

UNIVERSITY OF HOUSTON
Campus Facilities Planning Committee
Agenda Item Description Form

1. **Date:** **February 2, 2018**
2. **Item:** **Solar Panel Ground Installation at ERP 19**
3. **Requesting Department:** **Center for Innovation and Partnerships (CIP)**
4. **Contact Names & Phone Numbers:** **Ryan Black, CIP Program Manager, 713-743-6402;
Tom Campbell, CIP Interim Exec Dir, 713-743-0553**
5. **Presenter:** **Ryan Black**
6. **Recommendation/Action Requested:** **Approval**
CIP seeks approval to receive a donation of 40x solar panels to be installed on the grass knoll adjacent to the north-northeast side of ERP 19. These solar panels can tie into the ERP 19 power grid network if desired.
7. **Summary:**
Dr. Ramanan Krishnamoorti, Chief Energy Officer for UH Energy, will sponsor a gift of 40x solar panels donated by Crius Energy to further the interests of UH Energy. If desired, solar panels can be tied into the power grid at Energy Research Park (ERP) to supplement power requirements for ERP building 19 or power potential car charging stations for an adjacent public parking area that may have future development.

Crius Energy is actively involved in the solar panel business and hopes to expand their public presence through the use of on-site signage, press releases, and other marketing materials that promote their contribution.
8. **Proposed Start Date: TBD pending approval of gift and completion of negotiations.**
9. **Supporting Documentation Description:** See Solar Panel Memo dated 1/30/2018 outlining the details of the project including solar panel specs, installation location, and life cycle cost estimates.

February 2, 2018

Date: January 30, 2018
From: Ryan Black, Program Manager, CIP
To: GAC and CFPC
Subject: Donation Gift of 40x Solar Panels

Introduction: This memo describes the details surrounding an offer to donate solar equipment, and the installation thereof, to the University of Houston (UH) for the UH Gift Acceptance Committee (GAC) and Campus Facilities Planning Committee (CFPC) to consider. Contact information for each party and supporting documentation are also provided.

Name of Donor: Crius Energy, LLC

Description of Equipment: Crius Energy will donate to the UH 40x standard polysilicon solar panels of approximate size 77" x 39" and approximate weight of 50lbs (Exhibit A). Crius Energy will select the model of solar panel used in this project based on price and availability upon time of purchase.

Wattage output of these solar panels will be determined by Crius Energy at the time of purchase. Currently, estimated power output from each solar panel will be approximately 340 watts.

UH Sponsor: Dr. Ramanan Krishnamoorti, Chief Energy Officer for UH Energy will sponsor this donation and assume all costs associated with maintenance disposal of the solar panels.

How UH will Benefit from this Gift: Dr. Krishnamoorti will use the solar panels to further the interests of UH Energy.

Secondarily, the solar panels can be tied into the power grid at Energy Research Park (ERP) without the need for batteries, perhaps to supplement power requirements for ERP building 19 or power potential car charging stations for an adjacent public parking area that may have future development.

How the Donor will Benefit from this Gift: Crius Energy is actively involved in the solar panel business. Any new discoveries or improved technologies by UH will help to benefit their industry as a whole. It is their strong preference to place information concerning their company and their donation at the site, and to refer to the donation in press releases and other marketing materials. They hope to have positive public relations from the onsite signage as well as press releases. They have formally requested to donate the solar equipment and pay for installation in an email as well as answered specific questions from GAC (Exhibit B).

Location: Solar panels will be location on the grass knoll lot on the NNE side adjacent to building 19 at the ERP (Exhibit A). Precise location of the solar panels in the grass knoll area will depend on 3 primary factors: exposure to sun and shadows from the building and roof sign, flatness of the ground, and what is most aesthetically pleasing to occupied offices with

windows facing the north side of the building. Design engineers, along with Transwestern, FP/C, and other UH affiliates will help identified the most ideal location on the knoll.

Life Cycle Costs: Estimated total donation value, including equipment, labor, and fees, is \$33,000 (Exhibit C). Estimated Net Value for the Solar Panels is below.

Value	High Case	Low Case
Net Donation Value (equipment only)	\$14,000	\$14,000
Energy Savings (25yrs)	\$33,000	\$33,000
Total Value (25yrs)	\$47,000	\$47,000

Costs

Equipment & Installation Costs	\$0	\$0
Operations Costs (25yrs)	\$0	\$58,000
Maintenance Costs (25yrs)	\$3000	\$3000
Disposal Costs	\$1000	\$1000
Total Costs (25yrs)	\$4000	\$62,000

Net Value (25yrs) \$43,000 (\$15,000)

*Estimates rounded to the nearest 1000. Original estimates can be found in Exhibit C.

Installation: Adaptive Solar, LLC, subcontracted by Crius Energy, will install and maintain the solar panels. Estimated timeframe to install solar panels is 10 business days.

Engineering Design: Renewable Design Solutions (RDS), subcontracted by Crius Energy, will provide engineering drawings for this project and will coordinate with FP&C throughout the design phase. RDS will also act as project manager for the installation on behalf of Crius Energy.

Warranty: Solar panels come with a standard 25-year production warranty, guaranteeing 80% output after 25 years (Exhibit D). The coating technology will not negate the warranty, as it is not expected to adversely affect the lifespan of the solar panel. Solar Panels also come with a 10-year mechanical warranty against defects. Solar Adaptive will provide a 1-year labor warranty on installation.

Maintenance: Adaptive Solar can provide an annual limited maintenance contract (Exhibit E). Though a maintenance contract is not recommended by CIP or Crius Energy, Crius Energy has offered to include a 5-year limited maintenance contract with the installers should UH choose to implement.

Contact Information:

UH Energy (Sponsor)

Dr. Ramanan Krishnamoorti, RKrishna@central.uh.edu

Crius Energy, LLC (Donor)

535 Connecticut Ave, Norwalk, CT 06854

Rob Cantrell, 281-210-2468, rcantrell@criusenergy.com

Adaptive Solar, LLC (Installer)

4101 Greenbriar Dr. #205B, Houston, TX 77098

Renewable Design Solutions (Engineering Design, PM for Crius Energy)

1409 S Lamar St. #953, Dallas, TX 75215

Will Baxter, 832-767-8788, wbaxter@rdssolar.com

CIP (PM for UH)

5000 Gulf Fwy, ERP 4, Houston, TX 77023

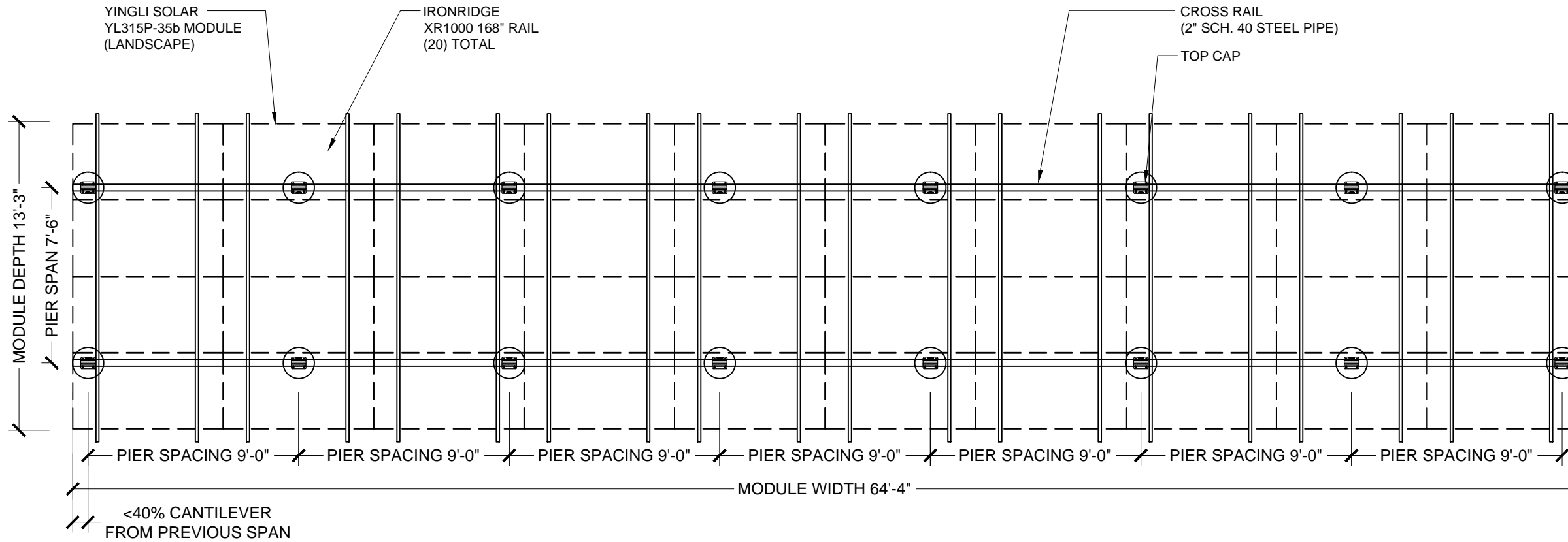
Ryan Black, 713-743-6402, rblack2@central.uh.edu

Tom Campbell, 713-743-0553, ctom@central.uh.edu

Exhibit A

STRUCTURAL DETAIL

SCALE: 3/16" = 1'-0"



PHOTOVOLTAIC PROJECT INFORMATION:

12.60 kW (DC) - 20.0 kW (AC)
PV UTILITY INTERACTIVE SYSTEM

UNIVERSITY OF HOUSTON
4902 GULF FREEWAY
HOUSTON, TX 77023
AHJ: UNIVERSITY OF HOUSTON REVIEW
UTILITY: CENTERPOINT

PROJECT NUMBER:
9378-204

PROJECT SHEET:
L-2

SHEET TITLE:
STRUCTURAL LAYOUT
AND
MECHANICAL DETAIL



INSTALLATION CONTRACTOR:

ADAPTIVE SOLAR DESIGN
6111 KIRBY DR.,
HOUSTON, TX 77005



SOLAR PV DESIGNER:

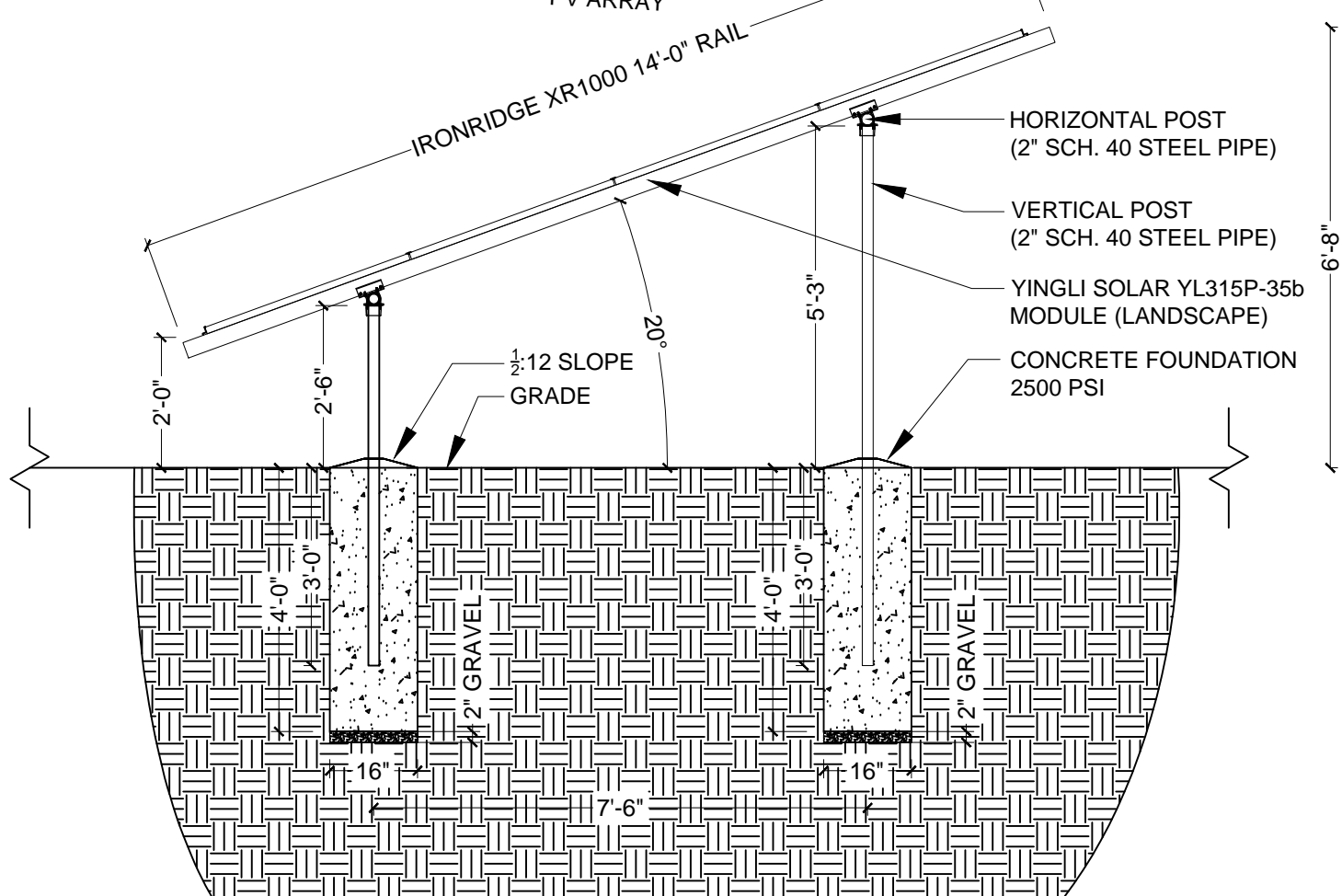
RENEWABLE DESIGN SOLUTIONS
10945 ESTATE LANE
SUITE E-105
DALLAS, TX 75238
PHONE: 214.564.9535
NABCEP PV: 092411-88
WWW.RENEWABLEDESIGNSOLUTIONS.COM

CIVIL ENGINEER:

CAIMAN ENGINEERING, INC
16922 OLD WASHINGTON ROAD
NEVADA CITY, CA 95959
PHONE: 530.478.9500
EMAIL: CAIMANENG@GMAIL.COM

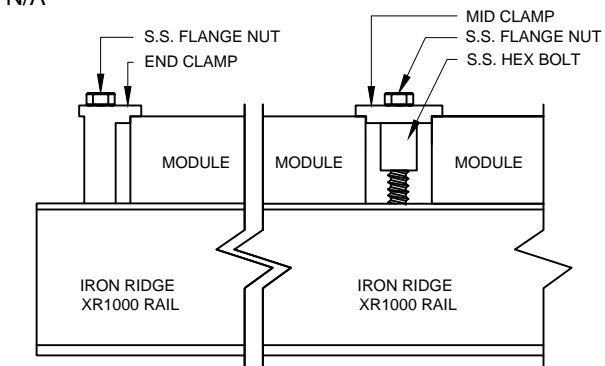
ELEVATION DETAIL

SCALE: 3/8" = 1'-0"



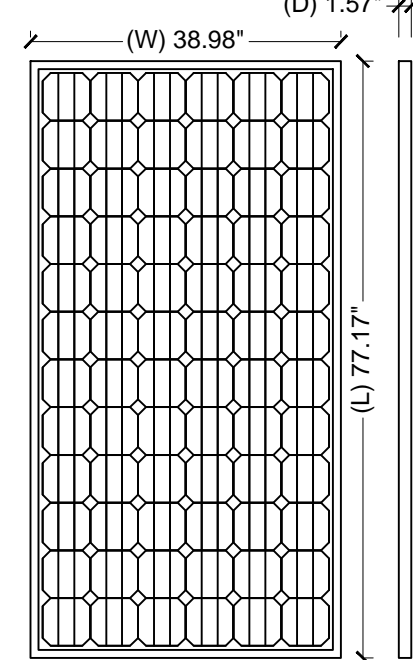
HARDWARE DETAIL

SCALE: N/A



MODULE DETAIL

SCALE: 1/2" = 1'-0"



SOLAR MODULE: MECHANICAL DATA
YINGLI SOLAR YL315P-35b MODULE
MODULE SPECIFICATIONS:
MODULE SQUARE FOOTAGE:
MODULE WEIGHT PER SQUARE FOOT:

77.17" x 38.98" x 1.57", 56.2 LBS
20.89 SQ.FT
2.69 LBS

SOLAR ARRAY: MECHANICAL DATA
MODULES:
ARRAY SQ.FT:
MODULE DEAD LOAD:
XR1000 RAIL DEAD LOAD:
2" SCH. 40 PIPE DEAD LOAD:
CONCRETE FOOTING DEAD LOAD:
TOTAL ARRAY DEAD LOAD:

(40) MODULES
835.60 SQ.FT
2,248.0 LBS
264.60 LBS
871.11 LBS
11,888 LBS
15271.71 LBS

CONNECTOR TYPE: CONCRETE FOOTING (16" DIAMETER X 4' DEEP)
ATTACHMENT POINTS: (16) TOTAL

DESIGNED BY: M. LABARBA

DATE: 08 / 04 / 2017

REVISED:

1.	N/A
2.	N/A
3.	N/A
4.	N/A
5.	N/A

SCALE: N/A

Exhibit A

GENERAL NOTES:

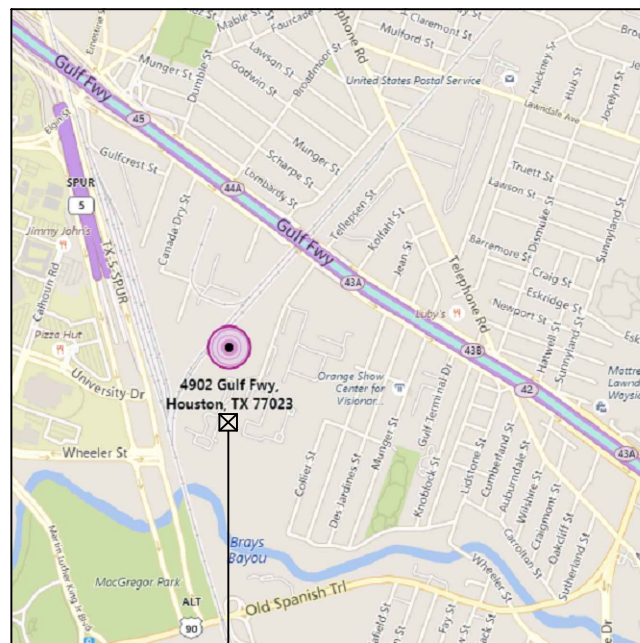
- THE FOLLOWING DOCUMENTS DO NOT PERMIT CONTRACTOR TO INSTALL THIS SYSTEM AGAINST ANY LOCAL, MUNICIPAL, OR INTERNATIONALLY RECOGNIZED BUILDING / ELECTRICAL CODE. THE PURPOSE OF THESE DOCUMENTS IS TO PROVIDE AUTHORITIES HAVING JURISDICTION AND UTILITIES A METHOD FOR INSPECTION.
- THE FOLLOWING DOCUMENTS ARE PROPERTY OF RENEWABLE DESIGN SOLUTIONS.. ALL DESIGNS AND INFORMATION CONTAINED WITHIN THE DRAWINGS ARE ONLY FOR THE SPECIFIED PROJECT AND SHALL NOT BE USED FOR ANY OTHER MEANS. USE OF THE DRAWINGS FOR ANY OTHER PURPOSE IS PROHIBITED WITHOUT EXPRESSED WRITTEN CONSENT OF RENEWABLE DESIGN SOLUTIONS.
- IN THE EVENT OF A DISCREPANCY IN QUANTITY OR SIZE OF CONDUIT, WIRE, EQUIPMENT, CIRCUIT BREAKERS, GROUND FAULT PROTECTION SYSTEMS, ETC. (ALL MATERIAL), DEPICTED ON THE DOCUMENTS OR SPECIFICATIONS, THE INSTALLATION CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND INSTALLING ALL MATERIAL AND SERVICE EQUIPMENT IN COMPLIANCE WITH ALL REGULATIONS, LAWS, ORDINANCES, OR AHJ.
- IN THE EVENT OF CONFLICTING REGULATIONS, LAWS OR ORDINANCES, THE MOST RESTRICTIVE SHALL PREVAIL
- ALL ELECTRICAL MATERIALS AND EQUIPMENT SHALL BE NEW AND LISTED BY A RECOGNIZED ELECTRICAL TESTING LABORATORY.
- AN INVERTER OR AC MODULE IN AN INTERACTIVE SOLAR PV SYSTEM SHALL AUTOMATICALLY DE-ENERGIZE ITS OUTPUT TO THE CONNECTED ELECTRICAL PRODUCTION AND DISTRIBUTION NETWORK UPON LOSS OF VOLTAGE IN THAT SYSTEM AND SHALL REMAIN IN THAT STATE UNTIL THE ELECTRICAL PRODUCTION AND DISTRIBUTION NETWORK VOLTAGE HAS BEEN RESTORED PER NEC 690.61
- ALL SPECIFIED WIRING IS BASED ON COPPER SPECIFICATIONS
- THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FILED DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.
- SEE PROVIDED SPEC-SHEETS FOR ADDITIONAL EQUIPMENT SPECIFICATIONS.
- ALL ELECTRICAL EQUIPMENT SHALL BE PROTECTED FROM ANY PHYSICAL DAMAGE.
- THE INSTALLATION CONTRACTOR SHALL OBTAIN ELECTRICAL PERMITS AND SHALL COORDINATE ALL INSPECTIONS, TESTING, COMMISSIONING AND ACCEPTANCE WITH THE CLIENT, UTILITY, AND MUNICIPAL INSPECTORS AS NEEDED.
- THE ELECTRICAL CONTRACTOR SHALL VERIFY THE EXACT LOCATIONS OF SERVICE POINTS AND COMPLY WITH ALL UTILITY REQUIREMENTS.
- DRAWINGS ARE DIAGRAMMATIC ONLY, ACTUAL INSTALLATION OF ALL ELECTRICAL EQUIPMENT SHALL BE THE DECISION OF INSTALLATION CONTRACTOR.
- IF DISTANCES OF CONDUCTOR RUNS ARE DIFFERENT THAN SHOWN, THE CONTRACTOR SHALL NOTIFY THE SYSTEM DESIGNER TO VALIDATE THE WIRE SIZE. FINAL DRAWINGS WILL BE REVISED AS APPROPRIATE.
- THE INSTALLATION CONTRACTOR IS RESPONSIBLE FOR NOTIFICATION AND COORDINATION WITH ALL PROPERTY OWNERS, UTILITIES AND APPROPRIATE DIG-ALERT UNDERGROUND MARKING AGENCIES. THE CONTRACTOR SHALL ALWAYS USE EXTREME CAUTION WHEN TRENCHING FOR INSTALLATION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER AND APPROVED REPAIR OF ANY AND ALL DAMAGES CAUSED DURING THE INSTALLATION.
- ALL SAFETY LABELS SHALL BE ENGRAVED AND MECHANICALLY ATTACHED. NO ADHESIVE SHALL BE PERMITTED.
- ALL INSTALLATION PRACTICES SHALL BE IN ACCORDANCE WITH:
 - 2014 NATIONAL ELECTRICAL CODE
 - 2012 INTERNATIONAL BUILDING CODE
 - 2012 INTERNATIONAL EXISTING BUILDING CODE
 - 2012 INTERNATIONAL FIRE CODE
 - 2012 INTERNATIONAL ENERGY CONSERVATION CODE
 - 2012 INTERNATIONAL MECHANICAL CODE
 - 2012 INTERNATIONAL PLUMBING CODE

ABBREVIATIONS:

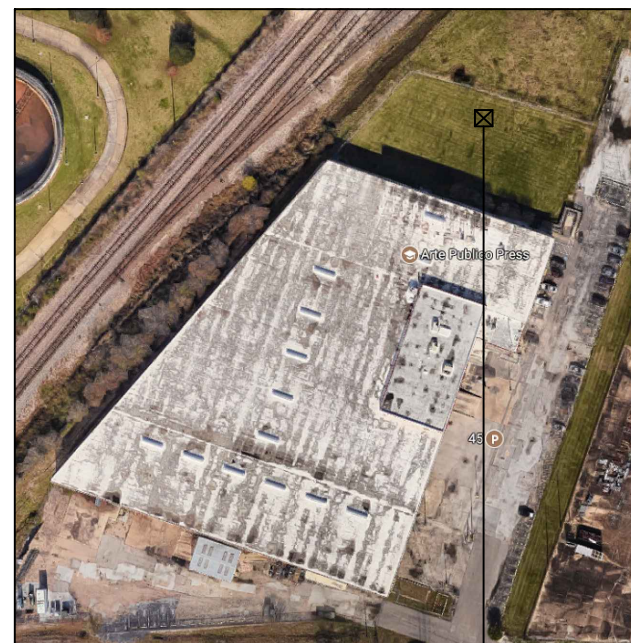
VMP:	MAXIMUM POWER VOLTAGE
IMP:	MAXIMUM POWER CURRENT
VOC:	OPEN CIRCUIT VOLTAGE
ISC:	SHORT CIRCUIT CURRENT
A:	AMPERES
V:	VOLTS
P:	POLE
CU:	COPPER
CEC:	CALIFORNIA ELECTRIC CODE
NEC:	NATIONAL ELECTRIC CODE
OC:	OFF CENTER
RR:	ROOF RAFTER
PV:	PHOTOVOLTAIC
AHJ:	AUTHORITY HAVING JURISDICTION
DC:	DIRECT CURRENT
AC:	ALTERNATING CURRENT
KW:	KILO-WATTS
W:	WATTS
STC:	STANDARD TESTING CONDITIONS
PTC:	PV USA TESTING CONDITIONS
AWG:	AMERICAN WIRE GAUGE
GEC:	GROUNDING ELECTRODE CONDUCTOR
MIN:	MINIMUM
DIA:	DIAMETER
UL:	UNDERWRITER'S LABORATORY

RACEWAY ABBREVIATIONS:

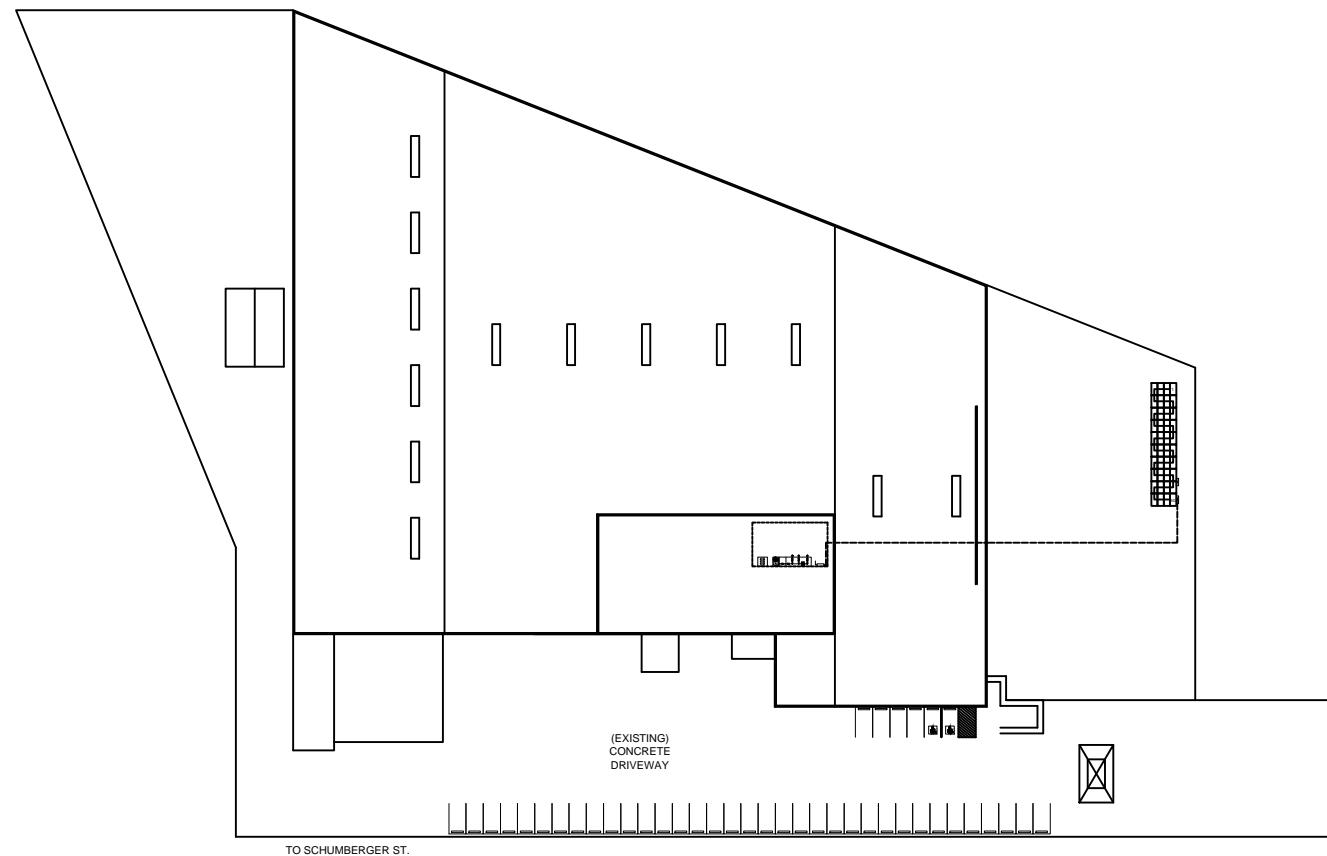
EMT:	ELECTRICAL METALLIC TUBING
ENT:	ELECTRICAL NON-METALLIC TUBING
FMC:	FLEXIBLE METALLIC CONDUIT
FMT:	FLEXIBLE METALLIC TUBING
IMC:	INTERMEDIATE METAL CONDUIT
LFMC:	LIQUID TIGHT FLEXIBLE METALLIC CONDUIT
LFNC:	LIQUID TIGHT FLEXIBLE NON-METALLIC CONDUIT
RMC:	RIGID METAL CONDUIT
RNC:	RIGID NON-METALLIC CONDUIT



PROJECT LOCATION



SITE MAP
SCALE: 1" = 100'-0"



SHEET INDEX:

M-1	MAP PLAN / COVER PAGE
L-1	SITE PLAN (WAREHOUSE BLDN ARRAY)
L-2	STRUCTURAL DETAIL
E-1	PV SYSTEM STRING DIAGRAM AND ELECTRICAL
E-2	THREE-LINE ELECTRICAL DIAGRAM
E-3	PV SYSTEM SAFETY LABELING DIAGRAM

PHOTOVOLTAIC PROJECT INFORMATION:

12.60 kW (DC) - 20.0 kW (AC)
PV UTILITY INTERACTIVE SYSTEM

UNIVERSITY OF HOUSTON
4902 GULF FREEWAY
HOUSTON, TX 77023
AHJ: UNIVERSITY OF HOUSTON REVIEW
UTILITY: CENTERPOINT

PROJECT NUMBER:
9378-204

PROJECT SHEET:
M-1

SHEET TITLE:
MAP PLAN
&
COVER PAGE



INSTALLATION CONTRACTOR:

ADAPTIVE SOLAR DESIGN
6111 KIRBY DR.,
HOUSTON, TX 77005



SOLAR PV DESIGNER:

RENEWABLE DESIGN SOLUTIONS
10945 ESTATE LANE
SUITE E-105
DALLAS, TX 75238
PHONE: 214.564.9535
NABCEP PV: 092411-88
WWW.RENEWABLEDESIGNSOLUTIONS.COM

ELECTRICAL ENGINEER:

JOE GIGANTIELLO PE (ELECTRICAL)
PHONE: 267.882.5393
EMAIL: JGIGANTIELLO@RDSSOLAR.COM

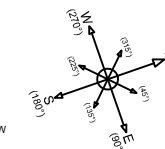
DESIGNED BY: M. LABARBA

DATE: 08 / 04 / 2017

REVISED:	
1.	N/A
2.	N/A
3.	N/A
4.	N/A
5.	N/A

SCALE: N/A

LAT/LONG: 29° 43' 10.37" N 95° 19' 51.68" W
ELEVATION: 40 FT
SOLAR IRRADIANCE: 55.34 KWH / M² / DAY (SUN HOURS)



PV SYSTEM ARRAY DATA	
PV SYSTEM:	12.60 kW (DC) - 20.0 kW (AC)
MODULES:	(40) (NEW) YINGLI SOLAR YL315P-35b POLY 315W MODULE
INVERTER:	(1) (NEW) SOLAR EDGE SE20KUS (277/480V) INVERTER
ROOF:	N/A
RACKING:	IRONRIDGE GROUND MOUNT SYSTEM WITH XR1000 RAIL
MODULE TILT:	20° DEG.
AZIMUTH:	199° DEG.

A	(EXISTING) UTILITY METER (277/480V, 3φ) (LOCATED AT SERVICE ENTRANCE)
B	(EXISTING) PANEL 200A, 277/480V, 3φ, 4W (LOCATED IN ELEC ROOM 122)
C	(1) (NEW) CONDUIT RUN (RUN BELOW CEILING, 10" BELOW SHEATHING)
D	(NEW) PV SYSTEM DEDICATED 60A, 277/480V, 3φ, 4W AC DISCONNECT SWITCH (VISIBLE, LOCKABLE, LABELED) (LOCATED OUTSIDE)
E	(1) (NEW) CONDUIT RUNS (PVC SCH. 40 BURIED 24" BELOW GRADE)
F	(NEW) PV SYSTEM DEDICATED 125A, 277/480V, 3φ, 4W AC AGGREGATE PANEL (1) BACK-FED PV CIRCUIT BREAKERS (LOCATED AT PV ARRAY)
G	(1) (NEW) SOLAR EDGE SE20KUS (277/480V) INVERTERS (INTEGRAL DC DISCONNECT) (LOCATED AT PV ARRAY)
H	(1) (NEW) LFMC CONDUIT RUN (RUN BEHIND ARRAY)
I	(1) (NEW) PV SYSTEM JUNCTION BOX (UL 1741, NEMA 3R) (LOCATED BEHIND MODULES)

PHOTOVOLTAIC PROJECT INFORMATION:

12.60 kW (DC) - 20.0 kW (AC)
 PV UTILITY INTERACTIVE SYSTEM
 UNIVERSITY OF HOUSTON
 4902 GULF FREEWAY
 HOUSTON, TX 77023
 AHJ: UNIVERSITY OF HOUSTON REVIEW
 UTILITY: CENTERPOINT

PROJECT NUMBER:
 9378-204

PROJECT SHEET:
L-1

SHEET TITLE:
 SITE PLAN



INSTALLATION CONTRACTOR:
 ADAPTIVE SOLAR DESIGN
 6111 KIRBY DR.,
 HOUSTON, TX 77005



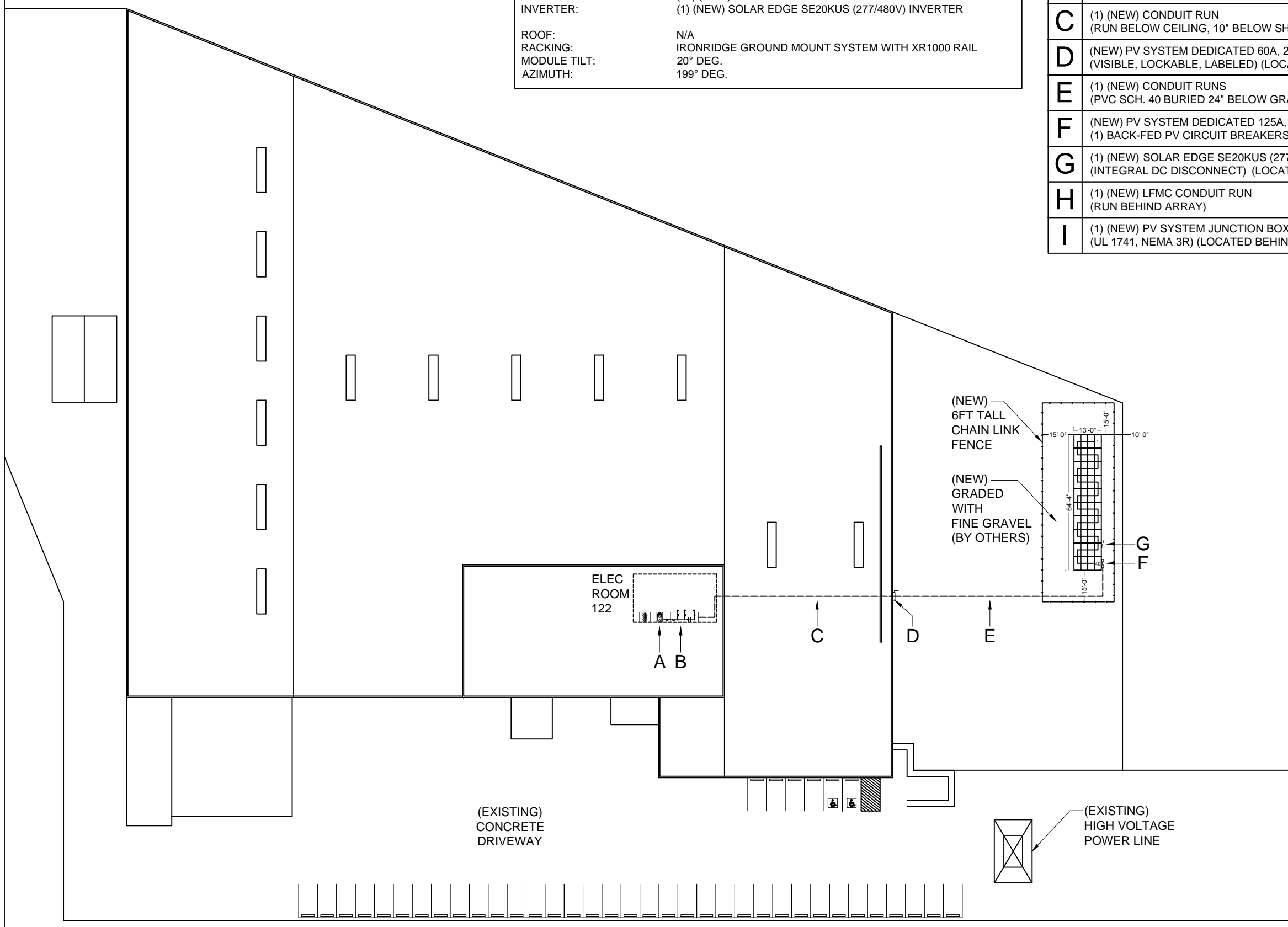
SOLAR PV DESIGNER:
 RENEWABLE DESIGN SOLUTIONS
 10945 ESTATE LANE
 SUITE E-105
 DALLAS, TX 75238
 PHONE: 214.564.9535
 NABCEP PV: 092411-88
 WWW.RENEWABLEDESIGNSOLUTIONS.COM

ELECTRICAL ENGINEER:
 JOE GIGANTIello PE (ELECTRICAL)
 PHONE: 267.882.5393
 EMAIL: JGIGANTIello@RDSSOLAR.COM

DESIGNED BY: M. LABARBA
 DATE: 08 / 04 / 2017

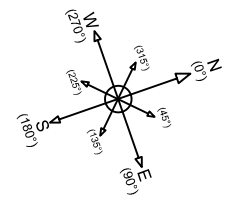
REVISED:	
1.	N/A
2.	N/A
3.	N/A
4.	N/A
5.	N/A

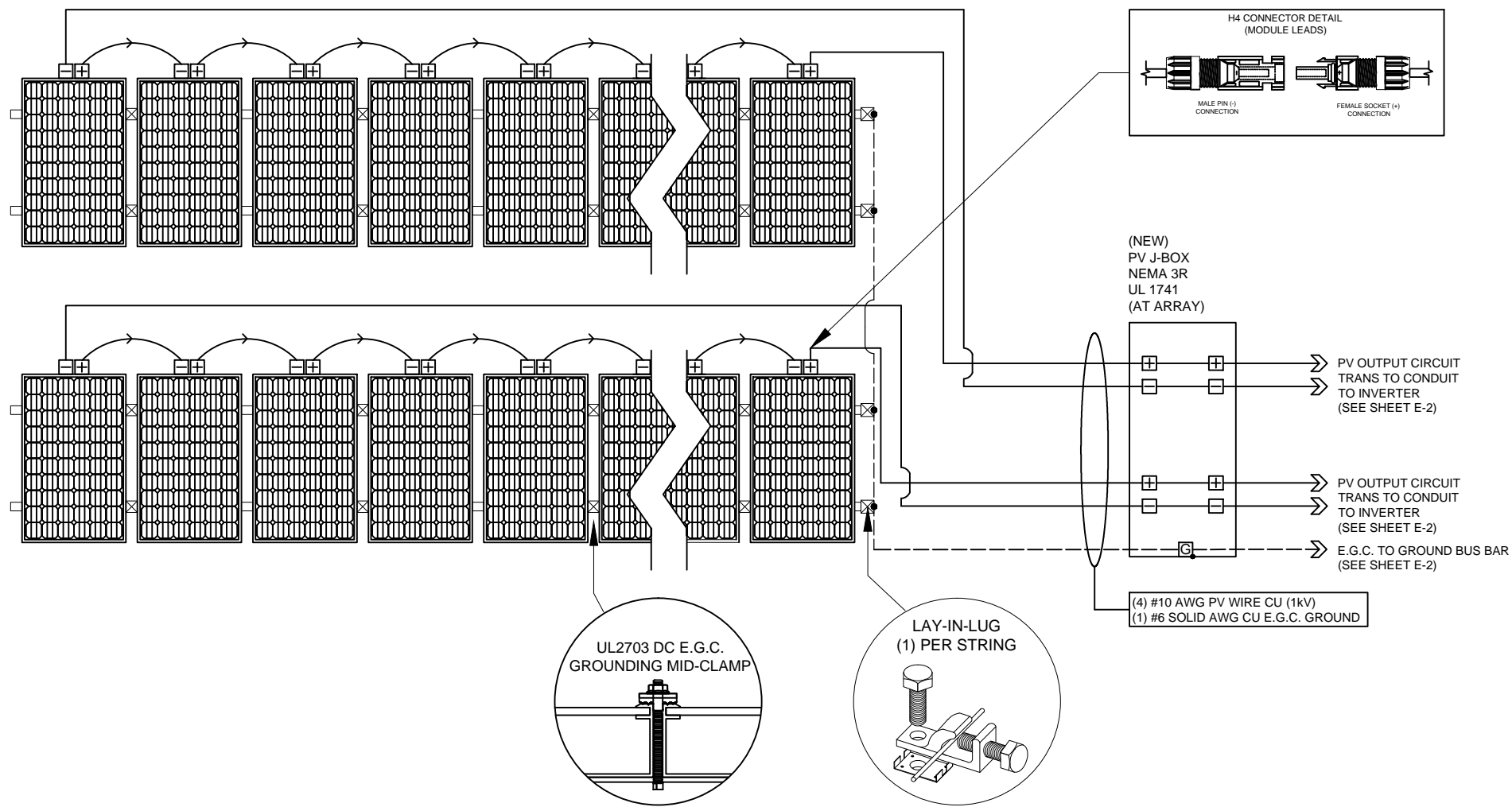
SCALE: 1" = 50'-0"



TO SCHUMBERGER ST.

LAT/LONG: 29° 43' 10.37" N 95° 19' 51.68" W
 ELEVATION: 40 FT
 SOLAR IRRADIANCE: 55.34 KWH / M² / DAY (SUN HOURS)





PV SYSTEM ELECTRICAL DATA:

STC: 12.60 kW (DC) WATTS

PV ARRAY:
 12.60 kW (DC)
 (40) YINGLI SOLAR YL315P-35b POLY 315W MODULE
 (1) SOURCE CIRCUIT OF (40) MODULES, (40) P400 OPTIMIZERS

SOLAR MODULE: ELECTRICAL DATA

YINGLI SOLAR YL315P-35b POLY 315W MODULE
 SPECIFICATIONS AT STC

MAXIMUM POWER VOLTAGE (V _{mp})	36.80V
MAXIMUM POWER CURRENT (I _{mp})	8.56A
OPEN CIRCUIT VOLTAGE (V _{oc})	45.70V
SHORT CIRCUIT CURRENT (I _{sc})	9.12A
SERIES FUSE RATING	20A
V _{oc} TEMPERATURE COEFFICIENT:	-0.32%/C°
WEIGHT	56.2 LBS
DIMENSION	77.17" x 38.98" x 1.57"

STC = 25°C, 1000W/M², 1.5 AIR MASS

SOLAR OPTIMIZER: ELECTRICAL DATA

SIZE:	400 WATTS (DC)
MFR:	SOLAR EDGE
MODEL:	P400
CERTIFICATION:	UL 1741
MAX INPUT VOLTAGE (V _{oc}):	80 VDC
MPPT VOLTAGE RANGE:	8-80 VDC
MAX INPUT CURRENT (I _{sc})	12.63 ADC
MAX OUTPUT CURRENT (I _{max})	15A ADC
MAX OUTPUT VOLTAGE	60 VDC
STRING SIZE	18-50 OPTIMIZERS PER STRING
MAX WATTAGE PER STRING:	12.75 kW
WEIGHT	2.40 LBS
DIMENSION:	5.97" x 5.0" x 1.37"

SOURCE CIRCUIT: ELECTRICAL DATA

V _{mp} = 36.80V x 1.09 =	40.11V
I _{mp} = 8.56A x 1.25 =	10.70A
V _{oc} = 45.70V x 1.09 =	49.81V
I _{sc} = 9.12A x 1.25 =	11.40A

STRING V_{oc} MAXIMUM CALCULATION:

(1 + (-4°C - 25°C)(-.32%/C°)) = V_{oc} MAX
 V_{oc} MAX = 1.09 AT -4°C (WEATHER.COM)

TEMPERATURE RECORD MINIMUM: 24.80°F / -4°C
 TEMPERATURE RECORD MAXIMUM: 98.60°F / 37°C

*WEATHER.COM

PHOTOVOLTAIC PROJECT INFORMATION:

12.60 kW (DC) - 20.0 kW (AC)
 PV UTILITY INTERACTIVE SYSTEM

UNIVERSITY OF HOUSTON
 4902 GULF FREEWAY
 HOUSTON, TX 77023
 AHJ: UNIVERSITY OF HOUSTON REVIEW
 UTILITY: CENTERPOINT

PROJECT NUMBER:
 9378-204

PROJECT SHEET:
E-1

SHEET TITLE:
 PV SYSTEM
 STRING DIAGRAM &
 ELECTRICAL SPECIFICATIONS



INSTALLATION CONTRACTOR:

ADAPTIVE SOLAR DESIGN
 6111 KIRBY DR.,
 HOUSTON, TX 77005



SOLAR PV DESIGNER:

RENEWABLE DESIGN SOLUTIONS
 10945 ESTATE LANE
 SUITE E-105
 DALLAS, TX 75238
 PHONE: 214.564.9535
 NABCEP PV: 092411-88
 WWW.RENEWABLEDESIGNSOLUTIONS.COM

ELECTRICAL ENGINEER:

JOE GIGANTIello PE (ELECTRICAL)
 PHONE: 267.882.5393
 EMAIL: JGIGANTIello@RDSSOLAR.COM

GENERAL NOTES:

1. EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH 2014 NEC ARTICLE 690, MUNICIPAL REQUIREMENTS, AND UTILITY REQUIREMENTS
2. PV CONSTRUCTION DOCUMENTS ARE NOT TO BE USED UNTIL APPROVED BY THE AUTHORITY HAVING JURISDICTION AND THE SERVING UTILITY.
3. WORKING CLEARANCES AROUND THE EXISTING AND NEW ELECTRICAL EQUIPMENT WILL BE MAINTAINED IN ACCORDANCE WITH NEC 110.26
4. ALL CONDUCTORS EXPOSED TO SUNLIGHT SHALL BE LISTED AS SUNLIGHT RESISTANT PER NEC 300.6 (C)(1), 310.8 (D).
5. MINIMUM 90° C MOISTURE RATED INSULATION WIRE IS REQUIRED ON ALL OUTDOOR WIRING.
6. CONDUCTORS ARE TO BE COPPER UNLESS OTHERWISE NOTED
7. ALL EQUIPMENT SHALL BE UL LISTED, NEMA 3R RATED, LABELED AND INSTALLED IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS.
8. EQUIPMENT GROUNDING CONDUCTOR SHALL BE INSTALLED IN ACCORDANCE WITH NEC 690.43, NEC 690.45, NEC 690.46.
9. EQUIPMENT GROUNDING CONDUCTOR TO BE CONTINUOUS PER NEC 690.48.
10. GROUNDING ELECTRODE CONDUCTOR SHALL BE INSTALLED IN ACCORDANCE WITH NEC 690.47
11. GROUNDING ELECTRODE CONDUCTOR SHALL BE CONTINUOUS PER NEC 250.64 (C).
12. ALL GROUNDING CONNECTIONS SHALL BE MADE WITH UL LISTED CONNECTORS.
13. GROUNDING CONNECTION TO MODULES SHALL BE SECURELY FASTENED WITH UL LISTED STAINLESS STEEL LAY-IN LUGS OR EQUIVALENT MEANS.
14. WHERE GROUNDING CONNECTIONS ARE MADE TO GROUNDING ELECTRODE(S), ONLY CAD-WELDED EXOTHERMIC CONNECTIONS SHALL BE USED.
15. FOR FLAT ARRAY INSTALLATIONS, PROVIDE THE NORTH EDGE OF ARRAYS 1/4" HIGHER TO DISPLACE WATER.
16. NO MODIFICATIONS TO RACKING SHALL BE PERMITTED. MAINTAIN MANUFACTURERS INSTALLATION PRACTICES.
17. WHEN POSSIBLE, INSTALL WIRING AND BOS EQUIPMENT IN A MANNER THAT MINIMIZES SUNLIGHT EXPOSURE.
18. ALL CONDUIT SYSTEMS EXPOSED TO TEMPERATURE DIFFERENTIALS SHALL BE INSTALLED WITH EXPANSION FITTINGS AND BONDING JUMPERS IN ACCORDANCE WITH NEC 300.7(B) ALWAYS LEAVE SUFFICIENT SLACK IN CONDUCTORS RUN FOR THERMAL EXPANSION AND CONTRACTION.
19. BI-DIRECTIONAL UTILITY METER TO BE INSTALLED IF REQUIRED. VERIFY METER SOCKET AND OTHER SPECIFICATIONS FOR COMPLIANCE WITH UTILITY.
20. ALL INVERTERS SHALL BE UL 1741 AND IEEE 1547 COMPLIANT AND INSPECTED BY LOCAL UTILITY PRIOR TO COMMISSIONING AND OPERATION.
21. INVERTERS SHALL BE PROTECTED FROM DIRECT SUNLIGHT EXPOSURE.
22. CIRCUIT BREAKER TO BE SUITABLE PER NEC 690.64 (B)(5)
23. THE UTILITY AC DISCONNECT SHALL BE LOCATED NO FURTHER THAN 5 FEET FROM THE NET METER.
24. THE UTILITY AC DISCONNECT SHALL BE LOCATED ADJACENT TO POINT OF INTERCONNECTION.
25. RE-TIGHTEN CURRENT-CARRYING CONNECTIONS, ENCLOSURE SUPPORT FRAMING AND PANELS TO MANUFACTURERS'S RECOMMENDATIONS.
26. TOTAL CURRENT HARMONICS SHALL BE LESS THAN 3% AT INVERTER AC TERMINAL.
27. ARRAY LAYOUT SHALL BE CONSISTENT WITH THE ORDERING (AND LABELING) OF SOURCE CIRCUITS IN THE ARRAY COMBINER BOXES.
28. ALL BURIED RACEWAYS SHALL BE BURIED 18" FROM TOP OF CONDUIT/CONDUCTOR TO GRADE
29. ALL WIRE SIZING SHALL BE IN ACCORDANCE WITH NEC 110.14
30. WHEN A BACKFED CIRCUIT BREAKER IS THE METHOD OF INTERCONNECTION, CIRCUIT BREAKER SHALL NOT READ "LINE AND LOAD".
31. FIELD VERIFY ALL SPECIFICATIONS PRIOR TO INSTALLATION. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY THE DESIGN ENGINEER OF ANY DISCREPANCIES BETWEEN THE PROVIDED DOCUMENT AND FIELD SPECIFICATIONS.
32. FIELD VERIFY EXACT REQUIREMENTS WITH UTILITY AND CLIENT, INCLUDING AVAILABLE FAULT CURRENT, PRIOR TO ORDERING EQUIPMENT.
33. THE INSTALLATION CONTRACTOR IS RESPONSIBLE FOR NOTIFICATION AND COORDINATION WITH ALL PROPERTY OWNERS, UTILITIES, AND APPROPRIATE DIG-ALERT AGENCIES. THE CONTRACTOR SHALL ALWAYS USE EXTREME CAUTION WHEN TRENCHING FOR INSTALLATION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER AND APPROVED REPAIR OF ANY AND ALL DAMAGES CAUSED DURING THE INSTALLATION.
34. FIELD VERIFY CONDUIT RUN FROM COMBINER BOX TO INVERTER. IF DIFFERENT THAN ILLUSTRATED, COORDINATE AND NOTIFY DESIGN ENGINEER TO REVISE ACCORDINGLY.
35. ALL DC CONDUCTORS (FROM ARRAY TO INVERTER) SHALL BE UL 1518, UL 44, UL 854 LISTED AND 1000V RATED (SEE SPEC SHEET).
36. ALL DC EQUIPMENT GROUNDING CONDUCTORS (FROM ARRAY TO INVERTER) SHALL BE UL 2703 LISTED AND 1000V RATED (SEE SPEC SHEET)
37. PV MODULES, J-BOX / COMBINER BOX, AND INVERTERS SHALL BE LISTED FOR 1000V OPERATION (SEE SPEC SHEETS).
38. ALL INSTALLATION PRACTICES SHALL BE IN ACCORDANCE WITH:
 - 38.1. 2014 NATIONAL ELECTRICAL CODE
 - 38.2. 2012 INTERNATIONAL BUILDING CODE
 - 38.3. 2012 INTERNATIONAL FIRE CODE
 - 38.3. 2012 INTERNATIONAL PLUMBING CODE
 - 38.4. 2012 INTERNATIONAL MECHANICAL CODE
 - 38.4. 2012 INTERNATIONAL FUEL GAS CODE
 - 38.4. 2012 INTERNATIONAL EXISTING BUILDING CODE
 - 38.5. 2012 INTERNATIONAL ENERGY CONSERVATION CODE
 - 38.6. ANY LOCAL AMENDMENTS

DESIGNED BY: M. LABARBA

DATE: 08 / 04 / 2017

REVISED:

1.	N/A
2.	N/A
3.	N/A
4.	N/A
5.	N/A

SCALE: N/A

Exhibit A

LEGEND	PV SYSTEM ELECTRICAL DATA:
GROUNDING CONDUCTOR	STC: 12.60 kW (DC) WATTS
CIRCUIT CONDUCTOR	PV ARRAY: 12.60 kW (DC) (40) YINGLI SOLAR YL315P-35b POLY 315W MODULE (1) SOURCE CIRCUIT OF (40) MODULES, (40) P400 OPTIMIZERS
LINE 1 TERMINAL	SOLAR MODULE ELECTRICAL DATA
LINE 2 TERMINAL	YINGLI SOLAR YL315P-35b POLY 315W MODULE SPECIFICATIONS AT STC MAXIMUM POWER VOLTAGE (Vmp) 36.80V MAXIMUM POWER CURRENT (Imp) 8.56A OPEN CIRCUIT VOLTAGE (Voc) 45.70V SHORT CIRCUIT CURRENT (Isc) 9.12A SERIES FUSE RATING 20A Voc TEMPERATURE COEFFICIENT: -0.32%/C° WEIGHT 56.2 LBS DIMENSION 77.17" x 38.98" x 1.57"
GROUND	STC = 25°C, 1000W/M ² , 1.5 AIR MASS
CIRCUIT BREAKER	SOLAR OPTIMIZER ELECTRICAL DATA
DISCONNECT SWITCH	SIZE: 400 WATTS (DC) MFR: SOLAR EDGE MODEL: P400 CERTIFICATION: UL 1741 MAX INPUT VOLTAGE (Voc): 80 VDC MPPT VOLTAGE RANGE: 8-80 VDC MAX INPUT CURRENT (Isc) 12.63 ADC
FUSE	MAX OUTPUT CURRENT (I _{max}) 15A ADC MAX OUTPUT VOLTAGE 60 VDC STRING SIZE 18-50 OPTIMIZERS PER STRING MAX WATTAGE PER STRING: 12.75 kW WEIGHT 2.40 LBS DIMENSION: 5.97" x 5.0" x 1.37"
IRREVERSIBLE SPLICE	
GROUND	

1	SOLAR EDGE SE20KUS INVERTERS
	277/480VAC 3Φ, 60Hz MPPT VOLTAGE RANGE: SEE OPTIMIZER DATA MAX OUTPUT CURRENT: 24.0A UL 1741, IEEE 1547 NOMINAL DC INPUT VOLTAGE: 850VDC MAX INPUT VOLTAGE: 980VDC MAX INPUT CURRENT: 26.5A CEC EFFICIENCY: 98% (INTEGRAL DC AND AC DISCONNECT) (NEGATIVELY GROUNDED DC SYSTEM)

STRING TO J-BOX	$V \text{ drop}\% = \frac{15A \times 2 \times 150'}{1000 \text{ ft/kft}} \times 1.2 \times 100 = .64\%$
LONGEST SOURCE CIRCUIT TO INVERTER	$V \text{ drop}\% = \frac{15A \times 2 \times 10'}{1000 \text{ ft/kft}} \times 1.2 \times 100 = .04\%$
INVERTER TO AC AGGREGATE PANEL	$V \text{ drop}\% = \frac{24A \times 2 \times 10'}{1000 \text{ ft/kft}} \times .78 \times .866 \times 100 = .07\%$
AC AGGREGATE PANEL TO INTER-CONNECTION	$V \text{ drop}\% = \frac{24A \times 2 \times 220'}{1000 \text{ ft/kft}} \times .31 \times .866 \times 100 = .59\%$
PV SYSTEM WORST CASE V-DROP	1.34%

- GENERAL NOTES:**
- EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH 2014 NEC ARTICLE 690, MUNICIPAL REQUIREMENTS, AND UTILITY REQUIREMENTS
 - PV CONSTRUCTION DOCUMENTS ARE NOT TO BE USED UNTIL APPROVED BY THE AUTHORITY HAVING JURISDICTION AND THE SERVING UTILITY.
 - WORKING CLEARANCES AROUND THE EXISTING AND NEW ELECTRICAL EQUIPMENT WILL BE MAINTAINED IN ACCORDANCE WITH NEC 110.26
 - ALL CONDUCTORS EXPOSED TO SUNLIGHT SHALL BE LISTED AS SUNLIGHT RESISTANT PER NEC 300.6 (C)(1), 310.8 (D).
 - MINIMUM 90° C MOISTURE RATED INSULATION WIRE IS REQUIRED ON ALL OUTDOOR WIRING.
 - CONDUCTORS ARE TO BE COPPER UNLESS OTHERWISE NOTED
 - ALL EQUIPMENT SHALL BE UL LISTED, NEMA 3R RATED, LABELED AND INSTALLED IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS.
 - EQUIPMENT GROUNDING CONDUCTOR SHALL BE INSTALLED IN ACCORDANCE WITH NEC 690.43, NEC 690.45, NEC 690.46.
 - EQUIPMENT GROUNDING CONDUCTOR TO BE CONTINUOUS PER NEC 690.48.
 - GROUNDING ELECTRODE CONDUCTOR SHALL BE INSTALLED IN ACCORDANCE WITH NEC 690.47
 - GROUNDING ELECTRODE CONDUCTOR SHALL BE CONTINUOUS PER NEC 250.64 (C).
 - ALL GROUNDING CONNECTIONS SHALL BE MADE WITH UL LISTED CONNECTORS.
 - GROUNDING CONNECTION TO MODULES SHALL BE SECURELY FASTENED WITH UL LISTED STAINLESS STEEL LAY-IN LUGS OR EQUIVALENT MEANS.
 - WHERE GROUNDING CONNECTIONS ARE MADE TO GROUNDING ELECTRODE(S), ONLY CAD-WELD EXOTHERMIC CONNECTIONS SHALL BE USED.
 - FOR FLAT ARRAY INSTALLATIONS, PROVIDE THE NORTH EDGE OF ARRAYS 1/4" HIGHER TO DISPLACE WATER.
 - NO MODIFICATIONS TO RACKING SHALL BE PERMITTED. MAINTAIN MANUFACTURERS INSTALLATION PRACTICES.
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 - 2012 INTERNATIONAL FIRE CODE
 - 2012 INTERNATIONAL PLUMBING CODE
 - 2012 INTERNATIONAL MECHANICAL CODE
 - 2012 INTERNATIONAL FUEL GAS CODE
 - 2012 INTERNATIONAL EXISTING BUILDING CODE
 - 2012 INTERNATIONAL ENERGY CONSERVATION CODE
 - ANY LOCAL AMENDMENTS

PHOTOVOLTAIC PROJECT INFORMATION:

12.60 kW (DC) - 20.0 kW (AC)
PV UTILITY INTERACTIVE SYSTEM

UNIVERSITY OF HOUSTON
4902 GULF FREEWAY
HOUSTON, TX 77023
AHJ: UNIVERSITY OF HOUSTON REVIEW UTILITY: CENTERPOINT

PROJECT NUMBER:
9378-204

PROJECT SHEET:
E-2

SHEET TITLE:
**PV SYSTEM
3-LINE ELECTRICAL
DIAGRAM**

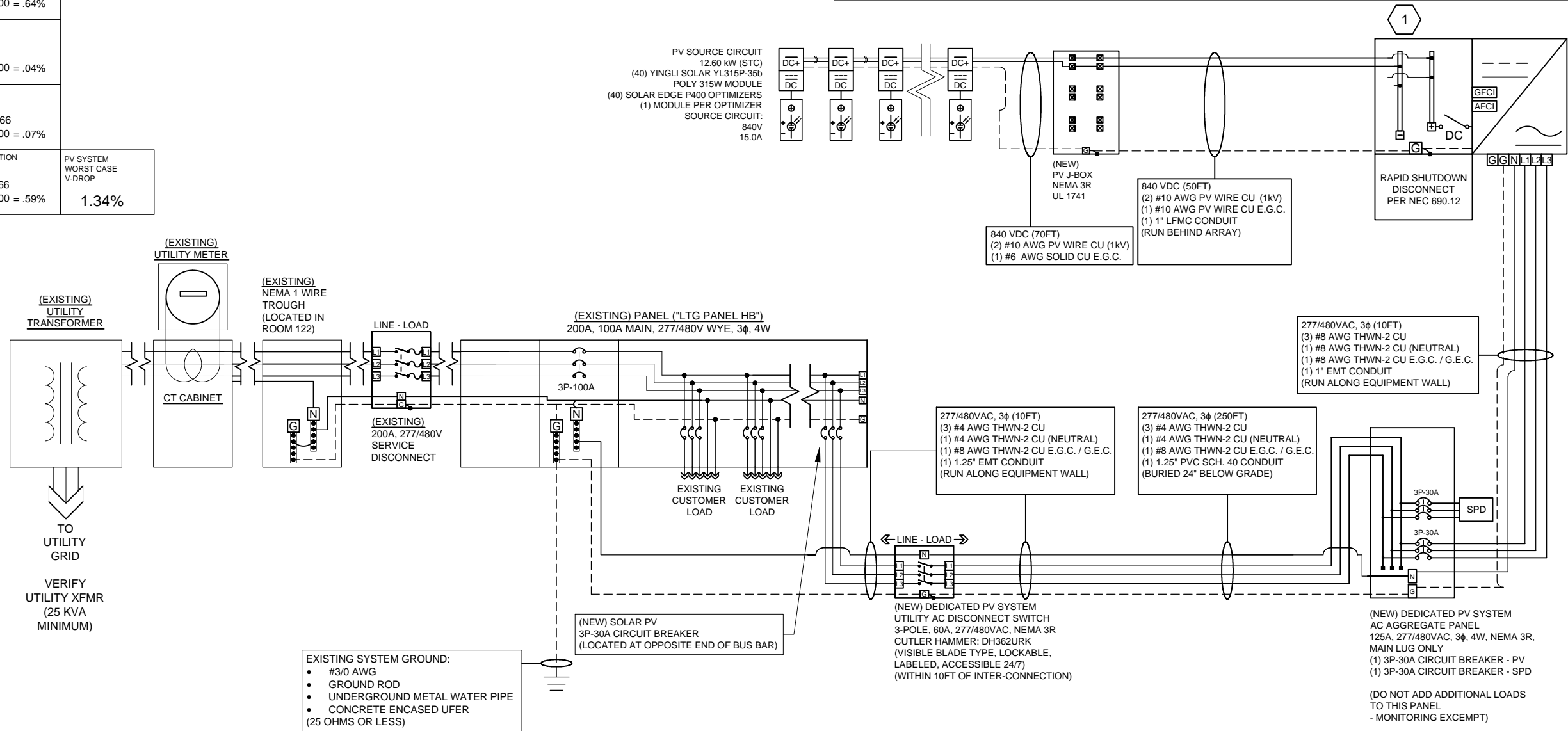


INSTALLATION CONTRACTOR:
ADAPTIVE SOLAR DESIGN
6111 KIRBY DR.,
HOUSTON, TX 77005



SOLAR PV DESIGNER:
RENEWABLE DESIGN SOLUTIONS
10945 ESTATE LANE
SUITE E-105
DALLAS, TX 75238
PHONE: 214.564.9535
NABCEP PV: 092411-88
WWW.RENEWABLEDESIGNSOLUTIONS.COM

ELECTRICAL ENGINEER:
JOE GIGANTIello PE (ELECTRICAL)
PHONE: 267.882.5393
EMAIL: JGIGANTIello@RDSOLAR.COM



EXISTING SYSTEM GROUND:

- #3/0 AWG
- GROUND ROD
- UNDERGROUND METAL WATER PIPE
- CONCRETE ENCASED UFER (25 OHMS OR LESS)

DESIGNED BY: M. LABARBA
DATE: 08 / 04 / 2017

REVISED:	
1.	N/A
2.	N/A
3.	N/A
4.	N/A
5.	N/A

SCALE: N/A

(DO NOT ADD ADDITIONAL LOADS TO THIS PANEL - MONITORING EXEMPT)

Exhibit A

L1
 LABEL J-BOX / COMBINER BOX / CIRCUITS / ENCLOSURES

WARNING
 ELECTRICAL SHOCK HAZARD.
 THE ALTERNATING CURRENT CIRCUIT CONDUCTORS OF THIS PHOTOVOLTAIC POWER SYSTEM ARE UNGROUNDED AND MAY BE ENERGIZED.

L2
 LABEL INVERTERS / BREAKER PANEL / PULL BOXES / PRODUCTION METER

WARNING
 ELECTRICAL SHOCK HAZARD.
 IF A GROUND FAULT IS INDICATED, NORMALLY GROUNDED CONDUCTORS MAY BE ENERGIZED AND UNGROUNDED.

L3
 LABEL INVERTERS / AC DISCONNECT / BREAKER PANEL / POINTS OF INTER-CONNECTION

THE MAXIMUM AC OUTPUT OPERATING CURRENT = 24A
 THE NOMINAL OPERATING AC VOLTAGE = 277/480VAC

L4
 LABEL DC DISCONNECT / RE-COMBINER

OPERATING CURRENT = 15A
 OPERATING VOLTAGE = 840V
 MAXIMUM SYSTEM VOLTAGE = 840V
 SHORT CIRCUIT CURRENT = 15A

L5
 LABEL COMBINER BOX / DC DISCONNECT / BREAKER PANEL / AC DISCONNECT / MAIN SERVICE DISCONNECT / PULL BOXES

WARNING
 ELECTRICAL SHOCK HAZARD.
 DO NOT TOUCH TERMINALS.
 TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

L6
 LABEL PRODUCTION METER / BREAKER PANEL / MAIN SERVICE PANEL / BI-DIRECTIONAL METER

WARNING
 DUAL POWER SOURCE
 SECOND SOURCE IS PV SYSTEM

L7
 LABEL AC DISCONNECT / BREAKER / POINT OF INTER-CONNECTION

PHOTOVOLTAIC DISCONNECT FOR UTILITY OPERATIONS

L8
 LABEL PRODUCTION METER / BREAKER PANEL / MAIN SERVICE PANEL

WARNING
 INVERTER OUTPUT CONNECTION
 DO NOT RELOCATE THIS OVERCURRENT DEVICE

L9
 LABEL PRODUCTION METER / MAIN SERVICE DISCONNECT / BREAKER PANEL

CAUTION
 SOLAR ELECTRIC SYSTEM CONNECTED

L10
 LABEL DC CONDUIT / RACEWAYS EVERY 10FT, AT TURNS AND ABOVE AND OR BELOW PENETRATIONS

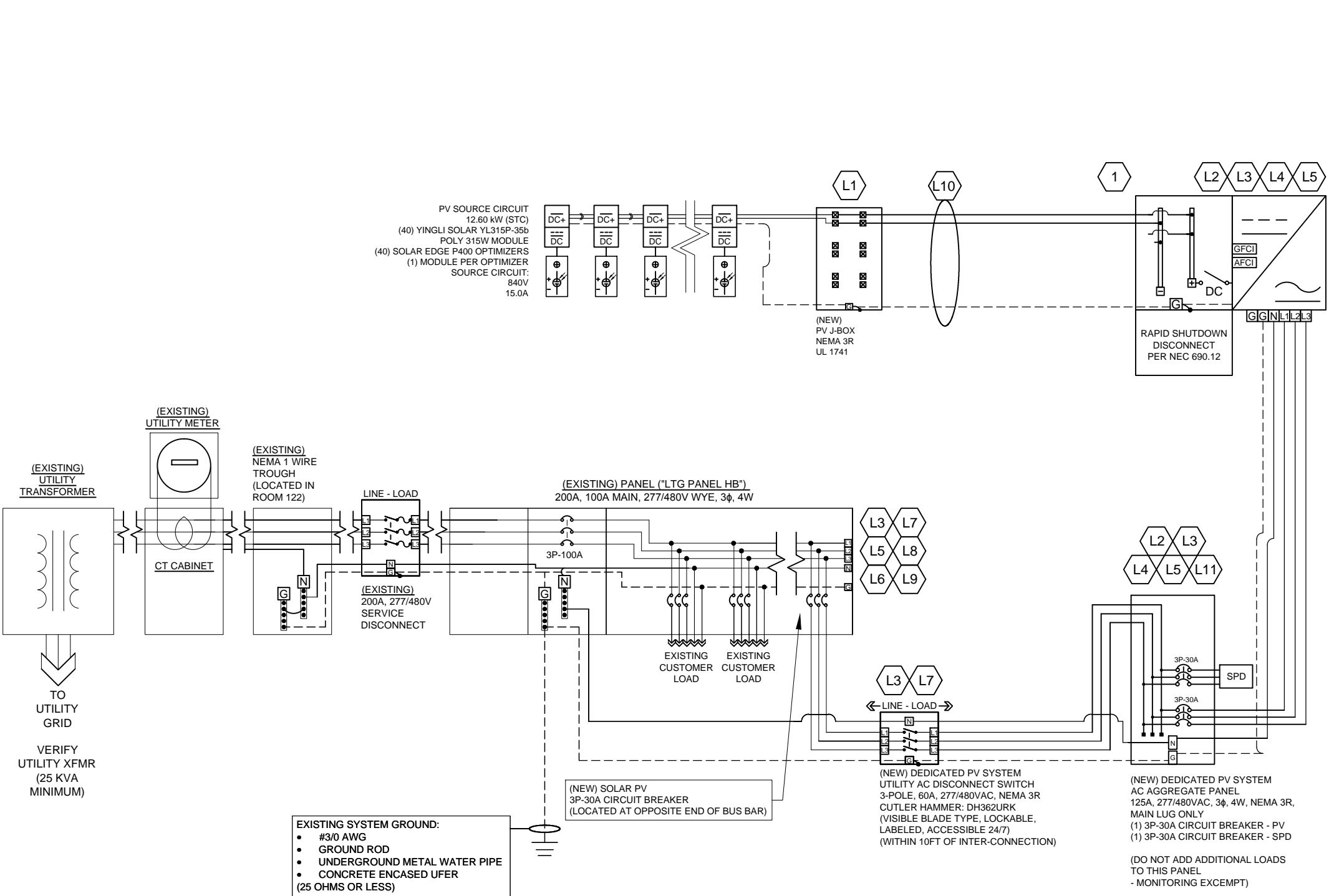
WARNING: PHOTOVOLTAIC POWER SOURCE

L11
 LABEL UTILITY AC DISCONNECT

PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN

- NOTES:
 *ALL SIGNAGE AND LABELING SHOULD FOLLOW THE FOLLOWING STANDARDS:
- A: RED BACKGROUND WITH WHITE LETTERING ON WEATHER RESISTANT MATERIAL.
 - B: ENGRAVED, LAMINATED PLASTIC NAMEPLATES: 3/8" LETTERS FOR EQUIPMENT DESIGNATION, 3/8" LETTERS FOR SOURCE CIRCUIT NUMBER.
 - C: ARIAL OR SIMILAR FONT, NON-BOLD.
 - D: WEATHER, SUNLIGHT RESISTANT MATERIAL SUITABLE FOR THE ENVIRONMENT.
 - E: PANELBOARD DIRECTORIES: PROVIDE TYPED CIRCUIT DIRECTORY IN A PERMANENT, CLEAR LEXAN CARD HOLDER LOCATED INSIDE OF DOOR OR ON PANEL BOARD.
 - F: ALL SAFETY LABELS SHALL BE ENGRAVED AND MECHANICALLY ATTACHED. NO ADHESIVE SHALL BE PERMITTED

* IN ACCORDANCE WITH NEC 705.10, A PERMANENT PLAQUE OR DIRECTORY, DENOTING ALL ELECTRIC POWER SOURCES ON THE PREMISES, SHALL BE INSTALLED AT EACH INTERCONNECTED SERVICE ENTRANCE.



PHOTOVOLTAIC PROJECT INFORMATION:

12.60 kW (DC) - 20.0 kW (AC)
 PV UTILITY INTERACTIVE SYSTEM
 UNIVERSITY OF HOUSTON
 4902 GULF FREEWAY
 HOUSTON, TX 77023
 AHJ: UNIVERSITY OF HOUSTON REVIEW UTILITY: CENTERPOINT

PROJECT NUMBER: 9378-204

PROJECT SHEET: E-3

SHEET TITLE: PV SYSTEM SAFETY LABELING DIAGRAM



INSTALLATION CONTRACTOR:
 ADAPTIVE SOLAR DESIGN
 6111 KIRBY DR., HOUSTON, TX 77005



SOLAR PV DESIGNER:
 RENEWABLE DESIGN SOLUTIONS
 10945 ESTATE LANE SUITE E-105
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 NABCEP PV: 092411-88
 WWW.RENEWABLEDESIGNSOLUTIONS.COM

ELECTRICAL ENGINEER:
 JOE GIGANTIELLO PE (ELECTRICAL)
 PHONE: 267.882.5393
 EMAIL: JGIGANTIELLO@RDSOLAR.COM

DESIGNED BY: M. LABARBA
 DATE: 08 / 04 / 2017

REVISED:	
1.	N/A
2.	N/A
3.	N/A
4.	N/A
5.	N/A

SCALE: N/A

Solar Panel UH Donation -- Clarification of Terms of Donation

3 messages

Ryan Black <rblack2@central.uh.edu>
To: rcantrell@criusenergy.com

Thu, Jun 22, 2017 at 4:58 PM

Hi Rob,

Thanks for returning my call today. You have my email address.

Ryan Black

Program Manager
Center for Innovation and Partnerships
Department of Research
5000 Gulf Frwy, Bldg 4, office 170
University of Houston
Houston, Texas 77023

rblack@uh.edu
(m) 832-640-8159

Rob Cantrell <rcantrell@criusenergy.com>
To: "Black, Ryan W" <rblack2@central.uh.edu>
Cc: William Baxter <wbaxter@rdssolar.com>

Fri, Jun 23, 2017 at 5:23 PM

Good Afternoon Ryan –

Please accept this email as a formal request that TriEagle/Crius be allowed to donate a 40-panel solar array to be positioned on Building 7 in the ERP. The donation will include the panels, installation, the equipment required to monitor and report on the system's performance, as well as all interconnection to the building and electricity grid. The panels themselves will come with a 10-year mechanical warranty plus a 25-year production warranty, and the company providing the installation is including a 1-year warranty on the installation and labor. Based on discussions with our designers and the purpose of these panels for research, a full ongoing maintenance contract should not be required, but we will also include a 5-year limited maintenance contract with the installers. We would also like UH to keep the panels at the end of the experiments.

Please let me know if there are any further questions – we look forward to working with University of Houston on this project!

Thanks!

Rob Cantrell

Executive Vice President

O: 281.210.2468 C: 713.907.2892

rcantrell@criusenergy.com | criusenergy.com



THE CRIUS ENERGY FAMILY OF BRANDS



Exhibit B

1. Who is donor's representative in this transaction – please provide contact information for the individual communicating with the University about the gift.

You can use me as the representative – my full contact info is:

Rob Cantrell, 281-210-2468, rcantrell@criusenergy.com

2. What other parties are involved in the gifting process? What is the relationship amongst them?

We have vendors that are performing parts of the design, installation, and consulting for us, but we are hiring them for this project

3. Is another third party funding the Donor's gift in kind donation?

No

4. Whose research is this benefitting? Does this individual(s) have input into the gift or gifting process and/or where the panels will be located?

We hope that numerous groups working on different solar projects can use the donation to further their research – Currently, we know of a coating product to be tested, as well as some new panel software to be tested

5. Please describe any conditions and restrictions on the gift? Who is imposing them?

No conditions or restrictions. However, it is our strong preference to be able to place information concerning our company and the donation at the site. Also, to refer to the donation in press releases and other marketing materials

6. Are Donor or other parties involved in the gifting process imposing any other obligations on the University with regard to the gift? In other words what are donor's or any parties named in no. 2 expectations from the University?

No

7. What are the benefits the parties named in 1 and 2 hope to receive from this gift?

We are actively involved in the solar business – any new discoveries or improved technologies by UH will help to benefit our industry as a whole. We also hope to have positive public relations from the onsite signage as well as press releases, etc.

8. Who at the University will be handling the day to day operations and maintenance of the solar panels?

Unknown to us at this time – I would envision this falling under the oversight of Dr. Krishnamoorti as chief energy officer at UH

9. Will any non-University personnel have access to the panels other than for installation, annual maintenance, and ultimate removal? If so, who, for what purpose, and under what situations?

No

Exhibit C

Given Information	
High Case	Low Case

Donation

Total Donation Value	\$ 33,000	\$ 33,000
Solar Equipment	\$ 14,000	\$ 14,000
M&L	\$ 14,000	\$ 14,000
RDS fees	\$ 5,000	\$ 5,000

Assumptions/Explanations

Sum of D7 - D9	Source: Solar Panel Memo 8.30.2017
Solar Equipment	Solar Panel Memo 8.30.2017
Material & Labor	Solar Panel Memo 8.30.2017
RDS is the installation company	Solar Panel Memo 8.30.2017

Array Operation

salary	\$ -	\$ 2,308	per year
Total Estimate for 25 years	\$ -	\$ 57,692	

Assumes UH will pay an employee 2 weeks worth of operational maintenance per yr at an annual salary of \$60,000

Array Maintenance

Est annual cost with maintenance contract	\$ -	\$ -	
Est annual cost without maintenance contract	\$ 150	\$ 150	for 1 service call
Total estimate for 25 years	\$ 3,000	\$ 3,000	

5 years maintenance contract
Conservative estimate by Will Baxter, RDS
Assumes first 5 years are free

Disposal

Salary	\$ 1,154	\$ 1,154
Recycle salvage return	\$ 200	\$ 200
Estimated disposal cost	\$ 954	\$ 954

Assumes an annual salary of \$60k
source: Will Baxter; conservative 1 week of labor
Aluminum parts can be recycled at a salvage yard.

Energy Savings

Power output	340	340	watts/solar panel
Daily charge input	5	5	sun hours
Power Output for control array set	34	34	kWh/day
Power Output for experimental array set	17	17	kWh/day
avg rate	\$ 7.04	\$ 7.04	c/kWh
Est return from energy created	\$ 1,310	\$ 1,310	per year
Total Estimate for 25 years	\$ 32,762	\$ 32,762	

Solar Panel Memo 8.30.2017
Will Baxter, RDS "rule of thumb"
assumes 20 solar panels at 100% capacity on average for 25 years
assumes 20 solar panels at 50% capacity on average for 25 years

Total Expenses after 25 years	\$3,954	\$61,646
Total Return after 25 years	\$32,762	\$32,762
Difference	\$28,809	(\$28,884)

94% of Total Expense for Low Case is UH salary costs
Total Return does not include donation value

Net Donation Value	\$ 14,000	\$ 14,000
--------------------	-----------	-----------

Net Value	\$ 42,809	\$ (14,884)
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* Costs of any experiments on the solar array are not included in this estimate.

HARC (Houston Area Research Council) will monitor the production output.

Notes only	
\$ 7.04	c/kWh residential
\$ 8.16	c/kWh commercial
\$ 5.57	c/kWh industrial



LIMITED WARRANTY

REV. 050114-LINEAR

Jinko Solar Import and Export Co., Ltd. (“**Jinko**”) generally provides the Warranties set forth herein to the original purchaser and its permitted successors and assigns (“**Customer**”) with respect to all solar photovoltaic modules sold by Jinko under purchase agreements signed on or after May 1, 2014 (“**Modules**”), subject to the terms and conditions herein (“**Limited Warranty**”). Jinko and Customer may hereinafter be referred to each as a “**Party**” and collectively as the “**Parties**”.

1. **WARRANTY START DATE.** Jinko provides the Warranties set forth herein commencing upon the earlier of delivery of Modules to the original purchaser thereof or that date which is one hundred and eighty (180) days following the Module manufacture date, as indicated by the serial number [digit no. 7 – 12 (YYMMDD)], starting from the left side of the serial number] for such Module (“**Warranty Start Date**”).

2. **LIMITED PRODUCT WARRANTY.** Beginning on the Warranty Start Date and terminating on that date which is one hundred and twenty (120) months thereafter, Jinko warrants that the Modules and their respective DC connectors and cables, if any, shall be free from material defects in design, materials and workmanship that affect the performance of the Module (“**Limited Product Warranty**”). Material defects shall not include normal wear and tear.

3. **LIMITED POWER WARRANTY.** Jinko warrants that the Degradation Rate shall not exceed the following for the periods identified following the Warranty Start Date: (a) for mono-crystalline Modules: (i) 3.0% in the first year; (ii) 0.7% each year thereafter until that date which is twenty-five (25) years following the Warranty Start Date, at which time the Actual Power Output shall be not less than 80.2% of the Nominal Power Output; and (b) for poly-

crystalline Modules: (i) 2.5% in the first year; (ii) 0.7% each year thereafter until that date which is twenty-five (25) years following the Warranty Start Date, at which time the Actual Power Output shall be not less than 80.7% of the Nominal Power Output (“**Limited Power Warranty**”).

4. **POWER DEFINITIONS.** “**Nominal Power Output (PO₀)**” means the original manufactured nameplate specification of the Module, expressed in Watts, as certified by Jinko and indicated on the Module, excluding any specified positive tolerance. “**Actual Power Output (PO_t)**” means the power output of the Module, expressed in Watts, at Watt peak that a Module generates at a given point in time in a year after the Warranty Start Date (**t**) in its ‘Maximum Power Point’ under Standard Test Conditions, corrected for any measurement error (“**STC**”). STC are as follows, measured in accordance with IEC 61215: (a) light spectrum of AM 1.5; (b) an irradiation of 1000W per m²; and (c) a cell temperature of 25 degrees centigrade at right angle irradiation. The “**Degradation Rate (DR)**” shall be any positive amount calculated in accordance with the following formula, expressed as a percent:

$$DR = 1.00 - [(PO_t) / (PO_0)]$$

5. **CLAIMS.** Customer shall bear the burden of establishing a breach of the Warranties hereunder. If Customer believes there has been a breach of the Limited Product Warranty or Limited Power Warranty (collectively, “**Warranties**”), then Customer shall promptly, and not later than thirty (30) days after knowledge thereof, provide notice to Jinko setting forth the following information related to the claim: (a) party making claim; (b) detailed description; (c) evidence, including photographs and data; (d) relevant serial numbers; (e)

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Warranty Start Date; (f) Module type; (g) physical address; (h) any additional evidence reasonably requested by Jinko; and (i) upon request from Jinko, the actual Module(s) allegedly causing the breach. Notwithstanding anything to the contrary herein, Jinko shall be entitled, in Jinko's sole discretion upon written notice to Customer, to require that any breach of the Warranties alleged by Customer be reviewed by TÜV Rheinland, TÜV SUD or other neutral third party testing laboratory selected by Jinko and approved by Customer, such approval not to be unreasonably withheld or delayed ("**Independent Testing Lab**"). The power measurement tolerance of any testing equipment utilized by any Independent Testing Lab in performing tests required by this Section 5 shall be disclosed in writing to both Parties prior to performance of any such tests and shall be reflected in any final test results provided by the Independent Testing Lab. The determination by an Independent Testing Lab as to whether a breach has occurred shall be final and conclusive with respect to the matters covered by such determination. Jinko shall be responsible for all costs incurred by it in connection with the shipment by Customer of a Module pursuant to Section 5(i) hereto and any Independent Testing Lab's services provided pursuant to this Section 5, including shipping, testing services, storage, insurance and any Module destruction incidental thereto; provided, however, Customer shall promptly upon receipt of notice indemnify Jinko for all such costs on a dollar-for-dollar basis in the event the Independent Testing Lab is unable to confirm a breach of the Warranties or Customer is otherwise unable to establish a breach of the Warranties.

6. **REMEDIES.** In Jinko's sole discretion, Jinko shall repair, replace or provide additional modules compensating for the related power

loss for any Module which causes a breach of the Warranties. Additional, repaired or replacement Modules shall be delivered to the same destination and on the same INCOTERMS 2010 delivery basis that the original Module causing breach of the Warranties was delivered under the purchase agreement to which this Limited Warranty applies. Replaced Modules received by Jinko pursuant to Section 5 shall be the sole property of Jinko. Jinko shall be solely responsible for all shipping costs incurred performing its additional supply, repair or replacement obligations under this Section 6. Additional or replacement Modules shall be of the same type and physical form as the original Module, electrically compatible with the original Module, and have an electrical output of not less than the warranted power output of the original Module at the time of supply or replacement, based on the warranted degradation rates set forth at Section 3 hereto. Notwithstanding the foregoing, if Jinko no longer supplies Modules meeting the foregoing criteria, then additional or replacement Modules provided under this Section 6 shall be those Modules then supplied by Jinko most substantially meeting the foregoing criteria. Jinko's performance of any repair, replacement or additional supply pursuant to this Section 6 shall not extend the term of any Warranties.

7. **EXCLUSIONS.** This Limited Warranty is subject to the exclusions set forth in this Section 7. The Warranties shall not apply to any Module which has been: (a) altered, repaired or modified without the prior written consent of Jinko or otherwise inconsistent with Jinko's written instructions; (b) removed and re-installed at any location other than the physical location in which it was originally installed following purchase by Customer or receipt from Jinko as a replacement Module; (c) subject to misuse, abuse, neglect, or accident except as may be

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caused by Jinko in the course of storage, transportation, handling, installation, application, use or service; (d) subject to force majeure, electrical surges, lightning, flood, fire, vandalism, tampering, accidental breakage, or other events beyond Jinko's control, resulting in material damage to the Module; (e) installed on mobile platforms (other than single- or dual-axis trackers) or in a marine environment; (f) subject to direct contact with corrosive agents or salt water; pest damage; or malfunctioning PV system components; or (g) used in a manner inconsistent with the version of Jinko Installation Manual available at www.jinkosolar.com on the date the Module is manufactured. The Warranties shall not apply to any Module for which the labels thereon indicating type or serial number have been altered, removed or made illegible. The Warranty shall not apply to Modules for which full and final payment has not been received by Jinko.

8. NOTICE. Any notice required or permitted under this Limited Warranty shall be in writing and deemed to be properly given by the sender and received by the addressee. Mailed notices and facsimile notices shall be addressed to the Jinko office located closest to the place of original installation, as identified at www.jinkosolar.com/contact.html. Notices by e-mail should be sent to cs@jinkosolar.com. Customer shall promptly provide contact information upon request. For the avoidance of doubt, e-mail alone shall not constitute valid notice pursuant to this Section 8.

9. LIMITS OF LIABILITY. **NOTWITHSTANDING ANYTHING TO THE CONTRARY IN THIS LIMITED WARRANTY, EXCEPT AS EXPRESSLY PROVIDED HEREIN, JINKO MAKES NO WARRANTIES, GUARANTEES OR CONDITIONS, EXPRESS OR IMPLIED, ARISING FROM OR RELATING TO THE**

MODULES AND JINKO DISCLAIMS ANY WARRANTY OR GUARANTEE IMPLIED BY LAW, INCLUDING IMPLIED WARRANTIES OF PERFORMANCE, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND IMPLIED WARRANTIES OF CUSTOM OR USAGE, ARISING FROM OR RELATING TO THE MODULES. THE REMEDIES FOR BREACH OF THIS WARRANTY ARE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES ARISING FROM OR RELATING TO ANY BREACH OF THE WARRANTIES. IN NO EVENT SHALL JINKO BE RESPONSIBLE PURSUANT TO THIS WARRANTY FOR ANY PERFORMANCE ANALYSIS, INSPECTION, DIAGNOSIS, REMOVAL, CUSTOMS, IMPORT DUTIES, EXPORT DUTIES, TAXES, REINSTALLATION COSTS, SPECIAL, INDIRECT, INCIDENTAL, PUNITIVE, EXEMPLARY OR CONSEQUENTIAL DAMAGES OF ANY NATURE WHATSOEVER, INCLUDING LOSSES OR DAMAGES CAUSED BY REASON OF LOSS OF USE, LOSS OF PROFITS OR REVENUE, INTEREST CHARGES (EXCEPT AS EXPRESSLY PROVIDED HEREIN), LOSS OF BONDING CAPACITY, COST OF CAPITAL OR CLAIMS OF CUSTOMER DAMAGES, WHETHER LIABILITY ARISES AS A RESULT OF BREACH OF CONTRACT, TORT LIABILITY (INCLUDING NEGLIGENCE), STRICT LIABILITY, BY OPERATION OF LAW OR IN ANY OTHER MANNER. EXCEPT AS SET OUT IN THIS LIMITED WARRANTY, JINKO SHALL HAVE NO RESPONSIBILITY OR LIABILITY WHATSOEVER FOR DAMAGE OR INJURY TO PERSONS OR PROPERTY, OR FOR OTHER LOSS OR INJURY RESULTING FROM ANY CAUSE WHATSOEVER ARISING OUT OF OR RELATED TO THIS LIMITED WARRANTY.

10. ASSIGNMENT. Notwithstanding anything to the contrary herein, this Limited Warranty is for the sole and exclusive benefit of Customer and there are no third party beneficiaries hereof; provided, however, subject to written notice to

Exhibit D

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and Jinko's receipt of full and final payment for the Modules, this entire Limited Warranty may be assigned in whole but not in part to any person or entity. Any permitted assignee of this Limited Warranty shall execute such agreements as may reasonably be requested by Jinko to confirm the applicability of any term hereof as a condition to assignment.

11. **LAW AND FORUM.** Any dispute related to or arising out of this Limited Warranty, including without limitation any question regarding its existence, validity, breach, or termination, shall be referred to and finally resolved pursuant to the governing law clauses and dispute resolution procedures under the purchase agreement between the original purchaser and Jinko. As a condition to any obligation of Jinko hereunder, Jinko may require any Customer seeking to enforce this Limited Warranty to execute such additional agreements as may reasonably be required to enforce the terms of this Section 11.

12. **MERGER CLAUSE.** This Limited Warranty sets forth the entire agreement and understanding of the Parties relating to the subject matter herein and supersedes all prior or contemporaneous discussions, understandings and agreements, whether oral or written, between them relating to the subject matter hereof.

13. **SEVERABILITY.** If one or more provisions of this Limited Warranty are held to be unenforceable under applicable law, the Parties agree to renegotiate such provision in good faith. In the event that the parties cannot reach a mutually agreeable and enforceable replacement for such provision, then (a) such provision shall be excluded from this Limited Warranty, (b) the balance of this Limited Warranty shall be interpreted as if such

provision were so excluded and (c) the balance of the this Limited Warranty shall be enforceable in accordance with its terms.

14. **MISCELLANEOUS.** The terms of this Limited Warranty are conditioned upon their incorporation in a contractual agreement between Jinko and Customer and are subject to modification when incorporated therein. Jinko reserves the right to modify or rescind this Limited Warranty at any time, with or without notice.

[END OF LIMITED WARRANTY]

Exhibit E

XXX KW (DC) SOLAR INSTALLATION AGREEMENT

By the execution of this XXXKW (DC) Solar Installation Agreement (this "Agreement"), Adaptive Solar, LLC, d/b/a Adaptive Solar Design ("ASD") and the undersigned ("Customer") hereby agree to the following:

DESIGN CRITERIA/PERMITS

Installation of all materials in the Scope of Work hereinbelow shall be in accordance with the approved design specifications set forth on Appendix "A", attached hereto and incorporated herein for all purposes (the "Design"). Customer acknowledges that the execution of this Agreement evidences acceptance of the Design and that any changes to the Design may result in additional costs above the stated price.

ASD shall secure and pay for all permits, agreements, licenses and inspections necessary for proper execution and completion of the work. In the event ASD is unable secure such permits, licenses and inspections, ASD shall have the right (not the obligation) to terminate this Agreement, whereupon the rights and obligations of the parties shall cease and be of no further force and effect, except that Customer shall reimburse ASD for any costs and expenses approved in advance by customer and incurred up to the date of termination.

SCOPE OF WORK

ASD shall provide the following to Customer:

1. XX QTY module brand XXX watt Modules*
2. Racking as per Design.
3. XXX Inverters as per Design.
4. Electrical materials as per Design.

* Exact number of modules and power ratings may vary with availability however, system rated power must meet or exceed XXX Watts (DC).

WARRANTIES

1. ASD warranties the labor and workmanship for a period of Ten (10) years from the date of installation as set forth in the terms and conditions attached to this agreement, and incorporated herein for all purposes (the "Terms & Conditions").

Exhibit E

2. All manufacturer's warranties shall be assigned to Customer, as is possible, which shall include a maximum XX year inverter warranty and a maximum XX year module warranties, all without recourse to ASD.

3. An additional \$XXXX will be added for a concierge service for a term of 10 years. This shall include annual cleanings, annual visual inspections of the inverters modules and wiring. Monitoring of the system via an internet portal and proactive maintenance is included. Any labor from the result of a warranted piece of equipment included in this contract will be provided at no charge. Any additional materials or replacement parts that are required and not covered by the manufacturers warranty will be charged at market rate. If for any reason the customer is dissatisfied with the service they may request a prorated reimbursement at any time. Requests must be submitted in writing and will be reimbursed within 90 days of the request being submitted.

EXPRESS ACCEPTANCE

By the execution of this Agreement, Customer acknowledges that they have read and understood the attached Terms & Conditions and expressly agree to be bound by all the provisions thereof as to the extent not inconsistent with the terms set forth in the agreement.

PRICE

Customer agrees to pay \$ XXXX. 10% down to begin design, 70% material deposit 10 business days before installation begins, 20% completion payment within **5 days** of completion of the installation. As used herein, "completion of the installation" shall mean the first day the system is fully installed and functioning per the Design, which determination is at the reasonable discretion of ASD, acting in good faith.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement to be effective as of _____, 2017.

ASD:

CUSTOMER:

ADAPTIVE SOLAR, LLC
d/b/a ADAPTIVE SOLAR DESIGN

Print Name Richard Sherwood

Print Name XXXX

Exhibit E

Signature

Signature

Title Adaptive Solar Owner

Title

Address

Terms and Conditions:

1) **DEFINITIONS.** The following capitalized terms, as used in these terms and conditions ("Terms & Conditions"), shall have the meanings defined for them as follows: "Agreement" shall mean the XXXKW (DC) Solar Installation Agreement ("Agreement") to which these Terms & Conditions are attached. "ASD" shall include Adaptive Solar Design, and any and all parents, subsidiaries, directors, shareholders, officers, employees, contractors and affiliates thereto. "Equipment" means any one or more of the items identified as such on the first page of the Agreement, and shall include any accessories, attachments or other similar items delivered to Customer. "Customer" means the person or entity identified as such on the first page of the Agreement, including any owner, representative, agent, officer or employee thereof. "Parties" shall mean both ASD and Customer. "Party" shall mean either ASD or Customer.

2) **MUTUAL INDEMNITY.** EACH PARTY (THE "INDEMNIFYING PARTY") HEREBY AGREES TO INDEMNIFY AND HOLD HARMLESS THE OTHER PARTY (THE "INDEMNIFIED PARTY") FROM ANY AND ALL CLAIMS, DEMANDS, ACTIONS, LIABILITIES, COSTS, EXPENSES, AND/OR DAMAGES TO PERSON OR PROPERTY ASSERTED AGAINST, IMPOSED UPON OR INCURRED BY THE INDEMNIFIED PARTY ARISING FROM, IN CONNECTION WITH OR ON ACCOUNT OF ANY ACT OR OMISSION (IN WHOLE OR IN PART, DIRECTLY OR INDIRECTLY) OF THE INDEMNIFYING PARTY IN RELATION TO THE EQUIPMENT OR ANY MATTER RELATED THERETO. THE INDEMNIFYING PARTY FURTHER AGREES TO PAY THE INDEMNIFIED PARTY'S COURT COSTS, REASONABLE ATTORNEYS' FEES INCURRED AND ALL OTHER ASSOCIATED COSTS ARISING FROM ANY SUCH CLAIMS, INCLUDING, BUT NOT LIMITED TO, ALL COSTS INCURRED IN ESTABLISHING THE APPLICABILITY OF THIS PARAGRAPH. THIS INDEMNITY SHALL APPLY WITHOUT REGARD TO WHETHER THE CLAIM, DEMAND, ACTION, LIABILITY, COST, EXPENSE, OR DAMAGE IS BASED ON BREACH OF CONTRACT, BREACH OF WARRANTY, NEGLIGENCE, STRICT LIABILITY OR OTHER TORT. THIS SECTION SHALL SURVIVE THE COMPLETION, EXPIRATION OR TERMINATION OF THE AGREEMENT.

3) **LIMITATION OF LIABILITY AND REMEDY.** Customer acknowledges and agrees that under no circumstances shall ASD be liable for deficiency in any performance on any matter caused in whole or in part by acts or omissions of third parties,

Exhibit E

delays, failures to perform, damages, losses, destruction, malfunction of the Equipment, or any consequence thereof, caused or occasioned by, or due to, fire, flood, water, the elements, explosions, civil disturbances, governmental actions, shortages of equipment or supplies, unavailability of transportation, or any other cause beyond ASD's reasonable control. CUSTOMER ACKNOWLEDGES AND AGREES THAT ASD SHALL NOT BE LIABLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY OR CONSEQUENTIAL DAMAGES RESULTING FROM, ARISING OUT OF OR IN CONNECTION WITH THE EQUIPMENT OR ANY MATTER RELATED THERETO. CUSTOMER AGREES TO ASSUME ALL RESPONSIBILITY AND RISK FOR THE DELIVERY, USE AND MAINTENANCE OF THE EQUIPMENT UNLESS OTHERWISE EXPRESSLY PROVIDED. CUSTOMER AGREES TO LOOK EXCLUSIVELY TO THE MANUFACTURER AND/OR CUSTOMER'S INSURER TO RECOVER FOR INJURIES, LOSS AND/OR DAMAGES DIRECTLY OR INDIRECTLY CAUSED BY CUSTOMER'S USE OF THE EQUIPMENT, ANY OTHER PARTIES' USE OF THE EQUIPMENT OR ANY MATTER RELATED THERETO. BECAUSE IT IS EXTREMELY DIFFICULT TO FIX THE ACTUAL DAMAGES, IF ANY, WHICH MAY RESULT FROM FAILURE ON THE PART OF ASD TO PERFORM ANY OF THEIR OBLIGATIONS HEREUNDER AND BECAUSE CUSTOMER DOES NOT DESIRE THE AGREEMENT OR THESE TERMS & CONDITIONS TO PROVIDE FOR FULL LIABILITY OF ASD, CUSTOMER AGREES THAT ASD SHALL BE EXEMPT FROM ANY AND ALL LIABILITY FOR LOSS, DAMAGE AND/OR INJURY DUE TO A FAILURE OF THE EQUIPMENT IN ANY RESPECT THAT IS NOT WITHIN THE REASONABLE CONTROL OF OR CAUSED BY ASD. CUSTOMER FURTHER AGREES THAT SHOULD ASD BE FOUND LIABLE FOR LOSS, DAMAGE, AND/OR INJURY DUE TO A FAILURE OF THE EQUIPMENT IN ANY RESPECT, ASD'S LIABILITY SHALL BE NO GREATER THAN A SUM EQUAL TO THE FAIR MARKET VALUE OF THE EQUIPMENT, AS THE AGREED UPON DAMAGES, NOT AS A PENALTY, BUT AS THE EXCLUSIVE REMEDY, AND THAT THE PROVISIONS OF THIS PARAGRAPH SHALL APPLY REGARDLESS OF WHETHER SUCH DAMAGE, INJURY AND/OR LOSS WAS DUE DIRECTLY OR INDIRECTLY FROM THE NEGLIGENCE, GROSS NEGLIGENCE OR WILLFUL MISCONDUCT OF ASD OR ARISING OUT OF STRICT LIABILITY IN TORT OR OTHERWISE. CUSTOMER FURTHER ACKNOWLEDGES AND AGREES THAT THE INCLUSION OF THIS PARAGRAPH WAS A MATERIAL CONSIDERATION FOR ASD TO ENTER INTO THE AGREEMENT. THE LIMITATIONS SET FORTH IN THIS PARAGRAPH ARE INDEPENDENT OF EACH OTHER AND BOTH THE LIMITATION OF DAMAGES AND LIMITATION OF REMEDY SET FORTH HEREIN ABOVE SHALL SURVIVE ANY FAILURE OF THE ESSENTIAL PURPOSE OF ANY OR ALL PARTS OF THE LIMITED REMEDY. THIS SECTION SHALL SURVIVE THE COMPLETION, EXPIRATION OR TERMINATION OF THE AGREEMENT.

4) USE OF EQUIPMENT; EQUIPMENT MALFUNCTIONS. Customer will not use or allow anyone to use the Equipment for an illegal purpose or in an illegal manner, without a license, if required under any applicable law, or who is not qualified to operate the Equipment. Customer, at Customer's sole expense, shall comply with all applicable municipal, state, and federal laws, ordinances and regulations that may apply to the use of the Equipment. Customer agrees to check, clean and visually inspect the equipment. Customer acknowledges the ASD has no responsibility to inspect the Equipment while it is in Customer's possession, unless otherwise expressly agreed to in writing by and between the Parties. Customer is responsible for any environmental risks associated with the use and maintenance of the Equipment. Should the Equipment become unsafe, malfunction or require repair, Customer shall immediately cease using such Equipment and immediately notify ASD and or an authorized dealer. ASD has no obligation to replace equipment rendered inoperable by any act or omission out of the reasonable control of ASD.

5) REASONABLE WEAR AND TEAR. Reasonable wear and tear of the Equipment shall mean only the normal deterioration of the Equipment caused by ordinary and reasonable use on a normal basis. The following (without limitation) shall "not" be deemed reasonable wear and tear: (a) damage resulting from lack of maintenance; (ii) Damage resulting from any collision, overturning, or operation, including overloading or exceeding the rated capacity of the Equipment; or (iii) the failure of Customer to service and perform maintenance on the Equipment according to the manufacturer's or ASD's instructions.

6) FOR CONSUMER TRANSACTIONS ONLY: CANCELLATION RIGHT; CONDITIONS CONSTITUTING ACCEPTANCE. Customer may, without any penalty or charge, cancel this Agreement at any time within three (3) days following the execution of this Agreement by the Parties. The deadline for cancelling the Agreement is _____ (the "Cancellation Period"). Attached as Exhibit "A" is a notice of cancellation that further explains this right. Following the elapse of the Cancellation Period, in the event the Parties have executed the Agreement, once ASD begins the process of procuring the Equipment or initiating any of the work for Customer, such process shall constitute an irrevocable acceptance of such Equipment or services. In the event Customer cancels this Agreement after the elapse of the Cancellation Period, this shall constitute an event of default in accordance with Section 8 hereinbelow and, in addition to the terms and provisions therein, Customer shall be subject to a Twenty Percent (20%) restocking fee on the total amount of the Agreement, which shall be seen not as a penalty, but as the mutually agreed upon sum of liquidated damages for the cancellation of this Agreement by Customer.

Exhibit E

7) **PAYMENT.** All sums due by Customer to ASD pursuant to the Agreement shall be immediately payable in full upon completion of the installation, unless otherwise expressly stated. Failure to pay any and all sums when due shall be deemed an event of default in accordance with Section 8 hereinbelow.

8) **DEFAULT.** Should Customer (i) fail to perform, observe or keep any of its obligations under the Agreement or these Terms & Conditions; (ii) fail to pay when due the full amount of any sums owed to ASD; (iii) become insolvent, have a petition in bankruptcy filed by or against them prior to full payment to ASD; (iv) assign any of the Equipment to any third party prior to full payment to ASD; (v) convey, sell or transfer, or attempt to convey, sell or transfer any of the Equipment to any third party in any manner prior to full payment to ASD; (vi) lose, substantially destroy or damage any of the Equipment prior to full payment to ASD, ASD may at its option do any one or more of the following: (a) terminate this agreement and retain all sums paid to ASD, not as a penalty, but as the agreed upon liquidated damages for such default; (b) declare all unpaid amounts owed immediately due and payable without further notice or demand and will thereafter bear interest at the highest rate allowed by law until paid; (c) pursue any other remedies available at law or equity; (d) take possession of the Equipment on demand by having Customer deliver the Equipment to a place designated by ASD. **CUSTOMER HEREBY WAIVES ANY CLAIMS AND/OR DAMAGES OF ANY MANNER ARISING OUT OF ASD'S TAKING POSSESSION OF THE EQUIPMENT.** Customer hereby expressly agrees that a fifteen (15) day period for notification of a proposed sale or disposition of the equipment is reasonable, that any notice or communication sent to Customer may be sent to Customer's address as listed in this Agreement, and that Customer shall be responsible for all costs incurred or sums advanced (including, without limitation, reasonable attorney's fees and associated costs) in relation to any remedy utilized.

9) **WARRANTIES.** ASD can only warrant the labor and workmanship (collectively, the "Work") on the installation and assembly of the Equipment only. The warranty afforded by ASD to Customer is strictly limited to ten (10) years on the Work only and further limited to (i) any aspect of the installation that does not conform to the standards set forth in the final customer approved Design; (ii) Equipment failure resulting from improper installation; (iii) Damage to property of the Customer during installation; and (iv) Leaks within a 5-inch radius of roof penetrations made by ASD. **THE EQUIPMENT IS PROVIDED ON AN "AS IS" AND "WITH ALL FAULTS" BASIS. ASD MAKES NO EXPRESS REPRESENTATIONS OR WARRANTIES ABOUT THE EQUIPMENT PROVIDED AND DISCLAIMS ANY IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, WARRANTIES OF TITLE, WARRANTIES OF MERCHANTABILITY, WARRANTIES OF QUALITY AND/OR WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE. ASD DOES NOT AUTHORIZE ANYONE TO MAKE A WARRANTY OF ANY KIND ON ITS BEHALF AND CUSTOMER MAY NOT RELY ON ANY STATEMENT OF WARRANTY. ASD IS NOT THE MANUFACTURER OF THE EQUIPMENT AND THE ONLY WARRANTY APPLICABLE TO THE EQUIPMENT IS THAT PROVIDED BY THE EQUIPMENT MANUFACTURERS, WHICH ASD SHALL PASS ALONG TO CUSTOMER, AS AVAILABLE. CUSTOMER HEREBY EXPRESSLY ACKNOWLEDGES THAT CUSTOMER IS NOT RELYING ON THE STATEMENTS, REPRESENTATIONS OR ACTIONS OF ANY EMPLOYEE, REPRESENTATIVE, AGENT OR CONTRACTOR OF ASD IN ANY WAY. THIS SECTION SHALL SURVIVE THE COMPLETION, EXPIRATION OR TERMINATION OF THIS AGREEMENT.**

10) **NO WAIVER; NO ACCORD AND SATISFACTION.** The failure of either Party to enforce any of the terms, provisions or covenants of the Agreement or the Terms & Conditions shall not be construed as a waiver of the same or of the right of such Party to enforce the same. Waiver by either Party hereto of any breach or default by any other Party of any term or provision of this Agreement shall not operate as a waiver of any other breach or default. The Parties hereto expressly agree that no payment made by Customer or on behalf of Customer of a lesser amount than the required amount shall be deemed an accord and satisfaction, regardless of any statement on any check or accompanying letter to the contrary, and ASD is hereby authorized to accept such payment(s) without prejudice to its rights to recover any balance due.

11) **SEVERABILITY.** Whenever possible, each provision of this Agreement shall be interpreted in such manner as to be effective and valid under applicable law, but if any provision (or any section of any provision) of the Agreement or these Terms & Conditions is held to be prohibited by or invalid under applicable law, such provision (or any section of any provision) shall be ineffective only to the extent of such prohibition or invalidity, without invalidating the remainder of such provision or the remaining provisions of the Agreement or these Terms & Conditions.

12) **INURNMENT; CONTRACT NEGOTIATION.** The provisions of the Agreement and these Terms & Conditions shall inure to the benefit of and shall be binding on the heirs, successors and permitted assigns of each of the Parties hereto. Customer shall bear all ASD's costs and expenses (including legal costs) in the event Customer wishes to negotiate the Agreement or these Terms & Conditions.

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13) **GOVERNING LAW; ARBITRATION.** The Agreement (which shall include these Terms & Conditions) has been executed in and shall be governed by the laws of the State of Texas, without giving effect to the conflicts of law principles of any state. The Parties hereby irrevocably consent to be subject to the personal jurisdiction of any United States, state, local court, or other administrative body sitting in Harris County, Houston, Texas in connection with any action to determine any dispute arising under this Agreement or to enforce the provisions hereof. **If any dispute shall arise relative to the interpretation of this Agreement (which shall include the Terms & Conditions) or to enforce any provisions herein, the dispute shall be submitted to arbitration at Houston, Harris County, Texas according to the then existing rules of the American Arbitration Association. Notice of the demand for arbitration of a dispute shall be filed in writing with the other Party to this Agreement. The Parties shall equally split the arbitrator fees. The decision of the arbitrator shall be a condition precedent to the right of legal action that any Party may have against any other. Judgment on any arbitration award may be entered in any court of competent jurisdiction. The losing Party shall pay the prevailing party's reasonable attorney's fees and other costs and expenses as assessed by the arbitrator.**

NOTICE OF CANCELLATION (1)

You may cancel this contract, without any penalty or obligation, at any time within three (3) days after the date the contract is signed.

If you cancel, any payment made by you under this contract will be returned within 10 days after date of receipt by Adaptive Solar Design of your cancellation notice.

To cancel this contract, mail or deliver a signed dated copy of this cancellation notice, or any other written notice to:

Adaptive Solar Design, at 4101 Greenbriar Suite 205b Houston, TX 77098 no later than midnight the date of _____ (INSERT DATE 3 DAYS FROM CONTRACT DATE)

I hereby cancel this transaction.

Exhibit E

Date: _____

Client's Printed Name: _____

Client's Signature: _____

DO NOT SIGN UNLESS YOU WANT TO CANCEL

NOTICE OF CANCELLATION (2)

You may cancel this contract, without any penalty or obligation, at any time within three (3) days after the date the contract is signed.

If you cancel, any payment made by you under this contract will be returned within 10 days after date of receipt by Adaptive Solar Design of your cancellation notice.

To cancel this contract, mail or deliver a signed dated copy of this cancellation notice, or any other written notice to:

Exhibit E

Adaptive Solar Design, at 4101 Greenbriar Dr. Suite 205b Houston, TX 77098 no later than midnight the date of _____ (INSERT DATE 3 DAYS FROM CONTRACT DATE)

I hereby cancel this transaction.

Date: _____

Client's Printed Name: _____

Client's Signature: _____

DO NOT SIGN UNLESS YOU WANT TO CANCEL