

CERTIFICATE OF COMPLIANCE

Certificate Number 20190107-E341165
Report Reference E341165-20171030
Issue Date 2019-01-07

Issued to: Enphase Energy Inc.
1420 N. McDowell Blvd. Petaluma, CA 94954-6515

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

Photovoltaic Grid Support Utility Interactive Inverter with Rapid Shutdown
Functionality

Models IQ7-60, IQ7PLUS-72, IQ7X-96, may be f/b -2, 5, or ACM, f/b -
US, may be f/b -NM

Models IQ7PD-72-2-US and IQ7PD-84-2-US

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

Standard(s) for Safety:

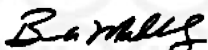
UL 1741, Standard for Safety for Inverters, Converters, Controllers
and Interconnection System Equipment for Use With Distributed
Energy Resources, UL 1741, Second Edition, dated January 28,
2010. Including the requirements in UL 1741 Supplement SA,
sections as noted in the Technical considerations.
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.
UL 62109-1, Safety of Converters for Use in Photovoltaic Power
Systems - Part 1: General Requirements; IEC 62109-2, Safety of
Power Converters for use in Photovoltaic Power Systems - Part 2:
Particular Requirements for Inverters.
CSA C22.2 No. 107.1-01, General Use Power Supplies.

Additional Information:

See the UL Online Certifications Directory at
www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's
Certification and Follow-Up Service.

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:

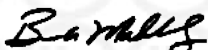
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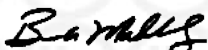
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Components covered by this certificate provide functionality in compliance with UL 1741 Supplement A (SA) when used in a UL Listed end product which has been evaluated by UL for its intended purpose. Compliance testing was conducted on samples of the 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	2019-01-07
LOW/HIGH VOLTAGE RIDE THROUGH	Electric Rule No. 21 Table Hh.1	UL 1741 SA 9	2019-01-07
LOW/HIGH FREQUENCY RIDE THROUGH	Electric Rule No. 21 Table Hh.2	UL 1741 SA10	2019-01-07
RAMP RATES	Electric Rule No. 21 Table Hh.2k	UL 1741 SA 11	2019-01-07
RECONNECT BY "SOFT START"	Electric Rule No. 21 Hh.2k	UL 1741 SA 11	2019-01-07
SPECIFIED POWER FACTOR	Electric Rule No. 21 Hh.2i	UL 1741 SA 12	2019-01-07
DYNAMIC VOLT/VAR OPERATIONS	Electric Rule No. 21 Hh.2J	UL 1741 SA 13	2019-01-07
FREQUENCY-WATT	Electric Rule No. 21 Hh.2.L	UL 1741 SA 14	2019-01-07
VOLT-WATT	Electric Rule No. 21 Hh.2.m	UL 1741 SA 15	2019-01-07

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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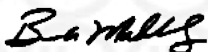


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Appendix

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



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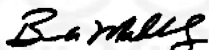
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Inverter Firmware Version:		
UL 1998 (grid support)	Date	Version/Revision
N/A	09/01/2017	V02.10.00
Yes	12/19/2017	V02.12.00
Yes	06/22/2018	V02.14.02

Inverter Ratings - Output	Model IQ7-60	
Output phase configuration	Single phase	Split phase
Nominal (line to line) output voltage V ac	208 V	240 V
Operating voltage range V ac	183-229 V	211-264 V
Normal out frequency Hz	47-68 Hz	47-68 Hz
Rated output current (A ac)	1.15 A	1.00 A
Rated output power, (kW)	240 VA	240 VA
Max. Branch Circuit overcurrent protection (A ac)	20 A	20 A
Maximum Air Ambient (°C)	65°C	65°C

Inverter Ratings - Output	Model IQ7Plus-72	
Output phase configuration	Single phase	Split phase
Nominal (line to line) output voltage V ac	208 V	240 V
Operating voltage range V ac	183-229 V	211-264 V
Normal out frequency Hz	47-68 Hz	47-68 Hz
Rated output current (A ac)	1.42 A	1.23 A
Rated output power, (kW)	290 VA	290 VA
Max. Branch Circuit overcurrent protection (A ac)	20 A	20 A
Maximum Air Ambient (°C)	65°C	65°C

Inverter Ratings - Output	Model IQ7X-96	
Output phase configuration	Single phase	Split phase
Nominal (line to line) output voltage V ac	208 V	240 V
Operating voltage range V ac	183-229 V	211-264 V
Normal out frequency Hz	47-68 Hz	47-68 Hz
Rated output current (A ac)	1.51	1.31
Rated output power, (kW)	0.315	0.315
Max. Branch Circuit overcurrent protection (A ac)	20 A	20 A
Maximum Air Ambient (°C)	60°C	60°C



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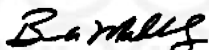
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Inverter Ratings - Output	IQ7PD-72-2-US	
Output phase configuration	Single phase	Split phase
Nominal (line to line) output voltage V ac	208 V	240 V
Operating voltage range V ac	183-229 V	211-264 V
Normal out frequency Hz	47-68 Hz	47-68 Hz
Rated output current (A ac)	0.92	0.80
Rated output power, (kW)	0.190	0.190
Max. Branch Circuit overcurrent protection (A ac)	20 A	20 A
Maximum Air Ambient (°C)	65°C	65°C

Inverter Ratings - Output	IQ7PD-84-2-US	
Output phase configuration	Single phase	Split phase
Nominal (line to line) output voltage V ac	208 V	240 V
Operating voltage range V ac	183-229 V	211-264 V
Normal out frequency Hz	47-68 Hz	47-68 Hz
Rated output current (A ac)	1.06	0.88
Rated output power, (kW)	0.210	0.210
Max. Branch Circuit overcurrent protection (A ac)	20 A	20 A
Maximum Air Ambient (°C)	65°C	65°C

Other ratings:	
Max. output fault current (A) / duration (ms)	5.8 A rms for 100 ms
Max. utility backfeed current to PV input (A)	0.08 A
Line Synchronization Characteristics / In-rush current	Method 2 / 0.9 A
Limits of accuracy of voltage measurement	+/- 1 % (of Volts nominal)
Limits of accuracy of frequency measurement	+ /- 0.1 Hz
Manufacturers stated accuracy of time response for voltage trips	+/- 2 line cycles or 0.1%
Manufacturers stated accuracy of time response for frequency trips	+/- 2 line cycles or 0.1%
Enclosure Ratings	Type 6



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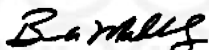
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INTERCONNECTION INTEGRITY TEST CATEGORIES:	
C62.42.2 Ring Wave Surge Category	Category B (6kV, 500A)
C62.42.2 Combination Wave Surge Category	Category B (6kV, 3kA)
C37.90.1 RF Immunity - compliance	Yes
C37.90.2 Communication circuit - compliance	N/A

<u>Magnitude and time Limits</u> - 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 %	N/A	N/A	0.1	0.5
HV2	104 %	120 %	0.3	19.8	0.5	20.0
HV1	102 %	115 %	0.8	299.8	1.0	300.0
LV1	70 %	98 %	0.3	299.8	0.5	300.0
LV2	50 %	96 %	0.1	149.8	0.2	150.0
LV3	48 %	94 %	0.06	29.8	0.1	30.0

<u>Magnitude and time Limits</u> - 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	N/A	N/A	N/A	N/A	N/A	N/A
HF2	60.1	65	N/A	N/A	0.1	0.5
HF1	60.1	65	0.3	599.8	0.5	600
LF1	50	59.9	0.3	599.8	0.5	600
LF2	49.9	57.0	N/A	N/A	0.1	0.5
LF3	N/A	N/A	N/A	N/A	N/A	N/A



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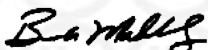


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SA11 Ramp Rate test ratings (RR/SSRR)		
Minimum normal ramp-up rate	1.0 %	%Irated/SEC
Maximum normal ramp-up rate	100 %	%Irated/SEC
Minimum soft start ramp-up rate	0.1 %	%Irated /SEC
Maximum soft start ramp-up rate	100 %	%Irated /SEC

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



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SA13 Volt/Var Mode (VV) extent of curve range settings

Units operating at 208V:

Settings		Qmax Values - Maximums	Qmin Values - Minimums	Units
Reactive power production setting	Q ₁	154	0.00	VAR
Reactive power absorption setting at the left edge of the deadband	Q ₂	154	-154	VAR
Reactive power absorption setting at the right edge of the deadband	Q ₃	154	-154	VAR
Reactive power absorption setting	Q ₄	0.00	-154	VAR

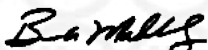
Functional in the following priority modes: active power reactive power

Units operating at 240V:

Settings		Qmax Values - Maximums	Qmin Values - Minimums	Units
Reactive power production setting	Q ₁	185	0.00	VAR
Reactive power absorption setting at the left edge of the deadband	Q ₂	185	-185	VAR
Reactive power absorption setting at the right edge of the deadband	Q ₃	185	-185	VAR
Reactive power absorption setting	Q ₄	0.00	-185	VAR

Functional in the following priority modes: active power reactive power

Settings		Maximum	Minimum	Units
The voltage at Q ₁	V ₁	97 %	80 %	%Vnom
The voltage at Q ₂	V ₂	99 %	90 %	%Vnom
The voltage at Q ₃	V ₃	110 %	101 %	%Vnom
The voltage at Q ₄	V ₄	119 %	103 %	%Vnom



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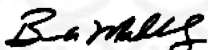
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SA14 Frequency-Watt (FW) extent of curve range settings

Settings	Frequency		Power level	
	Low end of the adjustment range of the start of the curtailment function	F _{start_min}	60.1	100 %
High end of the adjustment range of the start of the curtailment function	F _{start_max}	62.0	100 %	%Watts
Low end of the adjustment range of the endpoint of the curtailment function	F _{stop_min}	62.5	0 %	%Watts
High end of the adjustment range of the endpoint of the curtailment function	F _{stop_max}	65.0	0 %	%Watts

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 _{start_min}	101 %	100%
High end of the adjustment range of the start of the curtailment function	V _{start_max}	108 %	100 %	%Watts
Low end of the adjustment range of the endpoint of the curtailment function	V _{stop_min}	103%	0 %	%Watts
High end of the adjustment range of the endpoint of the curtailment function	V _{stop_max}	115 %	0 %	%Watts



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