Certificate of Compliance

Certificate: 2708151 **Master Contract:** 259813

Project: 2708151 **Date Issued:** March 6, 2014

Issued to: ABB, Inc.
16250 W. Glendale Drive
New Berlin, WI 53151
USA

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US or with adjacent indicator 'US' for US only or without either indicator for Canada only.

C US

Issued by: Jocelyn Jens
Product Group Coordinator

Authorized by: Lindsay Clark
Operations Manager

PRODUCTS

CLASS 5311 09 - POWER SUPPLIES - Distributed Generation Power Systems Equipment
CLASS 5311 89 - POWER SUPPLIES - Distributed Generation - Power Systems Equipment
- Certified to U.S. Standards

Transformerless Utility Interactive Inverter, Models UNO-8.6-TL-OUTD-S-US-A, UNO-8.6-TL-OUTD-S-US-Z-A, UNO-7.6-TL-OUTD-S-US-A and UNO-7.6-TL-OUTD-S-US-Z-A, permanently connected

For details related to rating, size, configuration, etc. reference should be made to the CSA Certification Record or the Certificate of Compliance Annex A.

APPLICABLE REQUIREMENTS

CSA C22.2 No. 107.1-01	-	General Use Power Supplies
*UL Std. No. 1741-2nd Edition	-	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources (January 28, 2010)
UL CRD	-	Non-Isolated EPS Interactive PV Inverters Rated Less Than 30kVA
UL 1699B	-	Outline of Investigation for Photovoltaic (PV) DC Arc-Fault Circuit Protection (Issue Number 2, January 14, 2013)
CSA TIL M-07	-	Interim Certification Requirements for Photovoltaic (PV) DC Arc Fault Protection (Issue Number 1, March 11, 2013)

*Note: Conformity to UL 1741-Second Edition (January 28, 2010) includes compliance with applicable requirements of IEEE 1547 and IEEE 1547.1

ANNEX A - Ratings for Certificate of Compliance

Transformerless Utility Interactive Inverter, Models UNO-8.6-TL-OUTD-S-US-A, UNO-8.6-TL-OUTD-S-US-Z-A, UNO-7.6-TL-OUTD-S-US-A and UNO-7.6-TL-OUTD-S-US-Z-A, permanently connected, system ratings as follows:

	Models UNO-8.6-TL-OUTD-S-US-A and UNO-8.6-TL-OUTD-S-US-Z-A	Models UNO-7.6-TL-OUTD-S-US-A and UNO-7.6-TL-OUTD-S-US-Z-A
Maximum Input Voltage (DC)	600 V dc	600 V dc
Range of Input Operating Voltage (DC)	90-580 V dc, 380 V dc nominal	90-580 V dc, 380 V dc nominal
Range of Input Operating Voltage (DC) at Full Power	200-480 Vdc	200-480 Vdc
Maximum Input Current (DC)	24 A (Each Input - 2 provided)	24 A (Each Input - 2 provided)
Maximum Input Short Circuit Current (DC)	30 A (Each Input - 2 provided)	30 A (Each Input - 2 provided)
Maximum Utility Backfeed Current (AC)	0 A	0 A
Output Power Factor Rating	>0.995 Adjustable range +0.9 to -0.9 (+/-0.8 at 8.6 kVA max.)	>0.995 Adjustable range +0.9 to -0.9 (+/-0.8 at 7.6 kVA max.)
Operating Voltage Range (AC) (See Note 2)	244-304 V ac for 277 V ac configuration 211-264 V ac for 240 V ac configuration	244-304 V ac for 277 V ac configuration 211-264 V ac for 240 V ac configuration 183-228 V ac for 208 V ac configuration
Operating Frequency Range (HZ)	59.3-60.5 Hz (Default)	59.3-60.5 Hz (Default)
Field Adjustable Operating Frequency Range (HZ)	57.0-59.8 Hz, 60.2-63.0 Hz	57.0-59.8 Hz, 60.2-63.0 Hz
Nominal Output Voltage (AC) (See Notes 2 & 3)	277 V ac / 240 V ac	277 V ac / 240 V ac / 208 V ac
Normal Output Frequency	60 Hz	60 Hz
Continuous Output Current (AC)	31A/ 36A	27.5A / 32A / 36.5A
Maximum Continuous Output Power (AC) (See Note 6)	8600W	7600W
Maximum Output Fault Current and Duration	See Note 8	See Note 8
Maximum Output Overcurrent Protection	40A / 50A	40A / 40A / 50A
Utility Interconnection and Voltage and Frequency Trip Limits and Trip Times	See Note 5	See Note 5
Trip Limit and Trip Time Accuracy	Voltage: +/- 2% Frequency: +/- 0.10 Hz Time: 2 grid cycles (33 ms @ 60 Hz)	Voltage: +/- 2% Frequency: +/- 0.10 Hz Time: 2 grid cycles (33 ms @ 60 Hz)
Normal Operation Temperature Range	-25°C to 60°C (See Note 6)	-25°C to 60°C (See Note 7)
Output Power Temperature Derating and Maximum Full Power Operating Ambient	-25°C to 50°C (See Note 6)	-25°C to 50°C (See Note 7)
Enclosure Rating Type	4X	4X

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Firmware Version:

Device	Device Version	Device Checksum
DSP Booster	A009	abf01821b3d1f3c7
DSP Inverter	B00C	3413bc0e0241c5a2
MICRO Microprocessor	C00D	01cada377bf69893
Display	D009	eca5d7875e8d5d02

ARCFAULT-Module

Device	Device Version	Device Checksum
DSP Arc Detector	B.2.3.3	N/A

Notes:

1. Inverter, Models UNO-8.6-TL-OUTD-S-US-A, UNO-8.6-TL-OUTD-S-US-Z-A, UNO-7.6-TL-OUTD-S-US-A and UNO-7.6-TL-OUTD-S-US-Z-A have been evaluated for use in utility-interactive applications.

2. The output of Inverter, Models UNO-8.6-TL-OUTD-S-US-A and UNO-8.6-TL-OUTD-S-US-Z-A may be 277 V ac or 240 V ac, which is user settable based on the utility system.

3. The output of Inverter, Models UNO-7.6-TL-OUTD-S-US-A and UNO-7.6-TL-OUTD-S-US-Z-A may be 277 V ac, 240 V ac or 208 V ac, which is user settable based on the utility system.

4. These models are provided with PV DC Arc Fault Protection (AFCI) for series arcing faults.

5. Utility Interconnection and Voltage and Frequency Trip Limits and Trip Times:

Condition	Simulated utility source		Maximum time (sec) at 60 Hz before cessation of current to the simulated utility
	Voltage (V)	Frequency (Hz)	
A	$< 0.50\ V_{nor}$ (Fixed)	Rated (60 Hz)	0.16 (Fixed)
B	$0.50\ V_{nor} \leq V < 0.88\ V_{nor}$ (Adjustable Set Points 50% to 88%)	Rated (60 Hz)	2 (Default) (Adj. Set Points 0.16 to 5s)
C	$1.10\ V_{nor} < V < 1.20\ V_{nor}$(*) (Adj. Set Points 110% to 115%)	Rated (60 Hz)	1 (Default) (Adj. Set Points 0.16 to 5s)
D	(*)$1.20\ V_{nor} \leq V$ (Fixed)	Rated (60 Hz)	0.16 (Fixed)
E	Rated	f > 60.5 Hz (Default) (Adj. 60.2 to 63.0 Hz)	0.16 (Default) (Adj. 0.16 to 300 sec)
F	Rated	f < 59.3 Hz (Default) (Adj. 59.8 to 57.0 Hz)	0.16 (Default) (Adj. 0.16 to 300 sec)
G	Rated	f < 57.0 Hz	0.16 (Fixed)
H	Rated	f > 63.0 Hz	0.16 (Fixed)
I	Reconnection 300s (Default) (Adj. 2s to 300s)		

[a] When a utility frequency other than 60 Hz is used for the test, the maximum number of cycles it takes to cease to export power to the simulated utility shall not exceed the number of cycles a utility frequency of 60 Hz takes regardless of the time the inverter takes to cease to export power to the simulated utility.

[b] V is the nominal output voltage rating.

(*) Note: For model at 277 V High Voltage is fixed at 110% V_{nor} and Very High Voltage is fixed at 115% V_{nor}.

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6. Maximum output power for model UNO-8.6-TL-OUTD-S-US series can be delivered only with an input voltage range of:

200-480 V dc for 240 V ac configuration
200-480 V dc for 277 V ac configuration

240 V ac

Volts dc	-25C	+25C	+40C	+50C	+60C
150	6845	7037	7025	7083	6236
200	8796	8835	8850	8867	7192
280	8810	8853	8834	8840	7976
335	8779	8838	8849	8846	8542
475	8820	8852	8845	8848	8844

277 V ac

Volts dc	-25C	+25C	+40C	+50C	+60C
150	6852	7130	7137	7136	6178
200	8809	8842	8846	8850	7258
280	8793	8829	8827	8839	8210
335	8721	8827	8826	8840	8517
475	8792	8822	8826	8837	8837

7. Maximum output power (W ac) for model UNO-7.6-TL-OUTD-S-US series can be delivered only with an input voltage range of:

200-480 V dc for 208 V ac configuration
200-480 V dc for 240 V ac configuration
200-480 V dc for 277 V ac configuration

208 V ac

Volts dc	-25C	+25C	+40C	+50C	+60C
150	6789	7038	7026	7023	6093
200	7747	7770	7778	7785	6954
280	7749	7765	7782	7791	7646
335	7751	7770	7777	7784	7786
475	7748	7773	7782	7793	7800

240 V ac

Volts	-25C	+25C	+40C	+50C	+60C
150	7085	7080	7082	7078	6222
200	7856	7851	7860	7866	7112
280	7854	7851	7858	7872	7856
335	7856	7851	7861	7872	7861
475	7852	7854	7858	7873	7847

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277Vac

Volts	-25C	+25C	+40C	+50C	+60C
150	7134	7134	7137	7125	6076
200	7853	7851	7836	7845	7112
280	7847	7849	7835	7843	7846
335	7849	7849	7845	7831	7848
475	7852	7848	7841	7836	7847

8. Maximum Output Fault Current and Duration:

Models	Output Voltage	Fault Current RMS (A) @ 1 cycle	Fault Current RMS (A) @ 3 cycles	Fault Current PK (A)	Total Overall Duration (mSec)
UNO-8.6-TL-OUTD-S-US-A and UNO-8.6-TL-OUTD-S-US-Z-A	240	44.4	32.2	162	141
	277	42.9	29.3	200	140

Models	Output Voltage	Fault Current RMS (A) @ 1 cycle	Fault Current RMS (A) @ 3 cycles	Fault Current PK (A)	Total Overall Duration (mSec)
UNO-7.6-TL-OUTD-S-US-A and UNO-7.6-TL-OUTD-S-US-Z-A	208	38.7	24.7	174	140
	240	36.8	25.8	124	141
	277	40.7	28.9	188	141

9. These inverter models are intended to be used in ungrounded photovoltaic power systems, with ungrounded PV source and PV output circuits, in conjunction with the requirements specified in the National Electrical Code, ANSI/NFPA 70, section 690.35.

10. All models meet the surge requirements of IEEE C62.41.2-2002, Location Category B (6kV). Tests were performed using ring wave and combination waveforms, both polarities, for common mode and differential model coupling, 20 pulses each test. After surge testing the units were optional with control functionally verified by frequency and voltage disconnect tests.

MARKINGS

The manufacturer is required to apply the following markings:

- Products shall be marked with the markings specified by the particular product standard.
- Products certified for Canada shall have all Caution and Warning markings in both English and French.

Additional bilingual markings not covered by the product standards may be required by the Authorities Having Jurisdiction. It is the responsibility of the manufacturer to provide and apply these additional markings, where applicable, in accordance with the requirements of those authorities.

The following markings appear on the enclosure by silk-screening, permanent ink stamping, on adhesive labels that appear on the CSA List of Accepted Adhesive Nameplates, or by other permanent method:

1. Submittor's name and/or CSA Master Contract number "259813";
2. Model designation;
3. Date code or date-traceable serial number;

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4. The CSA Monogram with the "C" and "US" indicators (the products are eligible to bear the CSA Mark with adjacent indicators 'C' and 'US' for Canada and US, or with adjacent indicator 'US' for US only, or without either indicator for Canada only), and optionally marked with "UL 1741" and/or "CSA C22.2 No 107.1-01";
5. "Transformerless (or Non-Isolated), Utility-Interactive Inverter";
6. The electrical ratings (specified for Utility Interactive) other than items a, d, e, m, n, q, r, s, t and u specified in the following table:

Rating type	Utility interactive	Stand-alone	Utility interactive with charge control[d]	Stand-alone with charge control[d]	ISE	Charge controllers[d]
a) Maximum input voltage[a]	X[b]	X	X	X	X	X
b) Range of input operating voltage	X[b]	X	X	X	X	X
c) Maximum input current (ac or dc)	X[b]	X	X	X		X
d) Maximum input short circuit current	X[b]	X	X	X	X	X
e) Maximum input source backfeed current to input source [see 47.6.2]	X		X			
f) Output power factor rating	X	X	X	X		
g) Operating voltage range (ac)	X	X	X	X	X	X
h) Operating frequency range or single frequency	X	X	X	X		X
i) Nominal output voltage (ac)	X	X	X	X		
j) Normal output frequency	X	X	X	X		
k) Maximum continuous output current (ac)	X	X	X	X		
l) Maximum continuous output power (ac)	X	X	X	X		
m) Maximum output fault current (ac) and duration [see 47.3.3]	X	X	X	X		
n) Maximum output overcurrent protection[c]	X	X	X	X		
o) Nominal output voltage (dc)			X	X		
p) Charging output voltage operation range (dc)			X	X		X
q) Utility interconnection voltage and frequency trip limits and trip times	X				X	
r) Synchronization in-rush current	X					
s) Trip limit and trip time accuracy	X		X		X	
t) Normal operation temperature range	X	X	X	X	X	X
u) Output power temperature derating and maximum full power operating ambient[e]	X	X	X	X		X

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Rating type	Utility interactive	Stand-alone	Utility interactive with charge control[d]	Stand-alone with charge control[d]	ISE	Charge controllers[d]
Note - A nationally accepted conventional abbreviation may be used for the rating type. [a] The maximum input voltage determined in accordance with Section 690.7(a) of the National Electrical Code, NFPA 70, may be used for photovoltaic inverters and charge controllers. [b] Not required for ac modules. [c] Normally the branch-circuit overcurrent protection. [d] Charging of batteries is able to originate from dc or ac sources. The rating types for either ac or dc are to be applied accordingly. [e] Only for units that derate with output temperature.						

7. Each unit that may be produced or assembled at more than one factory is provided with a distinctive marking - which is able to be in code - to identify the product of a particular factory;

8. The AC Terminals are identified (Line 1, Line 2, N, PE);

9. The DC positive and negative terminals are identified by the symbols "PV+" and "PV-", or color coding - red for positive and black for negative, or equivalent wording;

10. The means for equipment grounding provided for each PV Input Circuit (PV Frame) are identified by being marked with "G", "GR", "GND", "Ground", "Grounding", or equivalent symbol adjacent to the grounding terminals;

11. Field-wiring terminals shall be identified with AWG size, 75°C or 90°C, Copper Wire Only or with a marking to refer to instruction manual for reference to the Canadian Electrical Code, CEC Table 2 and Table 4 (for Canada); National Electrical Code, NFPA Table 310.15(B)(16), formerly Table 310.16 (for US), for suitable wire size (AWG) and to use wire rated for 75°C or 90ºC (167°F or 194 °F) and Copper Wire Only.

12. Pressure terminal connector for field wiring connections shall be provided with a marking making reference to the instruction manual for the tightening torque to be applied to the wiring terminals;

13. The indicators on the display panel are identified;

14. A marking shall be provided identifying the disconnect device for the output ac and dc power circuits.

15. The enclosure shall be marked "TYPE 4X";

16. Model –A inverters shall be marked "Photovoltaic Arc-Fault Circuit Protection" or equivalent, and "Type 1", and be visible after installation (as per UL1699B, section 50);

17. CAUTIONARY MARKINGS: A cautionary marking shall be prefixed by the word "CAUTION", "WARNING", or "DANGER" in letters not less than 3.2 mm (1/8 in.) high. The remaining letters shall not be less than 1.6 mm (1/16 in.) high. A cautionary marking shall be:

    (a) Located on a part that cannot be removed without impairing the operation of the inverter, (such as the product front cover); and
    (b) Visible and legible to the operator during the normal operation of the inverter.

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Exception: Cautionary markings pertaining to internal parts that are applicable only to service personnel are to be located internally in an appropriate location with respect to the parts of concern.

(i) The unit shall be marked with the following warning or equivalent, "CAUTION - Risk of Electric Shock, Do Not Remove Cover. No User Serviceable Parts Inside. Refer Servicing To Qualified Service Personnel."

(ii) The inverter shall be marked with the word "CAUTION" and the following words, "Risk Of Electric Shock" - and the following or the equivalent. The marking shall be either located on the outside of the unit or shall be prominently visible with any cover or panel opened or removed:

(a) "Both ac and dc voltage sources are terminated inside this equipment. Each circuit must be disconnected individually and the service person must wait 5 minutes before servicing", and

b) "When the photovoltaic array is exposed to light, it supplies a dc voltage to this equipment."

c) A removable panel covering a capacitor in accordance with Exception No. 1 to 11.2.3 shall be marked “CAUTION – Risk of electric shock from energy stored in capacitor” and the following or equivalent wording: “Do not remove cover until 5 minutes after disconnecting all sources of supply”.

d) Products intended for connection to ungrounded arrays shall be marked as follows: “WARNING: ELECTRIC SHOCK HAZARD. THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUNDED AND MAY BE ENERGIZED.”

e) Non-isolated inverters with a permanent or intermittent array functional grounding feature shall be marked as follows: “WARNING: Electric Shock Hazard. The DC conductors of this photovoltaic system are normally ungrounded but will become intermittently grounded without indication when the inverter measures the PV array isolation.”

(iii) There shall be legible and durable marking indicating the ampere, voltage and "ac" or "dc" rating of each fuse provided in the inverter system and inverter module. The marking shall be located so that it is obvious as to which fuse or fuseholder the marking applies. This marking is able to consist of a pictorial identifying the rating of one or more fuses. In addition, the following prominent marking shall be provided - a single marking is usable for a group of fuses, "WARNING - For Continued Protection Against Risk Of Fire, Replace Only With Same Type And Ratings Of Fuse."

18. SERVICING INSTRUCTIONS: The servicing instructions shall be preceded by a warning worded as follows "Warning - These servicing instructions are for use by qualified personnel only. To reduce the risk of electric shock, do not perform any servicing other than that specified in the operating instructions".

19. OPERATING AND INSTALLATION INSTRUCTIONS: The operating and installation instructions shall:

(a) Describe the equipment installation, including specifically:

(1) Assembly, and mounting instructions including mounting orientation, securement.

(2) Grounding means.

(3) Ventilation consideration.

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(b) Explain equipment markings, including specifically:
  (1) Symbols.
  (2) Controls.
  (3) All applicable ratings as described in the table in item 6 above.

(c) Identify and describe interconnections with:
  (1) The photovoltaic array.
  (2) The utility.
  (3) Auxiliary and accessory equipment.

(d) Explain the operation of the equipment, including derating information for operation in elevated ambient.

(e) Indicate that the ac output (neutral) is not bonded to ground.

(f) An inverter provided with a fixed AC output shall inform the installer that the input and output circuits are isolated from the enclosure and that system grounding, if required by Sections 690-40 and 690-42 of the National Electric Code, ANSI/NFPA 70, is the responsibility of the installer.

(g) Field adjustable trip limits for voltage and frequency are described and include the adjustment range for voltage, frequency and trip time. The "as shipped" default settings is specified.

(h) The installation instructions should indicate that the National Electrical Code, ANSI/NFPA 70 wiring methods to be used.

(i) Installation instructions are provided with an enclosure intended for field assembly of the bonding means that identifies the parts for bonding and specifies the method of installation.

(j) The installation manual shall include all required markings and explain that to the installer that the unit is not provided with an isolation transformer and is intended to be installed per NFPA 70, 690.35 with an ungrounded PV array.

(k) For models with PV DC Arc Fault Circuit Protection installation instructions shall include: Type 1 Device, intended to interrupt series arcing faults, operation and self test instructions, explanation of fault codes, and annunciator instructions.

The headings for the instruction manual, and the opening statements of the instructions specified in Important Safety Instructions, Section 66 - "IMPORTANT SAFETY INSTRUCTIONS" and "SAVE THESE INSTRUCTIONS" - shall be entirely in upper case letters not less than 4.8 mm (3/16 in.) high or emphasized to distinguish them from the rest of the text. Upper case letters in the instructions shall not be less than 2.0 mm (5/64 in.) high, and lower case letters shall not be less than 1.6 mm (1/16 in.) high.

There shall be no substitute for the words "CAUTION", "WARNING", or "DANGER" in the text of the instructions.
Exception: The words "WARNING" or "DANGER" may be used in lieu of the "CAUTION".

20. IMPORTANT SAFETY INSTRUCTIONS: The important safety instructions shall include Items A - J The statement "IMPORTANT SAFETY INSTRUCTIONS" and the statement "SAVE THESE INSTRUCTIONS" shall precede the list. The word "CAUTION" shall be entirely in upper case letters.

The information described in Items A - J, as appropriate, shall be provided. The information contained in Items B - J may be marked on the unit in lieu of providing it in the instruction manual.

(a) SAVE THESE INSTRUCTIONS - This manual contains important instructions for Models (model as indicated in front of Report) that shall be followed during installation and maintenance of the inverter.
Exception: When the instructions are exactly the same for all models, specific model numbers are not required.

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(b) A unit employing pressure terminal connectors for field wiring connections shall be provided with instructions specifying a range of values or a nominal value of tightening torque to be applied to the clamping screws of the terminal connectors. The minimum specified tightening torque should not be less than 90 percent of the value specified as applicable for the wire size. Exception: The torque value less than 90 percent is usable when the connector is investigated in accordance with the lesser assigned torque value in either the Standard for Wire Connectors and Soldering Lugs for Use With Copper Conductors, UL 486A, the Standard for Wire Connectors for Use With Aluminum Conductors, UL 486B, or the Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E.

(c) When a symbol is used for compliance with marking requirements the instruction manual shall identify the symbol.

(d) The instruction manual for a unit that exceeds the surface temperature limits shall specify that the unit is to be installed so that it is not expected to be contacted by persons.

(e) The instruction manual for the inverter shall indicate the maximum ambient temperature rating.

(f) For a unit provided with field-wiring terminals or leads, the instruction manual shall include the necessary supply wire type and temperature rating.

(g) The instruction manual for a unit shall include the word "CAUTION" and the following or the equivalent: "To reduce the risk of fire, connect only to a circuit provided with __ amperes maximum branch circuit overcurrent protection in accordance with the National Electrical Code, ANSI/NFPA 70".

(h) The instruction manual shall include a statement indicating that overcurrent protection for the ac output circuit shall be provided in the end installation.

(i) The instruction manual shall include a statement indicating that a disconnect switch shall be provided by others for the dc input and ac output circuit.

(j) The inverter shall be connected only to a dedicated branch circuit.