

Information Bulletin

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Fire Pump Battery Failures Version 1

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FIRE PROTECTION ASSOCIATION AUSTRALIA



Fire Pump Battery Failures

FPA Australia aims to promote the protection of life, assets and the environment from fire and related emergencies.

1.0 Purpose Statement

The purpose of this Information Bulletin is to raise awareness amongst stakeholders about concerning industry trends associated with batteries supporting fire pump installations that serve fire hydrant and sprinkler systems.

2.0 Audience

This Information Bulletin is intended for:

- FPA Australia members
- Fire pumpset installers
- Facilities managers and maintenance contractors
- Building Surveyors and certifiers.

3.0 Background

FPA Australia members have reported and recorded faults with batteries supporting fire pumpsets associated with fire hydrant and sprinkler installations.

The consistent fault reported has been that flooded-cell lead-acid batteries are “exploding”. This is thought to be a result of failure and rupture of the battery casing due to internal gas accumulation and in some cases, ignition of this gas.

The prescriptive deemed-to-satisfy provisions of the Building Code of Australia as referenced by Federal, State and Territory Governments across Australia, require fire hydrant and sprinkler systems to be installed in accordance with the following standards:

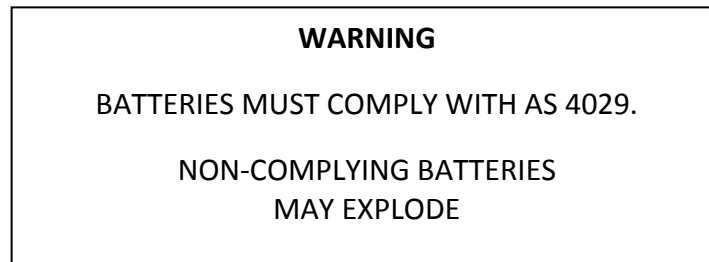
- AS 2419.1-2005, *Fire hydrant installations – System design, installation and commissioning*
- AS 2118.1-1999, *Automatic fire sprinkler systems – General systems*
- AS 2118.4-1995, *Automatic fire sprinkler systems – Residential*
- AS 2118.6 – 1995, *Automatic fire sprinkler systems – Combined sprinkler and hydrant*

All of these standards require fire compression-ignition (diesel) pumpsets associated with these systems to be installed in accordance with AS 2941-2008, *Fixed fire protection installations – Pumpset systems*.

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Clause 3.13.6 of AS 2941-2008 requires a warning sign to be fixed adjacent to batteries serving fire pumpsets, as follows:



AS 2941-2008 references AS 4029, which consists of three parts:

- AS 4029.1-1994, *Stationary batteries – Lead-acid – Vented type*
This covers flooded-cell lead-acid type batteries similar to automotive starter batteries.
- AS 4029.2-2000, *Stationary batteries – Lead-acid – Valve-regulated type*
- AS 4029.3-1993, *Stationary batteries – Lead-acid – Pure lead positive pasted plate type*

4.0 Issue

In the first instance, failure or rupture of the battery casing due to internal gas accumulation is a significant occupational health and safety issue. The corrosive substances contained within the battery casing are particularly harmful to clothing, skin and eyes and can be fatal if ingested. This is particularly concerning as typically there is no prior warning that failure or rupture is imminent when gases are ignited.

Such failures may also render the diesel fire pumpset inoperable, which may also affect the performance of the fire hydrant or sprinkler system it serves.



FPA Australia is aware that reported failures or ruptures are likely to be the result of incorrect charging of flooded-cell lead-acid automotive batteries that have been poorly maintained. Incorrect charging can cause electrolysis of the electrolyte fluid (sulphuric acid and water) that surrounds the lead plates within the battery. Electrolysis produces hydrogen and oxygen gases and depletes the electrolyte of water. Whilst

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these types of batteries typically have vent holes to allow gases to escape the casing, these are insufficient to expel a high rate of gas production. Gas build-up can swell the casing, which may lead to ruptures and leakage of the fluid. Any spark associated with this build-up of gas will result in an explosion.

The use of AS 4029 compliant batteries is required by AS 2941 and should prevent such incidents occurring, provided they are correctly maintained. Industry sources suggest that it is difficult to obtain confirmation from some battery manufacturers that their products are certified to AS 4029. However, FPA Australia is aware that the risk is likely to be significantly reduced, even with batteries that aren't certified to AS 4029.2, if the following conditions are met:

- The battery is correctly maintained.
- The battery is of the Absorbed Glass Matt (AGM) type.

These batteries do not require maintenance of the electrolyte fluid and are sealed except for the inclusion of a safety pressure relief valve to discharge gas build-up. The technology adopted by AGM batteries produces water as a by-product of the chemical reaction process. This means that there is no requirement to maintain electrolyte levels manually. This eliminates the identified risk of “explosion” that results from batteries drying out through depletion of electrolyte.

- The correct float charge voltage is used.

Float charge voltage is commonly recommended to be between 13.0 VDC and 13.8 VDC at 26.7°C; however, each manufacturer will have a specific charge voltage for their batteries. It is extremely important that the float charge voltage of the battery is set in accordance with the battery manufacturer's requirements to prevent incorrect charging and gas build-up, which may result in an “explosion” risk.

5.0 Recommendations

FPA Australia recommends that stakeholders take the following steps to ensure the safety and integrity of batteries supporting fire pumpsets:

1. Wear eye protection and appropriate personal protective equipment (PPE) when conducting maintenance.
2. Use additional caution at pumpset start up (either manual start up or when automatic start up is expected after instigating pressure drop of fire protection systems).
3. Observe OH&S rules that prevent the introduction of ignition sources within the proximity of batteries.
4. Where possible, determine that installed batteries comply with AS 4029.2. Where batteries have not been marked, check with the supplier of the batteries to ensure their compliance.

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5. Batteries should be of the Absorbed Glass Matt (AGM) type, regardless of compliance with AS 4029.2, to reduce the likelihood of failure or explosion due to gas build-up caused by incorrect charging and depletion of electrolyte.
6. Always make sure the maintenance and the float charge voltage of the battery are in accordance with the manufacturer's requirements.
7. Ensure that any documentation associated with installation of fire pumpsets clearly specifies the use of batteries in accordance with recommendations 1 to 6 above.

In particular, when replacing the battery, replace any flooded-cell lead-acid battery with an AGM type battery. This may require the charging voltage to be re-adjusted.

8. Where wet (flooded-cell) batteries with cell caps are fitted, check the electrolyte levels at each service or test before starting the diesel motor. If the electrolyte level is at or below the level of the plates, distilled water must be added before attempting to start the pump.

A sufficient quantity of distilled water should be left where batteries are located at each site for battery top up.

9. Consider replacing existing batteries if the system's original installation pre-dates the AS 2941-2008 requirement or if the batteries are older than 2 years. Mark or record the date the battery was installed using an indelible marker or similar method.
10. Install appropriate warning signage.

6.0 Disclaimer

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7.0 References

- Fire Protection Association Australia Technical Advisory Committee 4/8/9.
- National Construction Code Series – Volume 1, Building Code of Australia – Published by Australian Building Codes Board, Canberra.
- Australian Standard AS 2118.1-1999, *Automatic fire sprinkler systems – General requirements* – Published by Standards Australia International Ltd.
- Australian Standard AS 2118.4-1995, *Automatic fire sprinkler systems – Residential* – Published by Standards Australia International Ltd.
- Australian Standard AS 2118.6-1995, *Automatic fire sprinkler systems – Combined sprinkler and hydrant*– Published by Standards Australia International Ltd.
- Australian Standard AS 2419.1-2005, *Fire hydrant installations – System design, installation and commissioning* – Published by Standards Australia International Ltd.
- Australian Standard AS 2941-2008, *Fixed fire protection installations – Pumpset systems* – Published by Standards Australia International Ltd.
- Australian Standard AS 4029.1-1994, *Stationary batteries – Lead-acid – Vented type* - Published by Standards Australia International Ltd.
- Australian Standard AS 4029.2-2000, *Stationary batteries – Lead-acid – Valve-regulated type* – Published by Standards Australia International Ltd.
- Australian Standard AS 4029.3-1993, *Stationary batteries – Lead-acid – Pure lead pasted plate type* – Published by Standards Australia International Ltd.

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