TS 04955.6:1.0

Standard

Services, Systems and Equipment

Part 6: Electric Vehicle Charging

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Preface

This standard is the first issue as TS 04955.6.

This document forms part of TS 04955 series of documents relating to services, systems and equipment.

This document set outs the requirements for services, systems and equipment associated with the provision of EVSE. It applies to TfNSW owned or operated (or both) buildings and spaces.

The aim of this document is to provide transport facilities with EVSE, based on currently available technologies and user demand that include flexibility for future growth in consideration of the continuous acceleration of EV uptake and evolution of technologies.

This document is a response to TfNSW's *Future Energy Action Plan 2020–2025* to reduce transport carbon emissions. It has been developed to allow for aims and requirements of this plan. This document addresses the increased demand for electrification of vehicles including buses, commercial vehicles, ferries, light vehicles, cars, and motorbikes.

This document should be read in conjunction with TS 04955.1.

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1 Scope

This standard sets out minimum requirements for services, systems and equipment associated with the provision of EVSE at TfNSW owned and operated facilities.

This document aids the selection of chargers and items specific to EV charging infrastructure including but not limited to:

- types of charges (modes)
- electrical infrastructure associated with charging facilities
- control systems including interfaces with BMCS
- user interface
- ventilation provisions
- location requirements for EVSE installed within a building
- fire separation requirements and fire services provisions
- security.

This document does not cover HV system elements for example HV switchgear and transformers that are used to convert the power from HV to an acceptable voltage to be used by the LV chargers. Refer to TS 00058 for requirements for HV systems.

2 Application

This document applies to new installations, and upgrades, changes, or additions to existing installations of EVSE.

In terms of application to various asset ownership arrangements, the following applies:

- TfNSW owned asset: mandatory
- other assets: subject to terms of the contract.

Bus depots should also comply with the TfNSW zero emission bus (ZEB) bus depot project specifications. Where there are discrepancies, the requirements in the ZEB project specifications will take precedence.

This document is intended to be used by competent persons involved in the provision of EV charging services within the TfNSW network.

This document should be read and applied in conjunction with relevant legislation, Australian standards and other TfNSW standards.

3 Referenced documents

The following documents are cited in the text. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document applies.

International standards

IEC 61851 (all parts) *Electric vehicle conductive charging system*

IEC 61851-1 *Electric vehicle conductive charging system – Part 1: General requirements*

IEC 61851-21-2 *Electric vehicle conductive charging system – Part 21-2: Electric vehicle requirements for conductive connection to an AC/DC supply – EMC requirements for off-board electric vehicle charging systems*

IEC 62196 (all parts) *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles*

IEC 62752 *In-cable control and protection device for mode 2 charging of electric road vehicles (IC-CPD)*

IEC 62893 (all parts) *Charging cables for electric vehicles for rated voltages up to and including 0,6/1 KV*

ISO 15118 (all parts) *Road vehicles – Vehicle to grid communication interface*

Australian standards

AS 1319 *Safety signs for the occupational environment*

AS 1428.1 *Design for access and mobility – Part 1: General requirements for access – New building work*

AS 1428.2 *Design for access and mobility – Part 2: Enhanced and additional requirements – Buildings and facilities*

AS 60068.2.30 *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle) (IEC 60068-2-30:2005 (ED. 3.0) MOD)*

AS 60529 *Degrees of protection provided by enclosures (IP Code)*

AS 62053.21 *Electricity metering equipment – Particular requirements – Part 21: Static meters for AC active energy (classes 0.5, 1 and 2) (IEC 62053-21:2020 (ED.2.0) MOD)*

AS/NZS 3000 *Electric installations (known as the Australian/New Zealand Wiring Rules)*

AS/NZS 62368.1 *Audio/video, information and communication technology equipment – Part 1: Safety requirements (IEC 62368-1:2018 (ED. 3.0), MOD)*

AS/NZS IEC 61000.3.2 *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*

AS/NZS IEC 61000.3.12 *Electromagnetic compatibility (EMC) – Part 3.12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase*

Transport for NSW standards

TS 00008 (series) *Fire Life Safety*

TS 00008.1 *Fire Life Safety – Part 1: Principles*

TS 00058 *High Voltage Requirements for Electric Bus Charging Depots*

TS 00089 *Battery Electric Buses – Charging Interoperability*

TS 00106 *Electric Vehicle Signposting*

TS 04955.1 *Services, Systems and Equipment – Part 1: Principles*

TS 04955.8 *Services, Systems and Equipment – Part 8: Low Voltage Electrical Installations*

TS 04991 *Cybersecurity for IACS – Baseline Technical Cybersecurity System Requirements and Countermeasures*

TS 04992 *Surface Transport Fixed Infrastructure Physical Security Standard*

TS 04993 (T MU SY 10013 PR) *Cybersecurity for IACS – Cyber Risk Management Procedure*

Other referenced documents

Commonwealth of Australia, National Transport Commission, *Australian Code for the Transport of Dangerous Goods by Road & Rail*

Payment Card Industry (PCI) Security Standards Council, *Payment Card Industry Data Security Standard (PCI DSS)*

State of New South Wales, NSW Department of Planning, Industry, and Environment, *NSW Electric Vehicle Fast Charging Infrastructure Master Plan*

State of New South Wales through Division of Energy, Climate Change and Sustainability, NSW Department of Planning, Industry and Environment, *Service and Installation Rules of New South Wales*

State of New South Wales, NSW Treasury, NSW Government Electric Vehicle Fleet Charging Infrastructure Prequalification Scheme, *EVSE Specification* (Available from the Electric Vehicle Fleet Charging Infrastructure Scheme web page on the buy NSW website)

Transport for NSW, 2020, *Future Energy Action Plan 2020 -2025*

4 Terms, definitions and abbreviations

The following terms, definitions and abbreviations apply in this document.

ac alternating current

ADG Code Australian Code for the Transport of Dangerous Goods by Road & Rail

BMCS building management and control system

CCS combined charging system

CCTV closed circuit television

dc direct current

DNSP distribution network service provider

EMC electromagnetic compatibility

EMV Europay, Mastercard and Visa

EV electric vehicle; any vehicle propelled by an electric motor drawing current from a rechargeable storage battery or from other portable energy storage devices (rechargeable, using energy from a source off the vehicle such as a residential or public electric service), which is manufactured primarily for use on public streets, roads or highways
(Source: ISO 15118-1:2013)

EV charger electric vehicle charger; charging assembly to recharge batteries within an electric vehicle

EVSE electric vehicle supply equipment; overarching term to describe the system that includes both hardware and software which provides electric power to an electric vehicle and recharges the vehicle’s batteries. EVSE includes the electrical equipment, conductors, software, and communications protocols. This term is used interchangeably with EV charging infrastructure

FRL fire resistance level

HV high voltage

IC-CPD in-cable control and protection device

IK impact protection

induction charging also known as wireless charging, is a method used to charge electric vehicles without the need for physical cables or plugs. Instead, it relies on electromagnetic fields to transfer energy from a charging pad or ground-based unit to the vehicle's onboard receiver then charger

IP ingress protection

LV low voltage

NMI national metering identifier

OCA Open Charge Alliance

OCPP open charge point protocol

RFID radio frequency identification

service provider party providing a service to an Asset Custodian or Asset Steward either directly or indirectly

SOC state of change

tethered cable charging cable permanently connected to EV charging station

TfNSW Transport for New South Wales

V2G vehicle to grid

V2I vehicle to infrastructure

5 Electric vehicle supply equipment

5.1 Overview

EVSE is categorised into four types, mode 1 to mode 4, according to charging ability, as described in IEC 61851-1. The charging abilities are as follows:

- Mode 1 – see Section 5.2 for information.
- Mode 2 and mode 3 EVSE supply grid power to EVs and utilise an ac charger (a charging device built inside the EV that converts power from ac to dc) to charge the EV battery. For charging requirements, see Sections 5.3 and 5.4 for modes 2 and 3 respectively.
- Mode 4 EVSE involves a charging station that converts grid power from ac to dc which connects to the EV's dc charging inlet. This is achieved via a charging cable permanently connected to the charging station, or pantograph components, or an induction system. For charging requirements, see Section 5.5.

EVSE shall be able to operate in environmental conditions as follows:

- ambient temperature: −10°C to +45°C (without performance loss). −45°C to +60°C with linear performance loss in accordance with AS 60068.2.30
- humidity: <95% relative humidity, non-condensing
- altitude: up to 2000 m above sea level.

EVSE shall be installed such that an EV can be connected to the charging equipment safely and easily.

EVSE shall comply with TfNSW cybersecurity standards that apply to programmable and communications equipment.

EVSE charging for e-bikes should not be permitted within station precincts or on trains.

Type test certificates shall be provided by the service provider for EVSE to confirm compliance of the product design with relevant Australian and international standards.

Factory testing shall be arranged by the service provider to verify the quality and proper operation of the EVSE as it leaves the factory. Factory testing shall comprise acceptance testing and production testing. Prior to delivery onsite, certificates of compliance shall be submitted for acceptance and production testing.

Site acceptance testing shall be arranged by the service provider for EVSE installation. A test procedure as part of the commissioning program shall be submitted to TfNSW to demonstrate proper testing of all major functions of the EVSE. This shall include a test procedure to demonstrate that the EVSE does not overcharge an EV battery in the event of a corruption in the software (that is, software update) of the EV battery management system.

5.2 Mode 1

Mode 1 charging shall connect the EV to the ac supply network utilising an extension cord and standardised single or three phase sockets not exceeding 20 A rating.

With this type of charging, there are no protective measures that allow control and communication with the EV. Mode 1 charging shall not be used in any TfNSW installations.

5.3 Mode 2

Mode 2 charging shall connect the EV to the ac supply network utilising standardised single or three phase socket outlets not exceeding 32 A rating that are dedicated for EV charging.

Mode 2 charging incorporates IC-CPD in the charging cable assembly which controls the flow of ac electricity to the on-board EV charger.

The vehicle connector and plug associated with mode 2 EVSE shall comply with IEC 62196 (all parts). Charging cables shall comply with the requirements of IEC 62893 (all parts) and IC-CPD shall comply with the requirements of IEC 62752.

Mode 2 chargers shall be equipped with under and over voltage, over temperature, electricity leakage and lightning protection.

Prior to use, mode 2 charging cables and IC-CPDs should be visually inspected to ensure there is no damage.

Mode 2 chargers utilise standard general purpose outlets (GPOs) and as such are not independently metered.

5.4 Mode 3

Mode 3 charging shall be provided by wall or floor mounted charging stations that range from 3 kW single phase to 22 kW three phase and supply ac to the in-vehicle charger. Each station shall be supplied via a dedicated circuit with appropriate upstream circuit protection compliant with AS/NZS 3000.

Mode 3 EVSE shall comply with IEC 61851 (all parts). Mode 3 EVSE shall have the following features in addition to the mandatory functions stipulated in IEC 61851 (all parts):

- 10/100 Base-T ethernet and LTE/5G modem communication interface in accordance with AS/NZS 62368.1
- certified to the latest OCA certified version of OCPP at the time of installation
- in-built NMI approved energy meter for integration with external metering system where payment per kWh can be charged, or an in-built energy monitoring meter in accordance with AS 62053.21 for load management and reporting
- under and over voltage, over temperature, electricity leakage and lightning protection
- UV protection for outdoor charging stations. Enclosure ingress protection of IP54 (minimum) in accordance with AS 60529. Impact protection of IK09 or higher for TfNSW staff car parks, IK10 elsewhere
- vehicle connector and EV plug in accordance with IEC 61851-1
- RFID reader for payment or user verification, where used, with frequency range of 918–926 MHz, and 1 W effective isotropic radiated power
- emergency stop to charging station.

Chargers should comply with the NSW Government *EVSE Specification*.

Each station shall supply single phase or three phase ac power to the EV utilising a tethered cable with vehicle connector, EV user supplied cable, a pantograph, or pad-based wireless components. The charging cable shall comply with IEC 62893 (all parts).

5.5 Mode 4

Mode 4 charging shall be provided by wall or floor mounted charging stations that range from 25 kW to 450 kW and supply dc directly to the vehicle battery. Each charging station shall be supplied via a dedicated circuit with appropriate upstream circuit protection compliant with AS/NZS 3000.

Mode 4 station shall supply dc power to the EV utilising a tethered cable with vehicle connector, pantograph or pad-based wireless components.

Mode 4 charging station shall comply with IEC 61851 (all parts). Mode 4 charging station shall have the following features in addition to the mandatory functions stipulated in IEC 61851 (all parts):

- 10/100 Base-T ethernet and LTE/5G modem communication interface in accordance with AS/NZS 62368.1
- certified to the latest OCA certified version of OCPP at the time of installation

- a touchscreen or buttons for user interface
- in-built NMI approved energy meter for integration with external metering system where payment per kWh can be charged, or an in-built energy monitoring meter in accordance with AS 62053.21 for load management and reporting
- efficiency of 95% or greater
- under/over voltage, over current, over temperature, electricity leakage, lightning protection.
- UV protection for outdoor charging stations. Enclosure ingress protection of IP54 (minimum) in accordance with AS 60529. Impact protection of IK09 or higher for TfNSW staff car parks, IK10 elsewhere
- RFID reader for payment or user verification, where used, with frequency range of 918–926 MHz, and 1 W effective isotropic radiated power
- emergency stop to charging station
- cable management arrangement to minimise accidental damage to plug or cable.

Chargers should comply with NSW Government *EVSE Specification*.

The charging station shall protect the EV battery from over current, over temperature, and over discharge (for bi-directional charger).

When a mode 4 charging station is 50 kW or larger, two sets of tethered cables shall be provided. Pantograph up/down connector may be considered for bus or commercial vehicle depot where more than two vehicles are charged from the same charger.

5.6 Bespoke applications

EV charging solutions vary and should be tailored to specific applications.

As an example, electric ferry fleets with several electric propulsion vessels are currently operating in the world. Due to large batteries, 1500 V dc chargers that are sized in the range of 4000 kW to 5000 kW are likely to be employed for onshore charging. With charging currents likely to reach 3000 A, a chiller system forms an integral part of a charging station to provide the required cooling of the cables and charging system components.

5.7 Electromagnetic compatibility

EMC provisions shall comply with AS/NZS IEC 61000.3.2, AS/NZS IEC 61000.3.12, and IEC 61851-21-2. Refer to TS 00058 for additional requirements for achieving compliance.

5.8 Vehicle connector and electric vehicle plug types

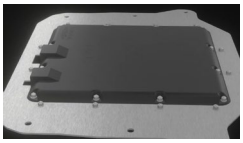
Charging cable shall comply with the requirements of IEC 62893 (all parts). Vehicle connecting cable shall be able to reach all sides of a vehicle in the identified parking bay. The cables should not impede on footpaths, bike paths, roads, car parks, recreation space, or pedestrian and cyclist access in any way.

Vehicle connectors and EV plugs shall comply with IEC 62196 (all parts). Vehicle connector or EV plug (or both) shall be provided with mechanical or electromechanical means to prevent unintentional disconnection.

The location of the vehicle connector on the charging station shall be between 0.9 m and 1.1 m above ground level.

Table 1 sets outs out the EV plug type requirements.

Table 1 – Vehicle connector type and EV plug types

Charger function	Electric vehicle type	Charger mode	Connector
Single phase ac charging	Car, e-motorbike	Mode 2 Mode 3	Type 1 
Single or three phase ac charging	Light vehicle, car, van, light commercial, e-motorbike	Mode 2 Mode 3	Type 2 
Single or three phase ac charging dc charger	Light vehicle, car, bus, truck	Mode 3 Mode 4	CCS2 
Single or three phase ac charging dc charger	Light vehicle, car, bus, truck	Mode 3 Mode 4	Wireless pad 
dc charger	Bus or heavy vehicle, truck	Mode 4	Pantograph up 
dc charger	Bus or heavy vehicle, truck	Mode 4	Pantograph down 

6 Electric vehicle supply equipment functional considerations

6.1 Selection process

6.1.1 General

EVSE selection process should begin with the evaluation of user needs. These needs can significantly differ depending on the types of vehicles to be charged, the time the vehicles are parked, and cost of charging the batteries. Minimum design life for an EV charging station should be equal to or greater than 12 years.

The NSW Government's *NSW Electric Vehicle Fast Charging Infrastructure Master Plan* and strategic network mapping should be taken into account to support planning, and to determine appropriateness of charging solution and site selection. Factors to take into account should include as a minimum:

- Provision of EVSE for major transport corridors, strategic direction for charger placement and alternative options in the vicinity.
- Adequate provisions for current and future traffic volumes and potential impact of the installation of the charging unit on the road network, for example the use of the road including clearways, kerbside regulations, and active transport corridors.
- Minimising adverse impact on existing infrastructure, for example landscaping, walkways, curbs, and other structural elements as they add cost for removal if required.
- Integration with existing and planned pathways, building entryways, street crossing to ensure EVSE does not impede on pedestrian traffic but is also easily visible and accessible.

Locations with short dwell time are usually equipped with high-power charging stations. Locations with long dwell time are usually equipped with charging stations that have lower charging rates.

The evaluation of user needs described in this section shall inform the selection of the most appropriate EV charging solution at different sites.

These multi-criteria include evaluation of what type of chargers to use, consideration of number and size of charging stations, if to use equally rated chargers or provide a combination of slow and fast charging units, what is availability of electrical power to the site, cost of electrical infrastructure upgrades, understanding of initial cost, as well as whole of life cycle cost of the entire works.

6.1.2 Example: Car parks

The type of car park should be taken into account as part of the selection process. As an example, EVSE selection process for commuter and TfNSW staff car parks across NSW should take into account the following factors:

- EVSE location in relation to car park entry and exit laneways.
- Typical occupancy and average parking time versus hourly charging rate. For instance, where parking is available for only two hours, many EV owners are expected to charge their vehicle for up to two hours only.
- Vehicular movement patterns with consideration of vehicle movement per hour. High vehicle movement within a car park suggests the need for more high-power charging stations than low-power charging stations. Local environmental factors including area demographics, nearby attractions, and commercial activities may also be used to determine the selection.
- Security considerations may affect the selection of location where EVSE are installed. Crime rate of the area, existing or proposed CCTV coverage, existing or proposed help points locations, and perceived risk based on car park artificial lighting levels at night should be taken into account. TfNSW Security should be contacted for assistance in determining the security risks for each site.

6.1.3 Electric passenger vehicles

EV charging station selection process should include estimation of theoretical charging time based on the following assumptions:

- 75 kWh battery for light vehicles
- starting charge of battery is not less than 20%
- battery is charged up to 90% capacity.

Mode 2 charges shall not be counted as part of the total number of charging stations.

Low speed chargers between 7 kW and 11 kW should be selected for rail commuter or similar long-dwell car parks, and TfNSW staff facilities where vehicles are kept overnight.

High speed chargers should be selected for the following:

- highway or travel route roadside charging facilities
- facilities with time limited parking, typically under one hour
- TfNSW staff facilities where vehicles are used for work purposes and charging opportunities are limited.

Induction chargers may be considered for accessible parking spaces. An evaluation should be carried out at the feasibility stage of the project to consider operational needs.

6.1.4 Electric heavy commercial vehicles

Electric heavy commercial vehicles are currently emerging as viable replacements for combustion predecessors. The selection of charging systems should take into account the use case and duty cycle for each vehicle. The same principles apply as to electric passenger vehicles when selecting appropriate chargers. The charging system designers should take into account the dwell time of the vehicle in its intended duty cycle and size the charger to meet the operational needs, with a calculated redundancy in place that reflects the criticality of the vehicle's duty. Charging system designers should also be looking to the future transition of other vehicles and planning for strategic upgrades to meet the electrical capacity requirements for fleet replacement schedules.

Charging station selection process should include estimation of theoretical charging time based on the following assumptions:

- 450 kWh battery for heavy vehicle
- starting charge of battery is not less than 20%
- battery is charged up to 90% of its capacity.

6.1.5 Electric bus

Electric bus charging station selection process should take into account the following factors:

- operational readiness and driver scheduling considerations
- vehicle workload, including route considerations
- depot size, fleet numbers and configuration in terms of battery capacity.

Charging station selection process should include estimation of theoretical charging time based on the following assumptions:

- 400 kWh battery for bus
- starting charge of battery is not less than 20%
- battery is charged up to 90% of its capacity.

Pantograph up or pantograph down connector may be provided.

Bus depots may accommodate both low speed and high speed chargers. Where fast charging is required, the charging process shall follow vehicle manufacturers' recommendations. En route charging should be considered to supplement the charge. Bus battery cell balancing should be taken into account as part of the charging schedules.

The charging provisions should be tailored to each depot's requirements. Depots or bus parking with short and frequent routes should be provided with a greater number of charging stations. The charging rate should be higher for depots or bus parking with short and frequent routes.

Refer to TS 00089 for further information.

6.1.6 Electric ferry

Electric ferries are currently emerging as viable replacements for combustion predecessors. The selection of charging systems should take into account the use case and duty cycle for each vessel. The same principles apply as to electric buses when selecting appropriate chargers. Charging system designers should take into account the dwell time of the fleet asset in its intended duty cycle and size the charger to meet the operational needs, with a calculated redundancy in place that reflects the criticality of the vessel’s duty. Charging system designers should also be looking to the future transition of other vessels and planning for strategic upgrades to meet the electrical capacity requirements for fleet replacement schedules.

When considering the potential for electric ferries, hydrogen fuel cell electric ferries can be considered as they provide higher energy density and potentially shorter refuelling times than full battery systems.

6.1.7 Accessible car parking

The feasibility of induction chargers for locations of designated parking spaces for people with disabilities should be investigated as wireless charging has the potential of maximum convenience. Where induction charging is not an option, the heights of the various components of charging station including the charging cable, vehicle connector, screen or interface height of a payment terminal, shall be suitable for all users. The charging station shall be positioned and oriented such that its components can be accessed from a seated or fully standing position by providing sufficient clearance in front of the charging station to access all components in compliance with AS 1428.1 and AS 1428.2.

The requirements in this section shall not apply to charging stations in a bus depot stacking area.

6.2 User interface

Screen or indication lights (or both) shall be provided on the charger to indicate charging status for each charge point.

The selection of user interface should take into account who the end user of the charging system will be across the full life cycle of the system. User interfaces for staff only systems are different to user interfaces for public charging systems and also vary across that market between slower and faster charging solutions. Charging solution for TfNSW staff use shall meet

the requirements set out in the NSW Government *EVSE Specification*. For public charging this is typically delivered by a charge point operator on behalf of Transport. In this instance Transport staff procuring these services should ensure the full user experience has been considered and meets industry best practice for user experience.

6.3 Electric vehicle supply equipment location

6.3.1 General

There are many factors to take into account when selecting EV charging locations. Typically, charger locations should be in close proximity to distribution boards with adequate capacity to accommodate the chargers. The use case of the parking area where chargers are to be installed shall be taken into account.

Chargers shall be located to achieve the following:

- charger locations do not impede facility evacuation during an emergency, including the charger or EV being on fire
- use of the chargers does not disrupt the use of the facility
- charger locations are easy to find from each access point to the facility or room within which they are located
- chargers are easy to access
- charging bays are not under or adjacent to critical utilities such as electrical mains and gas pipe lines
- charging bays are a minimum width of 2.6 m to accommodate both the vehicle as well as users to access the chargers and vehicle sockets
- chargers are located away from heat sources that can elevate the fire risk, diminish charging efficiency or reduce the useful life of the equipment.

See Section 7 for further requirements.

6.3.2 Fire safety

Although fires in EVs are rare and there is little evidence to suggest a correlation between charging and EV fires, EV charging systems should be designed for optimised user safety and minimal property damage. This includes ensuring emergency exits remain clear and emergency responders can safely access electrical isolation and firefighting infrastructure to minimise any impacts of fire events.

To minimise the risk of fire spread, EV charging stations shall be separated from other services by not less than the following distances:

- 10 m from emergency exits
- 10 m from fire hydrant outlets and fire brigade booster assembly
- 10 m from power transformer oil bund wall, unless a fire separation of minimum FRL –/120/120 is achieved
- 10 m from main switchboard or any switchboard that feeds safety service or operation-critical service. This shall exclude ac-dc dispensers and all-in-one cabinets
- 10 m from diesel generator and generator fuel storage tank
- 10 m from air compressor plant, unless a fire separation of minimum FRL –/120/120 is achieved
- 10 m from dangerous goods (including those defined in the ADG Code), unless a fire separation of minimum FRL –/120/120 is achieved.

Where the required separation cannot be achieved, for instance an existing car park, fire safety assessments shall inform specific measures to be applied.

In addition, separation between EV parking spaces and any combustible materials, hazardous items and substances should be taken into account. Fire safety assessments shall inform the specific measures to be applied.

EV charging stations shall not be located in restricted locations defined for switchboards in AS/NZS 3000.

The location of EV charging should be clearly marked on the site block plan located near the main fire control panel including being clearly marked on the electrical room doors, main switchboard and distribution boards to ensure emergency services can quickly and confidently isolate the electrical supply.

All chargers and associated electrical switchboards shall be located a minimum of 400 mm above the 1 in 100 years maximum flood level determined by the hydrology engineer as part of the flood study. Switchboards shall be provided with unimpeded access for shutdown of EV charging at switchboard or distribution board by fire brigade.

6.4 Ventilation

EV charging facilities should be located in open areas. Enclosed spaces where EV vehicles reside for example enclosed or partially enclosed car parks equipped with EV charging facilities shall be risk-assessed by a fire safety engineer.

Mechanical ventilation systems that operate in the event of a fire shall be designed to allow for the ventilation of the smoke and vapours from an EV fire, with the smoke hazard management arrangements determined by a fire safety engineer in consultation with a Building Code of Australia certifier and Fire and Rescue NSW.

6.5 Security and safety

EV charging shall comply with Transport cybersecurity standards TS 04993 and TS 04991.

Charging bays shall meet the security requirements in accordance with TS 04992. Charging stations should be protected from vehicle impact by bollards or impact protection barriers. The placement of the bollards and protection barriers shall not impede the access to charging cable or the serviceability of the EV charger in accordance with the access requirements in the manufacturer's installation manual.

Placement of bollards and protection barriers shall provide sufficient space for people who use wheelchairs and other mobility aids to access the charging station. This shall not apply to charging stations in a bus depot stacking area.

Bollards shall be of 1000 mm height. The extremities of bollards shall not be located more than 300 mm forward or to the side of a public charge point. The extremities of bollards should not be located closer than 100 mm forward or to the side of a public charge point.

Impact protection barriers shall be low-level barriers of maximum 600 mm height placed between 200 mm and 220 mm in front of or surrounding a charging station.

6.6 Symbols and signage

During the design phase, the types of vehicles to be charged in charging bays shall be agreed. In cases where charging of specific vehicles is not permitted, charging bays shall have signage showing what kinds of vehicles are not permitted to be charged in the bay.

EV charging stations shall be designated with the EV charging station symbol, sized to be visible from a 100 m distance. Labels shall be affixed at EV charger vehicle connector cable storage location, and on a flag attached to the connector cable in proximity of the EV plug. For multiple vehicle chargers, labels shall be applied to each charging point. The symbol and signage shall be provided in accordance with AS 1319.

Charging sites shall have safety signage for EV charging for users.

At least 30% luminance contrast between bollards and the surrounding ground shall be achieved. At least 30% luminance contrast between bollards and the charger shall be achieved.

For charging stations in parking or staff parking, TS 00106 shall also apply.

6.7 Provisions for future

Based on NSW government net zero emission target, the number of EVs will increase significantly into the future, requiring an increase in capacity of associated electrical infrastructure.

Planning should ensure that EV chargers are strategically located to support the required demand and take into account the existing charging network.

Designers of EV charging systems should consult the stakeholders to understand the likely demand increase. The future provisions should take into account any significant upgrade costs such as upgraded network connections and how appropriate that may be at a given site with consideration to whether the site is owned or leased, whether the location is intended for ongoing use, are there other locations that should be considered or is charging as a service (CaaS) a more appropriate option.

The EV transition plan should be provided to the responsible persons to consider in the format they require, for example this may be a business case outlining the options and their benefits with cost modelling for each financial year.

Requirements for LV connected bus charging depots that are expected to be converted to HV connected depots are listed in TS 00058.

6.8 Maintenance and repair

Maintenance and repair shall comply with original equipment manufacturer technical maintenance plans.

7 Electrical services

7.1 General

EVSE electrical infrastructure including upstream switchboards, mains and submains cables and associated conduits or other containment used shall include a minimum of 25% spare capacity in physical space and rated current. This requirement does not apply to the sub-circuit cabling for individual charging stations.

Total harmonic distortion (THD) measured at the point of common coupling shall not exceed values stipulated in TS 04955.8.

7.2 Maximum demand

Estimation of maximum demand shall be carried out in accordance with AS/NZS 3000.

For a single EV charger installation, full rated current for the EV charger shall be used. When more than one EV charger is used, the maximum demand calculation shall assume that all EV chargers are used simultaneously with full rated current. Diversity factors may only be applied where a load management system is installed or charging schedules have been established to meet operational requirements.

When adding EVSE to existing facilities, demand measurements should be carried out at peak load times to determine the existing maximum demand of the facility.

7.3 Electrical switchboards

A group of EVSE should be powered from dedicated switchboards that comply with TS 04955.8. Each switchboard shall be equipped with an automatic shutdown facility integrated with fire signal from fire detection control and indicating equipment (FDCIE) to enable automatic shutdown in the event of a fire. Automatic shutdown of the charging facilities shall not include lighting and emergency lighting circuits.

Switchboards for EVSE should be located indoors. Where indoor locations are not available, switchboard enclosure shall be IP65. All switchboards shall be built and installed to facilitate the following:

- protection against environmental factors including ambient temperature, water ingress and air pollution
- accessibility for installation and servicing, safety and ergonomics for operators and maintainers in all types of ambient conditions including 30 degrees angled rain, to facilitate safe operation or emergency maintenance work
- appropriate ventilation, vermin-proofing and protection against water condensation within switchboard
- controlled access to protect from vandalism. Bollard or barrier protection around switchboard to protect the switchboard from vehicle impact
- an optimum position to provide the required functionality while reducing the cable length, impact on cable sizes and voltage drops.

All protection devices shall be selected to ensure full discrimination. The minimum fault level requirement for any switchboard shall be 10 kA.

8 Load and energy management

8.1 General

Energy metering for EV charging shall be provided in accordance with TS 04955.8.

All installations of EV chargers should take into account the user or business unit needs. The owner of the energy procurement contract for the selected location shall be consulted as part of the design process. It is highly likely an approved sub-meter will be required so the cost of EV charging can be appropriately apportioned within the business units. If future provision is being made for EV charging, the design shall include provision of adequate space for a sub-meter within the distribution board.

A load management system regulates and distributes the flow of electricity to EV charging stations that utilise smart chargers, ensuring efficient utilisation of available electrical capacity while minimising the risk of overloads or peak demand spikes. Load management systems shall have a default position that will not exceed the nominated limits.

8.2 Smart chargers

Smart chargers shall be equipped with a technology that utilises digital networks that interact with grid infrastructure and EV users to manage and monitor the charging process. Smart chargers may be integrated to form part of a facility-wide power management system.

Where V2G or V2I is employed, the smart charging features shall include multiple charging and discharging scenarios, including one based on peak and off-peak electricity rates. Where bi-directional charging is introduced, an agreement may need to be established for specific vehicles to participate.

8.3 Vehicle to grid integration

V2G integration shall allow energy to flow to and from the EV (via a two-way ‘bi-directional’ charger) to DNSP grid.

Where V2G integration is required in a new facility it shall comply with ISO 15118 (all parts). Energy export to the grid shall meet the requirements of NSW Department of Planning, Industry and Environment, *Service and Installation Rules of New South Wales*.

8.4 Vehicle to infrastructure integration

V2I shall allow energy to flow to and from the EV (via a two-way ‘bi-directional’ charger) to the local electrical infrastructure only, without export to grid. V2I systems may support the resilience of other infrastructure providing energy during peak demand.

V2I may be accepted in TfNSW facilities where V2G is not accepted by DNSP.

8.5 Communication protocols

Communication between EV charging stations and the load management system shall utilise OCPP to allow interoperability. Charging stations shall be able to be updated to newer version protocol to allow for security and stability fixes or required additional features as they become available.

OCPP shall be fully tested and certified under the OCPP certification program as developed by the OCA.

8.6 Charging management system

A load and energy management system should be provided where operational benefits can be achieved, or limitations in electrical infrastructure capacity exists. It should be employed to maximise utilisation of the facility electrical infrastructure while optimising the charging of EV batteries at multiple charging stations, in real time, and through algorithms that can be tailor-made to site-specific requirements that include current and future EV fleet needs.

The system shall intelligently manage the charging process based on each charging station energy consumption. The system shall be user-configurable, and able to adjust the rate of charging for individual EV chargers based on the facility's electrical demand.

Additionally, the state of charge information from EVs that are being charged may be used to prioritise specific charging stations to facilitate faster charging of batteries of nominated vehicles. The system may also extend to include integration with on-site energy storage system, where available.

Project-specific capabilities of load management system shall be subject to stakeholders' consideration and project team approval.

The EV charging load management system should include the following features as a minimum:

- Static load management that distributes the power available across all EVs being charged at the time, with each vehicle receiving a pre-determined amount of power.
- Scheduled load management that allows EVs to receive different charging power depending on the time of day, allowing for time-of-use pricing (or increasing the power available to EV's when the energy is cheaper).
- Active load management for mixed use facilities that are not fully dedicated to EV charging, prioritising the facility energy needs over the energy used for EV charging. At times when the facility requires more power, less power should be allocated to the EV charging, and vice versa.

Where available, the load and energy management system shall be integrated into the BMCS to provide summary status of each charger.

The charging management system shall monitor the EV's battery charging temperature and generate fault signals for exceedances above manufacturer's recommended safety limits. The fault signals shall be used to generate automatic alarms to be issued to facilities management and the operator for further investigation.

Where available, the charging management system shall be integrated to the depot management system to provide charger, EV status information and to set target SOC levels and other parameters.

8.7 Public payment systems

EV charging stations, depending on their intended use (for example, charging for TfNSW fleet vehicles, public charging), may require to be equipped with a user-pay access and payment facility for onsite payment using RFID cards or fobs or apps.

The payment facility shall be open and interoperable, able to be integrated with the EMV credit and debit smart card system and utilise EFTPOS or any other approved digital card system including OpalPay.

RFID cards and fobs and apps are typically limited to one charge point operator. The open charge point interface protocol allows for ‘roaming’ between charge point operator networks and allows for authentication and payment across different providers.

In the future, it is likely that plug-and-charge will be a standard option, where authentication can occur by simply plugging in the vehicle. Chargers and vehicles meeting the ISO 15118 (all parts) standard will be capable of authenticating in this manner.

Appropriate security measures shall be incorporated into the charging station to ensure that its functions are resilient to cyber attack. Any communications exchanged for the payment system shall have an appropriate level of authentication and encryption that prevents unauthorised interception by a third party.

Payment systems associated with EVSE shall comply with TfNSW cybersecurity standards. These include but are not limited to:

- TS 04991
- TS 04993.

When selecting access control and payment systems, the following should be taken into account:

- interoperability with existing charger network (including compliance with open charge point interface)
- future-proofing opportunities to take advantage of emerging access and payment features
- compliance with existing payment security standards, including *Payment Card Industry Data Security Standard (PCI DSS)*
- the risk of the car park being used as a charging facility for non-transport users (taking charging spaces by non-transport users and treating the car park as a charging station first rather than a public car park for transport users is an undesirable user behaviour and should be discouraged where practical).

9 Fire services

Fire services and systems for locations with EV chargers shall be in accordance with TS 00008.1. In addition, fire services and systems for bus depots shall be in accordance with the relevant parts of TS 00008 (series).