Electric vehicles in the built environment

A fire safety guideline for electric vehicles (EVs) and EV charging infrastructure in carparks and buildings

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Tasmania Fire Service

Tasmanian Government

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Disclaimer

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1. Application

This guideline is developed pursuant of Section 10(4) of the *Fire Service Act 1979* (Tasmania) to provide supporting advice and guidance in relation to Regulation 26A and 67 of the *Building Regulations 2016* (Tasmania) and where electric vehicle (EV) charging infrastructure is being installed within existing buildings.

This guideline is applicable to building surveyors, building designers, fire safety engineers, bushfire hazard practitioners, persons involved in the construction and management of buildings and other building professionals involved in the design, approval, construction, and management of EV carparks and EV charging infrastructure.

Throughout this guideline is reference to supporting documentation and policies. For completeness it is recommended these references be read and understood before proceeding with design and/or installation of EV charging infrastructure within buildings.

2. Purpose

This guideline has been prepared to outline the position of the Tasmania Fire Service (TFS) regarding the minimum operationally suitable fire safety requirements for carparks that facilitate parking for EVs, specific EV carparks and carparks where EV charging infrastructure is located (including single carpark spaces and small and large volume carparks - internal and external use).

This guideline is relevant to situations where electric vehicles can be parked, stored, or charged, either in an existing building or a proposed building or alteration/addition to a building.

This guideline contains a summary of information to ensure an appropriate level of fire safety is achieved for firefighters and building occupants. This guideline incorporates information provided by the Australian Building Codes Board (ABCB) and the Australasian Fire & Emergency Services Authorities Council (AFAC) to the Tasmanian context.

3. Introduction

The emergence of EV technology and the subsequent installation of EV charging infrastructure within buildings raises concerns for community and firefighter safety. EV technology primarily consists of lithium chemistry technology but moreover is continually changing to incorporate new innovations and technology.

Incidents involving EVs appear to be low frequency, but potentially high consequence events that provide challenges for firefighters. EV initiated fires within buildings can lead to long duration and/or high intensity fires that can impact on fire resisting elements of a building, accelerate structural degradation, and facilitate earlier fire spread beyond that of the building design.

The characteristics of EV fires involving lithium technology are different to those of an internal combustion engine and provide challenges for firefighters or conventional fire suppression systems to contain and extinguish.

A failure within a lithium chemistry battery (such as overcharge, equipment failure or mechanical impact) has the potential to lead to a thermal runaway event within the battery. A thermal runaway event may pose the following challenges:

- Rapid rate of fire spread.
- Toxic smoke production.
- Flammable vapour cloud production.
- Intense heat release.
- Fire extension to adjacent fuel loads such as other vehicles and building infrastructure.
- Reduced safety of firefighting resources.
- Failure of fire safety elements of a building due to fire intensity and duration.

The TFS position on EVs and EV charging equipment in the built environment is reflective of that of the Australasian Fire & Emergency Services Authorities Council position on Electric Vehicles (EV) and EV charging equipment in the built environment. Practitioners are recommended to review the AFAC position.

In summary, the installation of EV charging infrastructure must be assessed through the building approvals process. This will allow for an assessment of the fire safety features that will address the risks to firefighters and building occupants. Accordingly, under Part 2 of the *Building Act 2016*, all proposed building work must be in accordance with the National Construction Code (NCC) and the applicable Directors Determinations, including the relevant fire safety provisions.

This guideline seeks to provide for fire safety measures to enhance both community and firefighter safety. This guideline adopts the Australian Institute of Building Surveyors (AIBS) Policy Position on Charging of electric vehicles in existing buildings, and outlines the fire safety considerations for EV charging locations in respect of key elements of a building including but not limited to facades, building infrastructure and fire safety features.

4. Building fire safety considerations

The TFS provides the following guidance to assist with the design of operationally suitable fire safety measures for EVs and EV charging equipment within buildings.

Design and construction compliance

The BCA Volume 1 provision for special hazards, clause E1D17 and E2D21, is relevant to the design and construction of EV charging infrastructure in new buildings with consideration of the operational suitability of fire safety features.

The TFS will review performance-based design proposals in terms of their community fire safety obligations and operational suitability requirements relating to expected activities and the ability for firefighters to satisfactorily interact with the installed fire safety systems.

The Australian Fire Engineering Guidelines (AFEG) and the Fire Safety Verification Method (FSVM) provides a contemporary framework for fire safety design in buildings and should be adopted as best practice when preparing performance-based design of buildings.

Where EV charging infrastructure has been installed without consideration of the operational suitability of the fire safety features in a carpark, the provisions within the BCA Volume 1, E1D17 and E2D21 must be considered.

EV infrastructure in existing buildings

It is acknowledged that the installation of some EV charging infrastructure within the existing building stock has been undertaken without the application of the 'special hazard' (E1) provisions in the BCA. In this situation, the TFS recommends that all retrospective and new installations of EV charging infrastructure is referred to the TFS for assessment of the fire safety features. Consideration of the information contained in this guideline should form part of the referral.

Fire brigade intervention capability

Consideration must be given to the capability of the responsible fire brigade in relation to the hazard. Intervention and response capabilities may not be comparable across all brigades and therefore must form a key consideration in the approach to the minimum operationally suitable fire safety requirements for EV carparks and EV charging stations. Stranded energy and secondary ignition are key considerations for firefighters.

The following risks to the firefighters should be considered:

- Electrocution from exposure to High Voltage (HV) components.
- Impact injury from unexpected vehicle movement or projectiles.
- Burns from exposure to corrosive vapours, gases or liquids, or extreme fire behaviour.
- Respiratory illness from exposure to toxic vapours and gases.

Note: Certain situations may not allow for direct firefighting attack; therefore, it may be preferable to allow the fire to continue to burn until the vehicle/battery is burned out.

Fire resistance levels

Fire resistance levels (FRLs) should be applied to building materials, elements, and systems that house EV charging infrastructure. FRLs should also be applied to adjoining rooms or adjoining building units where possible to provide support for firefighting to protect exposures.

FRLs should also be applied to critical building infrastructure such as gas and electrical mains and fire safety systems. The location of infrastructure in relation to EV charging requires careful consideration.

The BCA concession as provided in the BCA provisions S5C19 and S5C22 should not be applied to reduce the FRL requirements of carpark construction to less than 120/120/120 minutes, including any Performance Solution proposed to reduce this requirement.

Where EV charging infrastructure is installed external, but adjacent to a building, consideration should be given to the FRL of the external façade of the building and any other building asset such as electrical mains, gas mains and fire safety systems.

Combustible materials should not be placed in proximity of EV charging infrastructure.

Fire safety systems

Careful consideration should be given to the type of fire safety features fitted to buildings containing EV charging infrastructure. Where EV charging infrastructure is being retrospectively fitted, fire safety systems should be fitted to the building consistent with the requirements in the current Building Code of Australia (BCA) for that class of building.

Considerations include:

- Operationally suitable firefighting water supplies. The provisions for a fire hydrant separation distance of ten (10) metres from any EV Charging infrastructure must be maintained as per AS 2419.1, 3.5.3.1 General.
- Fire detection systems to provide firefighters with early notification.
- Occupant warning systems.
- Automatic fire sprinkler systems to assist firefighting and limit fire damage.
- Ventilation and smoke management systems to provide a safer environment for building occupants and firefighters.
- The type of firefighting resources available to the area and the capability of those resources.

Exit and egress pathways

EV charging infrastructure should be located to ensure it does not:

- Obstruct access to exits.
- Divert building occupants from paths of egress towards a required exit.
- Cause ‘corralling’ at exit doors and/or paths of egress.

Firefighter entry point

Consideration should be given to firefighter access points so firefighting can be initiated in an expedient, safe and practical manner.

Fire separation

Consideration should be given to the location of EVs to other vehicles and building infrastructure.

Where EVs and EV charging infrastructure are within buildings that are adjoining then fire separation methods should be used to assist firefighters with exposure protection.

Firewater run off

Fighting EV fires can consume copious quantities of water. During firefighting operations, firefighters will have limited capacity to fight the fire and control water run off at the same time. Therefore, water run off should be considered as part of the fire safety strategy for the building and/or site.

Bollards and impact protection

Bollards and impact protection measures may reduce the likelihood of impact incidents and the potential for fire spread.

Signage

Block plans must be provided at the Fire Detection Control and Indicating Equipment (FDCIE) and sprinkler/hydrant booster. These plans must identify the location of parking bays that are fitted with EV chargers and the location of all associated isolation switches.

Vehicle separation and car stacker parking

Consideration should be given to the adequacy of vehicle separation to prevent fire spread with respect to directional flame jetting in EV fires. This includes special considerations for vehicle access in stacked parking arrangements or automatic vehicle parking systems. ‘In rack’ rather than overhead style sprinkler protection should be used.

Class 1a and 1b buildings

Where a class 1a or 1b building has a conjoined garage or carport that is attached to the building or within a building fitted with EV charging infrastructure, the following fire safety features should be installed:

- A smoke alarm in the area where the EV charging infrastructure is installed. The smoke alarm should be interconnected with other smoke alarms installed within the building.
- The FRL within a conjoined garage is increased to provide additional protection to building occupants and to assist firefighters with fire containment and isolation. FRL’s should be applied to building materials, elements, and systems that house EV charging infrastructure.
- Signage on the switchboard denoting the presence of EV charging infrastructure within the building.

5. Bushfire safety considerations

Currently, there are no specific fire safety provisions that relate to requirements for EV carparks and EV charging infrastructure in bushfire prone areas.

When designing carparks or installing EV charging infrastructure in bushfire prone areas, EV chargers should not be positioned next to adjoining bush reserves and vegetation.

Consideration should be given to the adequacy of vehicle separation from bush reserves and vegetation to prevent fire spread with respect to directional flame jetting in EV fires.

6. Additional considerations

Installation requirements

EV charging infrastructure (including wires used to charge) should incorporate electrical protection such as Residual Current Detection, Overcurrent Protection, Short Circuit, Overvoltage, Surge Protection and Overtemperature Protection.

EV charging infrastructure installers should confirm the Battery Management System (BMS) within the EV charging infrastructure incorporates the above electrical protection.

EV charging infrastructure should comply with electrical safety regulations and best practices as outlined in AS 3000-2018 Appendix P. Other electrical safety elements should include:

- The electrical supply to the EV charging infrastructure should be interfaced with the fire detection and suppression system and should automatically shut down the power supply to all charging infrastructure upon activation of the general fire alarm (GFA) in the car parking areas.
- The interface arrangement should not allow charging to recommence automatically when the fire alarm occupant warning system is silenced.
- An emergency shutdown control (master switch) should be located at the FDCIE to allow fire brigade to shut down all EV installations manually.

Best practice

The TFS recommends the following as best practice for EV parking and EV charging:

- Located external to a building and in the open air where possible.
- Regardless of the location within or outside of a building, be protected by hydrant coverage consistent with the performance requirements in AS 2419.1.
- If located internal to a building, the carparking area should:
    - Be protected by an automatic fire sprinkler system with a performance equivalent to a system complying with AS 2118.1 or AS 2118.6; and
    - Not apply concessions to FRLs that may be provided within the BCA deemed-to-satisfy provisions.
- The provision of fire safety features consistent with the requirements in this guideline.

7. References

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