

MEGAPACK 2XL VARIANCE APPLICATION**Protection of Confidential Business Information**

The enclosed application and attachments include highly confidential business information, including trade secrets, regarding Tesla's product capabilities and future product plans. Pursuant to 17 Cal. Code Regs. § 91011 and the California Public Records Act, Cal. Gov. Code §§ 7920.000 *et seq.*, Tesla requests that specified information in the application and attachments be treated as confidential trade secret information and not be released to the public.

Certain information in the enclosed application and attachments is "corporate proprietary information" and "trade secret" within the meaning Cal. Gov. Code §§ 7924.510, 7927.605, and 17 Cal. Code Regs. § 91011, because it is information that is only known to certain individuals within Tesla and, if such information were released, it could result in competitive harm to Tesla. Tesla takes appropriate measures to maintain the confidentiality of this information and does not release information of this kind outside Tesla absent a compelling business need and a non-disclosure agreement. This information cannot be legitimately acquired by others except in those specific circumstances. Disclosure of this proprietary information would result in competitive damage.

We request confidentiality of the following items in the enclosed application and the attachments, and that confidentiality be maintained for 5 years from the date of the original document:

- Redacted information in responses
- Appendix A: milestone dates and achievements for response (L)
- Appendix B: calculations for responses (N) and (P)
- Attachment 1: Megapack 2 XL System Specification
- Attachment 2: Megapack 2 XL VOC Letter
- Attachment 5: Project Tracking Excel Spreadsheet
- Attachment 6: Affidavit of Sr. Manager Mechanical Design Engineering

Pursuant to 17 Cal. Code Regs. § 91022, upon receipt of a request from a member of the public that CARB disclose data claimed to be confidential or if CARB itself seeks to disclose such data, CARB must make a determination whether or not the data are confidential and thereby protected from disclosure. In the event you believe that all or part of the submitted information may not be entitled to confidential treatment, please contact our Office of the General Counsel in advance of the deadlines set forth in the regulation so that we can discuss these issues further. Please direct all notices to legal@tesla.com and energynotices@tesla.com.

(A) General information of the Applicant (name, ownership status (e.g., parent, subsidiary), address, telephone number, and contact email address):

Applicant name: Tesla, Inc.
Ownership status: Parent Company
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Telephone: 510-410-0882
Email address: anschwartz@tesla.com

Cc:
Attn: General Counsel/Legal
Telephone: 512-516-8177
Email address: legal@tesla.com; energynotices@tesla.com

(B) Description of business activity or product description:

The Megapack 2XL is a rechargeable lithium-ion battery energy storage system (“BESS”) that operates as a grid-scale battery storage solution. The Megapack 2XL includes a thermal management system that performs the essential function of keeping the battery at a temperature necessary to ensure optimum energy storage and release performance. The thermal management system contains the refrigerant R-134a.

The Megapack 2XL is primarily used for utility-scale projects and plays a critical role in the decarbonization of the electricity grid. As explained in the California BESS fact sheet, “Energy storage supports the electric grid by storing excess power – such as midday solar – and delivering it when generation is low, including during cloudy days or calm, windless periods. BESS helps manage the intermittency of solar and wind, balance supply and demand and provide grid services that improve reliability, flexibility, and stability.”¹

(C) Applicant’s relationship to the product:

Tesla is the manufacturer of the Megapack 2XL. In some cases, Tesla is also the installer, service provider and/or operator of the systems.

¹ <https://business.ca.gov/wp-content/uploads/Battery-Energy-Storage-Fact-Sheet-10.22.25-Draft.pdf>; *see also* <https://static.business.ca.gov/industries/climate-and-clean-energy/battery-energy-storage-systems-in-california/> (“Battery energy storage systems (BESS) have become a vital component in California to maintain electrical grid reliability, avoiding blackouts during peak demand hours in the summer months, and capturing and storing excess renewable energy generation from sources such as wind and solar for later use when it is needed the most.”).

(D) The specific section(s) of the regulation from which a variance is being requested:

California Code of Regulations, Title 17, section 95374 – List of Prohibited Substances, Table 3: End-Use and Prohibited Substances (Chillers - Industrial Process Refrigeration), and the related requirements in California Code of Regulations, Title 17, section 95375 – Prohibitions, Exceptions, Registration, Recordkeeping, Reporting, Labeling, and Disclaimer Requirements.

(E) Explanation and description of the reasons for seeking a variance:

1. Summary of Reasons for Variance

A variance is necessary because there is no substitute refrigerant available that can immediately be deployed in the thermal system for the Megapack 2XL while maintaining the intended and warranted performance of the battery energy storage system. The Megapack 2XL's thermal system must be materially reengineered in order to utilize a compliant refrigerant without significant loss of performance. As explained below, Tesla is moving as rapidly as possible to complete the reengineering process by the end of the third quarter of 2026.

The Megapack 2XL's thermal system was specifically designed to utilize R-134a as its refrigerant.² In April 2025, CARB notified Engie, a project developer utilizing Megapack 2XLs, that it had interpreted California's HFC regulations to cover the Megapack 2XL under the following category: "Chiller – Industrial Process Refrigeration." Prior to this notification, Tesla reasonably understood these regulations did not apply to Megapack 2XL, which is a battery energy storage system, or "BESS." It does not involve an "industrial process" as that concept is commonly understood or any other categories covered under the CA HFC regulation. To our knowledge, nothing in CARB's proposed rule, the public comments on the proposed rule, CARB's response to comments, the final rule, or CARB's post-enactment guidance indicates that energy storage might be considered an "industrial process." Moreover, the U.S. EPA's HFC regulations similarly apply to "chillers" associated with "industrial process refrigeration." Yet, EPA has taken the position that battery energy storage systems are *not* an "industrial process" and therefore are not regulated. EPA's position reinforces the reasonableness of Tesla's original understanding.

Once CARB confirmed to Tesla that CARB interprets the term "industrial process refrigeration" to cover battery energy storage systems, Tesla promptly expedited the process for reengineering its Megapack 2XL system to be able to use a compliant refrigerant without

² The Megapack 2XL specification sheet provided as Attachment 1 indicates that the product comes in several variants, including 2-hour and 4-hour variants that utilize HFO-1234yf in the thermal management system. These variants are not yet in production, but are expected to be in production and commercially available after September 30, 2026. Because of the long lead times associated with the sale of the Megapack 2XL, Tesla updated its specification sheet to ensure that customers looking to purchase the product for manufacture and installation after September 30, 2026 are aware that these variants will utilize HFO-1234yf.

compromising performance. While reserving its position that refrigeration for purposes of battery energy storage systems does not involve “industrial process refrigeration,” Tesla wishes to resolve this issue with CARB as soon as possible. A variance is needed, however, because there is no substitute refrigerant on the market that can immediately be deployed in the existing thermal system for the Megapack 2XL while maintaining its performance specifications. The Megapack 2XL’s thermal system will have to be reengineered in order to utilize a compliant refrigerant (HFO-1234yf, a next-generation ultra-low GWP refrigerant with a GWP of <1) without significant loss of performance.³

For these reasons, Tesla seeks a variance to cover the period of time from the effective date of the regulation until the end of Q3 2026, which is the earliest that Tesla can reasonably complete the reengineering process necessary to adapt the Megapack 2XL to the use of HFO-1234yf in its thermal system without significant loss of performance. The reasonableness of Tesla’s understanding, based on a plain reading of the CA HFC regulation and its lack of notice of CARB’s interpretation, is explained in more detail below.

2. The Megapack 2XL Battery Energy Storage System: Overview

The Megapack 2XL battery receives electricity from a separately sited generating source, such as from the power grid, or from a co-located generating facility, such as a solar facility or wind farm. The battery’s principal function is to store that electricity and discharge it back to the grid when it is most valuable through the provision of various grid services. This supports grid stability and addresses the natural intermittency of renewable energy sources such as solar and wind. At no point does the Megapack 2XL battery itself generate electricity – it can only store and discharge electricity that has been generated by other sources. The Megapack 2XL’s thermal management system circulates R-134a throughout the battery modules and power electronics to maintain the battery at optimal temperatures, which in turn maintain the health and efficiency of the battery cells and the system’s overall life. In the absence of a thermal management system, the system’s temperatures would fluctuate outside of acceptable engineering parameters thereby degrading system performance and the longevity of the system.

BESS solutions, such as the Megapack 2XL, serve as a critical resource in facilitating the State’s transition to renewable energy and grid decarbonization. The ability to increase reliance on low cost renewable energy sources like wind and solar, both of which are inherently “as available”

³ [REDACTED]

resources (as distinct from dispatchable resources that can be turned on to produce energy whenever that energy or power is needed by end users), depends on energy storage to capture that energy when it is produced and dispatch it to the grid at times when it is more valuable. BESS thus acts as an intermediary between solar and wind resources and electricity demand, capturing and holding this energy in a storage medium and then discharging that energy back to the grid when it is needed. In the absence of a cost-effective means of storing solar and wind energy, like BESS, the degree to which the energy needs of California could be met with these renewable resources would be inherently limited.

In addition, BESS solutions, such as the Megapack 2XL, are increasingly recognized as an alternative to conventional peaker facilities, which only operate for a limited number of hours of the year but are critical to maintaining grid reliability when energy demand is extremely high and/or in specific locations where, due to local transmission constraints, importing power during certain limited periods is not feasible. These peaker facilities are often inefficient, contributing disproportionately to greenhouse gas emissions as well as criteria pollutants (collectively “emissions impacts”).⁴ Because of the limited number of hours these facilities operate, BESS is viewed as an effective alternative to these facilities. BESS solutions such as the Megapack 2XL are capable of charging from the power grid during unconstrained periods and then discharging to meet local and system reliability needs—without the emissions impacts that would be associated with conventional peaker facilities.

3. The California HFC Regulation Does Not Clearly Apply to the Megapack 2XL

Tesla is undertaking a complex, time- and resource-intensive reengineering process in deference to CARB’s view of the applicability of the CA HFC regulation, but notes that there is a serious question whether the regulation actually applies to the Megapack 2XL’s thermal management system.

Regulatory Language: The plain language of the CA HFC regulation does not, on its face, apply to BESS products. CARB contends that the GWP limits for refrigerants applies because the thermal management system in the Megapack 2XL is a “Chiller – Industrial Process Refrigeration.” Cal. Code Regs., tit. 17, §§ 95371 *et seq.*, Prohibitions on Use of Certain Hydrofluorocarbons in Stationary Refrigeration, Stationary Air-conditioning, and Other End-Uses,

⁴ This additional emissions burden is often borne by communities located near these facilities who are considered Disadvantaged Communities per the California EnviroScreen, *i.e.*, communities which “most suffer from a combination of economic, health, and environmental burdens.” *See* <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/disadvantaged-communities#:~:text=What%20is%20a%20Disadvantaged%20Community,disadvantaged%20community%20in%20this%20context.>

2020. Although the Megapack 2XL’s thermal system includes a “chiller,”⁵ the Megapack 2XL is not a chiller used in “industrial process refrigeration.” The term “industrial process refrigeration” is defined as “to cool process streams at a specific location in manufacturing and other forms of industrial processes and applications.” *Id.* § 95373. The Megapack 2XL contains a thermal management system, but it is neither for manufacturing nor for any other “industrial processes and applications.”⁶ Rather, the chiller is for a battery energy storage system. Thus, it follows that the Megapack 2XL does not fit within the definition of the term “industrial process refrigeration.”

Rulemaking Docket and Public Engagement: A review of the rulemaking history of the CA HFC regulation provides further support for Tesla’s view that it is inapplicable to BESS systems.

The initial statement of reasons (“the proposal”) did not include the terms “battery” or “energy storage.”⁷ The proposal’s discussion of “industrial process refrigeration” states the sector “includes systems that cool process streams in industrial applications,” which “includes, but is not limited to, food and non-food production and manufacturing, respectively.”⁸ BESS products are

⁵ The regulations define the term “chiller” as “a machine specifically designed to make use of a vapor compression refrigeration cycle or absorption refrigeration cycle to transfer heat from a cold water or heat transfer fluid circulating system to the air, a heat transfer fluid, or another heat exchange media. ‘Chillers’ can be water-cooled, air-cooled, or evaporatively cooled, and include, but are not limited to, rotary chillers, centrifugal chillers, and positive displacement chillers, including reciprocating, scroll, and screw chillers.” Cal. Code Regs., tit. 17, § 95373.

⁶ Neither the term “manufacturing” nor the term “industrial processes and applications” is defined in the CA HFC regulation, and the energy storage and release function of the Megapack 2XL does not fit into the dictionary definition of either term. The term “industrial” is defined as “of or relating to industry” and the term “process” as “a series of actions or operations conducting to an end *especially*: a continuous operation or treatment especially in manufacture.” See <https://www.merriam-webster.com/dictionary/manufacture>; <https://www.merriam-webster.com/dictionary/industrial>. The term “manufacturing” is defined as “to make from raw materials by hand or by machinery.” See <https://www.merriam-webster.com/dictionary/manufacture>. The Megapack 2XL only serves to store energy that has been fed to it from the separate site of electricity generation and then release that same energy to the grid. It does not create a product from raw materials.

⁷ See Proposed Amendments to the Prohibitions on Use of Certain Hydrofluorocarbons (HFCs) in Stationary Refrigeration Chillers Aerosol Propellants and Foam and Uses Regulation Staff Report: Initial Statements of Reason *available at* [https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hfc2020/isor.pdf? ga=2.189684779.1876553987.1761167390-1455396825.1747757559](https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hfc2020/isor.pdf?ga=2.189684779.1876553987.1761167390-1455396825.1747757559).

⁸ *Id.* at 64.

neither food nor energy production, nor any other type of industrial processing or manufacturing. To the extent that energy *generation* could be considered “non-food production,” which itself is not clear, such generation occurs at a separate site from the BESS product, which merely receives energy for storage purposes.

The public comments and CARB’s responses in the Final Statement of Reasons reinforce that BESS manufacturers were not on notice that BESS products were in a sector regulated by the CA HFC regulation. Tesla is not aware of any public comments on the rulemaking docket that reference “battery” or “energy storage.”⁹ The term “storage” was used only in reference to storage of chemicals as opposed to storage of energy within a battery.¹⁰ CARB’s responses to comments similarly included no reference to “batteries” or “energy storage systems.” It appears that no BESS manufacturers or battery energy storage trade organizations participated in the rulemaking process at all. The final regulation does not mention—let alone discuss as an example of industrial process refrigeration—batteries or energy storage.

Guidance Documents: Further, CARB’s post-rulemaking guidance documents provide no indication that the CA HFC regulation would apply to BESS products. For example, the CARB fact sheet merely states that the CA HFC regulation requires facilities “that are installing direct and indirect refrigeration equipment” to comply with specific GWP limits.¹¹ Tesla is not aware of references to battery storage in any guidance documents or webinars published by CARB.

Federal Technology Transitions Rule: Further, the fact sheet references the federal AIM Act and attendant HFC regulations, stating that California’s “efforts complement” the federal

⁹ See Proposed Amendments to the Prohibitions on Use of Certain Hydrofluorocarbons (HFCs) in Stationary Refrigeration Chillers Aerosol Propellants and Foam and Uses Regulation Staff Report: Final Statements of Reason *available at* <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hfc2020/fsorrevised.pdf>

¹⁰ See *id.* The term “power generation” is included in a handful of public comments. For example, a public comment submitted by an industry group discussed generation in the context of emissions from power generation and that high energy efficiency of systems and equipment are important to reduce the environmental impacts due to power generation emissions. Another public comment submitted by a coalition of HVAC manufacturers and distributors and California utilities similarly discussed power generation. As discussed, BESS products do not generate power. These references to power generation in public comments do not fairly put BESS manufacturers on notice about CARB’s view regarding the scope of the regulation.

¹¹ Overview of California’s HFC Refrigerant Regulations: Industrial Process Refrigeration *available at* https://nasrc.org/wp-content/uploads/2025/07/FRIP_CA-Regulations-Fact-Sheet_IPR.pdf

regulations.¹² As explained below, U.S. EPA's position is that the thermal management system in the Megapack 2XL is not a covered sector under the federal Technology Transitions Rule, contained in 40 CFR Part 84 Subpart B.

The EPA Technology Transitions Rule, similar to the CA HFC regulation, imposes maximum GWP thresholds for hydrofluorocarbons used in certain sectors. The purpose of the rules is the same: to reduce the climate impact from HFC use and motivate the market's transition to climate-friendlier alternatives (such as the hydrofluoroolefins that Tesla is using as its substitute refrigerant). Like the CA HFC regulation, the Technology Transitions Rule regulates "chillers for industrial process refrigeration."¹³ The term "chiller" is not defined in the Technology Transitions Rule, but EPA's preamble explains that a chiller makes use of a secondary cooling fluid that is circulated to achieve a cooling effect.¹⁴ EPA explains that "IPR systems are used to cool process streams at a specific location in manufacturing and other industrial processes (e.g., chemical, pharmaceutical, petrochemical, and manufacturing industries). IPR systems are directly linked to the industrial process, meaning the refrigerant leaving the condenser and metering device is delivered directly to the heat source before returning to the compressor."¹⁵ The thermal management system of the Megapack 2XL does not cool manufacturing or industrial process streams and does not involve the chemical, pharmaceutical, petrochemical, or manufacturing industries. It only involves energy storage, which is not an industrial process.

EPA has provided a written response to Tesla confirming that the thermal management system of the Megapack 2XL is not subject to the Technology Transitions Rule. *See* Attachments 3 (Email correspondence from EPA to Tesla) and 4 (Email correspondence from Tesla to EPA). Tesla submitted an inquiry on July 18, 2025 to the Stratospheric Protection Division of the EPA asking if the "internal thermal management system" of a "battery energy storage system" containing refrigerant to control the temperature of the system was encompassed within the scope of the Technology Transitions Rule. Tesla's inquiry included a schematic of the thermal management system of the Megapack 2XL, to illustrate the circulating coolant. EPA responded on July 25, 2025 that "[c]hillers and HVAC equipment for battery energy storage systems are outside the scope of the subsectors covered by the October 2023 Technology Transitions Rule and are not subject to restrictions under the October 2023 Technology Transitions Rule." EPA's response provides further support for Tesla's original understanding of the inapplicability of such HFC regulations to the Megapack 2XL.

¹² *Id.*

¹³ 40 C.F.R. § 84.54(a)(10)(iii).

¹⁴ Restrictions on the Use of Certain Hydrofluorocarbons Under the American Innovation and Manufacturing Act of 2020, 88 Fed. Reg. 73,098, 73,174 (Oct. 24, 2023).

¹⁵ *Id.* at 73,141–42.

4. Timeline of CARB’s View about Regulatory Applicability of CA HFC Regulation

Tesla was not on notice that CARB considered the CA HFC regulation to be applicable to BESS such as the Megapack 2XL until April 24, 2025. On this date, Engie shared an email from CARB in which CARB staff indicated that they had determined that the thermal management system of the Megapack 2XL should be classified under the category “chillers – industrial process refrigeration,” and as such, these systems are prohibited from using a coolant with GWP greater than 750 pursuant to the HFC regulations that went into effect on January 1, 2024. Prior to this, Tesla understood that the HFC regulations did not apply to thermal management systems of the Megapack 2XL. As soon as Tesla had confirmation of CARB’s interpretation of the reach of the CA HFC regulation, Tesla promptly (1) expedited the engineering timeline for reengineering the thermal management system to utilize next-generation ultra-low GWP refrigerant HFO-1234yf and (2) began to actively engage with CARB staff on the variance process.¹⁶

The issue of the applicability of the HFC regulations came up initially in the context of the California Energy Commission’s (“CEC’s”) review of the Compass Project, a utility-scale storage project consisting of a 250 MW/1,000 MWh battery system.¹⁷ This project was being reviewed pursuant to CEC’s opt-in Assembly Bill 205 permitting process. As part of that review, the CEC submitted a data request to Engie for additional information regarding the refrigerant to be used for cooling purposes and its compliance with CARB’s HFC regulations. In its response, Engie provided its perspective that the regulation was not applicable.¹⁸ CARB staff provided its determination that the thermal management system should be deemed an industrial process chiller, bringing it within the ambit of the CA HFC regulation and the GWP limits established therein. On May 8, 2025, Tesla met with CARB and CEC staff to discuss this issue further. At this meeting and in an email following the meeting, CARB staff reaffirmed their view that the Megapack 2XL is covered by the HFC regulations. Since this date, Tesla has been actively reengineering the thermal management system to be able to use HFO-1234yf and has been engaging with CARB on the specifics of the variance process and this application.

¹⁶ Tesla has prioritized the reengineering of Megapack 2XL above other, competing projects.

¹⁷ See <https://www.energy.ca.gov/powerplant/battery-storage-system/compass-energy-storage-project>.

¹⁸ Although Tesla was not privy to conversations that may have taken place between the CEC and CARB subsequent to Engie providing its response to the CEC’s data request, it assumes such consultation did take place.

5. Technical Need for Variance

By the end of 2025, [REDACTED] Megapack 2XLs will have been installed in California. It is infeasible to immediately substitute HFO-1234yf¹⁹ in the thermal management system²⁰ for these already-installed products, and those products have a compression cycle for use only with R-134a.²¹ [REDACTED]

[REDACTED] With respect to future sales of Megapack 2XLs, it will be similarly infeasible for Tesla to immediately substitute an alternative refrigerant in the Megapack 2XL, as these systems will rely on the same thermal management system until Tesla transitions to a new thermal management system that uses HFO-1234yf.

Tesla estimates that with its expedited engineering timeline for the new thermal management system that can safely and efficiently use the substitute refrigerant, it will need until September 30, 2026 to produce Megapacks for use with the reengineered thermal management system. This timeline ensures that Tesla’s reengineering of the thermal management system is such that it meets the equivalent performance of the original thermal management system employing R-134a [REDACTED]

[REDACTED] Therefore, Tesla needs a variance for [REDACTED] Megapack 2XLs that have been manufactured and installed in California since January 1, 2024, and [REDACTED] Megapack 2XLs that will be manufactured prior to Q4 2026 for installation and use in California.²²

¹⁹ Aside from R-134a and HFO-1234yf, there are no other refrigerants that may be used with the hardware and operating temperature range of the thermal management system. Accordingly, these refrigerants are the only viable options for Tesla to use in the thermal management system.

²⁰ The compression cycle in the thermal management system utilizes refrigerant, with the refrigerant being compressed in moving heat from one location to another within the system.

²¹ Tesla was planning to use the substitute refrigerant in the Megapack 3, its forthcoming model. However, it was not planning to use the substitute refrigerant in the Megapack 2XL as currently designed [REDACTED]

²² See Attachment 6 (Affidavit of Sr. Manager Mechanical Design Engineering).

(F) Identify what type of variance is being requested:

Impossibility (the Applicant exercised best efforts but still was unable to comply with the regulatory requirements of the regulation for reasons beyond his or her control despite exercising foresight to prevent the noncompliance.)

Force Majeure Event (a sudden and unforeseeable event involving a clear danger, demanding action to prevent or mitigate the loss of, or damage to, life, health, property, or essential public services, arising from causes beyond the control of the Applicant, which delays or prevents the performance of any obligation under the regulation, despite the Applicant's best efforts to fulfill the obligation. This includes events where the local government, State of California, or federal government issues a declaration of emergency, such as war, wildfires, floods, hurricanes, tornadoes, earthquakes, volcanic eruptions, and pandemics. This does not include negligent acts or the Applicant's financial inability to perform that is unrelated to an event as defined in this section.)

Both Impossibility and Force Majeure Event

(G) For applicants that are seeking an Impossibility variance, please show that (1) A lower risk substitute is not currently or potentially available; (2) An exemption will not increase general harm to the public; and (3) The Applicant made all attempts to correct all potential noncompliance issues:

If seeking an Impossibility variance please provide clear and convincing evidence demonstrating how all of the following Impossibility variance criteria have been met:

1. A lower risk substitute is not currently or potentially available.

Tesla originally designed the Megapack 2XL's thermal management system to utilize R-134a because of R-134a's specific characteristics that enabled the thermal management system to maintain an optimum operation temperature. Tesla is currently testing prototypes of the Megapack 2XL that utilize HFO-1234yf instead of R-134a. Tesla cannot currently market or sell the Megapack using HFO-1234yf at this time because it cannot currently substitute HFO-1234yf in the thermal management system without leading to significant and detrimental impacts on efficiency, lifetime and overall product performance. Tesla remains committed to an expedited development and testing timeline for the reengineered thermal management system.

2. An exemption will not increase the overall risk to human health or the environment.

An exemption for the Megapack 2XL for a limited period of time while Tesla works to meet its expedited development and testing timeline for the reengineered Megapack 2XL will be a net-benefit to human health and the environment. The GHG emissions from potential leaks of R-134a in the Megapack battery cooling system are offset by the substantial benefits of approximately 74 million lbs of CO₂ (33,540 MTCO₂e) emissions from storing and distributing

clean power to California’s grid over the product’s 15-year lifetime. That is, the system’s overall contribution to GHG emission mitigation through renewable energy integration far outweighs the comparatively low risk from refrigerant leaks.

[REDACTED]

- **Efficiency Loss and CO2 Calculations:** [REDACTED]

- **Refrigerant Loss Scenario:** [REDACTED]

[REDACTED] We also make the conservative assumption that R-134a is not recycled but eventually released. Although our scenario assumes no recycling, Tesla has a process by which certified technicians recover, purify, and reuse the refrigerant at the end of the product’s lifetime to minimize releases. This recycling further reduces emissions.

3. The Applicant has used best efforts to anticipate and address the impossibility and any potential noncompliance.

As soon as Tesla learned about CARB’s view on the applicability of the CA HFC regulation, it immediately pursued an expedited reengineering timeline for a thermal management system that uses HFO-1234yf to support state-of-the-art, top-level efficiency for the Megapack. It continues to devote significant engineering resources to ensure that the reengineered thermal management system is ready for use by September 30, 2026. The attached affidavit (see

Attachment 6) describes Tesla’s efforts to expedite reengineering of the Megapack 2XL thermal management system to utilize HFO-1234yf.

(H) If seeking a Force Majeure Event variance please provide clear and convincing evidence demonstrating how all of the following Force Majeure variance criteria has been met:

1. Non-compliance is due to a Force Majeure event.

N/A

2. The Applicant has used best efforts to anticipate and address any force majeure event and any potential noncompliance, including minimizing any adverse effects of the greenhouse gas emissions related to noncompliance.

N/A

(I) Please attach supporting documentation for attributing noncompliance to Impossibility or a Force Majeure Event. Supporting documentation must be written in English. Please list the supporting documentation that is attached to this application.

1. Megapack 2XL System Specification
2. Megapack 2XL VOC Letter
3. Email correspondence from EPA to Tesla
4. Email correspondence from Tesla to EPA
5. Project Tracking Excel Spreadsheet
6. Affidavit of Sr. Manager Mechanical Design Engineering

(J) Describe all proposals, and potential plans that were developed in attempts to meet the time deadlines of the section(s) from which the variance is being requested.

Tesla was not aware of CARB’s view that the CA HFC regulation is applicable to BESS such as the Megapack 2XL. As explained above, Tesla’s reading of the regulatory language, public comments and CARB’s response during the rulemaking process, and applicable guidance documents, indicated that BESS such as the Megapack 2XL were not considered chillers for industrial process refrigeration and thus not within the scope of the CA HFC regulation. However, for reasons unrelated to the CA HFC regulation, by March 2023, Tesla’s engineers had begun to explore the possibility of using HFO-1234yf, a next-generation ultra-low GWP refrigerant, in the thermal management system of the Megapack 2XL.²³ After being informed of CARB’s view on the regulation’s applicability, Tesla pursued this reengineering process in an expedited manner.

²³ Given Tesla’s mission to accelerate the world’s transition to sustainable energy, the company is always considering opportunities to improve the sustainability of the products Tesla

(K) To the best of your knowledge, please give a preliminary schedule of when compliance with the deadlines will be met, in addition to the duration of variance requested.

Tesla requests a variance to make the effective date September 30, 2026, in Table 3, section 95374(c) to ensure enough time for all necessary tests to be completed and for prototypes to be developed and tested. As we will note below, the reengineered Megapack 2XL is tentatively anticipated to be rolled out by the third quarter of 2026. For newly manufactured Megapacks, that is the earliest date compliance could be achieved. This would be, at the latest case scenario, September 30, 2026.

(L) Provide a compliance plan which describes in detail how, if a variance is granted, compliance will be achieved as expeditiously as possible including all of the following:

(i) The method by which compliance will be achieved

Tesla is devoted to the development of future Megapacks that are compliant. Tesla is currently in the development phase of Megapacks that utilize next-generation ultra-low GWP refrigerants that are over-compliant with the rules. It remains committed to an expedited testing and development timeline for these new reengineered products.

(ii) Milestone dates

Please see Appendix A for a table of milestone dates and achievements.

(iii) Milestone achievements

Please see Appendix A for a table of milestone dates and achievements.

(M) Provide a description of the damage or harm that will result to the Applicant from immediate compliance with the regulatory requirements, including if compliance would result in an extraordinary economic hardship, such as closure of the entire facility or loss of a large portion of the revenue:

As explained above, there is no substitute compliant refrigerant currently on the market that can immediately be deployed in the Megapack 2XL without significant loss of functionality and performance. Tesla is therefore reengineering the Megapack 2XL's thermal system in order to

manufactures and to mitigate the environmental impacts of Tesla's products. [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

be able to use HFO-1234yf, which has a GWP of <1. If Tesla does not receive a variance for the time it takes to complete the reengineering process, the situation will be extremely disruptive for Tesla and its customers. Moreover, California's efforts to decarbonize the electricity grid will be impeded.

In particular, with respect to Megapack 2XL products that are already installed in California, the situation will be untenable. If those products are forced to come off-line, there could be immediate negative consequences for grid performance and reliability. There could also be contractual and financial consequences for Tesla's BESS business and those of Tesla's customers.

[REDACTED]

[REDACTED]

The decrease in the number of Megapack 2XLs installed and used in California, or significant delays thereto if projects slated for deployment need to wait until a compliant version of the Megapack 2XL is available, will also lead to significant setbacks for the State of California and CARB's goals of reducing GHG emissions and increasing grid stability and resilience, as battery energy storage systems play a critical role in both of these goals. The increased strain on the grid will have cascading effects on the State. [REDACTED]

[REDACTED]

(N) If applying for an Impossibility variance please provide quantification of current Greenhouse Gas (GHG) emissions resulting from normal business-as-usual operations as it directly relates to the continued use of any substance in end-uses listed in Table 1, section 95374 (a); Table 2, section 95374 (b); Table 3, section 95374 (c); or Table 4, section 95374 (d). This includes quantification of the direct GHG emissions resulting from refrigerant leaks or HFC emissions and indirect GHG emissions resulting from energy use (where applicable),

with all calculations, based on the average lifetime of the equipment or product that will continue to use prohibited substances. Applicant must include all calculations used to calculate GHG emissions estimates, including emission factors (i.e., charge size as defined in section 95373, leak rate as defined in 40 C.F.R. Part 82.152, and refrigerant used over the average lifetime of the equipment, system, or product). Please see the bottom of this application template for an example calculation.

The current Greenhouse Gas (GHG) emissions resulting from normal business-as-usual operations is 12,977.20 MTCO₂e. *See* Appendix B, Tables 1–3.

For these calculations, the average annual leak rate is assumed to be 2% (based on CARB emissions factors) and the average loss rate at end-of-life is assumed to be 100% (based on CARB emissions factors).²⁴ The average lifetime of the product is 15 years. The IPCC AR4, 100-year GWP value for HFC-134a is 1,430.

(O) Please describe any potential harmful effects on the general welfare of citizens and the general environment that may result from a variance and/or exemption:

Tesla recognizes and acknowledges that HFCs (even those with low GWP) are greenhouse gases that can have negative impacts to human health and the environment. However, Tesla believes any such impacts from granting an exemption for the Megapack 2XL for a limited period of time while Tesla works to meet its expedited development and testing timeline for the reengineered Megapack 2XL will be a net-benefit to human health and the environment. Specifically, any negative impacts to human health and the environment can be minimized and/or mitigated by the substantial benefits from the use of an over-compliant refrigerant with a GWP of <1 in the reengineered Megapack 2XL as shown in section (P). In addition, the substantial GHG emission reduction benefits from delaying the switchover to HFO-1234yf until after the reengineering of the Megapack 2XL's thermal management system is complete is shown in section (G). Moreover, as noted in sections (G) and (P), Tesla will implement refrigerant recovery and recycling at the end of the product's lifetime.

(P) Provide a mitigation plan that demonstrates how you will reduce excess GHG emissions to a level equal to or below what would have been emitted had you been in compliance and how you will mitigate any negative impacts to human health or the environment. You must include all calculations used to calculate GHG emission estimates including emission factors (i.e., charge size as defined in section 95373, leak rate as defined in 40 C.F.R. Part 82.152, and refrigerant used over the average lifetime of the equipment, system, or product). This may include an analysis of prohibited substances, efforts to reduce

²⁴ Tesla also notes that at the end of the product's lifetime, the entirety of the refrigerant is recycled or reclaimed; none of the refrigerant is disposed of through landfilling or incineration. Therefore, the use of the 100% end-of-life leak rate is extremely conservative.

leaks or venting of prohibited substances, and options to recycle or destroy high-Global Warming Potential refrigerants.

Summary: The mitigation amount is the difference between GHG emissions from business-as-usual operations (12,977.20 MTCO₂e, *see* Appendix B, Tables 1–3) and GHG emissions from operations with a minimally compliant refrigerant with a GWP of <750 (6,806.22 MTCO₂e, *see* Appendix B, Tables 4–6). The mitigation amount is thus 12,977.20 MTCO₂e - 6,806.22 MTCO₂e = 6,170.98 MTCO₂e.

For these calculations, the average annual leak rate is assumed to be 2% (based on CARB emissions factors), and the average loss rate at end-of-life is assumed to be 100% (based on CARB emissions factors). The average lifetime of the product is 15 years. The IPCC AR4, 100-year GWP value for HFC-134a is 1,430, and the IPCC AR4, 100-year GWP value for a minimally compliant refrigerant is 750.

Tesla is prepared to purchase carbon offsets to mitigate for the **6,170.98 MTCO₂e** of excess emissions, should CARB determine that to be necessary. However, Tesla contends that this figure should be modified by the mitigation benefits provided by the use of HFO-1234yf with a GWP of <1 in the reengineered Megapack 2XL, rather than a minimally compliant refrigerant with a GWP of <750.²⁵

Mitigation Factor: Tesla is utilizing HFO-1234yf, a next-generation refrigerant with a GWP of <1 for use in its reengineered Megapack. Tesla’s choice to use an ultra-low GWP HFO as the refrigerant is over-compliant. For the first year from the date of compliance after the variance period is complete (October 1, 2026 through September 30, 2027), Tesla anticipates there will be 1,487 Megapacks installed that will utilize the over-compliant HFO-1234yf refrigerant. The actual GHG emissions from these 1,487 reengineered Megapack 2XL units, a product that will utilize the refrigerant HFO-1234yf, total just 4.48 MTCO₂e.

In comparison with a scenario where Tesla was utilizing a minimally compliant refrigerant for that same number of Megapacks, its use of a next-generation HFO leads to a reduction of **3,356.01 MTCO₂e**. This figure is the difference between the estimated GHG emissions from operations with minimally compliant refrigerant installed in the first year (3,360.49 MTCO₂e, *see*

²⁵ Additionally, the disposal process for refrigerant at end-of-life should be considered: Tesla has a disposal process for the refrigerant that remains in its Megapack 2XL at the end of its lifecycle. [REDACTED]

[REDACTED] The entirety of the refrigerant is recycled or reclaimed; none of the refrigerant is disposed of through landfilling or incineration. Accordingly, the use of the 100% end-of-life leak rate is extremely conservative and inflates the actual GHG emissions from the use of R-134a.

Appendix B, Tables 7–9) and the estimated GHG emissions from operations with HFO-1234yf refrigerant installed in first year (4.48 MTCO₂e, *see* Appendix B, Tables 10–12).

For these calculations, the average annual leak rate is assumed to be 2%, and the average loss rate at end-of-life is assumed to be 100%. The lifetime is 15 years. The IPCC AR4, 100-year GWP value for a minimally compliant refrigerant is 750, and the IPCC AR4, 100-year GWP value for HFO-1234yf is 1.

Carbon Offsets: Tesla is willing to purchase carbon offset credits equivalent to the difference between the GHG emissions from business-as-usual operations and compliant operations (6,170.98 MTCO₂e). This figure, however, should be modified based on the mitigation factor described above. If CARB applies the mitigation factor, Tesla is prepared to purchase carbon offsets for 2,810.49 MTCO₂e, *i.e.*, the difference between the 6,170.98 MTCO₂e of excess emissions from the use of HFC-134a in the thermal management system and the saved emissions of 3,356.01 MTCO₂e from the mitigation factor.

(Q) Provide a detailed explanation of efforts that may be implemented to curtail noncompliance in lieu of obtaining a variance:

Tesla is in the process of evaluating and testing HFO-1234yf as the substitute refrigerant and designing a new thermal management system. [REDACTED]

[REDACTED]

[REDACTED] Accordingly, there are no reasonable actions that Tesla can take to “curtail noncompliance.” The only way to “curtail noncompliance” would be to fully stop selling or installing the Megapack 2XL in California, which would adversely impact local jobs in California and impede the State’s clean energy goals.

Appendix A

Appendix B

Table 1. Emissions Due to Annual Leakage of HFC-134a.

Model	Product Quantity	HFC-134a Usage per Product (lb)	Average Lifetime (yr)	Average Annual Leak Rate	GWP	Average Annual Leak Rate Emissions (lb)
Two-hour Megapack 2XL			15	2%	1,430	
Four-hour Megapack 2XL						

Table 2. End-of-Life Emissions from HFC-134a.

Model	Product Quantity	HFC-134a Usage per Product (lb)	Average Loss Rate at End-of-Life	GWP	End-of-Life Emissions (lb)
Two-hour Megapack 2XL			100%	1,430	
Four-hour Megapack 2XL					

Table 3. Total MTCO₂e Emissions from HFC-134a.

Model	Product Quantity	Average Annual Leak Rate Emissions (lb)	End-of-Life Emissions (lb)	Total Emissions (lb)	Total Emissions (MTCO ₂ e)
Two-hour Megapack 2XL					
Four-hour Megapack 2XL					
Total MTCO₂e emissions from HFC-134a					12,977.20

Table 4. Emissions Due to Annual Leakage of Minimally Compliant Refrigerant.

Model	Product Quantity	GWP750 HFC Usage per Product (lb)	Average Lifetime (yr)	Average Annual Leak Rate	GWP	Average Annual Leak Rate Emissions (lb)
Two-hour Megapack 2XL			15	2%	750	
Four-hour Megapack 2XL						

Table 5. End-of-Life Emissions from Minimally Compliant Refrigerant.

Model	Product Quantity	GWP750 HFC Usage per Product (lb)	Average Loss Rate at End-of-Life	GWP	End-of-Life Emissions (lb)
Two-hour Megapack 2XL			100%	750	
Four-hour Megapack 2XL					

Table 6. Total MTCO_{2e} Emissions from Minimally Compliant Refrigerant.

Model	Product Quantity	Average Annual Leak Rate Emissions (lb)	End-of-Life Emissions (lb)	Total Emissions (lb)	Total Emissions (MTCO _{2e})
Two-hour Megapack 2XL					
Four-hour Megapack 2XL					
Total MTCO_{2e} emissions from GWP750 HFC					6,806.22

Table 7. Emissions Due to Annual Leakage of Minimally Compliant Refrigerant in Reengineered System.

Model	Product Quantity	GWP750 HFC Usage per Product (lb)	Average Lifetime (yr)	Average Annual Leak Rate	GWP	Average Annual Leak Rate Emissions (lb)
Two-hour Megapack 2XL			15	2%	750	
Four-hour Megapack 2XL						

Table 8. End-of-Life Emissions from Minimally Compliant Refrigerant in Reengineered System.

Model	Product Quantity	GWP750 HFC Usage per Product (lb)	Average Loss Rate at End-of-Life	GWP	End-of-Life Emissions (lb)
Two-hour Megapack 2XL			100%	750	
Four-hour Megapack 2XL					

Table 9. Total MTCO₂e Emissions from Minimally Compliant Refrigerant in Reengineered System.

Model	Product Quantity	Average Annual Leak Rate Emissions (lb)	End-of-Life Emissions (lb)	Total Emissions (lb)	Total Emissions (MTCO ₂ e)
Two-hour Megapack 2XL					
Four-hour Megapack 2XL					
Total MTCO₂e emissions from GWP750 HFC					3,360.49

Table 10. Emissions Due to Annual Leakage of HFO-1234yf in Reengineered System.

Model	Product Quantity	HFO-1234yf Usage per Product (lb)	Average Lifetime (yr)	Average Annual Leak Rate	GWP	Average Annual Leak Rate Emissions (lb)
Two-hour Megapack 2XL			15	2%	1	
Four-hour Megapack 2XL						

Table 11. End-of-Life Emissions from HFO-1234yf in Reengineered System.

Model	Product Quantity	HFO-1234yf Usage per Product (lb)	Average Loss Rate at End-of-Life	GWP	End-of-Life Emissions (lb)
Two-hour Megapack 2XL			100%	1	
Four-hour Megapack 2XL					

Table 12. Total MTCO_{2e} Emissions from HFO-1234yf in Reengineered System.

Model	Product Quantity	Average Annual Leak Rate Emissions (lb)	End-of-Life Emissions (lb)	Total Emissions (lb)	Total Emissions (MTCO _{2e})
Two-hour Megapack 2XL					
Four-hour Megapack 2XL					
Total MTCO_{2e} emissions from HFO-1234yf					4.48