

PLAN REVIEW SUBMITTAL REQUIREMENTS AND REQUIRED INSPECTIONS FOR SOLAR PHOTOVOLTAIC SYSTEMS

PERMIT APPLICATION

Plans must be submitted electronically via the online portal at: <https://cityviewportal.thorntonco.gov/> . Instructions are available under the “Portal Help” link on how to register and how to apply for solar permits. A separate plan review is required for each property or address. Complete submissions must include:

A set of construction drawings as described below.

1. All commercial systems, and the structural portion of residential plans, are required to bear the stamp and signature of a professional engineer licensed to practice in the State of Colorado.
 2. PV System construction and specification sheets shall come in one plan set. The plan pages must be of one uniform size. Any size is acceptable.
 3. An area for the plan review stamp must be made available within the title block. That area must be in the same place throughout the plan set.
- **The plan set does not require photos of the existing electrical panel.**
 - **A separate line diagram is not required to be in the submittal package.**
 - **Any revisions made after the permit has been issued must be submitted within an entire plan set. Clouds around revisions are required.**

The applicable design codes are: 2017 NEC, 2018 IRC, 2018 IBC and 2018 IFC.

Design load criteria: 80 mph basic wind speed with a 110 mph 3 second gust, exposure C, snow load 30 lbs./sq. ft.

Electrical Plans

1. Provide a layout plan of the building with the location of all service equipment, disconnecting means, meters, inverters, junction boxes, batteries and arrays clearly identified. The layout plan must also depict all required fire access aisles and ridge ventilation setbacks for arrays with dimensions as required by the International Fire Code or the International Residential Code as amended by the City of Thornton.

2. Provide a one-line diagram in the plan set that includes:
 - number and wattage of modules,
 - conductor sizes and insulation types,
 - conduit sizes,
 - fuses and circuit breaker ratings,
 - inverter ratings,
 - AC & DC disconnect ratings,
 - the buss rating and main disconnect size of main distribution panels,
 - batteries and, grounding means,
 - all components must be listed and labeled,
 - if the PV disconnect is located on the bus bar, then it must be lockable.

Note: For systems 10,000 KVA and larger provide approximate wire lengths of each wire segment.

Please note the city requires that where the service equipment includes a split buss panel, the PV system must be connected by means of a line-side tap.

1. For other than single family dwellings, provide the calculations, including the temperature derating factors and voltage drop, used to determine wire sizes, fuses and breakers. (*Roof mounted systems should use worst case ambient temperature of 56-60 degrees C.*) Calculations must show that the PV system voltage does not exceed the maximum rated dc inverter input voltage or the rated voltage of any other connected equipment. If the main panel is de-rated, then an audit of that de-rate must appear on the line diagram page along with the name of the licensed electrician or engineer responsible for the audit. Provide the calculations used to size equipment grounding conductors in accordance with the currently adopted code. For systems 8,000 KVA with three or more arrays, provide the fault-current calculations for each array circuit.
2. Provide manufacturer's cut sheets and listing information for modules, inverters, batteries and mounting systems. Installation instructions for mounting systems or mounting feet are not required. However, research reports or stamped engineer letters from the manufacturers must be submitted for mounting systems and mounting feet to verify that the systems are designed to comply with local wind and snow loads. Mounting feet cut sheets must show how the feet will be flashed. Cut sheets for modules, inverters and batteries must show that the proposed equipment is labeled by UL, ETL or CSA_{us}. Module cut sheets must include the manufacturer's specific grounding instructions for the module in accordance with UL 1703.

Structural Plans

1. Roof installations for both residential and commercial projects require a structural engineering analysis of the building by an engineer licensed by the state of Colorado to verify that the existing structure is adequate for the additional equipment dead loads and wind uplift loads. The engineer letter must be separate from the plans and uploaded as an individual file. If the engineer specifies structural upgrades to support the additional weight, the details of those upgrades must be present on the PV installation plan set.

2. **The applicable design codes are:** 2017 NEC, 2018 IRC, 2018 IBC and 2018 IFC.
Design load criteria: 80 mph basic wind speed with a 110 mph 3 second gust, exposure C, snow load 30 lbs./sq. ft.
3. Plans or instructions must be submitted that indicate the locations of array mounting feet and that include the minimum size and type of fastener needed to attach the feet to the roof in order to comply with the wind load requirements.

INSPECTIONS

Final Inspection of the system will occur following the completion of the installation.

The following language related to roof array layouts is excerpted from the International Residential Code as locally amended by the City

R324.7 Access and pathways.

Roof access, pathways and spacing requirements shall be provided in accordance with Sections R324.7.1 through R324.7.2.5.

Exceptions:

1. Detached garages and accessory structures to one-and two-family dwellings and townhouses, such as parking shade structures, carports, solar trellises and similar structures.
2. Roof access, pathways and spacing requirements need not be provided where an alternative ventilation method approved by the code official has been provided or where the code official has determined that vertical ventilation techniques will not be employed.

R324.7.1 Roof access points.

Roof access points shall be located in areas that do not require the placement of ground ladders over openings such as windows or doors, and located at strong points of building construction in locations where the access point does not conflict with overhead obstructions such as tree limbs, wires, signs and roof eaves less than 7 feet (2134 mm) above and within the required access aisle.

R324.7.2 Solar photovoltaic systems.

Solar photovoltaic systems shall comply with Sections R324.7.2.1 through R324.7.2.5.

R324.7.2.1 Size of solar photovoltaic array.

Each photovoltaic array shall be limited to 150 feet by 150 feet (45 720 by 45 720 mm). Multiple arrays shall be separated by a clear access pathway not less than 3 feet (914 mm) in width.

R324.7.2.2 Hip roof layouts.

Panels and modules installed on dwellings with hip roof layouts shall be located in a manner that provides a clear access pathway not less than 3 feet (914 mm) in width from the eave to the ridge on each roof slope where panels and modules are located. The access pathway shall be located at a structurally strong location on the building capable of supporting the live load of fire fighters accessing the roof.

Exception: These requirements shall not apply to roofs with slopes of 2 units vertical in 12 units horizontal (16.6 percent) and less.

R324.7.2.3 Single ridge roofs.

Panels and modules installed on dwellings with a single ridge shall be located in a manner that provides two, 3-foot-wide (914 mm) access pathways from the eave to the ridge on each roof slope where panels or modules are located.

Exception: This requirement shall not apply to roofs with slopes of 2 units vertical in 12 units

Building Inspection Division 9500 Civic Center Drive Thornton, CO 80229 303-538-7250

horizontal (16.6 percent) and less.

R324.7.2.4 Roofs with hips and valleys.

Panels and modules installed on dwellings with roof hips or valleys shall not be located less than 18 inches (457 mm) from a hip or valley where panels or modules are to be placed on both sides of a hip or valley. Where panels are to be located on one side only of a hip or valley that is of equal length, the 18-inch (457 mm) clearance does not apply.

Exception: These requirements shall not apply to roofs with slopes of 2 units vertical in 12 units horizontal (16.6 percent) and less.

R324.7.2.5 Allowance for smoke ventilation operations.

Panels and modules installed on dwellings shall not be located less than 3 feet (914 mm) below the roof ridge to allow for fire department smoke ventilation operations.

Exceptions:

1. Where an alternative ventilation method approved by the code official has been provided or where the code official has determined that vertical ventilation techniques will not be employed, clearance from the roof ridge is not required.
2. The distance below the roof ridge may be reduced to 18 inches (457 mm) if there are no panels installed on the slope opposite the ridge.

Note: Panel upgrades when done in conjunction with any PV applications will require a separate permit. If a panel replacement is discovered during an inspection of a PV system, the inspection process will cease until a permit is issued for the upgrade. The permit/inspections, for the new service must be completed before the PV system will be passed. The inspection for the panel upgrade can be done at the same time as the final electrical inspection for the PV permit.