XXXX RESIDENCE : XXXX
10.4 kW DC ROOF MOUNTED PHOTOVOLTAIC SYSTEM

EQUIPMENT SUMMARY :

32 NO'S - CANADIAN SOLAR CS1H-325MS 325W MODULES
32 NO'S - ENPHASE IQ7-60-2-INT MICRO INVERTERS

SHEET INDEX :

GOVERNING CODES :

All Plans Designed According to
2017 FBC 6th Ed.
2014 NEC

SITE VICINITY VIEW

SITE AERIAL VIEW

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ELECTRICAL CONSTRUCTION GENERAL NOTES:

1.1 Site Notes

1.2 A ladder shall be in place for inspection in compliance with OSHA regulations.

1.3 The PV modules are considered non-combustible and this system is a utility interactive system with no storage batteries.

1.4 The solar PV installation shall not obstruct any plumbing, mechanical, or building roof vents.

1.5 Proper access and working clearance around existing and proposed electrical equipment will be provided as per section [NEC 110.26].

1.6 Alternative power source placard shall be plastic, engraved in a contrasting color to the plaque. This plaque will be attached using an approved method. If exposed to sunlight, it shall be UV resistant. All plaques and signage will be installed as required by the NEC.

1.7 The grounding electrode conductor shall be protected from physical damage between the grounding electrodes and the panel (or inverter) if smaller than #6 AWG copper wire per NEC 250-64B. The grounding electrode conductor will be continuous, expect for splices or joints at bus bars within listed equipment per [NEC250.64C.]

1.8 Roof coverings shall be designed, installed, and maintained in accordance with this code and the approved manufacturer's instructions such that the roof covering shall serve to protect the building or structure.

1.9 Rigid conduit (and/or nipples) must have a pull bushing to project wires.

1.10 Bolted connection required in dc disconnects on the white grounded conductor (use Polaris block or neutral bar)

1.11 Any connection above live parts must be watertight. Reducing washers disallowed above live parts, Meyers hubs recommended.

2.1 Solar Contractor

2.2 Module certifications will include UL1703, IEC61646, and IEC61730.

2.3 If applicable, module grounding lugs must be installed at the marked grounding lug holes per the manufactures installation requirements.

2.4 As indicated by design, other NRTL listed module grounding devices may be used in place of standard grounding lugs as shown in manufacturer documentation and approved by the AHJ.

2.5 Conduit and wire specifications are based on minimum code requirements and are not meant to limit up-sizing as required by field conditions.

2.6 Conduit point of penetration from to interior to be installed and sealed with a suitable sealing compound.

2.7 Dc wiring limited to module footprint w/ Enphase ac system.

2.8 Enphase wiring systems shall be located and secured under the array w/suitable wiring clips.

2.9 Max dc voltage calculated using manufacturer provided temp coefficient for Voc unless not available.

2.10 All inverters, motor generators, photovoltaic modules, photovoltaic panels, ac photovoltaic modules, source circuit combiners, and charge controllers intended for use in a photovoltaic power system will be identified and listed for the application per690.4(d).

2.11 All signage to be placed in accordance with local building code.

3.1 Equipment Locations

3.2 All equipment shall meet minimum setbacks as required by [NEC 110.26].

3.3 Equipment installed in direct sunlight must be rated for expected operating temperature as specified by [NEC 690.31 (a)-(b)] and [NEC table 310.15(b) (2) (c)].

3.4 Additional ac disconnects shall be provided where the inverter is not adjacent to the utility ac disconnect, or not within sight of the utility ac disconnect.

3.5 All equipment shall be installed accessible to qualified personal according to NEC applicable codes.

3.6 All components are listed for their purpose and rated for outdoor usage when appropriate.

4.1 Wiring & Conduit Notes

4.2 All conduit sizes and types, shall be listed for its purpose and approved for the site applications.

4.3 All PV cables and home run wires be #10AWG *USE-2, PV wire, or proprietary solar cabling specified by MFR, or equivalent; routed to source circuit combiner boxes as required

4.4 All conductors and OCPD sizes and types specified according to [NEC 690.8(a) (1) & (b) (1)], [NEC 240] [NEC690.7] for multiple conductors.

4.5 All PV dc conductors in conduit exposed to sunlight shall be de rated according to [NEC table 310.15(b) (2) (c) block only**

4.6 Exposed roof PV dc conductors shall be use-2, 90°C rated, wet and UV resistant, and UL listed rated for 600v, UV rated spiral wrap shall be used to protect wire from sharp edges.

4.7 Phase and neutral conductors shall be dual rated THHN/THWN-2 insulated, 90° C rated, wet and UV resistant, rated for 600V per NEC 2008 or 1000V per NEC 2011.

4.8 4-wire delta connected systems have the phase with the higher voltage to ground marked orange or identified by other effective means

4.9 All source circuits shall have individual source circuit protection

4.10 Voltage drop limited to 2% for dc circuits and 1% for ac circuits

4.11 Negative grounded systems dc conductors shall be color coded as follows: dc positive -red (or marked red), dc negative - grey (or marked grey)

4.12 Positive grounded systems dc conductors color coded: dc positive -grey (or marked grey), dc negative- black (or marked black)

4.13 AC conductors >4awg color coded or marked: phase a or L1-black, phase b or L2-red, phase c or L3-blue, Neutral- white/ gray

*USE-2 is not indoor rated but PV cable is rated THWN/THWN-2 and may be used inside

**USE-2 is available as UV white

5.1 Structural Notes:

5.2 Racking system & PV array shall be installed according to code-compliant installation manual.

5.3 Roof mounted standard rail requires one thermal expansion gap for every run of rail greater than 40'.

5.4 Array shall be a min. Height of 3” above the composition roof.

5.5 Junction box shall be installed per manufacturer's specifications.it shall be flashed &sealed per local requirements.

5.6 Rooftop penetrations permitting to solar racking will be completed and sealed w/approved chemical sealant per code by a licensed contractor.

5.7 All PV related racking attachments will be spaced no greater than the span distance specified by the racking manufacturer, O.C. final attachment locations may be adjusted in the field as necessary.

5.8 All PV related racking attachments shall be staggered by row amongst the roof framing members.

6.1 Grounding Notes

6.2 A grounding electrode system in accordance with [nec690-47] and [nec250-50] through [NEC 60 250-166] shall be provided. Per NEC, grounding electrode system of existing building may be used and bonded to at the service entrance. If existing system is inaccessible, or inadequate, or is only metallic water piping, a supplement grounding electrode will be used at the inverter location consisting of a UL listed 8ft ground rod with acorn clamp.

6.3 Grounding electrode conductors shall be no less than#8 AWG and no greater than#6 AWG copper and bonded to the existing grounding electrode to provide for a complete system.

6.4 PV system shall be grounded in accordance to [NEC 250.21], [NEC table 250.122], and all metal parts or module frames according to [NEC 690.43].

6.5 Module source circuits shall be grounded in accordance to [NEC 690.42].

6.6 The grounding connection to a module shall be arranged such that the removal of a module does not interrupt a grounded conductor to another module.

6.7 Each module will be grounded using the supplied connections points identified in the manufacturer's installation instructions.

6.8 Enclosures shall be properly prepared with removal of paint/finish as appropriate when grounding equipment with termination grounding lugs.

6.9 Grounding system components shall be listed for their purpose, and grounding devises exposed to the elements shall be rated for direct burial.

6.10 Grounding and bonding conductors shall be copper, solid or stranded, and bare when exposed.

6.11 Equipment grounding conductors shall be size according to [NEC 690.45] and be a minimum of #10awg when not exposed to damage (#6awg shall be used when exposed to damage).

6.12 Grounding and bonding conductors, if insulated, shall be color coded green (or marked green if #4awg or larger)

6.13 All conduit between the utility ac disconnect and the point of connection shall have grounded bushings at both ends.

6.14 AC system GEC sized according to [NEC 690.47], [NEC table 250.66], dc system GEC sized according to [NEC 250.166], minimum #8awg when insulated, #6awg when exposed to damage.

6.15 Exposed non-current carrying metal parts of module frames, equipment's, and conductor enclosures shall be grounded in accordance with 250.134 or 250.136(a) regardless of voltage.

7.1 Interconnection Notes

7.2 PV provided back feed breakers must be located at the opposite end of the bus from the main service breaker or transformer input feeder in accordance with [NEC 690.64(b) (7)]

7.3 Sum of breaker ratings supplying the bus may not exceed 120% of the bus bar rating per [NEC 690.64(b) (2)] and/or [nec705.12 (d) (1).

7.4 Ground fault protection in accordance with [nec215.9] & [NEC 230.95].all equipment to be rated for back feeding.

7.5 Supply side interconnection according to [NEC 690.64(a) and/or [NEC 705.12(a)] with service entrance conductors in accordance with [NEC 230.42(b)]

7.6 Micro inverter branches shall be connected to a single breaker OCPD in accordance with [NEC 110.3(b)].

8.1 Disconnect Notes

8.2 Disconnecting switches shall be wired such that when the switch is opened the conductors remaining live are connected to the terminals marked “line side” (typically the upper terminals).

8.3 AC disconnect must be accessible to qualified utility personnel, be lockable, and be a visible- break switch.

8.4 DC current conductors are to remain outside of building prior to either a fuse able source circuit combiner box or a load-break disconnecting device.

9.1 Storm Water Prevention

9.2 Storm water pollution prevention devices and practices shall be installed and/or instituted as necessary to ensure compliance with the city water quality standards contained in local regulations, federal regulations and any erosion control plan associated with this project. all such devices and practices shall be maintained, inspected and/or monitored to ensure adequacy and proper function throughout the duration of the construction project.

Compliance with the water quality standards and any erosion control plan associated with this project includes, but is not limited to the following:

9.3 All pollutants shall be retained on site until properly disposed of, and may not be transported from the site via sheet flow, swales, area drains, natural drainage courses or wind.

9.4 Stockpiles of construction-related materials shall be protected from being transported from the site by forces of wind or water flow.

9.5 Trash and construction solid wastes shall be deposited into covered receptacle to prevent contamination of rainwater and dispersal by wind.

10.1 Visibility From Adjacent Property : The solar panels may be visible from adjacent properties. Paint all structural elements to match the existing roofing.

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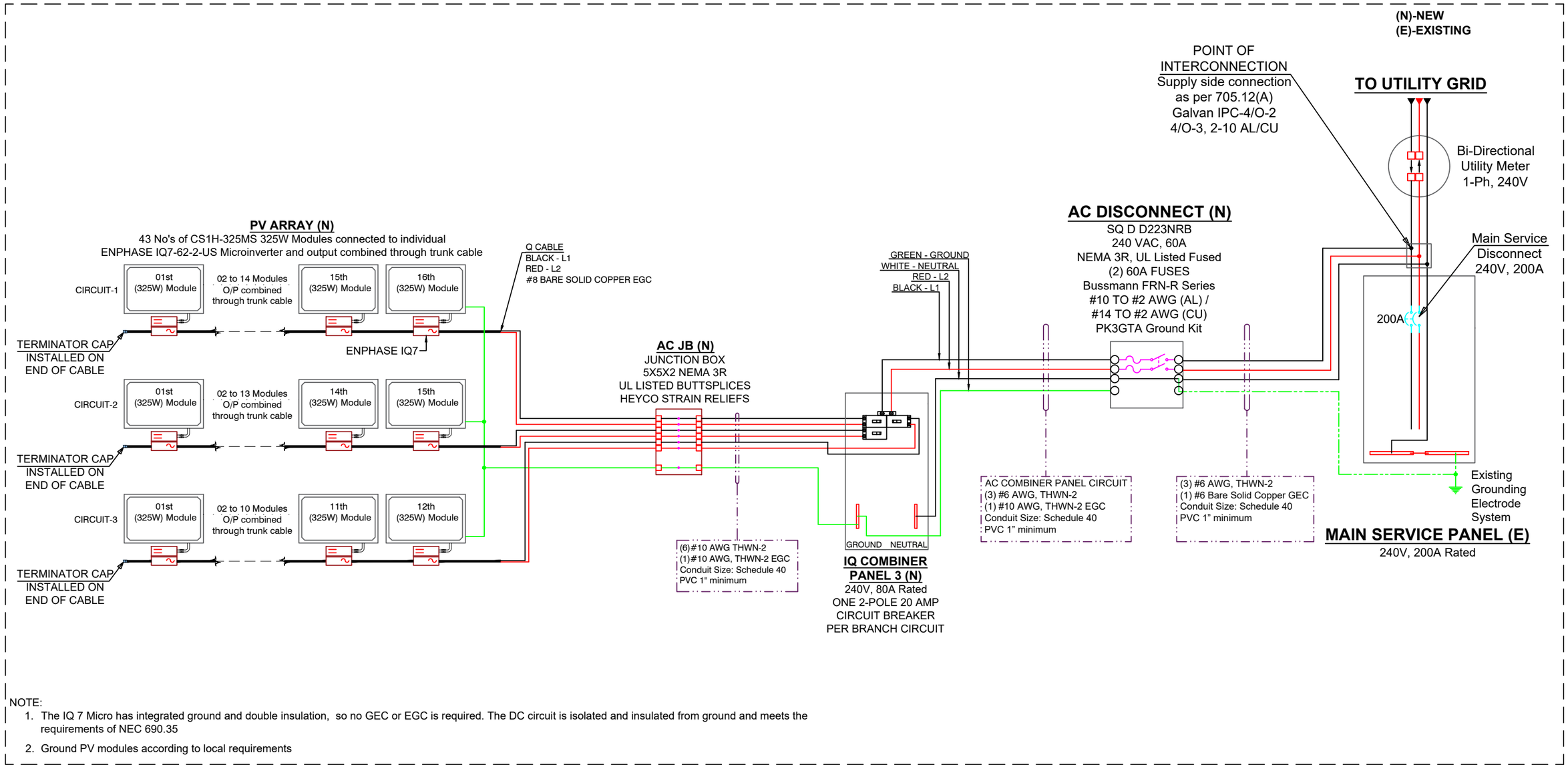
13.975 KW DC PROPOSED PV SYSTEM THREE LINE DIAGRAM



NOTE:

1. The IQ 7 Micro has integrated ground and double insulation, so no GEC or EGC is required. The DC circuit is isolated and insulated from ground and meets the requirements of NEC 690.35
2. Ground PV modules according to local requirements

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ELECTRICAL CALCULATION :

WIRING AND CONDUIT SCHEDULE

DC SCHEDULE

ITEM		DESCRIPTION	ID	QTY	Voc (V)	Vmpp (V) STC	Impp (A) STC	ISC (A) STC	Max Circuit current (A)	Nominal Power	Minimum Ampacity (A)	Adjusted Ampacity (A)	OCPD rating (A)	Multiple conductor Derate	Temperature Derate	Max ONE WAY LENGTH (ft)	WIRE SIZE	Wire Ampacity (A)	Derated Ampacity (A)	GROUND	WIRE TYPE	R/1000FT	V LOSS %	TEMP MAX	TOTAL NO OF CONDUCTORS	NO. OF CURRENT CARRYING CONDUCTORS	CONDUIT
1	MODULE	CANADIAN SOLAR	A	43	44.1	36.6	8.88	9.45	11.81	325	14.8	15.7	20	1.00	0.76	4.25	#12 AWG	30	22.8	#6 Bare	PV	1.98	0.41%	52 C	2	2	N/A
								Total Nominal Power		13975												DC Drop	0.41%				

AC SCHEDULE

ITEM		DESCRIPTION	ID	QTY	VOLTAGE (V)	Max Circuit Current (A)	Power	Minimum Ampacity (A)	Adjusted Ampacity (A)	OCPD rating (A)	Multiple conductor Derate	Temperature Derate	Max ONE WAY LENGTH (ft)	WIRE SIZE	Wire Ampacity (A)	Derated Ampacity (A)	GROUND	WIRE TYPE	R/1000FT	V LOSS %	TEMP MAX	TOTAL NO OF CONDUCTORS	NO. OF CURRENT CARRYING CONDUCTOR	CONDUIT
2	ARRAY	MICRO INVERTER OUTPUT CONNECTED TO INPUT OF TRUNK CABLE	B	43	240	1.04	240	1.3	1.4	NA	1.00	0.96	2	#10 AWG	40	38.4	#6 AWG	THWN-2	1.24	0.00%	52 C	4	2	N/A
3		TRUNK CABLE OUTPUT TO JUNCTION BOX (MICRO INVERTERS AC OUTPUT CONNECTED PARALLEL BY USING TRUNK CABLE)	C	1	240	16.64	3840	20.8	27.7	25	0.80	0.96	15	#10 AWG	40	30.72	#6 AWG	THWN-2	1.24	0.13%	52 C	7	6	1"PVC Min
4		IQ COMBINER PANEL TO AC DISCONNECT	E	1	240	44.72	10320	55.9	59.5	60	1.00	0.96	25	#6 AWG	75	72	#10 AWG	THWN-2	0.491	0.23%	52 C	4	2	1"PVC Min
5		AC DISCONNECT TO MAIN SERVICE PANEL	F	1	240	44.72	10320	55.9	59.5	60	1.00	0.96	25	#6 AWG	75	72	#6 AWG	THWN-2	0.491	0.23%	52 C	4	2	1"PVC Min
						Total Nominal Power	10320												AC Drop	0.59%				

BILL OF MATERIAL

REF. DES.	QTY.	MANUFACTURER	MODEL NUMBER	DESCRIPTION						
SOLAR MODULES	43	CANADIAN SOLAR	CS1H-325MS	SOLAR PANEL	325	W	1000	V (UL)		
		NOTES: 1. TYPE-1 UL 1703 class C								
INVERTER	43	ENPHASE	IQ7-60-2-US	INVERTER	0.2	Kw	NEMA Type 6		240	V AC
		NOTES: 1. UL1703, UL 1998, UL 1699B, IEE1547 2. DC INPUT WIRE RANGE (2) #12 to #2; AC OUTPUT WIRE RANGE (3) #12								
MSP	1	TBD	TBD	MAIN SERVICE PANEL, NEMA 3R ENCLOSURE	200	A	1	Ph	240	V AC
AC DISCONNECT	1	TBD	TBD	AC DISCONNECT	60	A				
		NOTES: 1. UL1741, INPUT WIRE RANGE 12 AWG 2 AWG; OUTPUT WIRE RANGE IS 12 AWG to 2 AWG								
ARRAY JUNCTION BOX	2	TBD	TBD	ARRAY JUNCTION BOX	600	V				
IQ COMBINER PANEL	1	TBD	TBD	IQ COMBINER PANEL, NEMA 3R ENCLOSURE	80	A	1	Ph	240	V AC

System Configuration

Number of strings	3	No's
Number of Modules	43	No's
Modules Per string	1 X 16 & 1 X 15 & 1 X 12	
Number of Inverter	43	No
Module Model	CS1H-325MS	
Inverter Model	IQ7-60-2-US	
PV Service Disconnect	-	A
DC Watts STC	13975	W
Max AC output Current	44.72	A
Operating AC Voltage	240	V

Inverter Rating Specs

ENPHASE	IQ7-60-2-US	
Nominal Input	-	A DC
Max.Short Circuit I/P	15	A DC
Output Voltage	240	V AC
Imax	1.04	A AC
Inec	1.3	A (@125%)
Outdoor	NEMA Type 6	Enclosure
UL1741 / IEEE 1547		

Module Rating Specs

CANADIAN SOLAR		
CS1H-325MS		
Pmax -	325	Wp
Vmp -	36.6	V
Imp -	8.88	A
Voc -	44.1	V
Isc -	9.45	A

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