Grid Interactive Inverter Test #1

Which two groups specify the parameters for grid connecting inverters?

* The group IEEE (Institute of Electrical and Electronics Engineers) have established the rules for grids and connecting power sources to the grid.
* Then UL (Underwriters Laboratories) 1741which sets out the parameters for equipment connecting to a grid.

Name 5 conditions that the UL1741 requires of grid interactive inverters?

* + Anti-Islanding
    - This prevents the inverter from sending out power to a grid that is down.
    - It keeps the line from being energized.
    - It makes the inverter not stand alone.
    - Utility workers will not be exposed to live wires when the grid is down.
  + Delay connecting to a grid
    - This keeps the grid from being exposed to power before the utility stabilizes it.
    - The inverter needs to see a stable grid for 5 minutes before it will connect to it.
    - This does not affect the inverter when it sees the sun in the morning as long as the grid was live all night.
  + Must not stay connected if the voltage is out of range
    - This keeps the inverter from staying connected or to connect to a grid where the voltage is too high or too low.
    - The voltage range is + - 10% of the nominal value.
  + Must not stay connected if the frequency is out of range
    - This keeps the inverter from staying connected or to connect to a grid where the frequency is too high or too low.
    - The frequency range is + - 2.5% of the nominal value.
    - 60Hz systems can only operate between 58.5Hz and 61.5 Hz
  + Must have a pure sinewave output that the harmonic distortion is less than 3-5 percent,
    - This keeps noise from entering the grid from a poor-quality device.
  + Must have a ground fault protection scheme,
    - This prevents the inverter from operating if there is a ground fault on the DC side.

Name the three main / basic types of grid interactive inverters.

* + String inverter
  + Microinverter
  + Hybrid inverter

Name a few characteristics for string inverters.

* String inverters are the original type of inverters.
* String refers to solar PV panels connected in series in a string.
* By placing the panels in series, the amperage is lower than if connected in parallel.
* Voltage is increased.

Name a few characteristics for a microinverter.

* Microinverters go under the PV panel.
* These types of “inverter to panel” connections keeps the DC from leaving the roof or structure.
* Can be one panel per microinverter or multiple panels per microinverter.
* As of this time 4 panels per microinverter is available.
* They are mounted behind a panel.

Name a few characteristics for a hybrid grid connected inverter.

* Hybrid inverters are a type of inverter that can be grid interactive or stand –alone.
* Battery based
* PV connects to a charge controller
* Usually supports a generator connection

Name pros and cons for transformer inverters.

* Transformer inverters:
* Pros
  + Due to the transformer, they have electrical isolation between the DC and AC which lowers the risk of shock and surges.
  + Rugged and dependable.
* Transformer inverters:
* Cons
  + Require extra components which costs more.
  + Bulky and take up larger footprint.

Name pros and cons for transformer less inverters.

* Transformer less inverters:
* Pros
  + Lighter than transformer types.
  + More efficient.
* Transformer less inverters:
* Cons
  + More prone to surges and shocks because the PV DC negative is tied to the AC neutral.
  + Look for models with built in surge protection.

Describe the MPPT for inverters.

* Both string and microinverters use MPPT technology to capture the DC power.
* MPPT stands for Maximum Power Point Tracking.
* To transfer power from one device to another it follows the “Maximum Power Transfer Theorem”
* “Maximum Power Transfer Theorem”
* States the output resistance / impedance must equal the input resistance / impedance to transfer the most power between devices.
* An example is an audio amplifier matched to the correct speaker ohms.
* 4Ω to 4Ω or 8Ω to 8Ω
* As the sun radiation varies so does the internal resistance of the PV panel.
* The load would need to match to get maximum power from PV panel
* To continually change the load would not be practical.
* MPPT is a circuit that shorts the PV panel.
* The short circuit current is put through an inductor.
* The inductor stores the energy in the air as magnetic energy.
* The maximum power that is available makes it way to the inverter input.
* Efficiencies can reach the high 90’s percent.

**The number of correct answers to this question is up to your discretion as an instructor.**