

## How the Grid Connected Inverter Works

### - Stand-by mode:

In stand-by mode the inverter is ready to switch into Grid mode. If the power generated by the wind turbine is insufficient for grid operation, the inverter remains in stand-by mode until the wind turbine has generated sufficient power to switch into 'connecting mode'.

### - Connecting mode:

After all system checks have been performed, in the course of which it is tested whether all connection conditions have been complied with, the inverter switches from stand-by mode to connecting mode. The inverter continues to check system values for the predefined connecting period, and if system checks are still OK, the inverter connects to the grid. Minimum connecting times are specified by utilities and authorities and may differ from region to region.

### - Grid mode:

In this mode the inverter is connected to the grid and delivers power to the grid. The inverter only leaves grid mode if a failure occurs or the wind power disappears. In this mode the inverter always works in the MPPT (maximum power point tracking) mode. This is the device's normal operating mode. The power taken by the inverter from the wind generator is also shown below this on the display. This is always more than the power supplied by the network. The difference is the so-called power loss of the inverter. It determines the conversion efficiency of the device. The power loss is emitted as heat.

### - Fault

When there is a fault happen, the inverter will switching off and go into fault mode to protect the wind power system.

### - Dumping load

When under strong wind conditions, high turbine rotation speeds makes the output

voltage of wind generator raise to a dangerous high value. In order to protect the wind turbine, reduce the turbine rotation speed and the generator output voltage can be carried out by switching in a resistor assembly (Dump load).In this mode, the electrical energy generated by the turbine is then converted to heat.

### **Connecting to the Grid**

The inverter operation is fully automatic, and the inverter automatically detects when grid connection is possible. The inverter works as follows when connecting to the grid:

- When wind power is available and the wind turbine starts to rotate, wind generator starts to power.
- The rectifier starts charging the DC bus to 600 V
- The AC modules receive power from the DC bus and start operating. The AC modules then switch into stand-by mode.
- If the DC input voltage exceeds 650V, inverter is allowed in grid operation.
- The inverter checks that grid conditions are OK.
- The inverter monitors grid conditions for 30 seconds and then connects to the AC grid.

### **Supplying Power to the Grid**

After grid connection, go into MPPT mode and control input voltage to achieve maximum power transfer. During grid connection, all inverter and grid parameters are monitored.

### **Disconnecting from the Grid**

If wind power is insufficient to generate power for the grid (when internal inverter power consumption is more or less equal to the available wind power), the inverter disconnects from the grid and goes into stand-by mode. The inverter continues to monitor the wind power available. If the wind power becomes available again within 5 minutes, a new grid connection procedure is initiated. If no wind power is available after 5 minutes, the inverter goes into stand-by mode to save power.

Conditions that cause the Grid Tie Inverter to be disconnected from the grid:

**Grid voltage:**

The grid voltage may be within a range of  $-15\%$  and  $+10\%$  of the nominal grid voltage.

Once the grid voltage exceeds this range the inverter is disconnected from the grid with 0.2s.

**Grid frequency:**

The grid frequency may be within a range of Hz of the nominal grid frequency. Once the grid frequency exceeds this range the WG20K3TL is disconnected from the grid with 0.2s.