Solar Water Heating and Photovoltaic Electrical Systems Installed on One or Two Family Dwellings

I. BACKGROUND

As awareness of renewable energy and green building options increases, solar energy systems are becoming a more common energy choice for Oregon homeowners. Energy from the sun can be harnessed using a solar water heating or solar electric system.

This Program Guide outlines the application and review procedures for obtaining the necessary permit(s) to install a solar energy system for a new or existing residential building. The guide also describes what system design elements may trigger the need for additional plan review.

II. SOLAR ENERGY SYSTEM DESCRIPTION

A solar energy system is defined, for the purpose of this Program Guide, as a solar water heating or solar electric (also known as a photovoltaic or PV) system.

A. Solar Water Heating

A solar water heating system reduces household energy consumption by preheating water so that the residence's water heater does less work. It consists of two, primary components:

1. Solar collectors, which are commonly installed on the roof; and
2. A storage tank, which is typically co-located with the residence's water heater and in which potable water is preheated by the solar collectors via a heat exchanger.

A residential solar pool heating system consists of plastic solar collectors, typically mounted on a roof, through which swimming pool water is circulated during the summer months to capture the sun's heat.

B. Solar Electric

A solar electric system produces electricity that is distributed to the home via the residence's main electrical panel, offsetting electric energy that would otherwise be purchased from the utility. It consists of two, primary components:

1. Photovoltaic panels, which are commonly installed on the roof; and
2. An inverter, which converts direct current electricity produced by the panels into alternating current electricity that can be used by the home.

III. SCOPE

This Program Guide is designed to provide guidelines and permitting requirements to those interested in solar hot water heaters or photovoltaic solar electric panels on residential construction. This may include adding a solar system on to an existing structure as an addition or an alteration, or incorporating a solar system into a new building. The intent of these guidelines is to streamline the permitting process for solar energy systems.

IV. INSTALLATION REQUIREMENTS

For a typical residential installation the following rules apply.

A. Land Use

Solar installations must comply with the local Zoning Code. Specific Zoning information regarding a site can be obtained from the City of Grants Pass Planning Division.

1. Height

In all instances, installations of solar equipment, including the rails and panels, are subject to the height limitations of the specific zone where they are being installed.

For installations mounted flush with a pitched roof, the height of the panels will not be calculated, unless the panels will extend above the highest ridge of the roof.

2. Setbacks

Installations that are 6 feet or less in height are allowed to be placed in the setbacks of the individual lot. Installations taller than 6 feet are not allowed in this area.

3. Historic Review:

a. General. Projects in the historic district or designated as historic landmarks may require design review. Please contact the City of Grants Pass Planning Division if you are unsure if the project is located in a design or historic zone.

b. Notice requirements. Historic design review is a discretionary review that requires a public notice and generally takes about 8 weeks to complete. Contact the City of Grants Pass Planning Division.

c. Historic plan review fees. Contact the City of Grants Pass Planning Division.

B. Structural

The solar collectors and underlying substructure (mounts, rails, etc.) must be designed to meet the loading requirements of the Oregon Residential Specialty Code. The prescriptive requirements as described in this section are assumed to meet the residential code requirements and therefore will not require the system be design by a registered Oregon engineer. ***An engineer registered in Oregon must complete the design and details of all other systems not meeting the prescriptive requirements provided in this guide.***

A project will qualify as a prescriptive installation with an acceptable supporting roof structure if all of the following criteria are met:

1. **Roof structure:** The supporting roof framing shall be of typical residential construction, with multiple parallel wood roof rafters or trusses. Minimum rafter or truss chord size is 2x4 and maximum spacing is 2 ft. on center. See attached diagram #1A. Provide existing roof rafter/truss size, spacing and span for review.

2. **Roof materials:** Roofing material must be either standing seam metal, single layer wood shingle or shake, or not more than two layers of composition shingle. Concrete or tile roofs will require structural review.

   a. Loading: Collectors are either directly attached to the roof framing or are mounted to continuous rails that are attached directly to the roof framing. These attachments must be anchored to roof framing at a spacing no greater than 4 ft. on center maximum or per manufacturer's instructions. Collector and mounting hardware (rails, frame, etc) weight shall not exceed 4.5 pounds per square foot (psf). Solar thermal collector weight shall include the weight of the working fluid inside the collector. See attached diagram #1A.

3. **Height:** Maximum panel height above roof shall be 18" from top of panel to roof surface. See attached diagram #1B.

   For additional information regarding the structural requirements for solar panel installations, please contact the City of Grants Pass Building Division.

C. Plumbing and Electrical

All portions of the installation of solar systems governed by the plumbing or electrical portions of the residential code shall comply with the respective requirements of each code section at the time of completion of the project. In general, plumbing or electrical plan review is not required for the installation of residential solar systems, but electrical and plumbing permits must be obtained either as separate permits, or combined with the residential building permit. In all instances, field inspection is required to verify code compliance. A PV 1 Line Drawing must accompany the permit application. See Example attached.

V. PERMITS

A. General Requirements

1. Alterations.

If solar systems are added to an existing one or two family dwelling, the installation of these components are considered an alteration. Under the provisions of the residential code, all alterations must meet the code requirements for new construction. Permits for solar panel qualifying as alterations may be processed in one of two ways:

a. Via the mail.
b. Through the traditional permitting system (over the counter).

1) Permits processed through the traditional permitting system. Permits that are processed through the traditional permitting system will follow the

same general application process that is used for new construction described in the next section.

2. New Construction

Solar panels that are part of new construction will be processed in conjunction with the new construction permit for the one or two family dwelling.

In all instances, the type of solar system to be installed shall be clearly indicated with the application documents and all necessary permits shall be obtained before installation of the system.

B. Application Process

1. New Construction and Alterations

All solar panels that are installed as a part of a new construction project or as part of an alteration will be processed in conjunction with the other work being permitted.

If the project is shown to comply with all necessary requirements, and all permit fees are paid, the permit will be issued to the applicant the same day.

In some cases, it may be necessary for a particular project to be reviewed more closely and the permit will be taken in for review. In these instances, the necessary reviews will be completed and the permit will be issued after all necessary reviews are completed and all necessary fees have been paid.

C. Permit Submittal Requirements

Regardless of the permit application process, the following information shall be submitted for each permit.

1. Structural Plans

a. Prescriptive system. If the system meets all of the prescriptive requirements of the structural section of this program guide, no structural plans and calculations will be required. Data showing that the solar installation meets the prescriptive requirements must be included with the site plan.

b. Designed elements.

1) If any of the prescriptive requirements for roof structure, roof materials, loading or height are not met, then structural calculations by an Oregon engineer showing complete details for the rails, support struts and roof attachments must be provided. In addition, stamped calculations verifying adequacy of the roof construction are required.

2) In the case where the support struts raise the panel height greater than 18” above the roof but all other prescriptive requirements of this program guide are met, then structural calculations by an Oregon engineer and details only for the support struts and its connections are required. In some cases, manufacturer’s information and installation details may be substituted for the required engineering.

2. Elevation Drawings

For installations where the panels will not be mounted flush with the roof, a simple building elevation will be required to measure the height of the installation. The elevation must show the height of the building, and the height of the solar installation, but does not need to show other building details, unless a Design Review will be required.

3. Electrical 1-Line Drawing (attached)

VI. INSPECTIONS

The following inspections may be required for the installation of the solar system. Approved permits must be posted at job location.

A. Building: Building inspections are required to verify that the solar support system is properly installed.

B. Plumbing: A plumbing inspection is required where the solar apparatus attaches to the potable water system, usually a water heater. The inspection will verify that the collection system is properly attached so that no contamination of the potable system can occur.

C. Electrical: An electrical inspection is required in all instances where the solar system provides power to the dwelling electrical system. The inspection will verify that the circuits and feeders have been installed properly and the system has been connected properly.

VII. FEES

Fees for all required building, plumbing or electrical permits will be calculated using the current and applicable City of Grants Pass fee schedule.

In general, building permit fees will be based on the valuation of the structural elements for the solar panels, including the mounting brackets and rails and the cost of labor to install them. Excluded from the permit valuation is the cost of the solar equipment, including the solar collector panels, inverters and preheat tanks.

Valuation of Project = Total Project Price – Solar Equipment Value

VIII. INSPECTIONS

One-line diagram comparison

Is a one-line diagram available at the site?

- PV module model number matches plans and cut sheets
- PV modules are properly grounded with lugs on each module or equivalent grounding method.
- PV array wiring is consistent with plans (# of modules)
- Check that cable and conduit is properly supported
- Where plug connectors are used for module wiring, inspect a sample to make sure that connectors are fully engaged.
- Inverter model number matches plans and cut sheets.

Structural Attachment of Array

Confirm that footings and support structure match the supplied detail.
Confirm that module attachment matches the supplied detail.

PV System Signs

Signs shall be permanent and have sufficient durability to withstand the environment.
Sign Identifying Photovoltaic Power Source (at DC disconnect)

- Rated maximum power-point current (690.53)
- Rated maximum power-point voltage
- Maximum system voltage
- Short-circuit current
- Maximum rated output current of the charge controller (if installed)

Sign identifying AC point of connection

- Maximum operating current (provided in initial plan review)
- Operating AC voltage (provided in initial plan review)

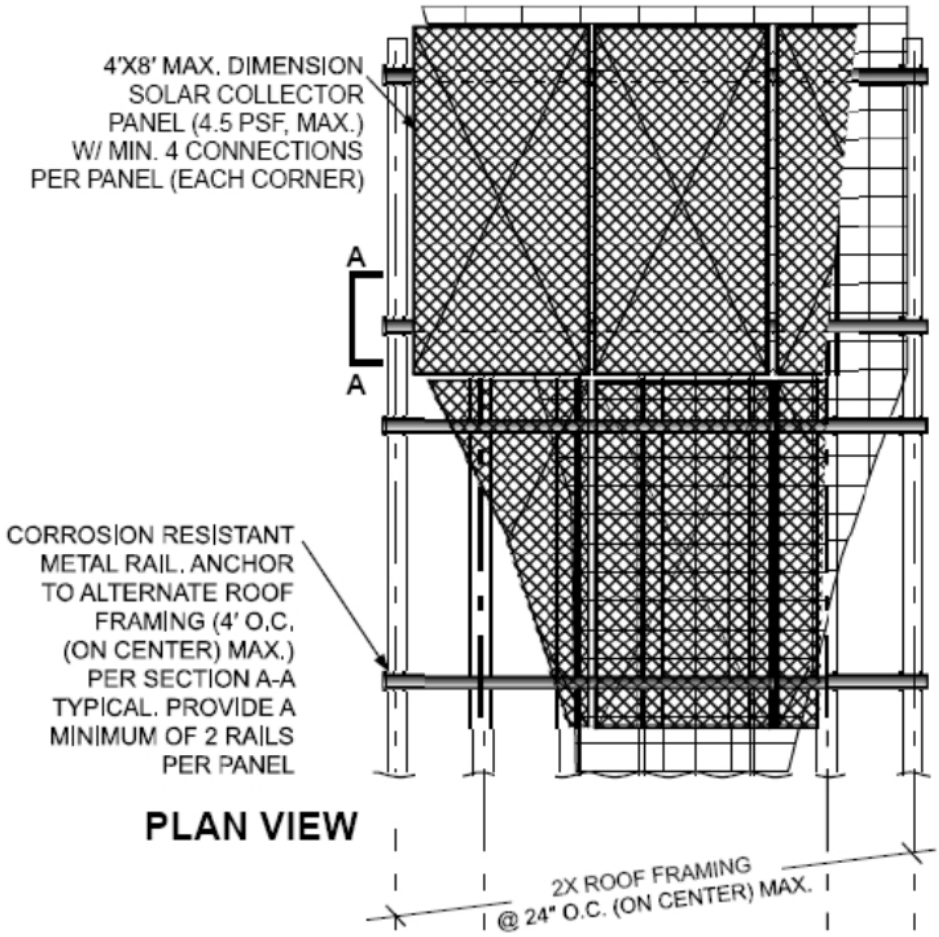
Sign identifying switch for alternative power system
Sign at the main service disconnect (702.8) notifying the type and location of the optional standby system

Plumbing

Refer to the Oregon Plumbing Specialty Code

IX. ENFORCEMENT

All code enforcement shall be in accordance with the applicable permitting and inspection procedures.



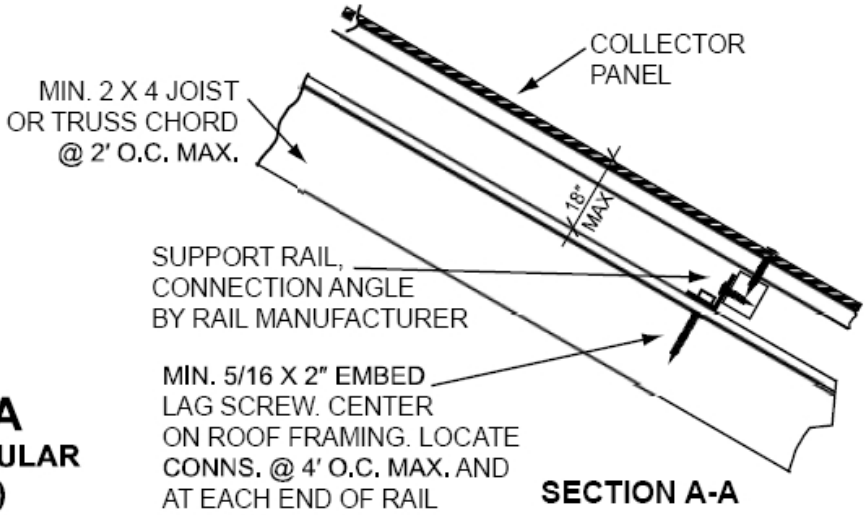
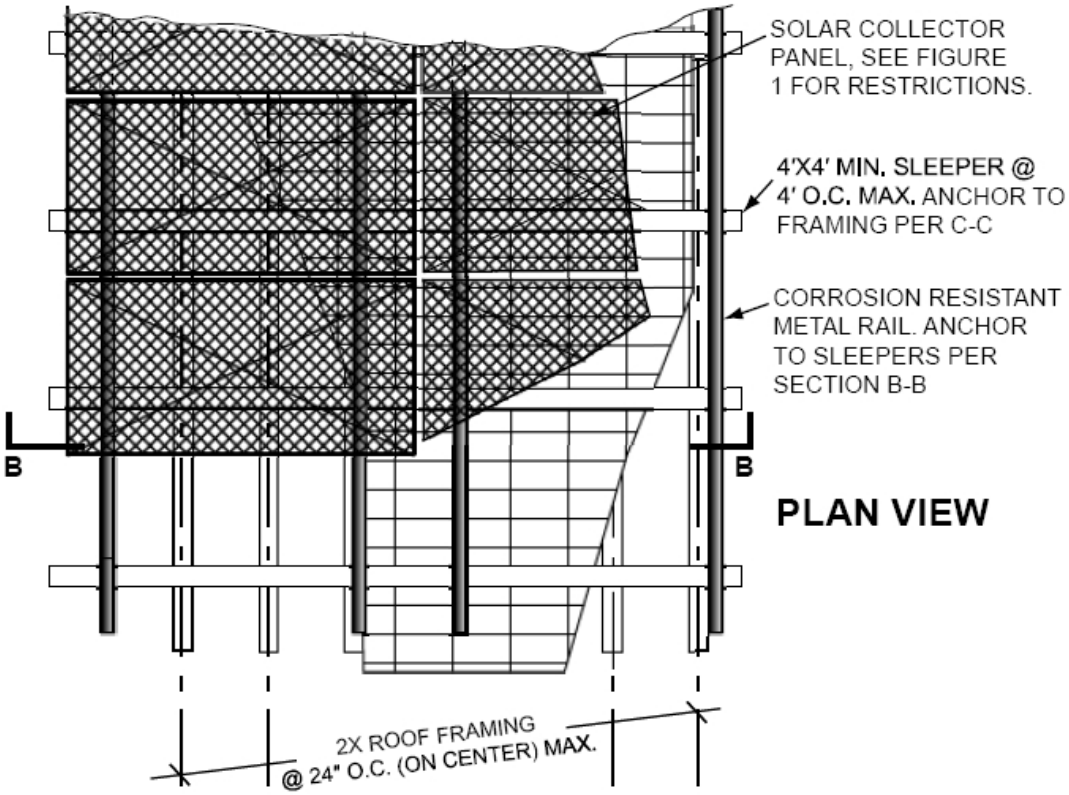


DIAGRAM #1A
(RAILS PERPENDICULAR TO ROOF FRAMING)



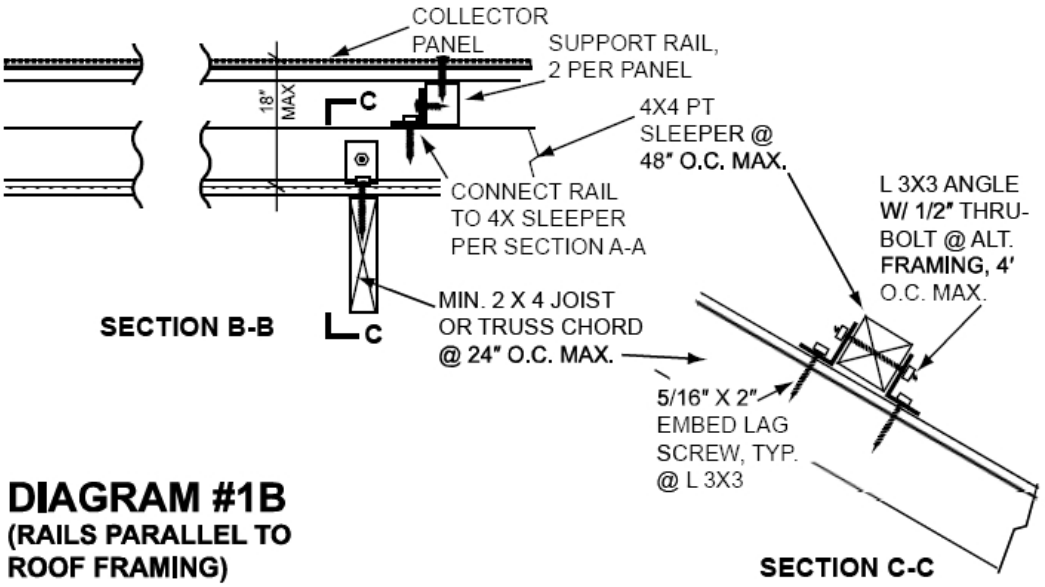


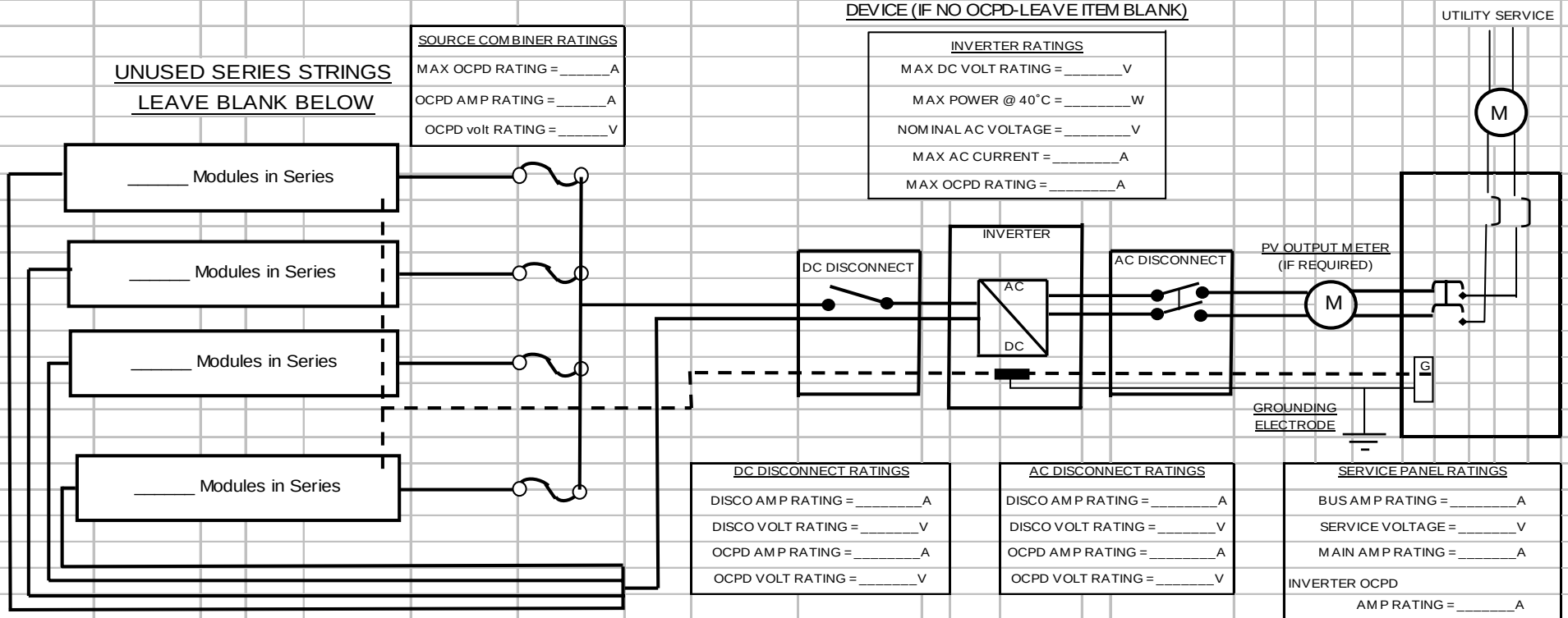
DIAGRAM #1B
(RAILS PARALLEL TO ROOF FRAMING)

OCPD = OVERCURRENT PROTECTION DEVICE (IF NO OCPD-LEAVE ITEM BLANK)

UNUSED SERIES STRINGS
LEAVE BLANK BELOW

SOURCE COMBINER RATINGS
MAX OCPD RATING = _____A
OCPD AMP RATING = _____A
OCPD volt RATING = _____V

INVERTER RATINGS
MAX DC VOLT RATING = _____V
MAX POWER @ 40°C = _____W
NOMINAL AC VOLTAGE = _____V
MAX AC CURRENT = _____A
MAX OCPD RATING = _____A



DC DISCONNECT RATINGS
DISCO AMP RATING = _____A
DISCO VOLT RATING = _____V
OCPD AMP RATING = _____A
OCPD VOLT RATING = _____V

AC DISCONNECT RATINGS
DISCO AMP RATING = _____A
DISCO VOLT RATING = _____V
OCPD AMP RATING = _____A
OCPD VOLT RATING = _____V

SERVICE PANEL RATINGS
BUS AMP RATING = _____A
SERVICE VOLTAGE = _____V
MAIN AMP RATING = _____A
INVERTER OCPD AMP RATING = _____A

PV MODULE RATINGS @ STC
MODULE MANUFACTURER _____
MODULE MODEL # _____
OPEN-CIRCUIT VOLTAGE = _____V
OPERATING VOLTAGE = _____V
MAX SYSTEM VOLTAGE = _____V
OPERATING CURRENT = _____V
SHORT-CIRCUIT CURRENT = _____V
MAXIMUM POWER = _____W
Voc TEMP COEFF = _____mV or %/°C
(if supplied)

PV ARRAY INFORMATION
OF MODULES IN SERIES_____
OF PARALLEL CIRCUITS_____
LOWEST EXPECTED TEMP _____°C
HIGHEST EXPECTED TEMP _____°C

690.53 PHOTOVOLTAIC POWER SOURCE SIGN ON DC DISCO
RATED CURRENT = _____A
RATED VOLTAGE = _____V
MAX SYS VOLTAGE = _____V
MAX CIRC CURRENT = _____V

SOUURCE CIRCUIT WIRE TYPE (OUTSIDE CONDUIT-CIRCLE ONE)
USE-2 WIRE

SOURCE CIRCUIT WIRE TYPE (INSIDE CONDUIT-CIRCLE ONE)
THWN-2; XHHW-2; RHW-2; USE-2

SOURCE CIRCUIT WIRE SIZE (SEE NOTE BELOW)_____

NOTES:
1) ASHRAE FUNDEMENTALS OUTDOOR DESIGN TEMPERATURES DO NOT EXCEED 47°C IN THE UNITED STATES (PHOENIX, AZ; PALM SPRINGS, CA)
2) FOR LESS THAN 9 CURRENT-CARRYING CONDUCTORS IN ROOF-MOUNTED SUNLIT CONDUIT AND USING THE OUTDOOR DESIGN TEMPERATURE OF 47°C,
a) 12 AWG CONDUCTORS ARE GENERALLY ACCEPTABLE FOR MODULES WITH isc OF 6.4 AMPS OR LESS WHEN PROTECTED BY A 10-AMP FUSE.
b) 10 AWG CONDUCTORS ARE GENEREALLY ACCEPTABLE FOR MODULES WITH isc OF 9.6 AMPS OR LESS WHEN PROTECTED BY A 15-AMP FUSE.

NOTES:

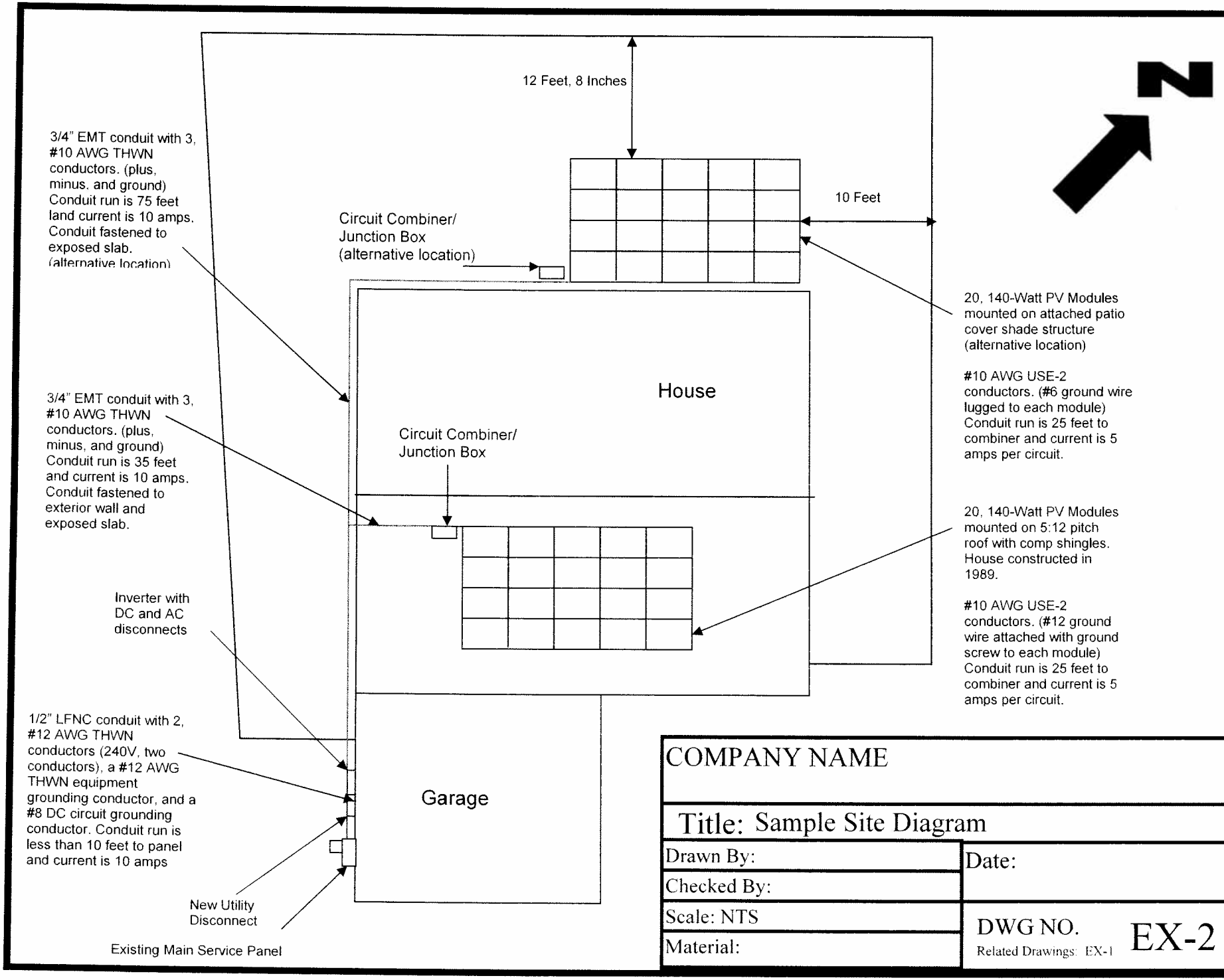
1) IF UTILITY REQUIRES VISIBLE-BREAK SWITCH, DOES THE AC DISCONNECT SATISFY THE UTILITY REQUIREMENTS OR IS AN ADDITIONAL SWITCH NECESSARY?

2) IF INCENTIVE PROGRAM REQUIRES PV OUTPUT METER, ADD METERBASE THAT MEETS REQUIREMENTS.

Southern Oregon Chapter
International Code Council
www.soc-icc.org

SCALE: NTS

Generic Photovoltaic System Electrical Diagram
for PV Systems of 10 kW or less



COMPANY NAME

Title: Sample Site Diagram

Drawn By:	Date:
Checked By:	
Scale: NTS	DWG NO. EX-2
Material:	Related Drawings: EX-1