



## TESLA POWERPACK INVERTER

# 1 SPECIFICATIONS

These specifications apply to the following inverter variants, which are named according to the power rating of a single Powerstage:

- Powerpack 65 kVA Inverter, Tesla Part Number 1095371
- Powerpack 70 kVA Inverter, Tesla Part Number 1134768

## 1.1 Mechanical Specifications

Width	1394 mm (54.9 in)
Depth	1044 mm (39.9 in)
Height	2191 mm (86.2 in)
Weight, Max.	1120 kg (2470 lbs)

**NOTE:** Dimensions include lifting flanges in product height and bottom anchor tabs, which interleave in installation and are not indicative of overall spacing. For pallet width and depth dimensions, refer to the “Transportation and Storage Guidelines” document.

**NOTE:** Product weight changes depending on the number of installed Powerstages.

## 1.2 Power Specifications

The inverter is configurable to a nominal output voltage of 400 VAC or 480 VAC. The specs below are split for each default voltage value. Each inverter contains up to 10 inverter modules, or “Powerstages”.

### 1.2.1 Grid-Connected (Utility-Interactive) Mode

Default Voltage	400 VAC	420 VAC	440 VAC	450 VAC	480 VAC
65 kVA Rated Output Power (10 Powerstages)	540 kVA	568 kVA	595 kVA	609 kVA	650 kVA
70 kVA Rated Output Power (10 Powerstages, due Q4 2018)	580 kVA	610 kVA	640 kVA	655 kVA	700 kVA
Overload Capability	120% of rated power (10 sec max)				
Input Voltage Range	880-950 VDC				
Output Voltage Range (steady state voltage)	360-528 VAC (380-480 VAC grid)				
Nominal Frequency (configurable)	50 or 60 Hz				
Frequency Range	45-65 Hz				
Input Current	720 A				
Phases	3				
System configuration	4-wire, Wye (A, B, C, N with ground bus bar available)				
Max Output Current	65 kVA: 800 A (80 A per Powerstage) 70 kVA: 860 A (86 A per Powerstage)				
Peak Efficiency	> 98.9%				
Full Load Efficiency	98.5%				
CEC Weighted Efficiency	98.84%				
Power Factor at Full Load	> 99%				
Adjustable Power Factor (Controller Feature)	-1 to +1				
Total Current Harmonic Distortion (THD)	< 1.2%				

Default Voltage	400 VAC	420 VAC	440 VAC	450 VAC	480 VAC
Power Regulation Accuracy	< 2%				
Overvoltage Category	Category III up to 3000 m				
Pollution Degree	III				

## 1.2.2 Supplemental Specifications for Grid-Forming (Islanding) Mode

Imbalanced Phase Load Power Output	100%
------------------------------------	------

The inverter may be de-rated by changing software parameters to meet specific site restrictions and requirements.

## 1.2.3 Voltage Tolerance

Event Description	Overvoltage Condition		
Instantaneous voltage (L-N)	< 474 V	474 – 553 V	> 553 V
Instantaneous current limit*	Inverter self-protects	1.4 p.u.	0 p.u.

*\*If this value is exceeded, permanent damage to the Powerstage will occur*

## 1.3 Environmental Specifications

Operating Temperature	-30°C to 50°C (-22°F to 122°F)
Storage Temperature	-40°C to 60°C (-40°F to 140°F)
Humidity	Up to 100% condensing
Maximum Altitude	3000 m (9840 ft) above sea level
Noise	< 70 dBA at 1 meter
Ingress Rating	IP66, NEMA 3R
Impact Rating	IK09
Seismic Rating	High seismic level, 1.0g ZPA, 2% damping per IEEE 693-2005

## 1.4 Product Configurations

Each inverter is configured by Tesla with one of the following:

- 1 to 10 Powerstages
- Four DC fuse variants: 5, 10, 15, or 20 pre-installed DC fuses (corresponding to the number of DC Powerpack Units installed with each inverter)

**Note:** Systems required to operate in grid-forming (islanding) mode have a maximum of 9 powerstages.

Powerpack Inverter part numbers end in an -XY-Z extension, where X is a number 0-9 that denotes the number of Powerstages ("0" denotes 10 Powerstages) and Y denotes the fuse configuration.

**Note:** Inverter configurations are at Tesla's discretion.

Number of Powerstages	65 kVA Nameplate Variant Power (kVA)					Max Continuous Current (A)
	400 VAC	420 VAC	440 VAC	450 VAC	480 VAC	
1	54	56	59.5	60.5	65	80
2	108	113	119	121.5	130	160
3	162	170	178.5	182.5	195	240
4	216	227	238	243.5	260	320
5	270	284	297.5	304.5	325	400
6	324	340.5	357	365	390	480
7	378	397	416.5	426	455	560
8	432	454	476	487	520	640
9	486	511	535.5	548	585	720
10	540	568	595	609	650	800
Number of Powerstages	70 kVA Nameplate Variant Power (kVA)					Max Continuous Current (A)
	400 VAC	420 VAC	440 VAC	450 VAC	480 VAC	
1	58	61	64	65.5	70	86
2	116	122	128	131	140	172
3	174	183	192	196.5	210	258
4	232	244	256	262	280	344
5	290	305	320	327.5	350	430
6	348	366	384	393	420	516
7	406	427	448	458.5	490	602
8	464	488	512	524	560	688
9	522	550	576	589.5	630	774
10	580	610	640	655	700	860

## 2 FEATURES

### 2.1 Voltage Ride-Through

**NOTE:** All listed LVRT and HVRT values apply to both 65 kVA and 70 kVA Powerstages.

The inverter has five voltage and time setpoints for low voltage ride-through (LVRT), configurable to the following ranges (measured as line to neutral):

**Table 1: Inverter LVRT Settings**

Parameter	Voltage Range	Time (sec)	Notes
LVRT Point 5	0 – 335 V	0-30	0.01 sec resolution
LVRT Point 4	0 – 335 V	0-30	0.01 sec resolution
LVRT Point 3	0 – 335 V	0-30	0.01 sec resolution
LVRT Point 2	0 – 335 V	0-30	0.01 sec resolution
LVRT Point 1	0 – 335 V	0-30	0.01 sec resolution

The inverter has four high voltage ride-through (HVRT) setpoints, with one instantaneous trip voltage setting, configurable to the following ranges (measured as line to neutral):

**Table 2: Inverter HVRT Settings**

Parameter	Voltage Range	Time (sec)	Notes
HVRT Point 3	0 – 335 V	0-30	0.01 sec resolution
HVRT Point 2	0 – 335 V	0-30	0.01 sec resolution
HVRT Point 1	0 – 335 V	0-30	0.01 sec resolution
HVRT max trip	0 – 335 V	N/A	

**Table 3: Maximum HVRT Values**

Nominal System Voltage	400 VAC	420 VAC	440 VAC	480 VAC
Maximum HVRT	145%	138%	130%	120%

The inverter ships with the following pre-defined settings:

**Table 4: Interconnection System Default Settings for Abnormal Voltages**

Voltage Range (% of base voltage)	Clearing Time (s)
$V < 45$	0.16
$45 \leq V < 60$	1
$60 \leq V < 88$	2
$110 < V < 120$	1
$V \geq 120$	0.16

## 2.2 Frequency Ride-Through

The inverter has three under-frequency (UF) and three over-frequency (OF) trip points and times, as well as one under-frequency instantaneous trip point and one over-frequency instantaneous trip point. These parameters are configurable to the following ranges:

**Table 5: Inverter Frequency Trip Points**

Trip Point	Frequency Range	Time (sec)	Notes
Instantaneous UF Trip	40 Hz-70 Hz	N/A	0.1 Hz resolution
UF Trip Time 3	40 Hz-70 Hz	0-600	0.1 Hz and 0.01 second resolution
UF Trip Time 2	40 Hz-70 Hz	0-600	0.1 Hz and 0.01 second resolution
UF Trip Time 1	40 Hz-70 Hz	0-600	0.1 Hz and 0.01 second resolution
OF Trip Time 1	40 Hz-70 Hz	0-600	0.1 Hz and 0.01 second resolution
OF Trip Time 2	40 Hz-70 Hz	0-600	0.1 Hz and 0.01 second resolution
OF Trip Time 3	40 Hz-70 Hz	0-600	0.1 Hz and 0.01 second resolution
Instantaneous OF Trip	40 Hz-70 Hz	N/A	0.1 Hz resolution

The following FQRT settings are pre-programmed in the inverter to comply with IEEE 1547 requirements:

**Table 6: Inverter FQRT Default Settings**

Function	Frequency (Hz)	Clearing Time (s)
UF1	< 57	0.16
UF2	< 59.5	2
OF1	> 60.5	2
OF2	> 62	0.16

## 2.3 Anti-Islanding Features

The Powerpack Inverter includes these anti-islanding features:

- Reconnection delay timer
- Active anti-islanding: Sandia Frequency Shift implemented on all systems
- Passive anti-islanding: Configurable Rate of Change of Frequency (ROCOF) preferences

The reconnection delay timer is configurable with the following settings:

**Table 7: Reconnection Delay Timer Default Settings**

Feature Name	Effect	Setting Range	Default
Reconnect Time Delay	The amount of time the inverter waits before reconnection, after the grid returns within the frequency and voltage windows defined above	0-1,000 sec	300 sec
Reconnect Min. Voltage	The minimum voltage at which the inverter interprets the grid is within tolerable conditions	0-415.5 V	240.99 V
Reconnect Max. Voltage	The maximum voltage at which the inverter interprets the grid is within tolerable conditions	0-415.5 V	293.62 V
Reconnect Min. Frequency	The minimum frequency at which the inverter interprets the grid is within tolerable conditions	40-70 Hz	59.3 Hz
Reconnect Max. Frequency	The maximum frequency at which the inverter interprets the grid is within tolerable conditions	40-70 Hz	60.5 Hz

ROCOF is configurable with the following settings:

**Table 8: ROCOF Settings**

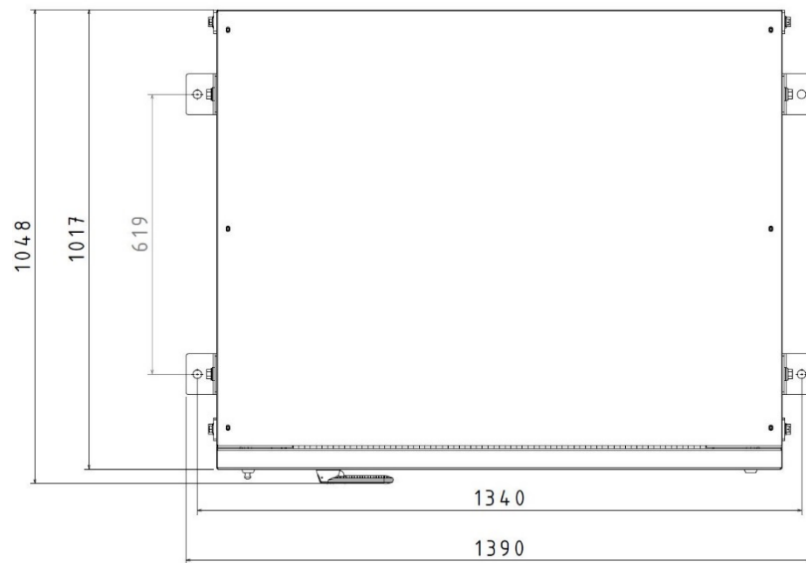
Feature Name	Effect	Setting Range	Default
ROCOF Enable	Turns ROCOF on or off	n/a	Off
ROCOF Fault Limit	Sets the rate of change required for a trip	0.1-100.0 Hz/sec	1 Hz/sec
ROCOF Time Delay	Sets how long the rate of change has to be present for the inverter to trip	0-1 seconds	1 second

## 2.4 Certifications

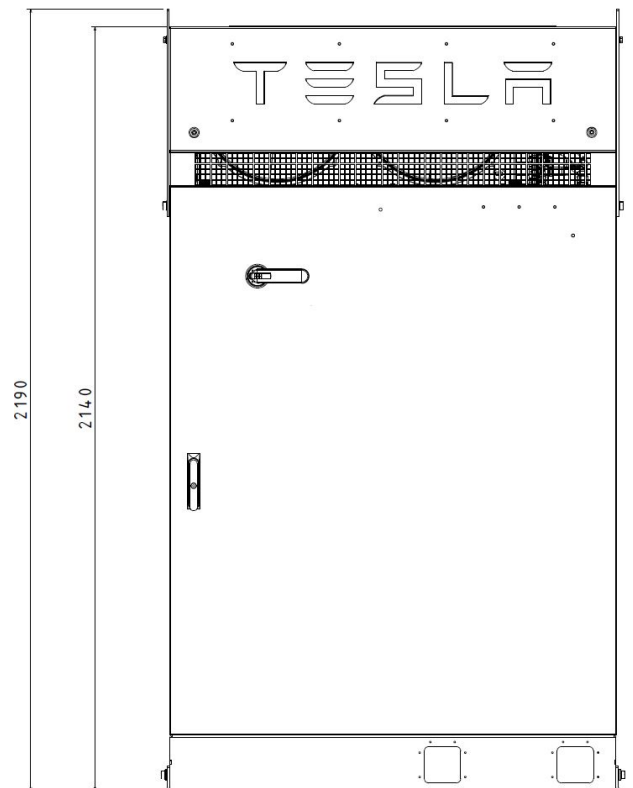
The Powerpack Inverter is compliant with grid codes and safety standards of all major markets. For a full list, see the Powerpack 2 System Compliance Package on the Partner Portal website:

<https://partners.teslamotors.com>

## 2.5 Dimensions



**Figure 1: Inverter Top View (in mm)**



**Figure 2: Inverter Front View (in mm)**



## Revision Log

<b>Revision #</b>	<b>Date</b>	<b>Description</b>	<b>Initials</b>
1.6	08-25-2017	<ul style="list-style-type: none"> <li>Added revision log</li> <li>Added inverter part number for clarity</li> </ul>	-
1.7	09-07-2017	<ul style="list-style-type: none"> <li>Clarified extensions of inverter part number</li> </ul>	-
1.8	10-03-2017	<ul style="list-style-type: none"> <li>Added specs for 70 kVA variant</li> </ul>	-
1.9	10-09-2017	<ul style="list-style-type: none"> <li>Updated units of measurement in VRT tables to Volts</li> </ul>	-
2.0	01-31-2018	<ul style="list-style-type: none"> <li>Removed harmonic data; see more comprehensive data in the document "Powerpack Inverter Interconnection Data"</li> <li>Removed list of specific certifications; see more comprehensive list of certifications in Compliance Packet</li> <li>Updated dimensions to include lifting eyes in product height instead of footnoting</li> <li>Updated more precise inverter weight</li> </ul>	-
2.1	08-09-2018	<ul style="list-style-type: none"> <li>Added data points at 420 VAC throughout</li> <li>Corrected overvoltage category and added pollution category</li> <li>Clarified max. HVRT by converting data to a table</li> </ul>	-
2.2	11-06-2018		-
2.3	2-12-2019	<ul style="list-style-type: none"> <li>Updated format</li> <li>Updated system enclosure measurements</li> <li>Updated system configuration language</li> <li>Added Initials column to Revision Log</li> </ul>	JK
2.4.0	10-01-2019	<ul style="list-style-type: none"> <li>Added note on Powerstage limitations for DC Balancer</li> <li>Added voltage tolerance spec</li> <li>Adjusted LVRT / HVRT time resolution</li> </ul>	AP / JK
2.4.1	10-16-2019	<ul style="list-style-type: none"> <li>Corrected Frequency Range to operating values</li> </ul>	JG / JC