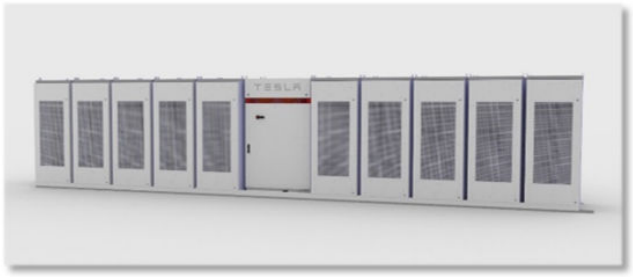


POWERWALL



MEGAPACK



POWERPACK

Lithium-Ion Battery Emergency Response Guide

For Tesla Energy Products Powerwall, Powerpack, and Megapack

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PRODUCT SPECIFICATIONS

All specifications and descriptions contained in this document are verified to be accurate at the time of printing. However, because continuous improvement is a goal at Tesla, we reserve the right to make product or documentation modifications at any time, with or without notice.

The images provided in this document are for demonstration purposes only. Depending on product version and market region, details may appear slightly different.

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1 Introduction and Scope

This guide serves as a resource for emergency responders and Authorities Having Jurisdiction (AHJs) with regards to safety surrounding Tesla Energy Products. This guide should also be reviewed by customers, site managers, and operators to ensure a clear understanding of the hazards and procedures to follow in case of emergencies.

Tesla Energy Products are defined as rechargeable lithium-ion battery energy storage products designed, manufactured, and sold by Tesla, and include products such as Megapack, Powerpack, and Powerwall. The information and recommendations set forth are made in good faith and believed to be accurate as of the date of preparation. TESLA, INC. makes no warranty, expressed or implied, with respect to this information.

This guide is available in various languages as indicated below. Information in this guide is periodically updated and translations are periodically added. Check the Tesla First Reponders Information page at *https://www.tesla.com/firstresponders* for the latest revision of this guide and any additional translations.

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עִבְרִית	Italiano	日本語	한국어
Nederlands	简体中文		

2 Company, Contact, & Product Info

2.1 Identification of Company and Contact Information

Table 1. Company and Contact Information

Products	Tesla Energy Products, designed for residential, commercial, and industrial/utility energy applications, and modules and sub-assemblies that can be installed in such products. Descriptions and specific part numbers are listed in *Product Descriptions* on page 7.	
Locations	Headquarters (USA)	13101 Tesla Road Austin, TX 78725 USA Tel. No. +1 512-516-8177 (do not use for emergencies; see below)
	Europe and Africa	Burgemeester Stramanweg 122 1101EN Amsterdam, The Netherlands Tel. No. +31 20 258 3916 (do not use for emergencies; see below)
	Australia and Asia	Level-14, 15 Blue Street North Sydney NSW, 2060, Australia Tel. No. 1800 686 705 (do not use for emergencies; see below)
	Manufacturer (USA)	13101 Tesla Road Austin, TX 78725 USA Tel. No. +1 512-516-8177 (do not use for emergencies; see below)
Emergency Contacts	CHEMTREC	For Hazardous Materials (or Dangerous Goods) Incidents: Spill, Leak, Fire, Exposure, or Accident Call CHEMTREC Day or Night Within USA and Canada: 1-800-424-9300 Contract Number: CCN204273 Outside USA and Canada: (int'l prefix) +1 703-741-5970 (collect calls accepted)
	Tesla Energy Technical Support Contacts	Powerpack & Megapack: • Hotline numbers: ◦ North America (24x7): +1 650-681-6060

		◦ Asia/Australia/New Zealand (24x7): +61 2 432 802 81 ◦ Europe/Middle East/Africa (24x7): +31 2 08 88 53 32 ◦ Japan: +0120 312-441 ◦ France: +33 173218702 ◦ The Netherlands: +31 208885332 ◦ Slovenia: +38 617778699 ◦ South Africa: +27 213004878 ◦ Switzerland: +41 445155607 ◦ United Kingdom: +44 1628450645 • Email support: *IndustrialStorageSupport@tesla.com* Powerwall: • Hotline numbers: ◦ North America (24x7): +1 877-961-7652 ◦ Asia/Australia/New Zealand (24x7): +61 2 432 802 81 ◦ Germany: +49 8955 0520235 ◦ Italy: +39 028 731 7132 ◦ South Africa: +27 87 550 3480 ◦ Switzerland: +41 618 553028 ◦ United Kingdom: +44 162 845 0630 • Email support: ◦ North America: *PowerwallSupportNA@tesla.com* ◦ Australia/New Zealand: *PowerwallSupportNA@tesla.com* ◦ Japan: *EnergyCustomerSupportJP@tesla.com* ◦ Europe/Middle East/Africa: *EnergySupportEmea@tesla.com*

2.2 SDS Information

Safety Data Sheets (SDS) are a sub-requirement of the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard, 29 CFR Subpart 1910.1200. This Hazard Communication Standard does not apply to various subcategories including anything defined by OSHA as an “article.” OSHA has defined “article” as a manufactured item other than a fluid or particle; (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities (e.g., minute or trace amounts) of a hazardous chemical, and does not pose a physical hazard or health risk to employees.

Tesla Energy Products referenced herein meet the OSHA definition of “article.” Thus, they are exempt from the requirements of the Hazard Communication Standard and do not require an SDS per OSHA.

NOTE: For projects in Australia or New Zealand, contact your Tesla representative for the product's safety data sheet.

Tesla Energy Products contain sealed lithium-ion battery cells (cells) that are similar to rechargeable batteries in many consumer electronic products.

Cells each contain lithium-ion electrodes, which can be composed of:

- Lithium Nickel Cobalt Aluminum Oxide (NCA material), LiNixCoyAlzO2;
- Lithium Nickel, Manganese, Cobalt Oxide (NMC material) LiNixMnyCozO2;
- Lithium Iron Phosphate (LFP material) LiFePO4;
- Lithium Nickel, Manganese Oxide (NMO material), LiNixMnyO2
- Lithium Cobalt Oxide, LiCoO2;
- or a mixture of these compounds

THE CELLS AND BATTERIES DO NOT CONTAIN METALLIC LITHIUM. Individual cells have nominal voltages of up to approximately 3.6 V.

Tesla Energy Products also include sealed thermal management systems containing coolants and/or refrigerants. Safety Data Sheets (SDS) are available for these liquid materials. Scan the QR code below or go directly to *MSDSonline* and enter the Product Name or CAS# to find the appropriate datasheet.

Figure 1. MSDSonline - SDS Search

Table 2. Thermal Contents

Non-Cell Materials with SDS found in Tesla Energy Products	Approximate Quantity
Ethylene glycol 50/50 mixture with water	Powerwall 1: 1.6 L of 50/50 mixture Powerwall 2: 2.3 L of 50/50 mixture Powerpack 1: 22 L of 50/50 mixture Powerpack 2: 26 L of 50/50 mixture Powerwall+: 2.3 L of 50/50 mixture Powerpack Inverter: 11 L of 50/50 mixture Powerpack Pod module: none Megapack: 540 L of 50/50 mixture Megapack battery module: 20 L of 50/50 mixture

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Non-Cell Materials with SDS found in Tesla Energy Products	Approximate Quantity
	Megapack 2: 360 L of 50/50 mixture Megapack 2 battery module: 20 L of 50/50 mixture
R-134a: 1,1,1,2-Tetrafluoroethane refrigerant	Powerwall 1, 2: none Powerwall+: none Powerpack 1, 2: 400 g Powerpack Pod module: none Megapack: 7.6 kg Megapack battery module: none Megapack 2: 7.6 kg Megapack 2 battery module: none

2.3 Product Descriptions

Individual lithium-ion cells are connected to form modules. Modules are battery sub-assemblies. These modules are installed in Tesla Energy Products. Approximate specifications of Tesla Energy Products are listed below.

2.3.1 Powerwall and Powerwall+

Powerwall is Tesla's battery system for residential and light commercial use. Powerwall+ is an integrated solar battery system that includes a Powerwall 2 for storage. Wherever "Powerwall" is mentioned, it applies to both Powerwall and Powerwall+ units unless otherwise noted.

NOTE: Images below are indicative representations designed to assist with product identification. Existing product models may vary.

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Figure 2. Powerwall (Left) and Powerwall+ (Right)



Figure 3. Example of a Powerwall Installed on a House



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Table 3. Approximate Powerwall Specifications

Part Number (Reman Number if available)	Description	Module Voltage – as shipped (V)	Max System DC Voltage	Max System AC Voltage	Weight	Height	Width	Depth
Powerwall 1 Versions								
1050100-x*y*-z*	POWERWALL, 2KW, 7KWH	<40 (DC)	450 (DC)	-	95 kg (210 lb)	130 cm (51 in)	86 cm (34 in)	18 cm (7 in)
1067000- x*y*-z*	POWERWALL, 3.3KW, 7KWH	<40 (DC)	450 (DC)	-	95 kg (210 lb)	130 cm (51 in)	86 cm (34 in)	18 cm (7 in)
1068000-x*y*-z*	POWERWALL, 6.6KW, 10KWH	<40 (DC)	450 (DC)	-	101 kg (223 lb)	130 cm (51 in)	86 cm (34 in)	18 cm (7 in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								
Powerwall 2 Versions								
1092170-x*y*-z*	AC POWERWALL	<40 (DC)	450 (DC)	300 (AC)	114 kg (251.3 lb)	115 cm (45.3 in)	75 cm (29.6 in)	14 cm (5.75 in)
1112170-x*y*-z*	DC POWERWALL	<40 (DC)	450 (DC)	-	115 kg (254 lb)	112 cm (44 in)	74 cm (29 in)	14 cm (5.5 in)
2012170-x*-y*-z*	AC POWERWALL	<40 (DC)	450 (DC)	300 (AC)	114 kg (251.3 lb)	115 cm (45.3 in)	75 cm (29.6 in)	14 cm (5.75 in)

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Part Number (Reman Number if available)	Description	Module Voltage – as shipped (V)	Max System DC Voltage	Max System AC Voltage	Weight	Height	Width	Depth
3012170-x*-y*-z*	AC POWERWALL	<40 (DC)	450 (DC)	300 (AC)	114 kg (251.3 lb)	115 cm (45.3 in)	75 cm (29.6 in)	14 cm (5.75 in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								
Powerwall+ Versions								
2012170-x*-y*-z*	POWERWALL+	<40 (DC)	450 (DC)	300 (AC)	140 kg (310 lb)	159.6 cm (62.8 in)	75.5 cm (29.7 in)	16 cm (6.3 in)
3012170-x*-y*-z*	POWERWALL+	<40 (DC)	450 (DC)	300 (AC)	140 kg (310 lb)	159.6 cm (62.8 in)	75.5 cm (29.7 in)	16 cm (6.3 in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								

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2.3.2 Powerpack

Powerpack is Tesla's energy storage system for commercial and industrial use.

NOTE: Images below are indicative representations designed to assist with product identification. Existing product models may vary.

Figure 4. Powerpack: Units and Inverter



1. Powerpack Units (include lithium-ion cells)
2. Powerpack Inverter

Figure 5. Example of a Powerpack Site



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Table 4. Approximate Powerpack Specifications

Part Number (Reman Number if available)	Description	Module Voltage – as shipped (V)	Max System DC Voltage	Max System AC Voltage	Weight	Height	Width	Depth
Powerpack 1 Versions								
1047404-x*y*-z*	POWERPACK (2hr continuous net discharge)	<30 (DC)	450 (DC)	480 (AC)	1680 kg (3700 lb)	219 cm (86 in)	97 cm (38 in)	132 cm (52 in)
1060119-x*y*-z*	POWERPACK (4hr continuous net discharge)	<30 (DC)	450 (DC)	480 (AC)	1665 kg (3670 lb)	219 cm (86 in)	97 cm (38 in)	132 cm (52 in)
1121229-x*y*-z*	POWERPACK (4hr continuous net discharge)	<30 (DC)	450 (DC)	480 (AC)	2160 kg (4765 lb)	219 cm (86 in)	97 cm (38 in)	132 cm (52 in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								
Powerpack 1.5 Version								
1089288-x*y*-z*	POWERPACK 1.5 C/2 SYSTEM	<30 (DC)	960 (DC)	480 (AC)	1622 kg (3575 lb)	219 cm (86 in)	131 cm (51.5 in)	82 cm (32.5 in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								
Powerpack 2 / 2.5 Versions								
1083931-x*y*-z* (1130518-x*y*-z*)	POWERPACK 2,C/4 SYSTEM	<30 (DC)	960 (DC)	480 (AC)	2160 kg (4765 lb)	219 cm (86 in)	131 cm (51.5 in)	82 cm (32.5 in)

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Part Number (Reman Number if available)	Description	Module Voltage – as shipped (V)	Max System DC Voltage	Max System AC Voltage	Weight	Height	Width	Depth
1083932-x*y*-z*	POWERPACK 2,C/2 SYSTEM	<30 (DC)	960 (DC)	480 (AC)	2160 kg (4765 lb)	219 cm (86 in)	131 cm (51.5 in)	82 cm (32.5 in)
1490025-x*y*-z*	POWERPACK 2.5,C/4 SYSTEM	<30 (DC)	960 (DC)	480 (AC)	2160 kg (4765 lb)	219 cm (86 in)	131 cm (51.5 in)	82 cm (32.5 in)
1490026-x*y*-z*	POWERPACK 2.5,C/2 SYSTEM	<30 (DC)	960 (DC)	480 (AC)	2160 kg (4765 lb)	219 cm (86 in)	131 cm (51.5 in)	82 cm (32.5 in)
1490027-x*y*-z*	POWERPACK 2.5,C/2 SYSTEM	<30 (DC)	960 (DC)	480 (AC)	2160 kg (4765 lb)	219 cm (86 in)	131 cm (51.5 in)	82 cm (32.5 in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								
Spare Parts								
N/A	POWERPACK POD MODULE	<30 (DC)	960 (DC)	N/A	98 kg (215 lb)	12 cm (5 in)	100 cm (39 ½ in)	75 cm (29 ½ in)

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2.3.3 Megapack

Megapack is Tesla's all-in-one utility-scale energy storage system.

NOTE: Images below are indicative representations designed to assist with product identification. Existing product models may vary.

Figure 6. Megapack



Figure 7. Example of a Megapack Site



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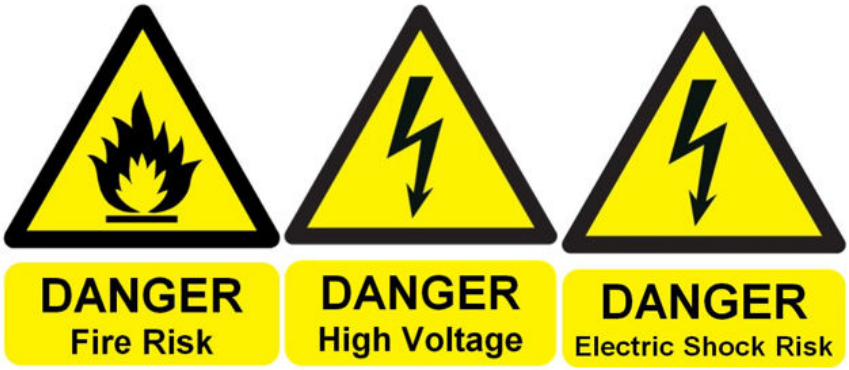
Table 5. Approximate Megapack Specifications

Part Number (Reman Number if available)	Description	Module Voltage – as shipped (V)	Max System DC Voltage	Max System AC Voltage	Weight	Height	Width	Depth
Megapack (all versions - dimensions as measured for enclosure envelope for 1462965-x*y*-z*)								
1462965-x*y*-z*	MEGAPACK	<450 (DC)	960 (DC)	518 (AC)	25,400 kg (56,000 lb) (max)	252.2 cm (99 ¼ in)	716.8 cm (282 ¼ in) (length)	165.9 cm (65 ¼ in)
1748844-x*y*-z*	MEGAPACK 2	480 (AC)	<1230 (DC)	480(AC)	30,500 kg (67,250 lb) (max)	250.6 cm (98 ¾ in)	725.0 cm (285 ½ in) (length)	163.7 cm (64 ½ in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								
Spare Parts								
N/A	MEGAPACK BATTERY MODULE	<450 (DC)	960 (DC)	N/A	1,085 kg (2,400 lb)	66 cm (26 in)	81 cm (32 in)	149 cm (59 ½ in)
N/A	MEGAPACK 2 BATTERY MODULE	480 (AC)	<1230 (DC)	480(AC)	1,250 kg (2,760 lb)	67 cm (26 ½ in)	81 cm (32 in)	149 cm (59 ½ in)

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3 Handling, Use, & Hazard Precautions

3.1 General Precautions



The products described by this document are dangerous if mishandled. Injury to property or person, including loss of life is possible if mishandled.

Tesla Energy Products contain lithium-ion batteries. A battery is a source of energy. Do not short circuit, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. An internal or external short circuit can cause significant overheating and provide an ignition source resulting in fire, including surrounding materials or materials within the cell or battery. Under normal conditions of use, the electrode materials and electrolyte they contain are not exposed, provided the battery integrity is maintained and seals remain intact. Risk of exposure may occur only in cases of abuse (mechanical, thermal, electrical).

3.2 High-Voltage Hazards

Under normal conditions of use, provided that a Tesla Energy Product enclosure remains closed, handling the product does not pose an electrical hazard. Numerous safeguards have been designed into Tesla Energy Products to help ensure that the high voltage battery is kept safe and secure as a result of a number of expected abuse conditions. All of the constituent component battery cells are sealed within the product as sub-groups within enclosures (Pods for Powerpack or battery modules for Megapack).

In Powerpack and Megapack, the exterior of each Pod/battery module is isolated from internal components and connectors are touch-safe. Pods are then installed in a rigid metal enclosure, which is isolated from high voltage. Megapack battery modules are similarly sealed and cannot be accessed from the exterior. In the Powerwall, the module is contained within the unit and not accessible to non-Tesla personnel. Access to these components is limited to Tesla-authorized personnel only.

A Tesla Energy Product may pose a significant high voltage and electrocution risk if the outer enclosure, Pod / battery module enclosures and/or safety circuits have been compromised or have been significantly damaged. A battery pack, even in a normally discharged condition, is likely to contain substantial electrical charge and can cause injury or death if mishandled. If a Tesla Energy Product has been significantly visibly damaged or its enclosure compromised, practice appropriate high-voltage preventative measures until the danger has been assessed (and dissipated if necessary).

WARNING: NEVER CUT INTO A SEALED TESLA ENERGY PRODUCT ENCLOSURE due to the high voltage and electrocution risks.

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For proper installation / removal instructions please contact the Tesla Service Support team (*Identification of Company and Contact Information* on page 4).

3.3 Hazards Associated with Mechanical Damage

Mechanical damage to Tesla Energy Products can result in a number of hazardous conditions (discussed below) including:

- Leaked battery pack coolant (see *Hazards Associated with Leaked Coolant* on page 17)
- Leaked refrigerant (Powerpack System and Megapack only, see *Hazards Associated with Leaked Refrigerant (Powerpack and Megapack Only)* on page 17)
- Leaked cell electrolyte (see *Hazards Associated with Leaked Electrolyte* on page 18)
- Rapid heating of individual cells due to exothermic reaction of constituent materials (cell thermal runaway), venting of cells, and propagation of self-heating and thermal runaway reactions to neighboring cells.
- Fire

To prevent mechanical damage to Tesla Energy Products, these items should be stored in their original packaging when not in use or prior to being installed (see *Storage Precautions* on page 28).

3.4 Hazards Associated with Elevated Temperature Exposure

Tesla Energy Products are designed to withstand operating ambient temperatures up to 50°C (122°F), with up to 100% operating humidity (condensing), and storage temperatures up to 60°C (140°F) and <95% relative humidity (non-condensing) for up to 24 hours without affecting the health of the unit.

Prolonged exposure of Tesla Energy Products to temperatures beyond that can drive battery cells into thermal runaway and result in a fire. Exposure of battery packs to localized heat sources such as flames could result in cell thermal runaway reactions and should be avoided.

3.5 Hazards Associated with Leaked Coolant

Thermal management of Tesla Energy Products is achieved via liquid cooling using a 50/50 mixture of ethylene glycol and water. A typical Powerpack battery unit includes about 26 L of coolant (Powerpack 2/2.5) or about 22 L of coolant (Powerpack 1). A typical Powerwall unit includes about 1.6 L of coolant (Powerwall 1) or about 2.3 L of coolant (Powerwall 2). The Powerpack Inverter (fully populated) includes about 11 L of coolant. A typical Megapack includes about 540 L of coolant. A typical Megapack 2 includes about 360 L of coolant. Mechanical damage of a Tesla Energy Product that has been installed could result in leakage of the coolant. The fluid may be blue, green, or orange in color and does not emit a strong odor.

For information regarding the toxicological hazards associated with ethylene glycol, as well as ecological effects and disposal considerations, refer to the specific Safety Data Sheet (SDS) for battery coolant.

Extended exposure of a Tesla Energy Product to leaked coolant could cause additional damage to the product such as corrosion and compromise of protection electronics.

3.6 Hazards Associated with Leaked Refrigerant (Powerpack and Megapack Only)

The Powerpack and Megapack thermal management system includes 400 g and 7.6 kg respectively of R-134a: 1,1,1,2-Tetrafluoroethane refrigerant in a sealed system. Mechanical damage of a Powerpack or Megapack could result in a release of the refrigerant. Such a release would appear similar to the emission of smoke.

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For information regarding the toxicological hazards associated with R-134a, as well as ecological effects and disposal considerations, refer to the specific Safety Data Sheet (SDS) for R-134a.

3.7 Hazards Associated with Leaked Electrolyte

The electrolyte within constituent cells includes a volatile hydrocarbon-based liquid and a dissolved lithium salt (which is a source of lithium ions) such as lithium hexafluorophosphate. The electrolyte in Tesla Energy Products' cells is largely absorbed in electrodes within individual sealed cells. The electrolyte reacts with those materials and is consumed during normal operation of the batteries. As such, the absence of free liquid electrolyte makes it impractical to report the volume of electrolyte within Tesla Energy Products.

The possibility of a spill of electrolyte from Tesla Energy Products is very remote. Electrolyte can be extracted from a single cell using a centrifuge, or under some extreme abuse conditions such as a severe crush. However, it is very difficult to mechanically damage cells in such a way as to cause leakage of electrolyte. Even if a single cell were damaged in a manner that could cause electrolyte leakage, it is extremely difficult to cause a leak from more than a few cells due to any incident. Furthermore, cells are connected into modules which are placed within a sealed steel compartmentalized enclosure. Each compartment has the capacity to contain liquid from a large number of individual cells. For the electrolyte liquid to come into contact with a user of a Tesla Energy Product, the external enclosure, the Pod/battery module enclosure, and the cell would have to be severely mechanically damaged. As such, Tesla Energy Products are deemed not to pose a liquid electrolyte release hazard.

Any released electrolyte liquid is likely to evaporate rapidly, leaving a white salt residue. Evaporated electrolyte is flammable and will contain alkyl-carbonate compounds. Leaked electrolyte is colorless and characterized by a sweet odor. If an odor is obvious, evacuate or clear the surrounding area and ventilate the area.

WARNING: AVOID CONTACT WITH ELECTROLYTE.

Leaked electrolyte solution is flammable and corrosive / irritating to the eyes and skin. If a liquid is observed that is suspected electrolyte, ventilate the area and avoid contact with the liquid until a positive identification can be made and sufficient protective equipment can be obtained (eye, skin, and respiratory protection). Chemical classifier strips can be used to identify the spilled liquid (electrolyte will contain petroleum/organic solvent and fluoride compounds).

In case of an electrolyte leak, the following protective equipment is recommended: an air purifying respirator with organic vapor/acid gas cartridges (e.g. P100 masks), safety goggles or a full-face respirator, and safety gloves (Butyl rubber or laminated film (e.g., Silver Shield)). Protective clothing should be worn. Use a dry absorbent material to clean up a spill.

NOTE: An acceptable exposure concentration of electrolyte has not been identified by the American Council of Governmental Industrial Hygienists (ACGIH). In case of electrolyte leakage from the battery, the oral (rat) LD50 is greater than 2 g/kg (estimated).

3.8 Hazards Associated with Vented Electrolyte

Lithium-ion cells are sealed units, and thus under normal usage conditions, venting of electrolyte should not occur. If subjected to abnormal heating or other abuse conditions, electrolyte and electrolyte decomposition products can vaporize and be vented from cells. Accumulation of liquid electrolyte is unlikely in the case of abnormal heating. Vented gases are a common early indicator of a thermal runaway reaction – an abnormal and hazardous condition.

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If a suspicious odor is detected near a Tesla Energy Product, or, more generally, gases or smoke are observed escaping from a Tesla Energy Product, evacuate the area and notify a first responder team and/or the local fire department. Gases or smoke exiting a lithium-ion battery pack are likely flammable and could ignite unexpectedly as the condition that led to cell venting may also cause ignition of the vent gases. A venting Tesla Energy Product should only be approached with extreme caution by trained first responders equipped with appropriate personal protective equipment (PPE), as discussed in *Firefighter PPE* on page 23.

Cell vent gas composition will depend upon a number of factors, including cell composition, cell state of charge, and the cause of cell venting. Vent gases may include volatile organic compounds (VOCs) such as alkyl-carbonates, methane, ethylene, and ethane; hydrogen gas; carbon dioxide; carbon monoxide; soot; and particulates containing oxides of nickel, aluminum, lithium, copper, and cobalt. Additionally, phosphorus pentafluoride, POF3, and HF vapors may form.

WARNING: AVOID CONTACT WITH VENTED GASES.

Vented gases may irritate the eyes, skin, and throat. Cell vent gases are typically hot; upon exit from a cell, vent gas temperatures can exceed 600°C (1,110°F). Contact with hot gases can cause thermal burns. Vented electrolyte is flammable and may ignite on contact with a competent ignition source such as an open flame, spark, or a sufficiently heated surface. Vented electrolyte may also ignite on contact with cells undergoing a thermal runaway reaction.

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4 In Case of Emergency

WARNING: In case of emergency, severe physical impact, or transportation accident, do not approach the product or open any of its doors.

WARNING: In case of severe physical impact or transportation accident, it may take time before any visible indication of an abnormal and hazardous condition (e.g. smoke or fire) can be observed. Contact Tesla Energy Technical Support for guidance (*Identification of Company and Contact Information* on page 4).

CAUTION: Response should only be performed by trained professionals.

4.1 During Storage or Operation

During storage or operation, cases of emergency include but are not limited to:

- Suspicious odor observed near a Tesla Energy Product
- Smoke or fire emanating from a Tesla Energy Product
- Severe physical impact on a Tesla Energy Product

In case of emergency, the following should be performed:

1. If possible, shut off the unit/system (see *Shutting Down in an Emergency* on page 24).
2. Evacuate the area.
3. If not already present, notify appropriately trained first responders, the local fire department, and any appointed subject matter expert (SME) if available.
4. Contact Tesla Energy Technical Support for guidance (*Identification of Company and Contact Information* on page 4).

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4.2 During Transportation

During transportation, cases of emergency include but are not limited to:

- Suspicious odor observed near a Tesla Energy Product
- Smoke or fire emanating from a Tesla Energy Product
- Transportation accident causing a severe physical impact on a Tesla Energy Product
- Transportation accident leading to tipping over of a Tesla Energy Product

In case of emergency, the following should be performed:

1. If possible, move the unit/system to an open area and away from exposures (e.g. buildings, flammable material, or people).
2. Evacuate the area.
3. If signs of suspicious odor, smoke, or fire are detected, notify appropriately trained first responders, the local fire department, and any appointed subject matter expert (SME) if available.
4. Contact Tesla Energy Technical Support for guidance (*Identification of Company and Contact Information* on page 4).

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5 Firefighting Measures

WARNING: Response should only be performed by trained professionals. In the event of a response to a Tesla product fire or hazardous event, contact Tesla Energy Technical Support for guidance (*Identification of Company and Contact Information* on page 4).

5.1 Responding to a Venting Tesla Energy Product

Smoke or suspicious odor emanating from a Tesla Energy Product can be an indication of an abnormal and hazardous condition. Battery thermal runaway fires are preceded by a period of smoke. The smoke is likely flammable and may ignite at any time. If fire, smoke, or suspicious odor is observed emanating from a Tesla Energy Product at any time, the following should be performed:

1. If possible, **shut off the unit/system** (see *Shutting Down in an Emergency* on page 24).
2. **Evacuate the area.**

   WARNING: When responding to a fire event with the **Powerpack System**, do not approach the Powerpack units from the front (door-side) or the rear. Perform all incident response from the sides of the units. Do not attempt to open the enclosure doors or come in contact with the units.

   WARNING: When responding to a fire event with **Megapack**, do not approach the unit and attempt to open any doors. The doors are designed to remain shut, and built-in deflagration vents in the roof of the unit will vent any smoke and flame out of the top of the unit and front thermal system intake louvers.
3. If not already done, **contact Tesla Energy Technical Support** for assistance (*Identification of Company and Contact Information* on page 4).
4. **Maintain a safe distance from the unit and monitor** (*Defensive Firefighting* on page 23) for evidence of continued smoke venting or fire.

   WARNING: There may be periods of up to three hours at a time during which the thermal runaway propagates from battery modules to battery modules. During such time, the battery may not generate visible signs of thermal event although the event can still be active and the battery can flare up.

   a. **If a fire has not developed** and only smoke is visible, take a defensive stance toward the system and be prepared to apply water spray **to neighboring exposures and neighboring battery enclosures.**

   b. **If a fire develops:**

      - **Continue to take a defensive stance toward the burning unit.** Applying water to the burning unit will only slow its eventual combustion (see *Defensive Firefighting* on page 23).
      - **If advised by Tesla, apply water to neighboring battery enclosures.** If communication cannot be established with Tesla, apply water at the discretion of first responders.
      - **At the discretion of first responders, apply water to other neighboring exposures**.
5. **Allow the battery pack to cool down** for a minimum of 12 hours after all fire and smoke has visibly subsided.

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6. **Monitor the temperature** of the battery pack using a thermal imaging camera to determine if it is safe to interact with the unit.
7. Contact Tesla Energy Technical Support for next steps (*Identification of Company and Contact Information* on page 4).

5.2 Defensive Firefighting

Tesla's recommendation is to fight a Tesla Energy Product fire defensively. The fire crew should maintain a safe distance in any direction of at least:

- 5 m from Powerwall
- 10 m from Powerpack
- 20 m from Megapack

WARNING: Depending on the conditions of the event (such as location of the burning battery, wind speed and direction) a safe distance may be higher than those prescribed above.

As outlined in the procedure above, **the fire crew should allow the battery to burn itself out.** To further mitigate the spread of the hazards, Tesla may recommend the application of water spray to neighboring battery enclosures, and first responders may apply water spray to neighboring exposures. **Applying water directly to the affected enclosure will not stop the thermal runaway event, as the fire will be located behind several layers of steel material, and direct application of water has shown to only delay the eventual combustion of the entire unit.**

WARNING: In confined spaces, if water is used directly on the enclosure that is burning, electrolysis of water (splitting of water into hydrogen and oxygen) may contribute to the flammable gas mixture formed by venting cells, burning plastic, and burning of other combustibles.

Water spray has been deemed safe as an agent for use on exposed Tesla Energy Products. Water is considered the preferred agent for managing lithium-ion battery fires. Gaseous agents such as CO2, Halon, or dry chemical suppressants may temporarily suppress flaming of lithium-ion battery packs, but they will not cool lithium-ion batteries and will not limit the propagation of cell thermal runaway reactions. Metal fire suppressants such as LITH-X, graphite powder, or copper powder are not appropriate agents for suppressing fires involving lithium-ion battery packs as they are unlikely to be effective.

A battery fire may continue for several hours and it may take 24 hours or longer for the battery pack to cool after it has been fully consumed by a thermal runaway event. After all fire and smoke has visibly subsided for at least 12 hours, a thermal imaging camera can be used to actively measure the temperature of the unit and determine if it is safe to interact with.

5.3 Firefighter PPE

Firefighters should wear self-contained breathing apparatus (SCBA) and fire-protective turnout gear. Regulatory testing has shown that the products of combustion of Tesla Energy Products can include flammable and nonflammable gases. Based on those regulatory tests, the flammable gases were found to be below their lower flammable limit (LFL) and would not pose a deflagration or explosion risk to first responders or the general public. The nonflammable gases were found to be comparable to the smoke encountered in a typical Class A structure fire and do not contain any unique, or atypical, gases beyond what you would find in the combustion of modern combustible materials.

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6 Shutting Down in an Emergency

WARNING: Shutting off power to a Tesla Energy Product does not de-energize the battery, and a shock hazard may still be present.

WARNING: If smoke or fire is visible, do not approach the product or open any of its doors.

WARNING: In case of flooding, stay out of the water if any part of the Tesla Energy Product or wiring is submerged.

To shut off the Powerpack System, Megapack, or Powerwall in an emergency, perform the appropriate steps and then contact Tesla (*Identification of Company and Contact Information* on page 4):

6.1 Powerpack System

1. If an external emergency stop (E-Stop) button or remote shutdown contact to the Powerpack is present, engage it.
2. If the Powerpack is serviced upstream by an external AC breaker or disconnect, open the breaker or disconnect.

6.2 Megapack

1. If an external E-Stop button or remote shutdown contact to the Megapack is present, engage it.
2. If the Megapack is serviced upstream by an external AC breaker or disconnect, open the breaker or disconnect.

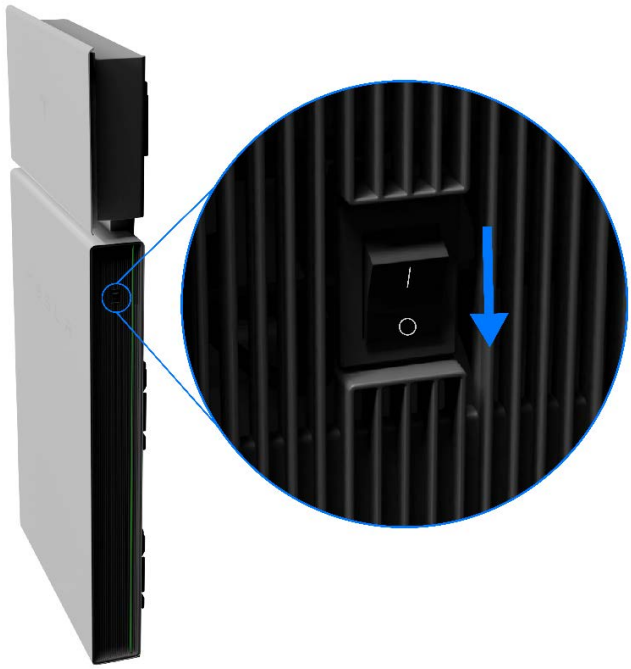
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6.3 Powerwall

If Safe to Access Switches and Breakers

1. If there is solar generation on-site, turn off the AC breaker for each inverter.
2. If an E-Stop button or external shutdown switch is present, engage it.
3. If it is safe to access the Powerwall(s), turn off each Powerwall using its on/off switch.

Figure 8. Powerwall+ On/Off Switch



4. Turn off the AC breaker for each Powerwall.
5. If there is a Backup Gateway installed, turn off the Backup Gateway breaker.

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Figure 9. Powerwall+ and Backup Gateway 2



6. If the emergency affects the rest of the site, turn off the entire site by opening the main service disconnect(s).

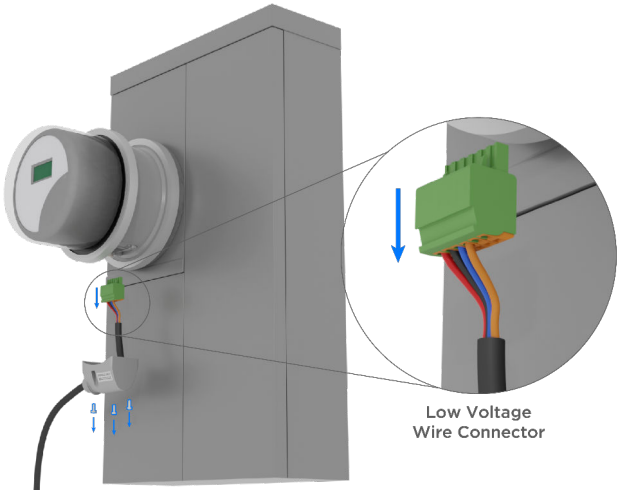
If Unable to Access Switches and Breakers

WARNING: Pulling the utility meter or Backup Switch from the meter socket is NOT a means of shutting down the Powerwall system. Do not pull the utility meter unless authorized to do so by the utility that owns it. Do not pull the Backup Switch unless authorized by Tesla.

To shut down the system in the event that Powerwall switches and/or breakers are not safely accessible:

1. If safe to do so, loosen the three (3) captive screws on the Backup Switch conduit hub and remove the conduit hub.
2. Pull the green low-voltage (<50 V) wiring connector to unplug OR cut the low voltage communication cable directly (cutting all four wires within the cable jacket) to force Powerwalls to cease charge/discharge.

Figure 10. Low-Voltage Wire Connector



7 First Aid Measures

7.1 Electric Shock / Electrocution

Seek immediate medical assistance if an electrical shock or electrocution has occurred (or is suspected).

7.2 Contact with Leaked Electrolyte

The constituent battery cells are sealed. Contents of an open (broken) constituent battery cell can cause skin irritation and/or chemical burns. If materials from a ruptured or otherwise damaged cell or battery contact skin, flush immediately with water and wash affected area with soap and water. If a chemical burn occurs or if irritation persists, seek medical assistance.

For eye contact, flush with significant amounts of water for 15 minutes without rubbing and see a physician at once.

7.3 Inhalation of Electrolyte Vapors

If inhalation of electrolyte vapors occurs, move person into fresh air. If not breathing give artificial respiration and seek immediate medical assistance.

7.4 Vent Gas Inhalation

The constituent battery cells are sealed and venting of cells should not occur during normal use. If inhalation of vent gases occurs, move person into fresh air. If not breathing give artificial respiration. Seek immediate medical assistance.

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8 Storage Precautions

Powerpack systems, Powerwalls, and sub-assemblies should be stored in approved packaging prior to installation. Megapack does not include packaging and can be stored as-shipped with a tarp.

Do not store Tesla Energy Products in a manner that allows terminals to short circuit (do not allow the formation of an electrically-conductive path).

Elevated temperatures can result in reduced battery service life. Tesla Energy Products can withstand ambient temperatures of -40°C to 60°C for up to 24 hours. However, Tesla Energy Products stored for longer than one month should be stored at ambient temperatures between -20°C and 30°C (-4°F and 86°F), at humidity <95%, and protected from condensation. Storing at temperatures outside the recommended range can result in degradation of product lifetime. Do not store Tesla Energy Products near heating equipment.

Ideally, a Tesla Energy Product should be stored at 50% state of charge (SOC) or less. Tesla Energy Products should not be stored for extended periods either at a full SOC or completely discharged since both conditions adversely impact battery life.

The storage area should be protected from flooding.

Long-term storage areas should be compliant with the appropriate local fire code requirements.

Acceptable storage density of battery packs and storage height of battery packs will be defined by the local authority having jurisdiction (AHJ). Requirements and limits will be based upon a number of factors including the structural and fire protection characteristics of the storage area and recommendations for fire protection promulgated by the National Fire Protection Association (NFPA) and similar organizations. At the time of this writing, no standard Commodity Classification has been defined for lithium-ion cells or battery packs (see 2016 NFPA 13: Standard for the Installation of Sprinkler Systems). Tesla products only have a 30-40 % state of charge (SOC) while in storage which reduces the energy impact on fire occurrences. As an example of the reduced energy, the 30% level has been determined to be acceptable for air flight shipping based upon extensive testing and analysis in conjunction with the FAA. Tesla recommends treating lithium-ion cells and batteries in packaging as equivalent to a Group A Plastic Commodity.

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9 Damaged Product Handling

This section describes the handling, storage, and transportation of damaged Tesla Energy Products

If the event of damage to a Tesla Energy Product, contact Tesla immediately (*Identification of Company and Contact Information* on page 4**).**

If a Tesla Energy Product has been damaged (battery enclosure has been dented or compromised), it is possible that heating is occurring that may eventually lead to a fire. Damaged or opened cells/batteries can result in rapid heating (due to exothermic reaction of constituent materials), the release of flammable vapors, and propagation of self-heating and thermal runaway reactions to neighboring cells.

Before handling or transporting a damaged Tesla Energy Product, wait at least 24 hours. Smoke may be an indication that a thermal reaction is in progress. If no smoke, flame, sign of coolant leakage, or signs of heat has been observed for 24 hours, the Tesla Energy Product may be disconnected and moved to a safe location. To obtain specific instructions for evaluating, disconnecting, and preparing a damaged Tesla Energy Product for transport, please contact the Tesla Energy Technical Support (*Identification of Company and Contact Information* on page 4).

A damaged Tesla Energy Product should be monitored during storage for evidence of smoke, flame, sign of coolant leakage, or signs of heat. If full-time monitoring of the Product is not possible (for example during extended storage), the Product should be moved to a safe storage location.

A safe storage location for a damaged battery will be free of flammable materials, accessible only by trained professionals, and 50 feet (15m) downwind of occupied structures. For example, a fenced, open yard may be an appropriate safe location. DO NOT STORE DAMAGED TESLA ENERGY PRODUCTS ADJACENT TO UNDAMAGED TESLA ENERGY PRODUCTS. It is possible that a damaged battery may sustain further damage during transportation and may lead to a fire. To further reduce this risk, handle the damaged battery with extreme caution.

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10 Disposal Procedures

Tesla Energy lithium-ion batteries do not contain heavy metals such as lead, cadmium, or mercury.

The procedures below apply to Tesla Energy Products at the end of their life (EOL). For disposal after a fire or thermal event, please contact Tesla for guidance (*Identification of Company and Contact Information* on page 4).

Tesla Energy Products should be disposed of or recycled in accordance with local, state, and federal regulations. Note that regulations regarding disposal of batteries vary by jurisdiction. In the United States, batteries are classified as Universal Waste, and in addition, many individual states have specific regulations regarding disposal of battery packs. For example, in California, all batteries must be taken to a Universal Waste handler or authorized recycling facility.

Tesla Energy Products contain recyclable materials. Tesla strongly encourages recycling. At this time, when a Tesla product must be decommissioned, we request that it be returned to a Tesla facility for disassembly and further processing.

If disposing without return to Tesla, please consult with local, state and/or federal authorities on the appropriate methods for disposal and recycling. Tesla has confirmed that at least two recycling processors are capable of recycling Tesla battery products in North America and three in the Europe, the Middle East and Africa (EMEA) region.

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11 Maintenance or Repair

Tesla requests all maintenance, service, and repairs of Tesla Energy Products be performed by Tesla-approved service personnel or Tesla authorized repair facilities. This includes all proactive and corrective maintenance over the lifetime of a Tesla Energy Product. Improper service or repair by personnel not approved nor authorized by Tesla could void the product's Limited Warranty, lead to failure of the Tesla Energy product, and potentially result in development of an unsafe condition and unexpected electrical events.

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12 Transportation

Lithium-ion batteries are regulated as Class 9 Miscellaneous dangerous goods (also known as “hazardous materials”) pursuant to the International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air, International Air Transport Association (IATA) Dangerous Goods Regulations, the International Maritime Dangerous Goods (IMDG) Code, European Agreements concerning the International Carriage of Dangerous Goods by Rail (RID) and Road (ADR), and applicable national regulations such as the USA’s hazardous materials regulations (see 49 CFR 173.185). These regulations contain very specific packaging, labeling, marking, and documentation requirements. The regulations also require that individuals involved in the preparation of dangerous goods for transport be trained on how to properly package, label, mark and prepare shipping documents.

NOTE: Transportation regulations vary by region. To ensure compliant transportation, always refer to local regulations as applicable.

UN Number	3480
Proper Shipping Name	Lithium-Ion Batteries
Hazard Classification	Class 9 Miscellaneous
Packing Group	N/A

NOTE: The information and recommendations set forth are made in good faith and believed to be accurate as of the date of preparation. TESLA, INC. makes no warranty, expressed or implied, with respect to this information.

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Revision History

Revision #	Date	Description
01	14-July-2015	ERG for Tesla Powerpack systems, Powerwalls, and Sub-assemblies
02	3-Sept-2015	Added part numbers, updated weights, voltages, and temperatures, clarified hazards associated with spilled electrolyte, updated storage requirements, updated warning label icons, updated packing group.
03	3-Oct-2016	Added part numbers, minor edits
04	30-June-2017	Added fire ground operations response for Powerpack 2, including approach; exhaust gases; and safety. Updated general product information and contacts, as well as part numbers and reman numbers
05	22-Oct 2018	Reformatted for ease of use and translation; removed Confidential status; corrected phone number for CHEMTREC
06	27-Feb-2019	Updated storage conditions and firefighting measures section to provide further context on response tactics to Tesla Energy Product fires. Adjusted formatting, included graphics for warnings and notices.
07	17-Dec-2019	Updates to contact information (Tesla contact), product specs section, leaked electrolyte section, and inclusion of Megapack throughout the document.
1.8	March 11, 2020	Fixed footer; fixed styles.
2.0	July 8, 2020	• Updated formatting • Updated product specs • Updated contact info • Corrected elevated temperature topic to include Megapack • Corrected name of Tesla Inverter to Powerpack Inverter • Separated information on shutting down into its own topic for visibility • Reorganized the Firefighting section for clarity • Updated language on re-ignition risks
2.1	August 28, 2020	Added spare parts specifications: • Megapack battery module • Powerpack Pod module
2.2	June 23, 2021	• Updated contact information in *Identification of Company and Contact Information* on page 4 • Updated specs according to updated products in *SDS Information* on page 5 • Added Powerwall part numbers to *SDS Information* on page 5 • Enhanced firefighting guidance: *Firefighting Measures* on page 22 • Added guidance in case of emergency: *In Case of Emergency* on page 20

Revision #	Date	Description
		• Added additional early signs of thermal runaway: *Hazards Associated with Vented Electrolyte* on page 18 • Updated Powerwall instructions in *Shutting Down in an Emergency* on page 24
2.3	July 28, 2021	• Added coolant volume for separately shipped Megapack battery modules (*SDS Information* on page 5) • Clarified firefighting guidance (*Firefighting Measures* on page 22) • Enhanced product identification information (*Product Descriptions* on page 7) • Simplified emergency shut-down procedures for Megapack and Powerpack (*Shutting Down in an Emergency* on page 24)
2.4	February 16, 2022	• Enhanced firefighting guidance regarding neighboring battery enclosures (*Firefighting Measures* on page 22) • Clarified products of combustion (*Firefighter PPE* on page 23) • Added Powerwall+ and Megapack 2 information. • Enhanced emergency shut-down procedures for Powerwall, especially in the event switches and breakers are unavailable (*Powerwall* on page 25) • Provided reference to safety data sheet specific to Australia/New Zealand (*SDS Information* on page 5) • Amended that coolant color can be blue, green, or orange (*Hazards Associated with Leaked Coolant* on page 17) • Added links and QR codes to download this guide in additional languages (*Introduction and Scope* on page 2) • Updated contact information (*Identification of Company and Contact Information* on page 4), including: Tesla headquarters, Powerwall North America hotline, Megapack and Powerpack Japan technical support



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