solaredge

Medium Voltage Transformer Connection of Commercial Systems, North America

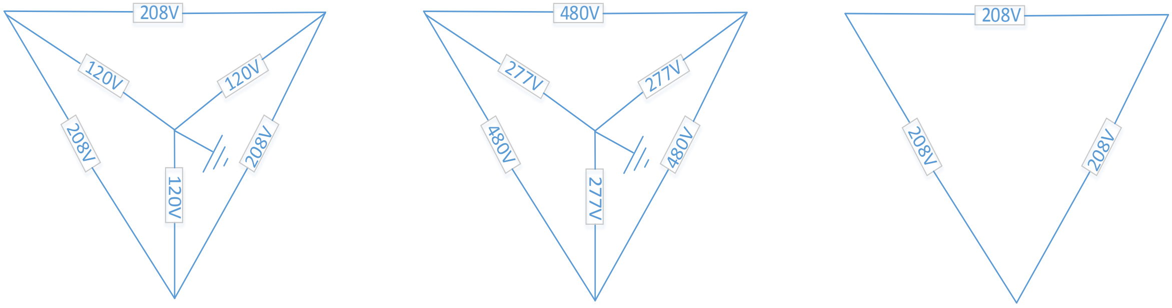
Introduction

Commercial PV systems often require a transformer in order to connect the installation to a medium voltage (MV) power grid, especially in cases where the PV system is not located near a low voltage grid. This application note provides guidelines for selecting, designing and connecting a medium voltage transformer to commercial PV systems with SolarEdge three phase inverters.

NOTE:
Transformer procurement, installation, maintenance and support are the responsibility of the installer. Damage to the inverter due to incorrect transformer installation or use of a transformer that is incompatible with the SolarEdge system will render the SolarEdge warranty invalid.

Guidelines

- System design should ensure that the voltage drop from the grid connection point to the inverter will not be excessive, as voltage drop may result in inverter disconnection from the grid, as required by grid connection regulations. The voltage drop should also be limited in order to minimize power losses. SolarEdge recommends a voltage drop <2% of nominal AC voltage at maximum power production between the inverter and the transformer.
- The transformer's primary connection must match that of the grid at the site (voltage and topology), and its secondary connection must match the inverter being used (voltage and topology). SolarEdge inverters have output voltages of 277/480V WYE, 120/208V WYE and 208V Delta (depending on inverter model), as seen in the figure below.



SolarEdge Inverter AC Voltage Topologies

- Most SolarEdge three phase inverters require a neutral line, which is often not provided with medium voltage distribution. Check inverter specifications of the model being used. Best practice is to provide a connection with a WYE low-voltage transformer winding, which will automatically provide a neutral connection.
- A ground point is required and will often be connected to the neutral connection of the transformer. If a delta configuration is used, a separate grounding system must be provided.
- For stable PV system operation, total AC system impedance seen by the inverter should be as small as possible. The total system impedance is the sum of the AC collection system (especially the LV cables), the MV transformer, the HV interconnect cabling, and the grid impedances:

$$Z_{Total} = Z_{LV\ cables} + Z_{transformer} + Z_{HV\ cable} + Z_{grid}$$

The total impedance can be decreased by minimizing any of these impedances. The transformer short circuit impedance (often marked as Uk% in the transformer datasheet), should be no greater than 6.5%.

- For optimal inverter performance and operation it is recommended to use a transformer with a rated power of at least 105% of total connected inverter power. Additional margins may be taken for transformer reliability as recommended by the transformer manufacturer, and for other design considerations such as environmental de-rating.
- The transformer must be protected from overloading and short circuiting using an appropriate over-current device, generally a circuit breaker.
- Each inverter should be protected by a current protection device, generally a circuit breaker, which will protect the inverter from the transformer's fault current.

- The transformer must be designed for a typical PV system production profile: high daytime loads with no loads at night.
- Variability of the voltage at the grid side of the transformer must be taken into account, due to design of the distribution network and other large loads near the PV system. SolarEdge recommends using an MV transformer with a tap changer on the MV side to enable voltage regulation.
- The load curve of the transformer and the ambient conditions at the installation site must be considered when defining the required transformer thermal rating.