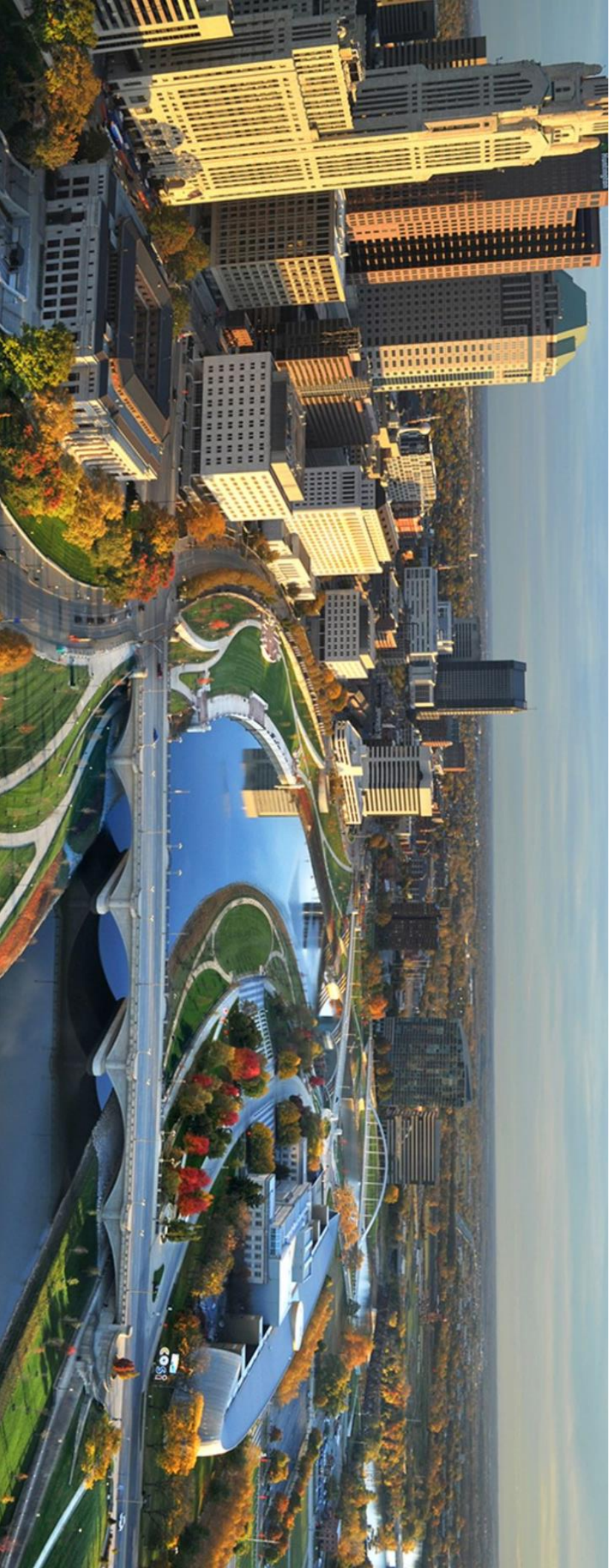


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VFD – Variable Frequency Drive

- Allows for speed adjustment and control of system processes
- Integrate into process control systems
 - Service Pumps
 - Pumps to a preset system pressure
 - Metering pumps – Set to maintain a flow rate
 - Chemical
 - Sludge
 - Return Sludge
 - Raw sewage pumps
 - Maintain a water level
- Centrifuges
 - Maintain a “plug” and discharge solids content

VFD – Variable Frequency Drive

- 6 pulse
 - Three phase power – regulates output frequency
- 12 pulse
 - Input phase shifting transformer
 - Six phase transformer
- 18 pulse
 - Input phase shifting transformer
 - Nine phase transformer
- Pulse Width Modulated
 - It's just magic

VFD – Variable Frequency Drive

An VFD operating at 100% load in a controlled environment that is non-harsh, 70 degrees F, non-condensating and good incoming power quality: the VFD should operate for 60,000 hours (6.9 years) until it will require replacement.

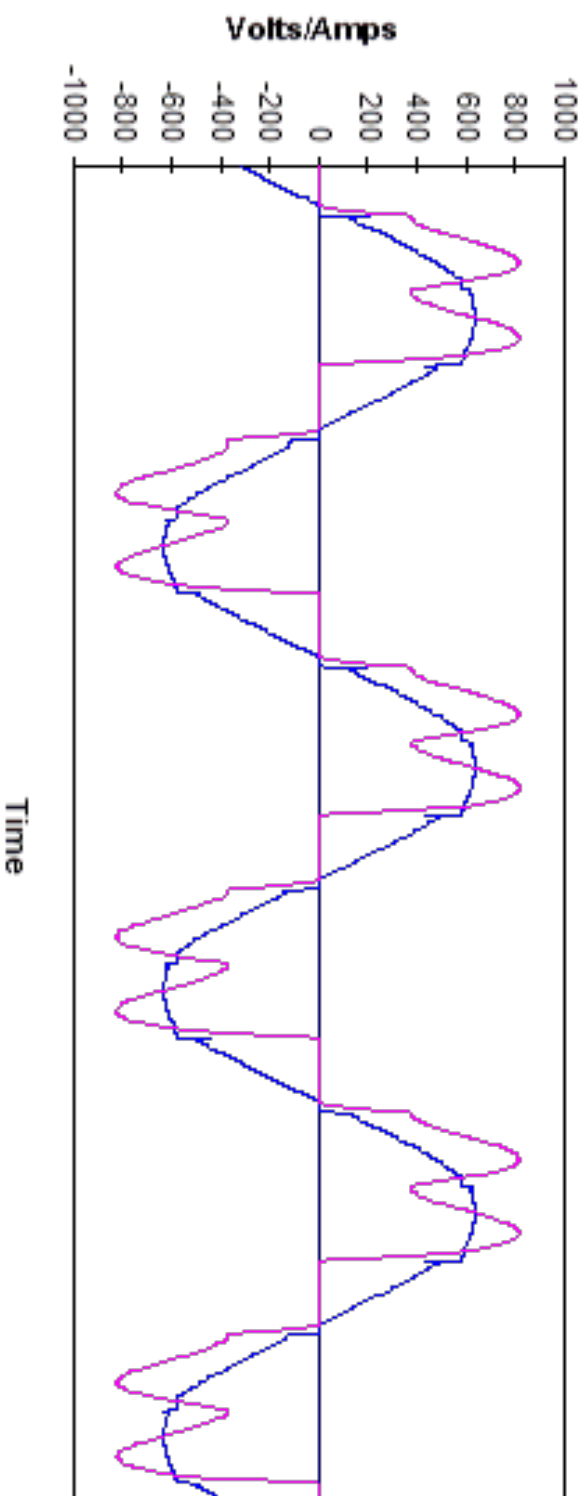
VFD – Variable Frequency Drive

Now, here are the disclaimers:

- Most VFDs are labeled to operate at a maximum temperature of 40 degrees C or 104 degrees F. This is a will operate but not continuously. VFDs are tested and designed to operate at 70 degrees F. Every 20 degrees F that the VFD can operate below 70 degrees F will double the expected life, every 20 degrees above 70, halves the life.
- While most VFDs are designed to operate at full load. Operating an VFD at less than 90% of full load will double its life expectancy.
- All VFDs are tested with perfect incoming power quality. A significant power quality anomaly will not only shorten the expected life expectancy it has the potential to kill it on the spot.
- Altitude affects VFDs because the thinner air provides less cooling. Most drives will work just fine up to 3,300 feet above sea level. The drive must then be de-rated 2% at this elevation and an additional 2% for every 1,000 feet.
- Voltage Dip: +10% -15% , generator load step = 30%
- Frequency: +/- 10%

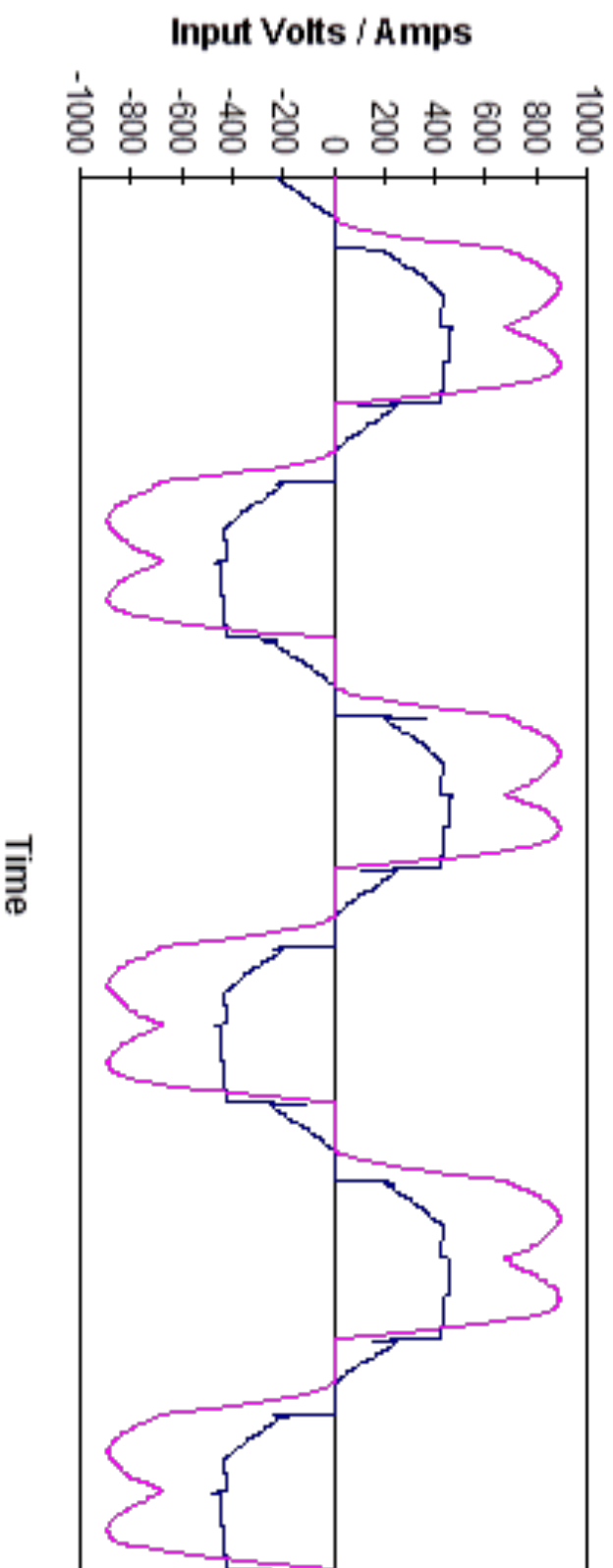
VFD – and Generators.....

Lightly Loaded Generator

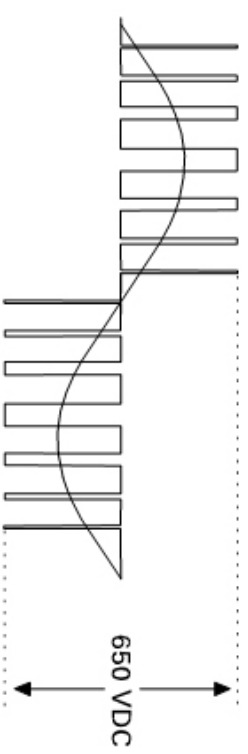
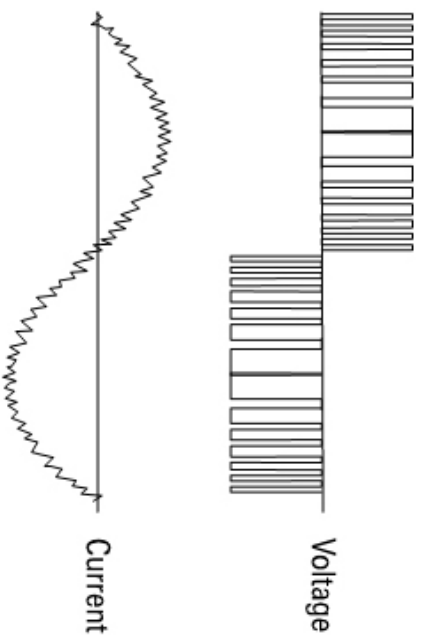


VFD – and Generators.....

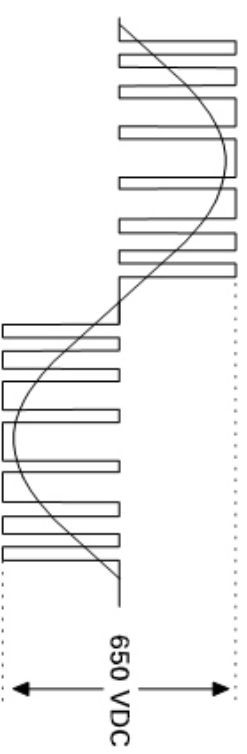
Loaded Generator



VFD – Output Flow

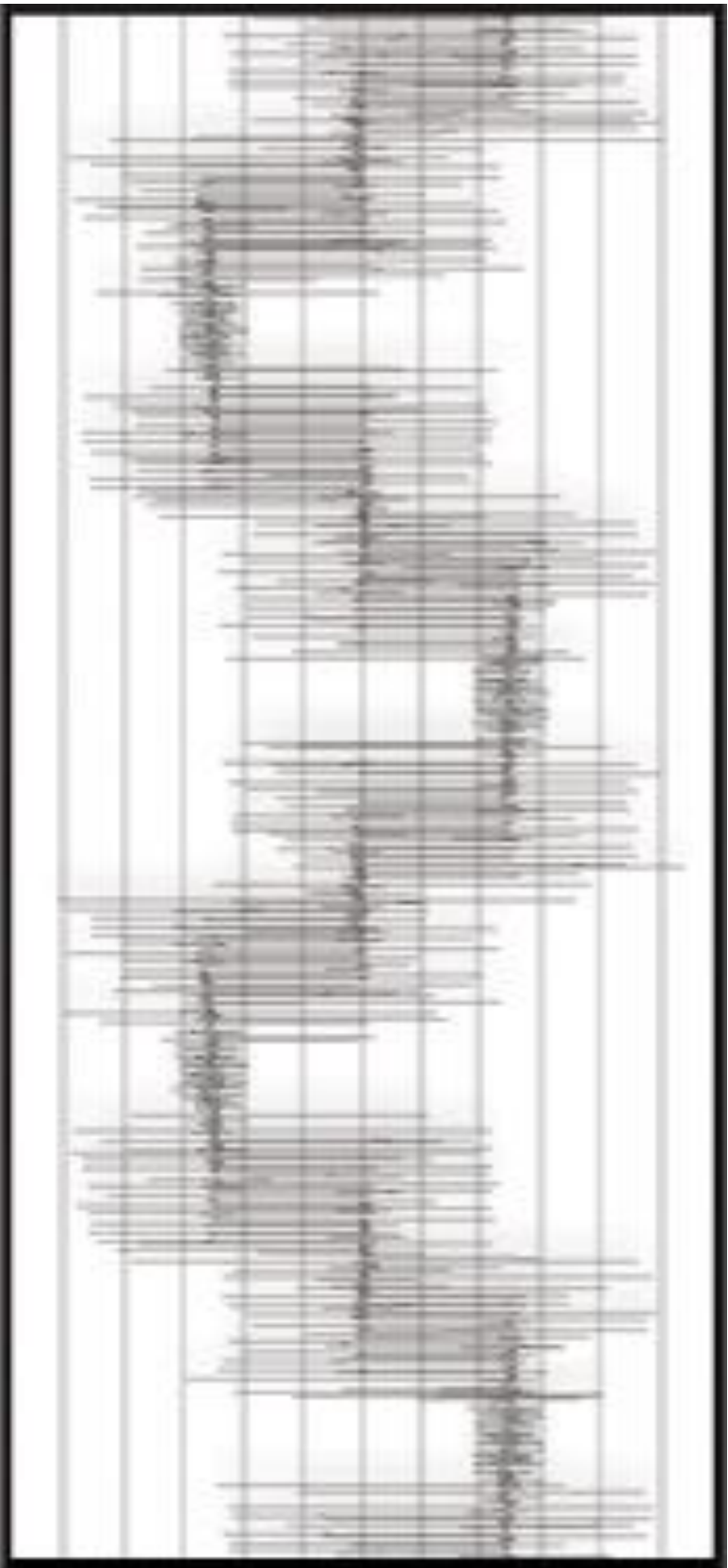


Shorter "On" Duration, Lower Voltage



Longer "On" Duration, Higher Voltage

VFD – FLOW?



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VFD – and Storage.....



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VFD -- Options

- Soft Starters
 - Soft Start/Soft Stop
 - Up to 180 seconds
- Magna Drives
 - Rare Earth Magnet coupling system
 - Best for low HP
 - Large HP systems available, more complicated
- Slip disc systems
- Variable pully systems



Thank You

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