

PURPOSE

This guide is intended to identify requirements associated with the plan review and inspection process related to the installation of solar photovoltaic systems and serve as a checklist prior to submission to the Plan Review group.

PERMIT REQUIREMENTS

Prior to application, verify deed restrictions with the civic association or county real property records regarding placement of solar panels on the subject property. At minimum, structural and electrical building permits are required for installation of any photovoltaic system. Both permits are issued under the same project/permit number. After approval is received from plan review, the building permits may be obtained. A registered licensed electrician must purchase the electrical building permit. Properties located in the Flood Plain, a historic district, or within designated areas near an airport will be subject to additional requirements.

NOTICE: In addition to City of Houston requirements, an application for interconnection must be submitted directly to Center Point Energy for approval and subsequent inspection approval prior to the start of installation.

APPLICATION & SUBMITTAL PROCESS

The application process and the submittal of plans must be done electronically. The Building Permit Application must be completed via [iPermits](#). A Declaration Supporting Building Permit Application (for individual or business entity depending on ownership) is required to be uploaded. The document must be signed by the property owner and will be validated against HCAD records. If ownership does not match HCAD, applicants must also upload proof of ownership. (<https://www.houstonpermittingcenter.org/media/2391/download> or <https://www.houstonpermittingcenter.org/media/2386/download>) A plan review fee (25% of the permit fee) must be paid once the application is finalized.

All the required plans and documents must be uploaded and submitted via [ProjectDox](#). Please refer to [the Solar Panel Only Electronic Plan Review \(EPR\) Submittal Guide](#) for complete instructions and procedures.

DRAWING PACKAGE CONTENTS

At minimum the submittal package shall include, but not be limited to the following information:

- ☐ A plan cover sheet, index of plans, and a code analysis sheet listing the applicable codes & standards: e.g., 2021 IRC or 2021 IBC (not both), and 2023 NEC, 2021 IFC, 2021 IEBC, 2021 IECC, 2021 UMC, 2021 UPC, 2021 ISPSC and associated Houston Amendments, Code Words, and HFD Life Safety Bureau Standards.
- ☐ A site or plot plan drawn to scale based on a survey of the property and showing the size and location of new construction and existing structures showing distances to all property/lot lines. In addition, easements, setbacks, exterior equipment and pads, and storage batteries, etc., shall be shown. This information may be obtained from the survey included with homeowner closing documents. There shall be no encroachment into easements by the new scope of work (solar panels, rack/rail systems, and equipment).
- ☐ Documents marked preliminary or not for construction are unacceptable and returned without review. All documents in the submitted review package shall be ready for construction, and shall not include alternates, options or preliminary designs. At minimum, the plans shall include, but not be limited to:
 - ☐ Roof plan drawn to scale with 1) the layout of solar panels and existing roof penetrations, chimneys, vents, etc., and 2) railing & mounting locations clearly identified (relative to roof rafters) with a cross-section anchorage detail with anchorage specifications clearly identified. Provide a note of the total square footage of the roof planes upon which have solar panels identified.
 - ☐ Structural letters, calculations, plans, details, manufacturer installation instructions for rails, racks, attachments, etc., nationally recognized certifications, and other related documents designed and sealed by a Texas Professional Engineer (PE) to address the added loads of the product used as well as anchorage of panels to the existing structure, as well as detailed structural design of new foundations or structures located at grade. (Refer to Exhibit 8)



- ☐ **NOTE:** Where the manufacturer cut/installation sheets document options, the engineer or installer shall designate the specific code compliant product(s) to be installed.
- ☐ A sealed Texas engineers' letter shall be provided indicating the existing structure with the proposed solar system complies with applicable building code structural requirements, or Texas engineer sealed, signed and dated plans shall identify additional framing needed for compliance with minimum structural design provisions of Houston Building or Residential code. Reference appropriate code and handout CE-1110:
<https://www.houstonpermittingcenter.org/media/2121/download>
- ☐ For residential buildings or structures constructed to the 2021 IRC plans shall show compliance with the appropriate minimum wind speed design for the specific address as specified by Table R301.2(1), footnote n., and <https://asce7hazardtool.online/> (include the printout of the results). All roofing and equipment assemblies must comply with the appropriate minimum wind design for the appropriate code applicable.
- ☐ For residential buildings or structures constructed to the 2021 IBC the plans shall show compliance with the appropriate minimum wind speed design for the specific address as specified by Section 1609.3 and <https://asce7hazardtool.online/> (include the printout of the results). All roofing and equipment assemblies must comply with the appropriate minimum wind design for the code used. (Do not combine with IRC)
- ☐ Plans details shall document compliance with applicable code provisions of the IRC or IBC. For example, general notes indicating "work to comply with 2021 IRC" is not appropriate or acceptable.
- ☐ The structural design shall be engineered in accordance with Texas Engineering Practice Act regulations and as specifically required by the Houston Building Official, whichever is more restrictive. All engineered sheets shall be sealed, signed and dated by a Texas licensed engineer.
- ☐ Electrical plans shall be prepared and signed/sealed by either a licensed electrician or a Texas engineer and show compliance with NEC Article 690, and the panels shall be listed for compliance with UL Standard 1703 and include, but not be limited to the following:
 - ☐ *Panel Layout*
 - ☐ *Panel Access Pathway Layout*
 - ☐ *Mounting Structure & Anchors*
 - ☐ *Roof Penetrations*
 - ☐ *Grounding Points*
 - ☐ *Conductor Size & Type*
 - ☐ *Conductor Insulation Type*
 - ☐ *Current Labels & Markings*
 - ☐ *Over Current Protection*
 - ☐ *Charge Controllers*
 - ☐ *Disconnect Size & Type*
 - ☐ *Inverter Size & Type*
 - ☐ *Battery(ies) Size & Type & weight*
 - ☐ *One-Line Diagram*
- ☐ Specification sheets with approved logos for all solar and associated solar electrical equipment showing listing by a recognized testing laboratory.
- ☐ Labeling and placards as required in NEC Article 690, 691 & Article 705: Interconnect Electrical Power Production Systems.

Note: Compliance with 2023 NEC Article 705 Interconnect Electrical Power Production Systems must be incorporated into the electrical design.

- ☐ Dimensioned roof layout plans showing roof access, required pathways, and spacing requirements compliant with 2021 IFC, Section 1205, Solar Photovoltaic Power Systems.
- ☐ Main breaker side tap conductors, minimum #6AWG or #4ALUM.
- ☐ Calculation/Tabulations to show how system was sized.

NOTE: NEW solar module products/systems not previously permitted, nor considered mainstream and/or missing labeling/listings or Code approvals may require an Alternative Method submittal noted in City Handout CE-1103: <https://www.houstonpermittingcenter.org/media/981/download>



EXHIBIT 1

DRAWINGS

EXHIBIT 2

SPECIAL ADDRESSES?


If the property is in the flood plain, it will trigger a review by FMO and will need this form: City of Houston Floodplain Management Office Project Cost Estimate Worksheet. This is used for more project types than Solar.

<https://www.houstonpermittingcenter.org/media/2826/download>

If the property is in a historic district, it will trigger a review by Planning, currently with no issues regarding solar panels.

EXHIBIT 3

SPECIAL ADDRESSES?


City of Houston Floodplain Management Office
Project Cost Estimate Worksheet

OWNER HAS HIRED/WILL HIRE CONTRACTOR
(This sample form for estimating cost estimates is an accurate and complete description of the requirements and associated costs scheduled for the property local efforts.)

Owner Signature _____ Date _____	Contractor Signature _____ Date _____
Owner Printed Name _____	Contractor Printed Name _____
Texas Driver's License or ID Number _____	Texas Driver's License or ID Number _____

Notary for Owner Signature
Notary to not witness before me, the undersigned authority on the _____ day of _____, To certify which witness my hand and seal of office.

NOTARY PUBLIC BY AND FOR THE STATE OF TEXAS _____ MY COMMISSION EXPIRES _____

Notary for Contractor Signature
Notary to not witness before me, the undersigned authority on the _____ day of _____, To certify which witness my hand and seal of office.

NOTARY PUBLIC BY AND FOR THE STATE OF TEXAS _____ MY COMMISSION EXPIRES _____

ENGINEER OR ARCHITECT CERTIFIES COST ESTIMATE

Engineer/Architect Signature _____ Seal & Date _____

Office Telephone Number _____

There are 3 options for signatures:

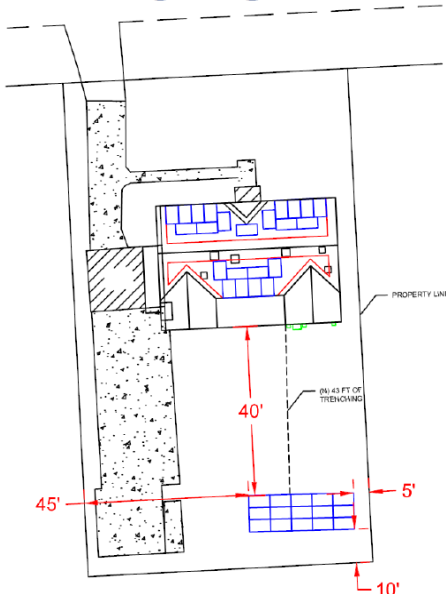
1. Owner w/o Contractor (N/A).
2. Owner w/ Contractor (there *must* be a TX notary on the sheet. If one of the signatories is out of state, *their* notary may be in their state).
3. Engineer or Architect (TX)

<https://www.houstonpermittingcenter.org/media/2826/download>

This must be placed in the Flood folder within the Form section of ProjectDox.

EXHIBIT 4

NOTES



All Single-Family residential buildings are classified as R3 and R3 accessory, **not** classified as Group U structures.

Label all structures with different addresses. Each address will require a separate solar permit.

Solar panels are prohibited from installation on un-permitted structures.

Ground-mounted panels are counted as structures and have setback requirements.

EXHIBIT 5

DRAWINGS

- Multiple buildings labeled?
- Property & setback lines labeled?
- Duplex/Townhouse fire-barrier location labeled?
- Roof plan drawn correctly?
- Escape windows blocked?
- Legend for eaves, ridges, rakes, hips, & valleys to be labeled?
- Roof levels & planes labeled?
- Flat roofs, parapets labeled?
- Roof materials labeled?
- Scale & North Arrow shown?

EXHIBIT 6

DRAWINGS

18" required on both sides if panels are on both sides of hip or valley. When on 1 side of the hip or valley, solar panels can go up to the edge.

- Ridge, rake, & valley, duplex-townhouse dividing line pathways?
- Arrays maximum of 150' in either direction?
- Equipment clearances shown?

EXHIBIT 7

DRAWINGS

- Ground-mounted structure details will be checked
- Address will be checked
- Setbacks will be checked
- Equipment will be checked
- Foundation will be checked
- Engineer's seal will be checked

EXHIBIT 8

DRAWINGS

- Cut sheets/specification will be checked
- Drawings will be checked for manufacturer's components
- Cuts sheets/specification items must match the items on the drawings.

EXHIBIT 9

INSTALLER ENGINEER LETTERS

Re: _____

To Whom It May Concern:

Pursuant to your request, we have reviewed the following information regarding solar panel installation on the roof of the above referenced home:

1. Site Visit/Verification Form prepared by a Current Insight representative identifying specific site information including size and spacing of rafters for the existing roof structure.
2. Design drawings of the proposed system including a site plan, roof plan and connection details for the solar panels. This information was prepared by Current Insight and will be utilized for approval and construction of the proposed system.
3. Photographs of the interior and exterior of the roof system identifying existing structural members and their conditions.

Based on the above information we have evaluated the structural capacity of the existing roof system to support the additional loads imposed by the solar panels and have the following comments related to our review and evaluation:

Description of Residence:

The existing residence is typical wood framing construction with the roof system consisting of 2 x 6 dimensional lumber at 24" on center. The attic space is unfinished and photos indicate that there was free access to visually inspect the size and condition of the roof rafters. All wood material utilized for the roof system is assumed to be Doug-Fir #2 or better with standard construction components. The existing roofing material consists of composite asphalt shingles.

Description of Ground Mount:

Based on our review of the Photovoltaic Array installed at 3 modules high and 5 modules wide. The PV array shall have a pier spacing of 7'-6" feet max north/south and 3'-2" east/west. Based on a wind speed of 110 mph (3-second gusts). Exposure C and a ground snow load of 0 PSF. It was determined that the minimum required footing depth is 48 inches below grade with a 18" diameter pier footing with 2" Dia schedule 40 post. The footing size based upon the worst case loading due to horizontal and vertical wind loading.

A. Loading Criteria Used

- 110 MPH (3-second gusts) wind loading based on ASCE 7-05 Exposure Category "C" at slopes of 32 degrees
- 7 PSF = Dead Load roofing/framing Live Load = 20 PSF Snow Load = 0 PSF
- 3 PSF = Dead Load solar panels/mounting hardware
- Total Dead Load = 10 PSF

The above values are within acceptable limits of recognized industry standards for similar structures in accordance with the 2012 IRC with Houston amendments. Analysis performed of the existing roof structure utilizing the above loading criteria indicates that the existing rafters will support the additional panel loading without damage, if installed correctly.

Uploaded as a single pdf

1. The solar panels shall be mounted in accordance with the most recent "Sunmodo Solar Installation Manual", which can be found on the Sunmodo Solar website (<http://sunmodo.com/>). If during solar panel installation, the roof framing members appear unstable or defect non-uniformly, our office should be notified before proceeding with the installation.

2. Connection on the roof is utilizing (4) #14 screws into the existing decking to resist uplift forces. Contractor to verify installation to be performed in accordance with the Sunmodo recommendations. Pull out values per screw are based on National Design Specification values for CDX plywood and are identified as 208 lbs/inch. Based on 1/2" sheathing the value per screw would be 104 lbs providing 416 lbs uplift resistance per attachment.

3. Considering the roof slopes, the size, spacing, condition of roof, the panel supports shall be placed no greater than 48" o/c.

Based on the above evaluation, it is the opinion of this office that with appropriate panel anchors being utilized the roof system will adequately support the additional loading imposed by the solar panels. This evaluation is in conformance with the 2012 IRC with Houston Amendments, current industry standards, and based on information supplied to us at the time of this report.

Should you have any questions regarding the above or if you require further information do not hesitate to contact me.

Very truly yours,

STATE OF TEXAS
YOUR NAME HERE
12345
LICENSED PROFESSIONAL ENGINEER

- The installer's engineer licensed in TX
- Verify the type of framing and roof
- Calls out wind load, dead load, design criteria, exposure category, & code of reference
- Calls out manufacturers

EXHIBIT 10

MANUFACTURER ENGINEER LETTERS

Attn.: Unirac - Engineering Department

Re: Engineering Certification for the Unirac U-Builder 2.0 SOLARMOUNT Flush Rail

_____ has reviewed the Unirac SOLARMOUNT rails, proprietary mounting system constructed from modular parts which is intended for rooftop installation of solar photovoltaic (PV) panels, and has reviewed the U-builder Online tool. This U-builder software includes analysis for the SOLARMOUNT LIGHT RAIL, SOLARMOUNT STANDARD RAIL, and SOLARMOUNT HEAVY DUTY RAIL with Standard and Pro Series hardware. All information, data and analysis contained within are based on, and comply with the following codes, city ordinances, and typical specifications:

1. Minimum Design Loads for Buildings and other Structures, ASCE/SEI 7-05, ASCE/SEI 7-10, ASCE/SEI 7-16.
2. 2006-2018 International Building Code, by International Code Council, Inc. w/ Provisions from SEAC PV-2 2017.
3. 2006-2018 International Residential Code, by International Code Council, Inc. w/ Provisions from SEAC PV-2 2017.
4. AC408, Acceptance Criteria for Modular Framing Systems Used to Support Photovoltaic (PV) Panels, November 1, 2012 by ICC-ES.
5. 2015 Aluminum Design Manual, by The Aluminum Association, 2015

Following are typical specifications to meet the above code requirements:

Design Criteria:

Ground Snow Load = 0 - 100 (psf)
Basic Wind Speed = 85 - 150 (mph)
Roof Mean Height = 0 - 60 (ft)
Roof Pitch = 0 - 45 (degrees)
Exposure Category = B, C & D

For Houston, TX:

Basic Wind Speed ASD Minimum 110 mph to 147 mph (3-sec gust ASCE 7-05 for IRC)
Basic Wind Speed LRFD Minimum 142 mph to 190 mph (Vult ASCE 7-10 for IBC)

Attachment Spacing:

Per U-builder Engineering report.

Cantilever:

Maximum cantilever length is L/3, where "L" is the span noted in the U-Builder online tool.

Clearance:

2" to 10" clear from top of roof to top of PV panel.

Tolerance(s):

1.0" tolerance for any specified dimension in this report is allowed for installation.

Installation Orientation:

See SOLARMOUNT Rail Flush Installation Guide.
Landscape - PV Panel long dimension is parallel to ridge/eave line of roof and the PV panel is mounted on the long side.
Portrait - PV Panel short dimension is parallel to ridge/eave line of roof and the PV panel is mounted on the short side.

Components and Cladding Roof Zones:

The Components and Cladding Roof Zones shall be determined based on ASCE 7-05, ASCE 7-10 & 7-16 Component and Cladding design.

Notes:

- 1) U-builder Online tool analysis is only for Unirac SM SOLARMOUNT Rail Flush systems only and do not include roof capacity check.
- 2) Risk Category II per ASCE 7-16.
- 3) Topographic factor, Kzt is 1.0.
- 4) Array Edge Factor F_e = 1.5
- 5) Average parapet height is 0.0 ft.
- 6) Wind speeds are LRFD values.
- 7) Attachment spacing(s) apply to a seismic design category E or less.

Design Responsibility:

The U-builder design software is intended to be used under the responsible charge of a registered design professional where required by the authority having jurisdiction. In all cases, this U-builder software should be used under the direction of a design professional with sufficient structural engineering knowledge and experience to be able to:

- Evaluate whether the U-Builder Software is applicable to the project, and
- Understand and determine the appropriate values for all input parameters of the U-Builder software.

This letter certifies that the Unirac SM SOLARMOUNT Rails Flush, when installed according to the U-Builder engineering report and the manufacturer specifications, is in compliance with the above codes and loading criteria.

This certification **excludes** evaluation of the following components:

- 1) The structure to support the loads imposed on the building by the array; including, but not limited to: strength and deflection of structural framing members, fastening and/or strength of roofing materials, and/or the effects of snow accumulation on the structure.
- 2) The attachment of the SM SOLARMOUNT Rails to the existing structure.
- 3) The capacity of the solar module frame to resist the loads.

This requires additional knowledge of the building and is outside the scope of the certification of this racking system.

If you have any questions on the above, do not hesitate to call.



- Uploaded as a single pdf
- Show Houston design criteria met
- Listings and labeling

The manufacturer's engineer licensed in TX

STATE OF TEXAS
YOUR NAME HERE
12345
LICENSED PROFESSIONAL ENGINEER

EXHIBIT 11

ROOFING



Existing roof coverings removed:

- When not adequate for covering
- Wood shake, slate, clay, cement, asbestos
- Two or more existing layers
- Requires a permit, which can combine with solar permit.

INSPECTION PACKAGE CONTENTS

The manufacturer's installation manual and the permit drawings shall remain on the jobsite during all inspections. The inspection requirements for installation of solar photovoltaic panels shall be based on the approved plans, the manufacturer's installation manual, and the Houston Construction Code, whichever is more restrictive.

1. The licensed electrical contractor shall schedule an inspection at the time of the completion of the work.
2. The licensed electrical contractor shall be on the job, and have one of the solar panels, the drawings, and all relevant paperwork for the inspector. The inspector will verify the labels and listings and whether the installation matches the approved plans.
3. The structural engineer must provide a special inspection letter certifying that the completed installation conforms to the city approved design. The special inspection letter may be submitted to the field inspector during the final field inspection or to the Structural Inspections Office at 1002 Washington Avenue 4th Floor, Houston, TX 77002.

CONTACT INFORMATION

Structural Inspections	(832) 394-8840	structural.inspections@houstontx.gov
Electrical Inspections	(832) 394-8860	hpcelectricalsection@houstontx.gov
Plan Review Questions	(832) 394-8820	solarpanels@houstontx.gov