

# CERTIFICATE OF COMPLIANCE

**Certificate Number** 20211109-E341165  
**Report Reference** E341165-20210317  
**Issue Date** 2021-11-09  
**Issued to:** Enphase Energy Inc.  
1420 N. McDowell Blvd. Petaluma, CA 94954-6515

**This is to certify that representative samples of**

Grid Support, Utility Interactive Supporting Energy Storage, Multimode, Bi-directional Microinverters

Models IQ8-60, IQ8PLUS-72, IQ8M-72, IQ8A-72, IQ8H-208-72, IQ8H-240-72, may be f/b -2, -5, -E, or -M, may be f/b -ACM, f/b -US, may be f/b -NM, may be f/b -RMA, may be f/b -&, where "&" designates additional characters.

Has been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

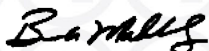
**Standard(s) for Safety:** See Page 2

**Additional Information:** See the UL Online Certifications Directory at [www.ul.com/database](http://www.ul.com/database) for additional information

This *Certificate of Compliance* is provided as a courtesy to help our customers communicate product compliance information, as documented in our UL Follow-Up Services procedure. This Certificate of Compliance does not provide authorization to apply the UL Mark. Only the UL Follow-Up Services Procedure provides authorization to apply the UL Mark.

Only those products bearing the UL Mark shall be considered as being UL Certified and covered under UL's Follow-Up Services. Look for the UL Certification Mark on the product.

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This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.

## Standards for Safety:

UL 62109-1, STANDARD FOR SAFETY OF POWER CONVERTERS FOR USE IN PHOTOVOLTAIC POWER SYSTEMS - PART 1: GENERAL REQUIREMENTS, Edition 1, Revision Date 04/30/2019

IEC 62109-2, SAFETY OF POWER CONVERTERS FOR USE IN PHOTOVOLTAIC POWER SYSTEMS - PART 2: PARTICULAR REQUIREMENTS FOR INVERTERS, Edition 1, Issue Date 06/2011

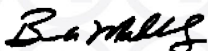
UL 1741, Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, Edition 2, Revision Date 06/10/2021, including the requirements in UL 1741 Supplement SA, sections as noted in the Technical considerations.

IEEE 1547, IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems.

IEEE 1547.1, IEEE Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.

CSA C22.2 No. 62109-1, Safety of Power Converters for Use in Photovoltaic Power Systems - Part 1: General Requirements, Edition 1, Issue Date 07/2016

CSA C22.2 No. 62109-2, Safety of Power Converters for Use in Photovoltaic Power Systems - Part 2: Particular Requirements for Inverters, Edition 1, Issue Date 07/2016



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Components covered by this certificate provide functionality in compliance with UL 1741 Supplement A (SA) when used in a UL Listed end product which has been evaluated by UL for its intended purpose. Compliance testing was conducted on samples of the products according to the test methods in the following sections of UL 1741 with compliant results:

Certified functions. Cross Reference table – UL 1741 SA to SRD	Source Requirement Document(s)	Test Standard(s) and Section(s)	Report Date
ANTI-ISLANDING PROTECTION - UNINTENTIONAL ISLANDING WITH GRID SUPPORT FUNCTIONS ENABLED	Electric Rule No. 21 Hh.1a	UL 1741 SA 8	2021-03-17
LOW/HIGH VOLTAGE RIDE THROUGH	Electric Rule No. 21 Table Hh.1	UL 1741 SA 9	2021-03-17
LOW/HIGH FREQUENCY RIDE THROUGH	Electric Rule No. 21 Table Hh.2	UL 1741 SA10	2021-03-17
RAMP RATES	Electric Rule No. 21 Table Hh.2k	UL 1741 SA 11	2021-03-17
RECONNECT BY "SOFT START"	Electric Rule No. 21 Hh.2k	UL 1741 SA 11	2021-03-17
SPECIFIED POWER FACTOR	Electric Rule No. 21 Hh.2i	UL 1741 SA 12	2021-03-17
DYNAMIC VOLT/VAR OPERATIONS	Electric Rule No. 21 Hh.2J	UL 1741 SA 13	2021-03-17
FREQUENCY-WATT	Electric Rule No. 21 Hh.2.L	UL 1741 SA 14	2021-03-17
VOLT-WATT	Electric Rule No. 21 Hh.2.m	UL 1741 SA 15	2021-03-17
DISABLE PERMIT SERVICE	Electric Rule No. 21 Hh.8.a	UL 1741 SA 17	2021-03-17
LIMIT ACTIVE POWER	Electric Rule No. 21 Hh.8.a	UL 1741 SA 18	2021-03-17

Testing conducted to the requirements of UL 1741 SA corresponds to the minimum requirements for CA Rule 21, 2015. An enumeration of functions tested, including complete ratings, and available certified settings for the Grid Support functions, are recorded in the appendix to this document. Test data and detailed results of compliance testing are retained in the complete UL Report for this product.



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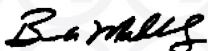


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## Appendix

Detailed Testing Summary	Test Standard(s) and Section(s)	Fixed / Adjustable	Pass / Fail
UNINTENTIONAL ISLANDING WITH GRID SUPPORT FUNCTIONS ENABLED	UL 1741 SA 8	Adjustable	Pass
HIGH VOLTAGE RIDE-THROUGH DURATION	UL 1741 SA 9.1	Adjustable	Pass
HIGH VOLTAGE RIDE-THROUGH / MUST TRIP MAGNITUDES	UL 1741 SA 9.2	Adjustable	Pass
HIGH VOLTAGE MUST TRIP CLEARING TIMES	UL 1741 SA 9.2	Adjustable	Pass
LOW VOLTAGE RIDE-THROUGH DURATION	UL 1741 SA 9.1	Adjustable	Pass
LOW VOLTAGE RIDE-THROUGH / MUST TRIP MAGNITUDES	UL 1741 SA 9.2	Adjustable	Pass
LOW VOLTAGE MUST TRIP CLEARING TIMES	UL 1741 SA 9.2	Adjustable	Pass
HIGH FREQUENCY RIDE-THROUGH DURATION	UL 1741 SA10.1	Adjustable	Pass
HIGH FREQUENCY RIDE-THROUGH / MUST TRIP MAGNITUDES	UL 1741 SA10.2	Adjustable	Pass
HIGH FREQUENCY MUST TRIP CLEARING TIMES	UL 1741 SA10.2	Adjustable	Pass
LOW FREQUENCY RIDE-THROUGH DURATION	UL 1741 SA10.1	Adjustable	Pass
LOW FREQUENCY RIDE-THROUGH / MUST TRIP MAGNITUDES	UL 1741 SA10.2	Adjustable	Pass
LOW FREQUENCY MUST TRIP CLEARING TIMES	UL 1741 SA10.2	Adjustable	Pass
NORMAL RAMP RATE	UL 1741 SA 11.2	Adjustable	Pass
"SOFT START" RAMP RATE	UL 1741 SA 11.4	Adjustable	Pass
SPECIFIED POWER FACTOR	UL 1741 SA 12	Adjustable	Pass
VOLT/VAR MODE (Q(V))	UL 1741 SA 13	Adjustable	Pass
FREQUENCY-WATT (FW)	UL 1741 SA 14	Adjustable	Pass
VOLT-WATT (VW)	UL 1741 SA 15	Adjustable	Pass
DISABLE PERMIT SERVICE	UL 1741 SA17	--	Pass
LIMIT ACTIVE POWER	UL 1741 SA18	Adjustable	Pass



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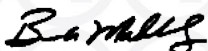
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Inverter Firmware Version:		
UL 1998 (grid support)	Date	Version/Revision
YES	2021-02-10	V2.19.01
YES	2021-03-15	V2.22.02
YES	2021-03-24	V2.23.01
YES	2021-06-22	V2.27.02
YES	2021-09-17	V2.38.02
YES	2021-11-03	V2.38.03

Generic Inverter Ratings - Output	240V	208V	Unit
Output phase configuration	L-L	L-L	--
Nominal (line to line) output voltage V ac	240	208	V
Operating voltage range V ac	211-264	183-229	V
Normal out frequency Hz	60	60	Hz
Rated output current (A ac)	1.6	1.73	A
Rated output power, (W)	384	360	W

Ratings output per specific model described below:	240 V	208 V
Rated output current (A ac) IQ8H	1.58	1.73
Rated output power (W) IQ8H	380	360
Rated output current (A ac) IQ8A	1.45	-
Rated output power (W) IQ8A	349	-
Rated output current (A ac) IQ8M	1.35	-
Rated output power (W) IQ8M	325	-
Rated output current (A ac) IQ8PLUS	1.21	-
Rated output power (W) IQ8PLUS	290	-
Rated output current (A ac) IQ8	1.0	-
Rated output power (W) IQ8	240	-



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<i>Manufacturers stated accuracy of Voltage measurement L-L</i>	<i>MSAvL-L</i>	1.00%	%Vnom
<i>Manufacturers stated accuracy of Voltage measurement L-N</i>	<i>MSAvL-N</i>	1.00%	%Vnom
Manufacturer's stated accuracy of time response (for Voltage trips) stated in percent, with fixed minimum limits	% based limits		
	0.033	Minimum accuracy (sec)	
	5.000	Time setting below which minimum accuracy applies (Sec)	
	1.00%	Percent (%) accuracy above minimum time setting.	

<i>Manufacturers stated accuracy of frequency measurement</i>	<i>MSAHZ</i>	0.10	Hz
Manufacturer's stated accuracy of time response (for Frequency trips) stated in percent, with fixed minimum limits	% based limits		
	0.033	Minimum accuracy (sec)	
	5.000	Time setting below which minimum accuracy applies (Sec)	
	1.00%	Percent (%) accuracy above minimum time setting.	

<b>Other ratings:</b>	
Max. output fault current (A) / duration (ms)	52 A rms for 100 ms
Max. utility backfeed current to PV input (A)	0.018 A
Line Synchronization Characteristics / In-rush current	Method 2 / 0.57 A
Enclosure Ratings	Type 6
Operating Temperature range	-40°C to 60°C

<b>INTERCONNECTION INTEGRITY TEST CATEGORIES:</b>	
C62.42.2 Ring Wave Surge Category	Category B (6kV)
C62.42.2 Combination Wave Surge Category	Category B (6kV, 3kA)
C37.90.1 RF Immunity - compliance	Yes
C37.90.2 Communication circuit - compliance	N/A



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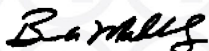
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Magnitude and time Limits - Utility interconnection voltage magnitude limits, Ride Through time limits and trip times:						
Nominal voltage	Single / Split phase					
UL 1741 SA9:	Magnitudes (% of nominal)		Ride Through (Seconds) (+)		Must Trip (Seconds)	
Boundary designation (++)	Min	Max	Min	Max	Min	Max
HV3	106%	122%	0.000	0.000	0.100	0.500
HV2	104%	120%	0.300	19.800	0.160	20.000
HV1	102%	120%	0.800	299.800	1.000	300.000
LV1	70%	98%	0.300	299.800	0.500	300.000
LV2	50%	96%	0.100	149.800	0.200	150.000
LV3	48%	94%	0.600	29.800	0.100	30.000
LV4	0%	0%	0.000	0.000	0.000	0.000

Magnitude and time Limits - Utility interconnection Frequency magnitude limits, Ride Through time limits and trip times:						
Nominal Frequency:	60 Hz					
UL 1741 SA10:	Magnitudes (Frequency)		Ride Through (Seconds) (+)		Must Trip (Seconds)	
Boundary designation	Min	Max	Min	Max	Min	Max
HF3	0.00	0.00	0.000	0.000	0.000	0.000
HF2	60.10	66.00	0.000	0.000	0.100	1000.0
HF1	60.10	66.00	0.3	999.0	0.5	1000.0
LF1	50.00	59.90	0.3	999.0	0.5	1000.0
LF2	49.90	57.00	0.000	0.000	0.100	1000.0
LF3	0.00	0.00	0.000	0.000	0.000	0.000

SA11 Ramp Rate test ratings (RR/SSRR)		
Minimum <b>normal</b> ramp-up rate	1.0 %	%Irated/SEC
Maximum <b>normal</b> ramp-up rate	100 %	%Irated/SEC
Minimum <b>soft start</b> ramp-up rate	0.1 %	%Irated /SEC
Maximum <b>soft start</b> ramp-up rate	100 %	%Irated /SEC



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<b>SA12 SPF Specified Power Factor (INV3)</b>	
Minimum Inductive (Underexcited) Power Factor (<0)	- 0.85
Minimum Capacitive (Overexcited) Power Factor (>0)	+ 0.85

<b>SA13 Volt/Var Mode (VV) extent of curve range settings</b>				
Settings		Qmax Values – Minimums	Qmin Values – Maximums	Units
Reactive power production setting	Q <sub>1</sub>	0.00	0.53	VAR
Reactive power absorption setting at the left edge of the deadband	Q <sub>2</sub>	-0.53	0.53	VAR
Reactive power absorption setting at the right edge of the deadband	Q <sub>3</sub>	-0.53	0.53	VAR
Reactive power absorption setting	Q <sub>4</sub>	-0.53	0.00	VAR
Functional in the following priority modes: [X] active power [X] reactive power				

Settings		Minimum	Maximum	Units
The voltage at Q <sub>1</sub>	V <sub>1</sub>	0.80	0.98	%Vnom
The voltage at Q <sub>2</sub>	V <sub>2</sub>	0.90	1.00	%Vnom
The voltage at Q <sub>3</sub>	V <sub>3</sub>	1.00	1.10	%Vnom
The voltage at Q <sub>4</sub>	V <sub>4</sub>	1.02	1.19	%Vnom

<b>SA14 Frequency-Watt (FW) extent of curve range settings</b>				
Settings	Frequency		Power level	
Low end of the adjustment range of the start of the curtailment function	F <sub>start_min</sub>	60.017	58.000	%Watts
High end of the adjustment range of the start of the curtailment function	F <sub>start_max</sub>	62.000	59.983	%Watts
Low end of the adjustment range of the endpoint of the curtailment function	F <sub>stop_min</sub>	0.008	0.008	%Watts
High end of the adjustment range of the endpoint of the curtailment function	F <sub>stop_max</sub>	0.083	0.083	%Watts



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## SA15 Volt-Watt (VW) extent of curve range settings

Settings	Volts		Power level	
	Low end of the adjustment range of the start of the curtailment function	V <sub>start_min</sub>	101%	100%
High end of the adjustment range of the start of the curtailment function	V <sub>start_max</sub>	109.0%	100 %	%Watts
Low end of the adjustment range of the endpoint of the curtailment function	V <sub>stop_min</sub>	102.5%	0 %	%Watts
High end of the adjustment range of the endpoint of the curtailment function	V <sub>stop_max</sub>	115.0%	0 %	%Watts



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