All cables installed into the electrolysis mitigation cubicle shall be flexible and have 3 m tails, with top or bottom entry or a combination of both. These tails will facilitate the future termination of the cables, if electrolysis mitigation equipment is installed in the cubicle. Unterminated cables installed into the electrolysis mitigation cubicle shall be appropriately insulated, secured, and labelled inside the cubicle.



SCADA

- 4.2.4.2 The electrolysis mitigation cubicle shall include at least the SCADA points outlined in Table 1. Each point shall be brought to the SCADA cubicle. The interpretation of Table 1 and additional SCADA requirements shall be in accordance with the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023].

Table 1: Summary of SCADA points

Point description - 'Plant'	Point description - 'Designation'	Point description - 'Quantity'	Analogue, Status or Command	Hardwired or Digital	Details	Conditions or Controls
Electrolysis equipment	Electrolysis	State	Status	Hardwired	2 bit	00 = Disconnected 01 = Off 10 = On [Normal] 11 = Indeterminate
Electrolysis equipment	Electrolysis	Unit Off	Command	Hardwired	1 Bit, Pulsed	010 (2s pulse) = Unit Off
Electrolysis equipment	Electrolysis	Unit On	Command	Hardwired	1 Bit, Pulsed	010 (2s pulse) = Unit On
Electrolysis equipment	Electrolysis	DC Current	Analogue	Hardwired	4-20mA Units: Amps [A]	

- 4.2.4.3 Yarra Trams understands that the SCADA points outlined in Table 1 are only a minimum requirement. The *Designer* shall include additional SCADA points, where required for the effective operation and diagnostics of the equipment.
- 4.2.4.4 Provision shall be made for remote monitoring of equipment. All measurements must be appropriately isolated from voltages.
- 4.2.4.5 If the *Designer* is planning to include additional SCADA points or deviate from the points outlined in Table 1, this information shall be provided to Yarra Trams in accordance with the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023].

Cables

- 4.2.4.6 Requirements for the cables are given in the Cable Specification [IN-021-ST-0003].

LV distribution

- 4.2.4.7 A 32 A, 230 V AC single phase power supply, shall be installed to the cubicle from the LV AC switchboard.



Negative cubicle

- 4.2.4.8 The total substation rectifier current input from a measurement shunt shall be installed into the cubicle, in accordance with the Negative Cubicle Specification [IN-021-ST-0013].
- 4.2.4.9 Negative bus connection shall be installed into the cubicle, in accordance with the Negative Cubicle Specification [IN-021-ST-0013].
- 4.2.4.10 A drainage bus connection shall be installed into the cubicle, in accordance with the Negative Cubicle Specification [IN-021-ST-0013].

4.2.5 Labelling and identification

Cubicle identification

- 4.2.5.1 The front of the cubicle shall be indelibly marked with a label containing the words “Electrolysis Mitigation Cubicle”. The lettering on the label shall be a minimum of 40 mm high.
- 4.2.5.2 Additionally, the equipment designation, which is defined in the *Scope of Works*, shall be clearly marked on the enclosure.

Cable identification

- 4.2.5.3 All cables shall clearly have the interface identified and be labelled as per the cable schedule.

4.3 Reliability, Availability, Maintainability and Safety (RAMS)

- 4.3.1.1 The RAMS requirements are defined in the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023].



4.4 Documentation

4.4.1.1 Submitted documentation shall at least comprise the items outlined in Table 2. This documentation shall be provided for the electrolysis mitigation cubicle throughout the procedure outlined in EMS Design Acceptance Standard [CE-023-ST-0020].

Table 2: Documentation

Documentation	Step 1: System Design Specifications (SDS)	Step 2: Acceptance Test Criteria	Step 3: Preliminary Design	Step 4: Detailed Design	Step 5: Production	Step 6: Installation/Site Assembly	Project completion
Statement of compliance			✓				
Technical specification			✓				
Single-line diagram of main circuit			✓				
General layout			✓				
Detailed drawings of mechanical arrangement, including cable boxes				✓	✓	✓	✓ ¹
Connection guide (conductors, earthing, auxiliary circuits, etc)			✓	✓	✓	✓	✓ ¹
¹ Drawings shall be submitted into PTV's Drawing Management System Compliant library.							

4.4.1.2 The documentation shall be compliant with the requirements defined in the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023].



5 DIAGRAMS AND GUIDANCE

5.1 Drawing M3995

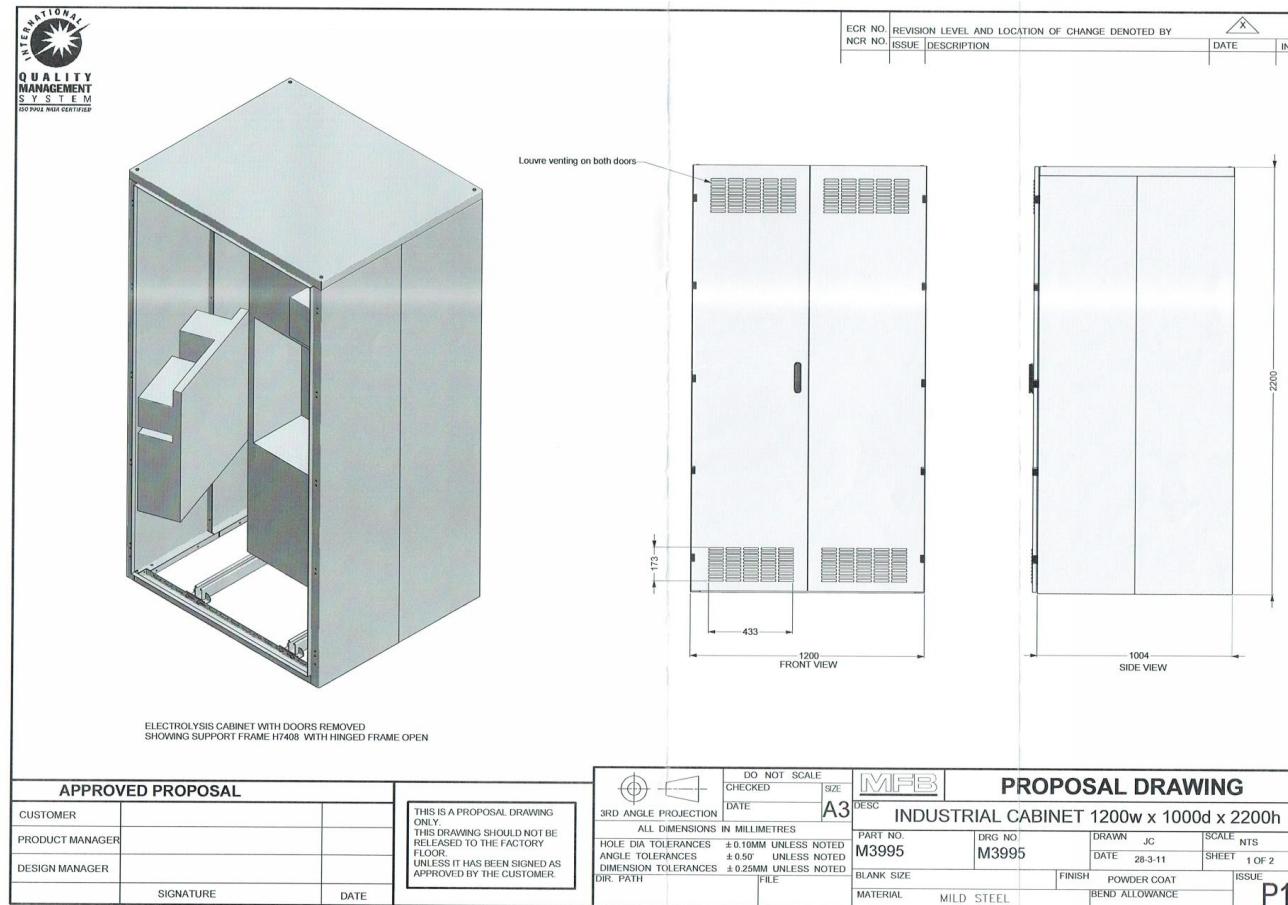


Figure 1: Drawing M3995 - Sheet 1

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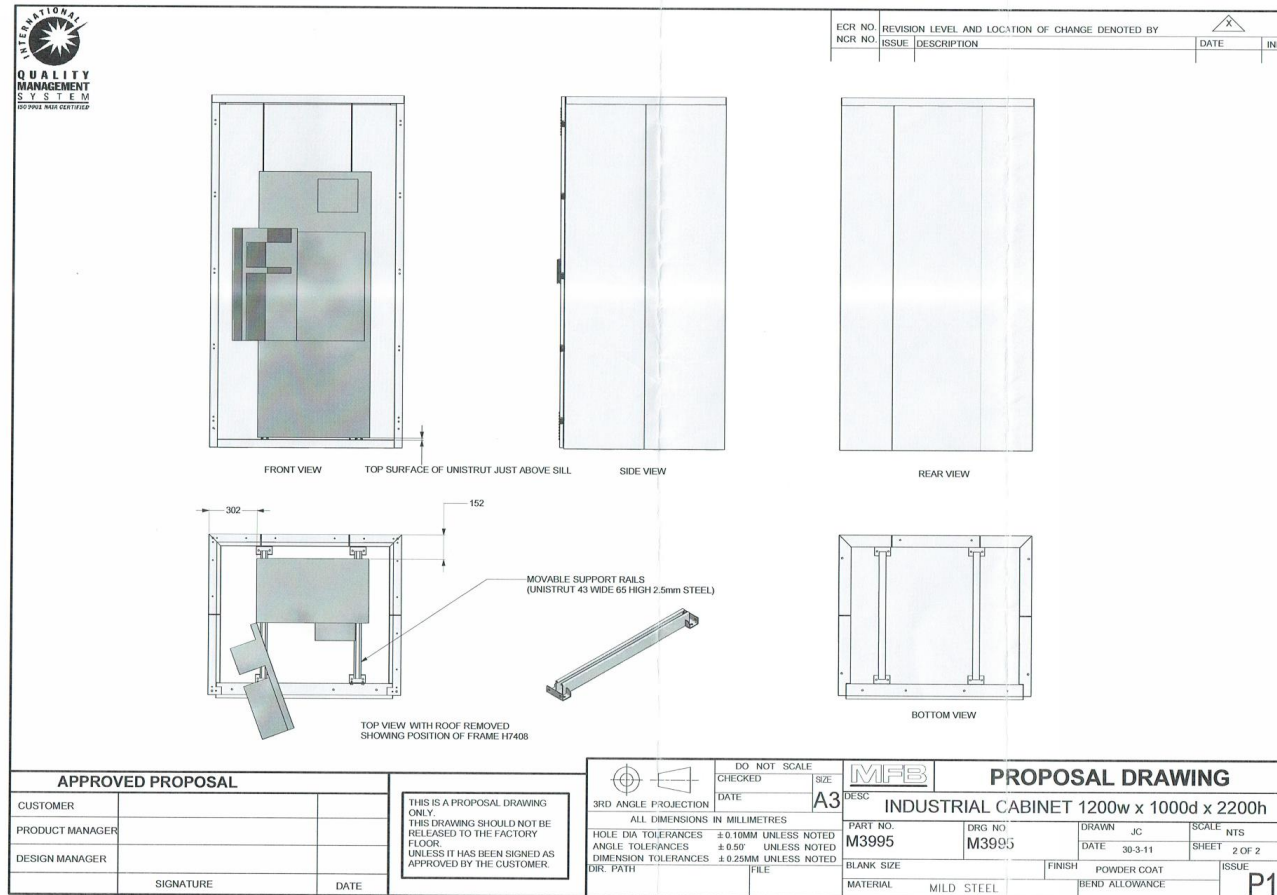


Figure 2: Drawing M3995 - Sheet 2

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6 RELATED LEGISLATION & DOCUMENTS

- 6.1.1.1 The design and construction of electrolysis mitigation cubicles shall be consistent with the best engineering practices and shall comply with all of the referenced documents listed in this section. These referenced documents shall be read in conjunction with this specification.
- 6.1.1.2 All referenced documents shall refer to the most recent published versions of them at the time of invitation to tender.
- 6.1.1.3 Wherever a conflict exists in the requirements of these documents, the order of precedence shall be observed as defined in the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023].

Table 3: Referenced documents

Name	Document number
Yarra Trams	
EMS Design Acceptance Standard	CE-023-ST-0020
Infrastructure - Network Power – Substation Design and Construction	CE-021-ST-0023
Infrastructure – Network Power – Traction power – Design and Construction	CE-021-ST-0037
Negative Cubicle Specification	IN-021-ST-0013
Cable Specification	IN-021-ST-0003
Public Transport of Victoria	
PTV Infrastructure Drafting Standards	
Proposed Equipment Layout – Substation Electrolysis Enclosure	Drawing MMN_E0104
Support Frame for Electrolysis Panels – 700 x 700 mm & 700 x 350 mm	Drawing H7408
Electrolysis Cabinet – Proposal (embedded in this specification)	Drawing M3395
Regulations & other legislative documents	
As defined in the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023]	
Industry codes of practice, guidelines, policies, and rules	
As defined in the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023]	
Australian Standards	
Electrical installations (known as the Australian/New Zealand Wiring Rules)	AS 3000



DOCUMENT VERSION CONTROL

Table 4: Document version control

Version History	Date	Detail
1.0	28/07/2021	Original approved issue
1.07	13/05/2025	Periodic review. Authoriser updated
1.08	10/03/2026	Periodic review. Author updated
1.09	24/06/2026	Changed from Standard to specification. The doc number has been changed from CE-019-ST-0052 to CE-019-SP-0010 and updated the YJM logo.

APPENDIX A – DEFINITIONS & ABBREVIATIONS

Table 5: Glossary - Words

Word	Definition
Scope of Works	The Scope of Works is a key document that defines the specific project-related requirements such as the configuration and rating of equipment to be installed. It prevails over all the specifications.
Designer	The party who is fully responsible for the suitability and compliance of the design of the DC traction substation and all its equipment and subsystems.

Table 6: Glossary - Abbreviations

Abbreviation	Definition
AC	Alternating Current
DC	Direct Current
EMC	Electromagnetic Compatibility
EMS	Engineering Management System (internal Yarra Trams abbreviation)
ESV	Energy Safe Victoria
HV	“High Voltage” means a nominal voltage exceeding 1000 V AC or exceeding 1500 V DC
LV	“Low Voltage” means nominal voltage exceeding 50 V AC / 120 V DC but not exceeding 1000 V AC / 1500 V DC
PTV	Public Transport of Victoria
RAMS	Reliability, Availability, Maintainability and Safety
SCADA	Supervisory Control and Data Acquisition
VEC	Victorian Electrolysis Committee



APPENDIX B – TENDER REQUIREMENTS

Table 7 summarises the information which shall be defined by Yarra Trams in the *Scope of Works* at the time of tender.

Table 7: Summary of information to be defined in the *Scope of Works*

Description	Requirement
Equipment designation	

Statement of compliance

The *Designer* shall return a clause by clause statement of compliance to this specification. The Yarra Trams statement of compliance template and deviation procedure for specifications is provided within the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023].

Equipment selection principles

The equipment selection principles are defined in the Infrastructure - Network Power – Substation Design and Construction [CE-021-ST-0023].