INSTALLATION OF NEW
ROOF MOUNTED PV SOLAR SYSTEM
372 FRANKLIN STREET
WRENTHAM, MA 02093

FRANKLIN STREET

SITE

VICINITY MAP
SCALE: NTS

GENERAL NOTES

1. THE INSTALLATION CONTRACTOR IS RESPONSIBLE FOR INSTALLING ALL EQUIPMENT AND FOLLOWING ALL DIRECTIONS AND INSTRUCTIONS CONTAINED IN THE DRAWING PACKAGE AND INFORMATION RECEIVED FROM TRINITY.
2. THE INSTALLATION CONTRACTOR IS RESPONSIBLE FOR INSTALLING ALL EQUIPMENT AND FOLLOWING ALL DIRECTIONS AND INSTRUCTION CONTAINED IN THE COMPLETE MANUAL.
3. THE INSTALLATION CONTRACTOR IS RESPONSIBLE FOR READING AND UNDERSTANDING ALL DRAWINGS, COMPONENT AND INVERTER MANUALS PRIOR TO INSTALLATION. THE INSTALLATION CONTRACTOR IS ALSO REQUIRED TO HAVE ALL COMPONENT SWITCHES IN THE OFF POSITION AND FUSES REMOVED PRIOR TO THE INSTALLATION OF ALL FUSE BEARING SYSTEM COMPONENTS.
4. ONCE THE PHOTOVOLTAIC MODULES ARE MOUNTED, THE INSTALLATION CONTRACTOR SHOULD HAVE A MINIMUM OF ONE ELECTRICIAN WHO HAS ATTENDED A SOLAR PHOTOVOLTAIC INSTALLATION COURSE ON SITE.
5. FOR SAFETY, IT IS RECOMMENDED THAT THE INSTALLATION CREW ALWAYS HAVE A MINIMUM OF TWO PERSONS WORKING TOGETHER AND THAT EACH OF THE INSTALLATION CREW MEMBERS BE TRAINED IN FIRST AID AND CPR.
6. THIS SOLAR PHOTOVOLTAIC SYSTEM IS TO BE INSTALLED FOLLOWING THE CONVENTIONS OF THE NATIONAL ELECTRICAL CODE. ANY LOCAL CODE WHICH MAY SUPERSEDE THE NEC SHALL GOVERN.
7. ALL SYSTEM COMPONENTS TO BE INSTALLED WITH THIS SYSTEM ARE TO BE "UL" LISTED. ALL EQUIPMENT WILL BE NEMA 3R OUTDOOR RATED UNLESS INDOORS.

GENERAL NOTES CONTINUED

8. THE DC VOLTAGE FROM THE PANELS IS ALWAYS PRESENT AT THE DC DISCONNECT ENCLOSURE AND THE DC TERMINALS OF THE INVERTER DURING DAYLIGHT HOURS. ALL PERSONS WORKING ON OR INVOLVED WITH THE PHOTOVOLTAIC SYSTEM ARE WARNED THAT THE SOLAR MODULES ARE ENERGIZED WHENEVER THEY ARE EXPOSED TO LIGHT.
9. ALL PORTIONS OF THIS SOLAR PHOTOVOLTAIC SYSTEM SHALL BE MARKED CLEARLY IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE ARTICLE 690 & 705.
10. PRIOR TO THE INSTALLATION OF THIS PHOTOVOLTAIC SYSTEM, THE INSTALLATION CONTRACTOR SHALL ATTEND A PRE-INSTALLTION MEETING FOR THE REVIEW OF THE INSTALLATION PROCEDURES, SCHEDULES, SAFETY AND COORDINATION.
11. PRIOR TO THE SYSTEM START UP THE INSTALLATION CONTRACTOR SHALL ASSIST IN PERFORMING ALL INITIAL HARDWARE CHECKS AND DC WIRING CONDUCTIVITY CHECKS.
12. FOR THE PROPER MAINTENANCE AND ISOLATION OF THE INVERTERS REFER TO THE ISOLATION PROCEDURES IN THE OPERATION MANUAL.
13. THE LOCATION OF PROPOSED ELECTRIC AND TELEPHONE UTILITIES ARE SUBJECT TO FINAL APPROVAL OF THE APPROPRIATE UTILITY COMPANIES AND OWNERS.
14. ALL MATERIALS, WORKMANSHIP AND CONSTRUCTION FOR THE SITE IMPROVEMENTS SHOWN HEREIN SHALL BE IN ACCORDANCE WITH:
    A) CURRENT PREVAILING MUNICIPAL AND/OR COUNTY SPECIFICATIONS, STANDARDS AND REQUIREMENTS

GENERAL NOTES CONTINUED

14. B) CURRENT PREVAILING UTILITY COMPANY SPECIFICATIONS, STANDARDS, AND REQUIREMENTS
15 THIS SET OF PLANS HAVE BEEN PREPARED FOR THE PURPOSE OF MUNICIPAL AND AGENCY REVIEW AND APPROVAL. THIS SET OF PLANS SHALL NOT BE UTILIZED AS CONSTRUCTION DRAWINGS UNTIL REVISED TO INDICATE "ISSUED FOR CONSTRUCTION".
16 ALL INFORMATION SHOWN MUST BE CERTIFIED PRIOR TO USE FOR CONSTRUCTION ACTIVITIES.

ABBREVIATIONS

AMP	AMPERE
AC	ALTERNATING CURRENT
AL	ALUMINUM
AF	AMP. FRAME
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AWG	AMERICAN WIRE GAUGE
C	CONDUIT (GENERIC TERM OF RACEWAY, PROVIDE AS SPECIFIED)
CB	COMBINER BOX
CKT	CIRCUIT
CT	CURRENT TRANSFORMER
CU	COPPER
DC	DIRECT CURRENT
DISC	DISCONNECT SWITCH
DWG	DRAWING
EC	ELECTRICAL SYSTEM INSTALLER
EMT	ELECTRICAL METALLIC TUBING
FS	FUSIBLE SWITCH
FU	FUSE
GND	GROUND
GFI	GROUND FAULT INTERRUPTER
HZ	FREQUENCY (CYCLES PER SECOND)

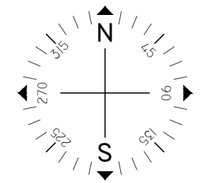
ABBREVIATIONS CONTINUED

JB	JUNCTION BOX
kCMIL	THOUSAND CIRCULAR MILS
kVA	KILO-VOLT AMPERE
kW	KILO-WATT
kWH	KILO-WATT HOUR
L	LINE
MCB	MAIN CIRCUIT BREAKER
MDP	MAIN DISTRIBUTION PANEL
MLO	MAIN LUG ONLY
MTD	MOUNTED
MTG	MOUNTING
N	NEUTRAL
NEC	NATIONAL ELECTRICAL CODE
NIC	NOT IN CONTRACT
NO #	NUMBER
NTS	NOT TO SCALE
OCP	OVER CURRENT PROTECTION
P	POLE
PB	PULL BOX
PH ∅	PHASE
PVC	POLY-VINYL CHLORIDE CONDUIT
PWR	POWER
QTY	QUANTITY
RGS	RIGID GALVANIZED STEEL
SN	SOLID NEUTRAL
JSWBD	SWITCHBOARD
TYP	TYPICAL
U.O.I.	UNLESS OTHERWISE INDICATED
WP	WEATHERPROOF
XFMR	TRANSFORMER
+72	MOUNT 72 INCHES TO BOTTOM OF ABOVE FINISHED FLOOR OR GRADE

SHEET INDEX

GENERAL NOTES

IF ISSUED DRAWING IS MARKED WITH A REVISION CHARACTER OTHER THAN "A", PLEASE BE ADVISED THAT FINAL EQUIPMENT AND/OR SYSTEM CHARACTERISTICS ARE SUBJECT TO CHANGE DUE TO AVAILABLITY OF EQUIPMENT.



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R1	REVISION	11/16/2018
P1	ISSUED TO TOWNSHIP FOR PERMIT	10/31/2018

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TRINITY ACCT #: 2018-10-297477

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42.074996,-71.337764

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DRAWN BY:	JC
REVISED BY:	MS

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DC SYSTEM SIZE:	13.23kW
AC SYSTEM SIZE:	11.4kW
TOTAL MODULE COUNT:	42
MODULES USED:	HANWHA 315
MODULE SPEC #:	Q.PEAK DUO BLK-G5 315
UTILITY COMPANY:	National Grid
UTILITY ACCT #:	51654-27024
UTILITY METER #:	86966774
DEAL TYPE:	SUNNOVA

Rev. No.: R1

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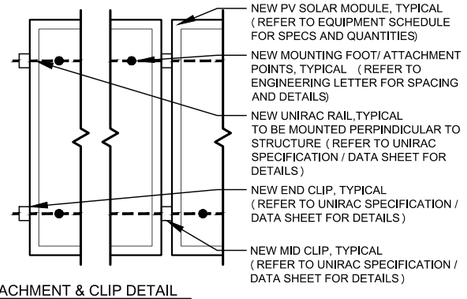
NOTES : *REFER TO MODULE SPECS FOR MODULE DIMENSIONS
*DEPICTED MODULES MAY BE PORTRAIT OR LANDSCAPE



ATTACHMENT & CLIP DETAIL
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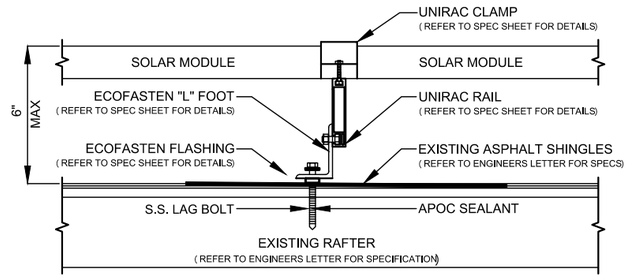
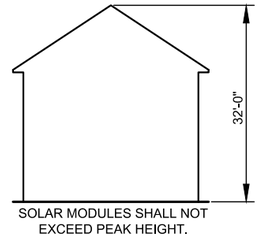


PV MODULE ATTACHMENT ON ASPHALT SHINGLE ROOF
SCALE: NOT TO SCALE



HEIGHT FROM GROUND LEVEL TO PEAK OF ROOF
SCALE: NOT TO SCALE

ARRAY SCHEDULE

ROOF 1
MODULES: 0
PITCH: 40°
ORIENTATION: 345°

ROOF 2
MODULES: 0
PITCH: 40°
ORIENTATION: 333°

ROOF 3
MODULES: 14
PITCH: 40
ORIENTATION: 153

ROOF 4
MODULES: 7
PITCH: 40
ORIENTATION: 165

ROOF 5
MODULES: 12
PITCH: 40
ORIENTATION: 255

ROOF 6
MODULES: 9
PITCH: 40
ORIENTATION: 75

ROOF 7
MODULES: 0
PITCH: 14°
ORIENTATION: 333°

ROOF 8
MODULES: 0
PITCH: 23°
ORIENTATION: 345°

ROOF 9
MODULES: 0
PITCH: 23°
ORIENTATION: 75°

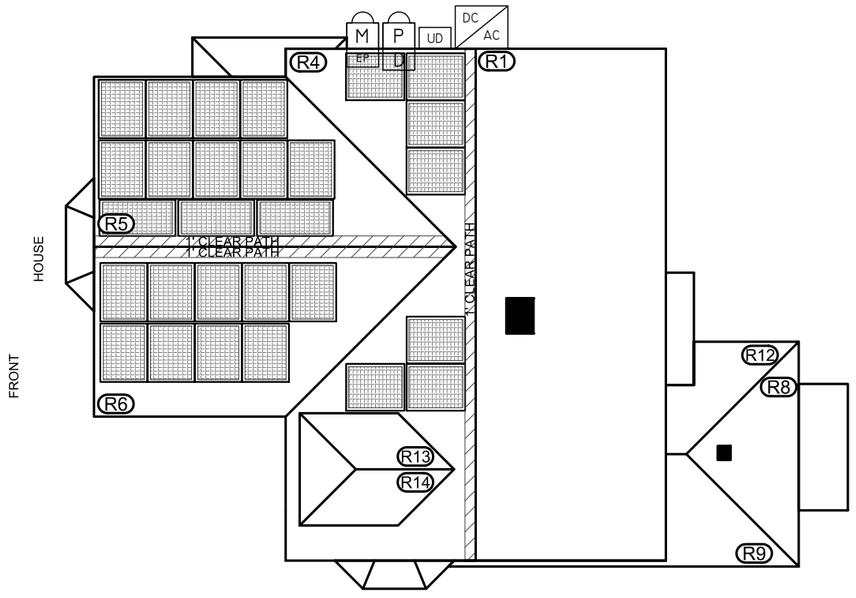
ROOF 10
MODULES: 0
PITCH: 40°
ORIENTATION: 243°

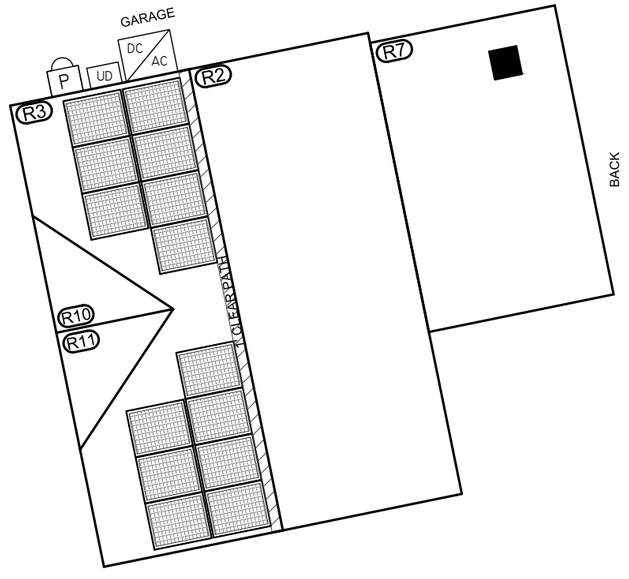
ROOF 11
MODULES: 0
PITCH: 40°
ORIENTATION: 63°

ROOF 12
MODULES: 0
PITCH: 23°
ORIENTATION: 255°

ROOF 13
MODULES: 0
PITCH: 40°
ORIENTATION: 255°

ROOF 14
MODULES: 0
PITCH: 40°
ORIENTATION: 75°





NOTES:
1.) ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.
2.) ARRAY BONDING TO COMPLY WITH MANUFACTURER SPECIFICATION.
3.) ALL LOCATIONS ARE APPROXIMATE AND REQUIRE FIELD VERIFICATION.
4.) AN AC DISCONNECT SHALL BE GROUPED WITH INVERTER (S) NEC 690.13 (E) .
5.) ALL OUTDOOR EQUIPMENT SHALL BE RAIN TIGHT WITH MINIMUM NEMA 3R RATING.
6.) ROOFTOP SOLAR INSTALLATION ONLY PV ARRAY SHALL NOT EXTEND BEYOND THE EXISTING ROOF EDGE.

SYMBOL LEGEND

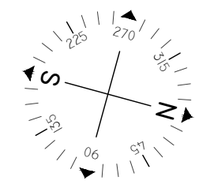
R1	INDICATES ROOF DESIGNATION . REFER TO ARRAY SCHEDULE FOR MORE INFORMATION	UD	INDICATES NEW UNFUSED PV DISCONNECT TO BE INSTALLED OUTSIDE (UTILITY ACCESSIBLE)	SP	INDICATES NEW PV ONLY SUBPANEL TO BE INSTALLED
M	INDICATES EXISTING METER LOCATION		INDICATES NEW PV SOLAR MODULE. RED MODULES INDICATE PANELS THAT USE MICRO INVERTERS. REFER TO EQUIPMENT SCHEDULE FOR SPECS.		
EP	INDICATES EXISTING ELECTRICAL PANEL LOCATION: IN BASEMENT	P	INDICATES NEW PRODUCTION METER TO BE INSTALLED OUTSIDE.		
D	INDICATES NEW FUSED PV DISCONNECT TO BE INSTALLED IN BASEMENT	DC AC	INDICATES NEW INVERTER TO BE INSTALLED OUTSIDE. REFER TO EQUIPMENT SCHEDULE FOR SPECS.		

PLUMBING SCHEDULE

OTHER OBSTRUCTIONS

EQUIPMENT SCHEDULE

QTY	SPEC #
42	HANWHA 315 (Q.PEAK DUO BLK-G5 315)
1	SE7600H-US000NNC2
1	SE3800H-US000NNC2



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ARRAY CIRCUIT WIRING NOTES

1.) LICENSED ELECTRICIAN ASSUMES ALL RESPONSIBILITY FOR DETERMINING ONSITE CONDITIONS AND EXECUTING INSTALLATION IN ACCORDANCE WITH NEC 2014

2.) LOWEST EXPECTED AMBIENT TEMPERATURE BASED ON ASHRAE MINIMUM MEAN EXTREME DRY BULB TEMPERATURE FOR ASHRAE LOCATION MOST SIMILAR TO INSTALLATION LOCATION. LOWEST EXPECTED AMBIENT TEMP = **-16°C**

3.) HIGHEST CONTINUOUS AMBIENT TEMPERATURE BASED ON ASHRAE HIGHEST MONTH 2% DRY BULB TEMPERATURE FOR ASHRAE LOCATION MOST SIMILAR TO INSTALLATION LOCATION. HIGHEST CONTINUOUS TEMP = **33°C**

4.) 2005 ASHRAE FUNDAMENTALS 2% DESIGN TEMPERATURES DO NOT EXCEED 47°C IN THE UNITED STATES (PALM SPRINGS, CA IS 44.1°C). FOR LESS THAN 9 CURRENT-CARRYING CONDUCTORS IN A ROOF-MOUNTED SUNLIT CONDUIT AT LEAST 0.5" ABOVE ROOF AND USING THE OUTDOOR DESIGN TEMPERATURE OF 47°C OR LESS (ALL OF UNITED STATES)

5.) PV SYSTEM CIRCUITS INSTALLED ON OR IN BUILDINGS SHALL INCLUDE A RAPID SHUTDOWN FUNCTION THAT CONTROLS SPECIFIC CONDUCTORS IN ACCORDANCE WITH NEC 690.12(1) THROUGH (5)

6.) PHOTOVOLTAIC POWER SYSTEMS SHALL BE PERMITTED TO OPERATE WITH UNGROUNDED PHOTOVOLTAIC SOURCE AND OUTPUT CIRCUIT AS PER **NEC 690.35**

7.) UNGROUNDED DC CIRCUIT CONDUCTORS SHALL BE IDENTIFIED WITH THE FOLLOWING OUTER FINISH: POSITIVE CONDUCTORS = RED
NEGATIVE CONDUCTORS = BLACK
NEC 210.5(C)(2)

8.) ARRAY AND SUB ARRAY CONDUCTORS SHALL BE #10 PV WIRE TYPE RHW-2 OR EQUIVELANT AND SHALL BE PROTECTED BY CONDUIT WHERE EXPOSED TO DIRECT SUNLIGHT. SUB ARRAY CONDUIT LONGER THAN 24" SHALL CONTAIN ≤ 20 CURRENT CARYING CONDUCTORS AND WHERE EXPOSED TO DIRECT SUNLIGHT SHALL CONTAIN ≤ 9 CURRENT CARRYING CONDUCTORS.

9.) ALL WIRE LENGTHS SHALL BE LESS THAN 100' UNLESS OTHERWISE NOTED

10.) FLEXIBLE CONDUIT SHALL NOT BE INSTALLED ON ROOFTOP AND SHALL BE LIMITED TO 12" IF USED OUTDOORS

11.)OVERCURRENT PROTECTION FOR CONDUCTORS CONNECTED TO THE SUPPLY SIDE OF A SERVICE SHALL BE LOCATED WITHIN 10' OF THE POINT OF CONNECTION NEC 705.31

12.) WHERE TWO SOURCES FEED A BUSSBAR, ONE A UTILITY AND THE OTHER AN INVERTER, PV BACKFEED BREAKER(S) SHALL BE LOCATED OPPOSITE FROM UTILITY
NEC 705.12(D)(2)(3)(b)

13.) ALL SOLAR SYSTEM LOAD CENTERS TO CONTAIN ONLY GENERATION CIRCUITS AND NO UNUSED POSITIONS OR LOADS

14.) ALL EQUIPMENT INSTALLED OUTDOORS SHALL HAVE A **NEMA 3R** RATING

SYSTEM #2

CALCULATIONS FOR CURRENT CARRYING CONDUCTORS
REQUIRED CONDUCTOR AMPACITY PER STRING
[**NEC 690.8(B)(1)**]: (15.00*1.25)1 = 18.75A

AWG #10, DERATED AMPACITY
AMBIENT TEMP: 33°C, TEMP DERATING FACTOR: .96
RACEWAY DERATING = 4 CCC: 0.80
(40*.96)1 = 38.4A

38.4A ≥ 18.75A, THEREFORE WIRE SIZE IS VALID

TOTAL AC REQUIRED CONDUCTOR AMPACITY
32A*1.25 = 40A

AWG #8, DERATED AMPACITY
AMBIENT TEMP: 30°C, TEMP DERATING: 1.0
RACEWAY DERATING ≤ 3 CCC: N/A
55A*1.0 = 55A

55A ≥ 40A, THEREFORE AC WIRE SIZE IS VALID

CALCULATION FOR PV OVERCURRENT PROTECTION
TOTAL INVERTER CURRENT: 32A
32A*1.25 = 40A
--> 40A OVERCURRENT PROTECTION IS VALID

SYSTEM #1

CALCULATIONS FOR CURRENT CARRYING CONDUCTORS
REQUIRED CONDUCTOR AMPACITY PER STRING
[**NEC 690.8(B)(1)**]: (15.00*1.25)1 = 18.75A

AWG #10, DERATED AMPACITY
AMBIENT TEMP: 33°C, TEMP DERATING FACTOR: .96
RACEWAY DERATING = 4 CCC: 0.80
(40*.96)1 = 38.4A

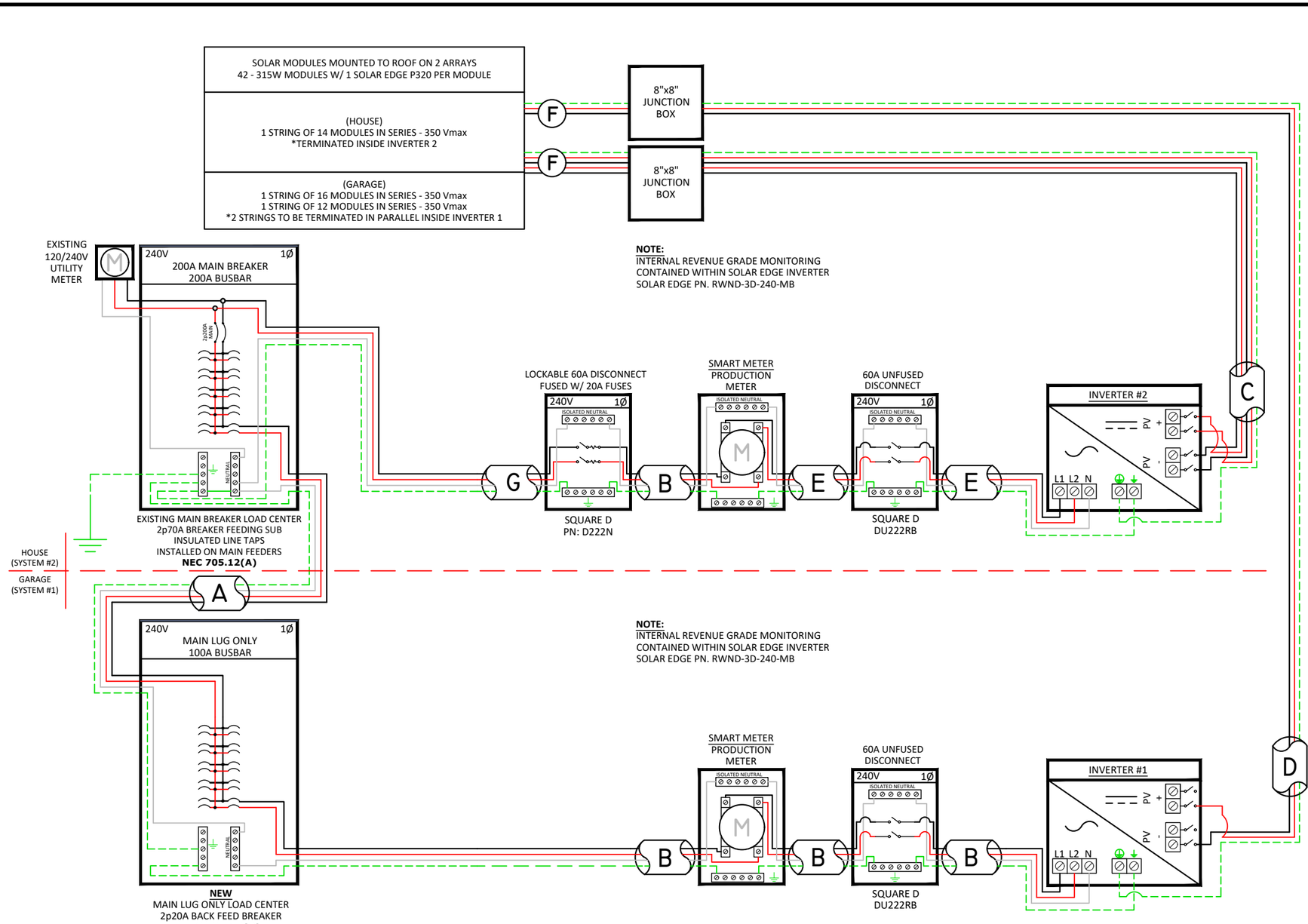
38.4A ≥ 18.75A, THEREFORE WIRE SIZE IS VALID

TOTAL AC REQUIRED CONDUCTOR AMPACITY
16.00A*1.25 = 20A

AWG #10, DERATED AMPACITY
AMBIENT TEMP: 30°C, TEMP DERATING: 1.0
RACEWAY DERATING ≤ 3 CCC: N/A
40A*1.0 = 40A

40A ≥ 20A, THEREFORE AC WIRE SIZE IS VALID

CALCULATION FOR PV OVERCURRENT PROTECTION
TOTAL INVERTER CURRENT: 16.00A
16.00A*1.25 = 20A
--> 20A OVERCURRENT PROTECTION IS VALID



PV MODULE SPECIFICATIONS	
HANWHA 315 (Q.PEAK DUO BLK-G5 315)	
Imp	9.41
Vmp	33.46
Voc	40.29
Isc	9.89

INVERTER #1 - SE7600H-US000NNC2			
DC		AC	
Imp	22.05	Pout	7600
Vmp	400	Imax	32
Voc	480	OCPDmin	40
Isc	30	Vnom	240

INVERTER #2 - SE3800H-US000NNC2			
DC		AC	
Imp	10.5	Pout	3800
Vmp	380	Imax	16
Voc	480	OCPDmin	20
Isc	15	Vnom	240

NOTE: CONDUIT TYPE SHALL BE CHOSEN BY THE INSTALLATION CONTRACTOR TO MEET OR EXCEED NEC AND LOCAL AHJ REQUIREMENTS

A	EXISTING 70A FEEDER TO GARAGE	G	3/4" CONDUIT W/ 2-#6 THWN-2, 1-#6 THWN-2, 1-#8 THWN-2 GROUND (TAP CONDUCTORS)
B	3/4'' CONDUIT W/ 2-#10 THWN-2, 1-#10 THWN-2, 1-#10 THWN-2 GROUND		
C	3/4'' CONDUIT W/ 4-#10 THWN-2, 1-#10 THWN-2 GROUND		
D	3/4'' CONDUIT W/ 2-#10 THWN-2, 1-#10 THWN-2 GROUND		
E	3/4'' CONDUIT W/ 2-#8 THWN-2, 1-#10 THWN-2, 1-#10 THWN-2 GROUND		
F	#10 PV WIRE (FREE AIR) W/ #6 BARE COPPER BOND TO ARRAY		

Engineer / License Holder:

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