

PumpTech Customer Education



<http://www.Pumptechnw.com>

Bellevue

Moses Lake

Canby

PumpTech Product Lines

UL Listed
Packaged Systems



METERMAN
Pump Systems, Inc.
"For The Best In Flow Technology"





Two full time Mechanical Engineers
Licensed in OR, WA & ID

SolidWorks & E-Drawings Viewer

AutoCad Compatible Drawings

All Systems UL QCZJ Listed

Designed to HI Standards





Manufacturing Facility Canby, OR





Installation, Maintenance & Repair

- 9 Full Time Service Technicians
- 3 Full Service Shops
- 6 Service Trucks
- 23 Ton Crane Truck
- 8 Ton Crane Truck
- 3 Ton Crane Truck
- 2 Ton Flatbed & Trailer
- 1 Ton Flatbed & Trailer





Pipeline

Summer 2010 www.PumpTechnw.com Volume 1, Issue 2

PumpTech Inc.
Bellevue, WA
12020 SE 32nd St #2
Bellevue, WA 98005
888-644-6888

Canby, OR
321 S Sequoia Parkway
Canby, OR 97013
503-659-6230

Moscow Lake, WA
209 S Hamilton Rd
Moscow Lake WA 98637
509-786-6330

PumpTech Pipeline
Serving the Pacific Northwest
Providing Knowledgeable Solutions

Cornell Names PumpTech Its Top Industrial Distributor

Cornell Pump Company (Clackamas, Oregon) has named PumpTech its number one industrial pump distributor in the US. Cornell pump manufacturers a wide line of clear water, solids handling, hot oil and food processing pumps for numerous industrial applications.

Mike Shoemaker, PumpTech's Industrial Products Manager, accepted the award at the annual distributor's meeting in Chicago. Our industrial sales team covers Idaho.

Oregon and Washington and focuses on the food processing, petrochemical, oil & gas, lumber, pulp & paper, power generation, and aluminum industries.

In addition to Cornell, PumpTech represents a number of other manufacturers of specialty industrial products. Congratulations to our industrial sales team!



PumpTech Named NW Master Distributor for Grundfos

Grundfos Pumps (Olathe, Kansas) has selected PumpTech as the Pacific Northwest master distributor for its Grundfos Dosing line of chemical metering pumps.

The product line includes a wide range of diaphragm metering pumps with flows to 1050 GPH and with flows to 3000 PSL. Grundfos pressures offer a variety of dosing technologies including digital dosing. Digital dosing pumps utilize stepper-motors that allow a 1000:1

turn down. In addition to dosing pumps, Grundfos offers a complete line of measurement & disinfection equipment including one of the best chlorine generators on the market.

Per this agreement PumpTech will stock \$100,000 of Grundfos Dosing pumps to support sales in the Pacific Northwest. This inventory will be centrally located in our Canby, OR branch and will allow quick delivery to other distributors, end users, and OEM's. Additionally, this inventory will support our MeterMan division which manufactures chemical metering systems in our Canby facility and also functions as the Grundfos Key Systems provider for the entire western United States.



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PumpTech's Feature Rich Multi-Pump Controller

PumpTech's intelligent, multi-pump controller features an integrated PLC and Color Touch-Screen Human Machine Interface (HMI) that makes setup simple and extremely flexible. Up to four pumps can be set up for VFD control, across the line starting or a combination of the two.

The PLC provides for 22 digital inputs and 12 digital outputs. Also two 4-20mA or 0-10VDC transducer inputs are provided.

The controller is preprogrammed for pump down, level control and booster applications. At start up all you have to do is select the application and follow the setup instructions on the screen.

When motors are started across the line or via RVSS, "smart" motor

Continued on Page 4



QCEC Introduces New Refrigerated Sampler

Quality Control Equipment Company (QCEC) has introduced a new sampler with a modular refrigeration system. The refrigerator unit slides out for easy service or replacement. All units are made right here in the US and come with a 2 year warranty.

It features the same, time proven sampling technology that has set QCEC apart from its competition for over 40 years. All samplers use vacuum pumps

rather than peristaltic pumps for higher reliability and accuracy. Vacuum pumps never need hose replacement and increase the sampling range by providing lifts to 28 feet and horizontal of flexibility when locating the sampling unit.

The QLS model is the only sampler in the world that provides repeatable, self calibration and consistent sample size. It also provides flow - paced samples from a 4 - 20 input.

For more information on the features and benefits of QCEC samplers, contact your local PumpTech branch.




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newsletter@PumpTechnw.com



Pump ED 101

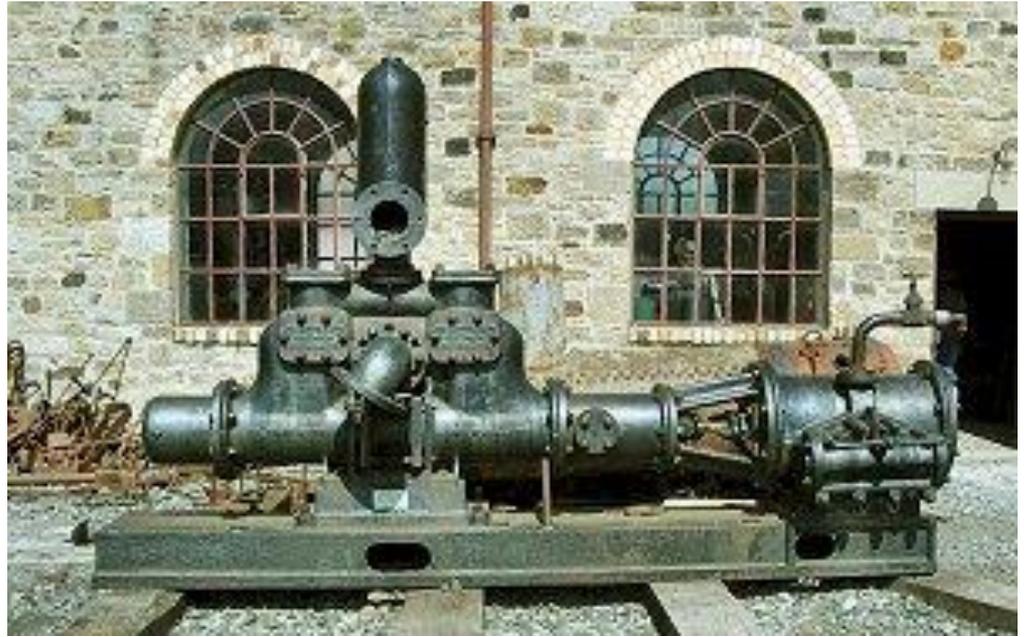
Joe Evans, Ph.D

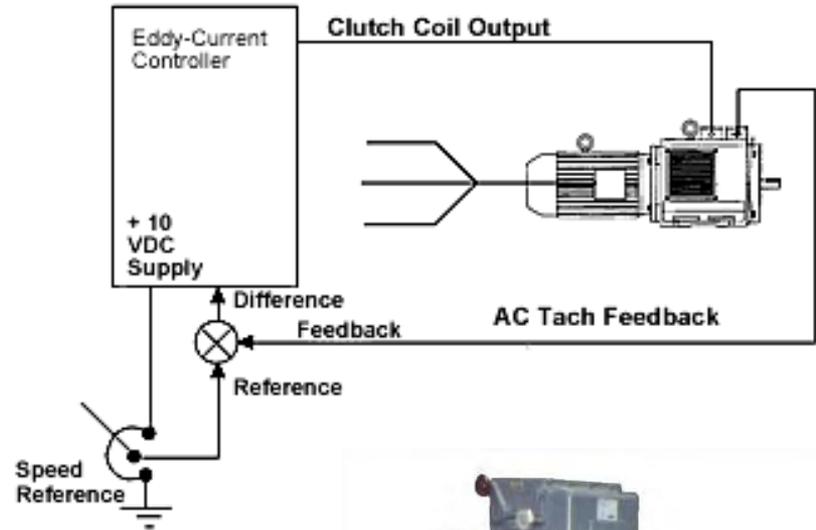
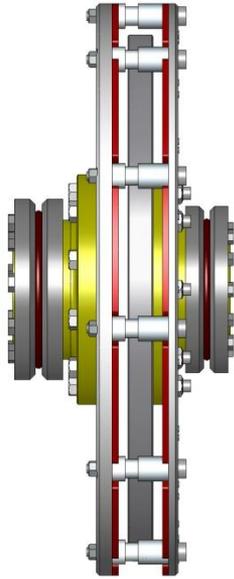
<http://www.PumpEd101.com>

Variable Frequency 101



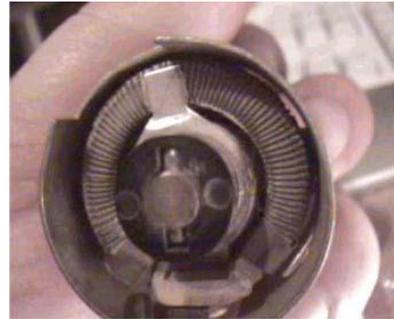
Variable Speed Pumping





Variable Speed Pump Side Control





Variable Speed Motor Side Control



Variable Speed
Today

Process Control

A "process" is a systematic series of actions that result in a desired end product.

A process should be repeatable and provide the same result each time it is performed.

"Control" is the application of direction or restraint on how that process proceeds.

Control supervises the actions of the process.

Process Control

Boolean Logic

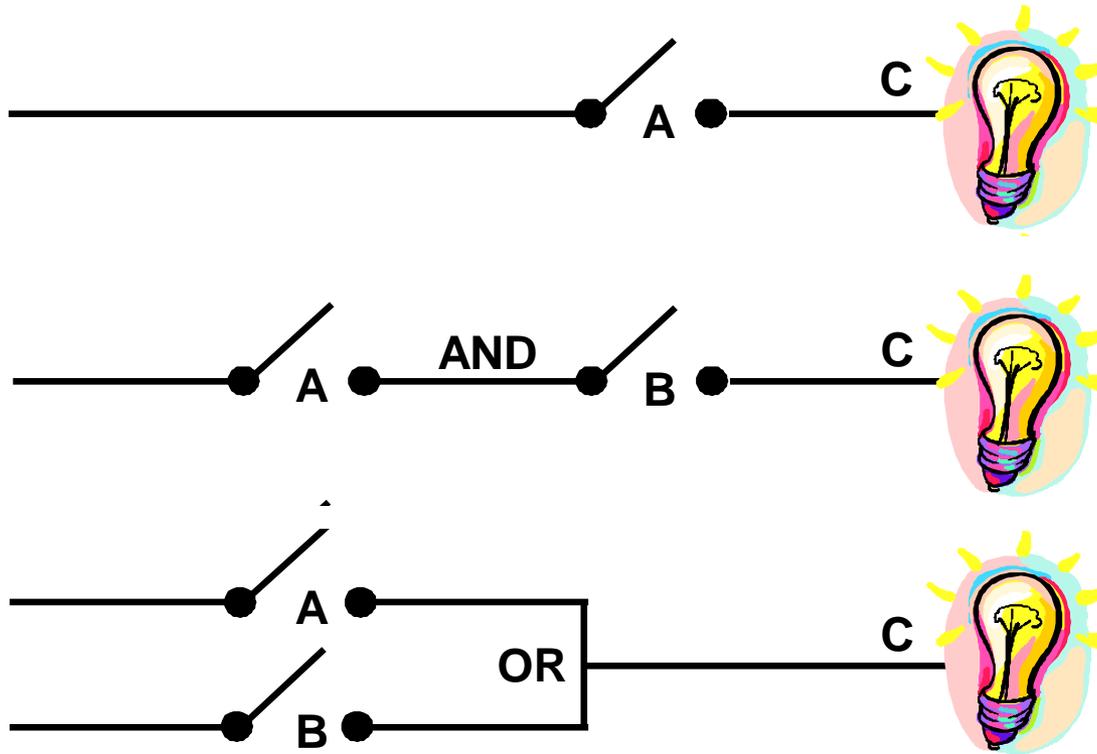
Developed by an English mathematician named George Boole in the early 1800's

Uses simple operators such as "if, and, or, not, and then" to form precise and logical statements that test the truth of a series of events.

It is the basis for the design of all control systems and several modern programming languages.

Process Control

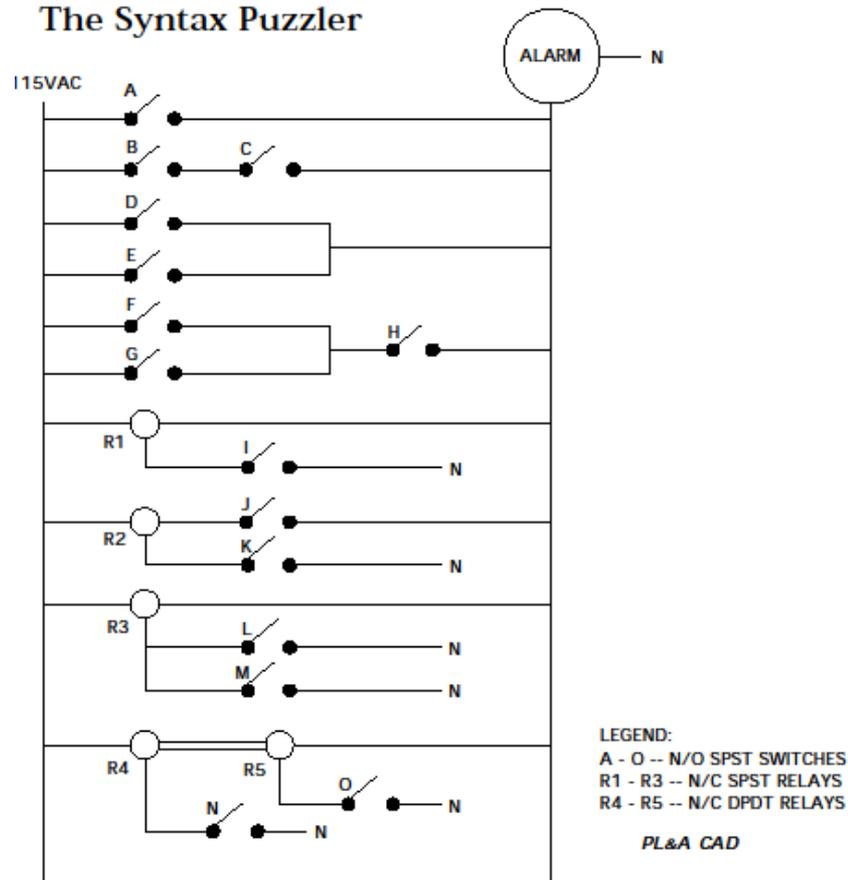
Boolean Logic



Process Control

Boolean Logic

The Syntax Puzzler

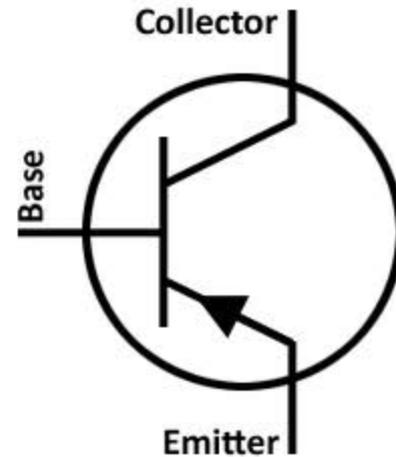


Process Control

Boolean Logic



Relays



Transistor

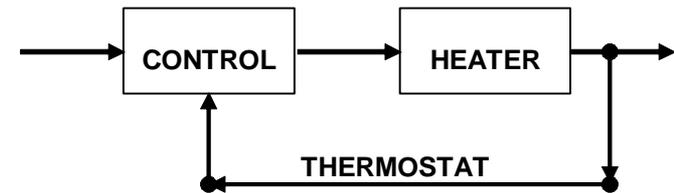
Process Control

Control Loops

Smart & Not So Smart Control



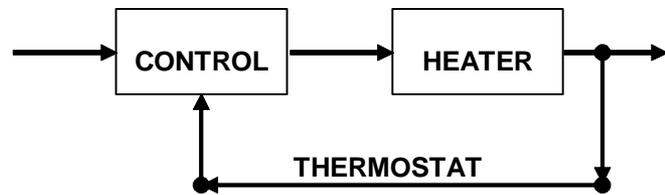
Open Loop



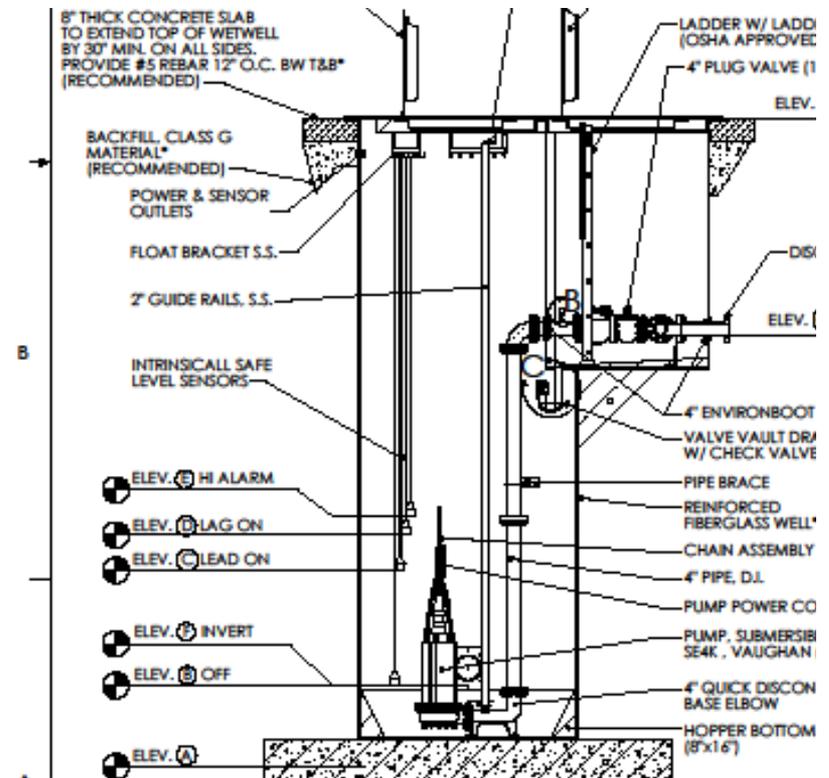
Closed Loop

Process Control

Closed Loop On / Off Control

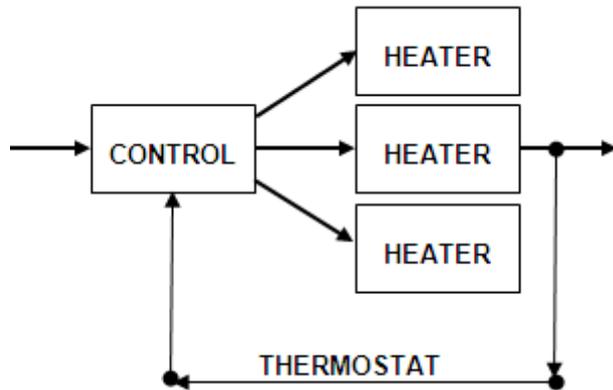


Closed Loop On / Off



Process Control

Closed Loop Proportional Control



Closed Loop Proportional



Variable Frequency 101

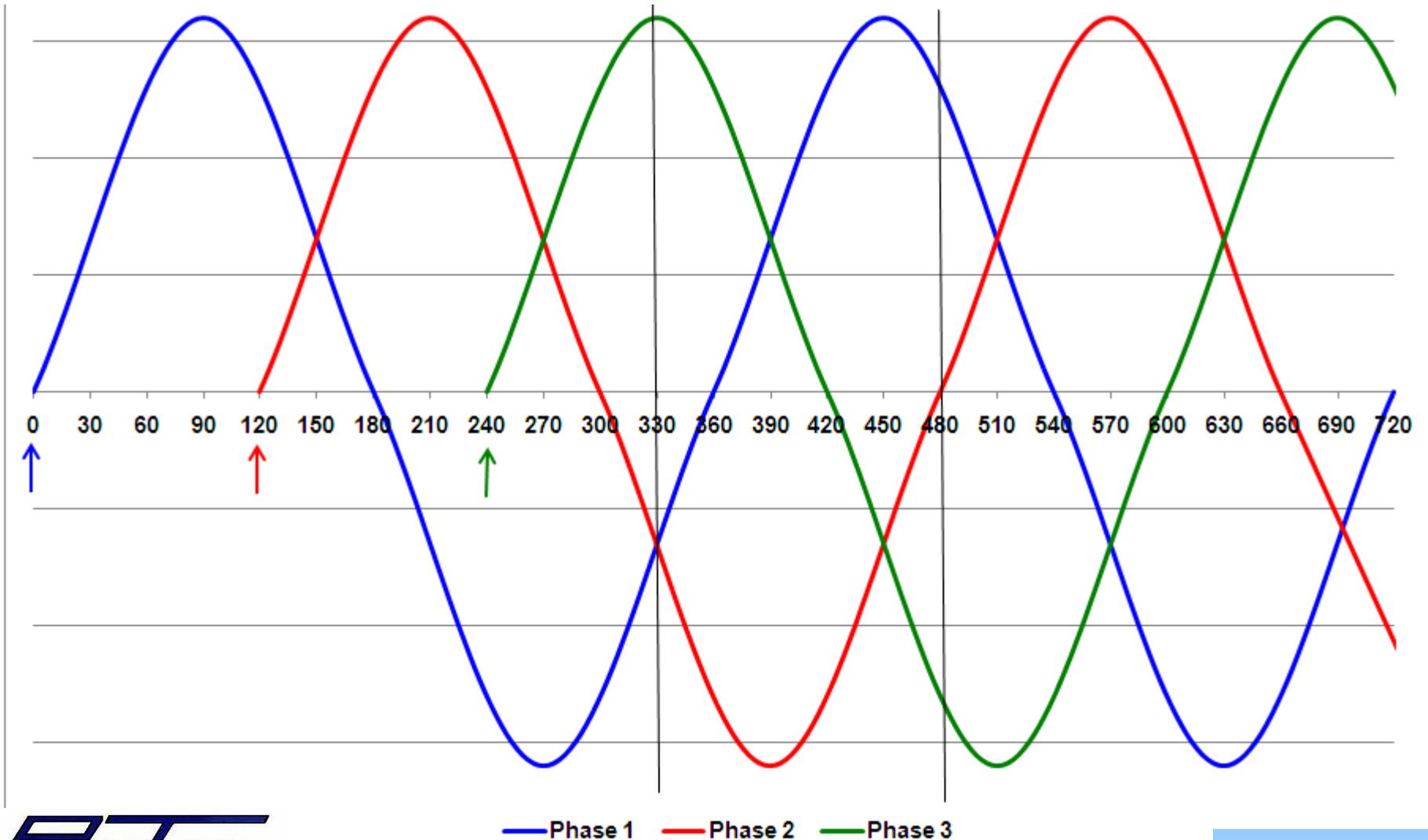
- What is an AC Variable Frequency Drive
- The AC Sine Wave
- The Rotational Field
- AC drive components
- Inverter Output
- Effective Voltage
- Potential Problems
- Pump Control
- Application Examples



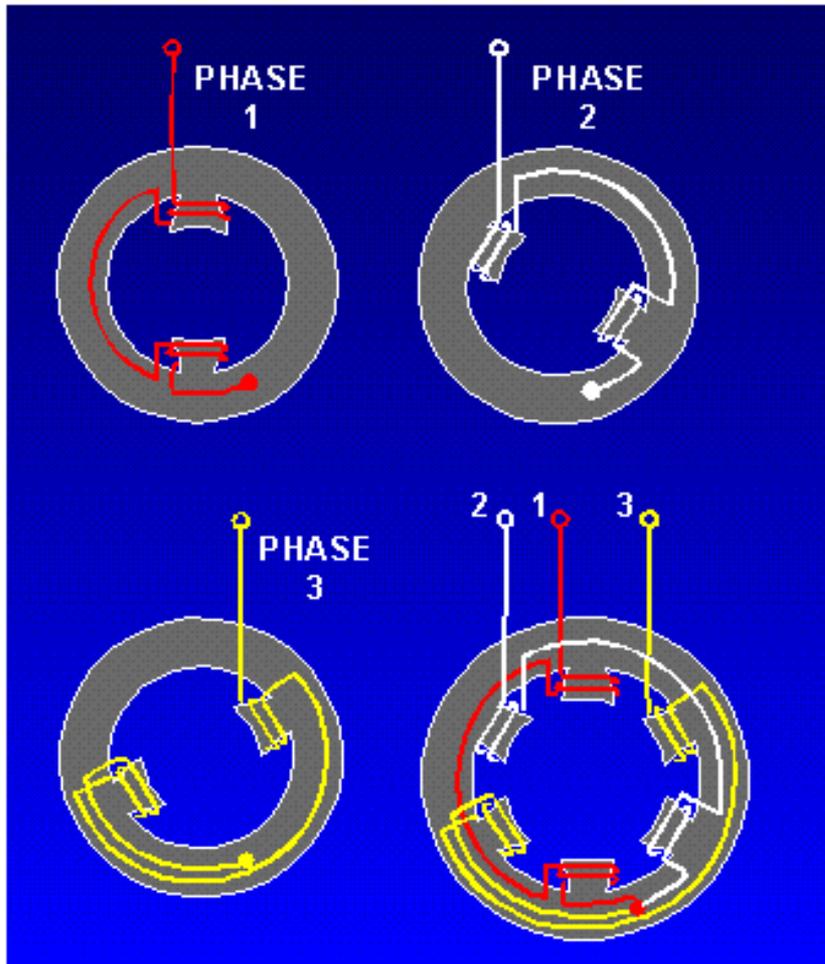
The VFD -- What & Why

- What
 - A VFD converts incoming AC power to DC and then produces DC pulses that emulate the AC sine wave.
 - Its purpose is to allow changes in AC frequency, and motor speed, at its point of use.
- Why
 - **Increased** energy savings for pumps and fans
 - **Improved** process control
 - **Reduced** stress through soft start & stop
 - **Improved** electrical system power factor
 - **Balanced** Voltage & Current
 - **Phase** conversion

Three Phase Curve



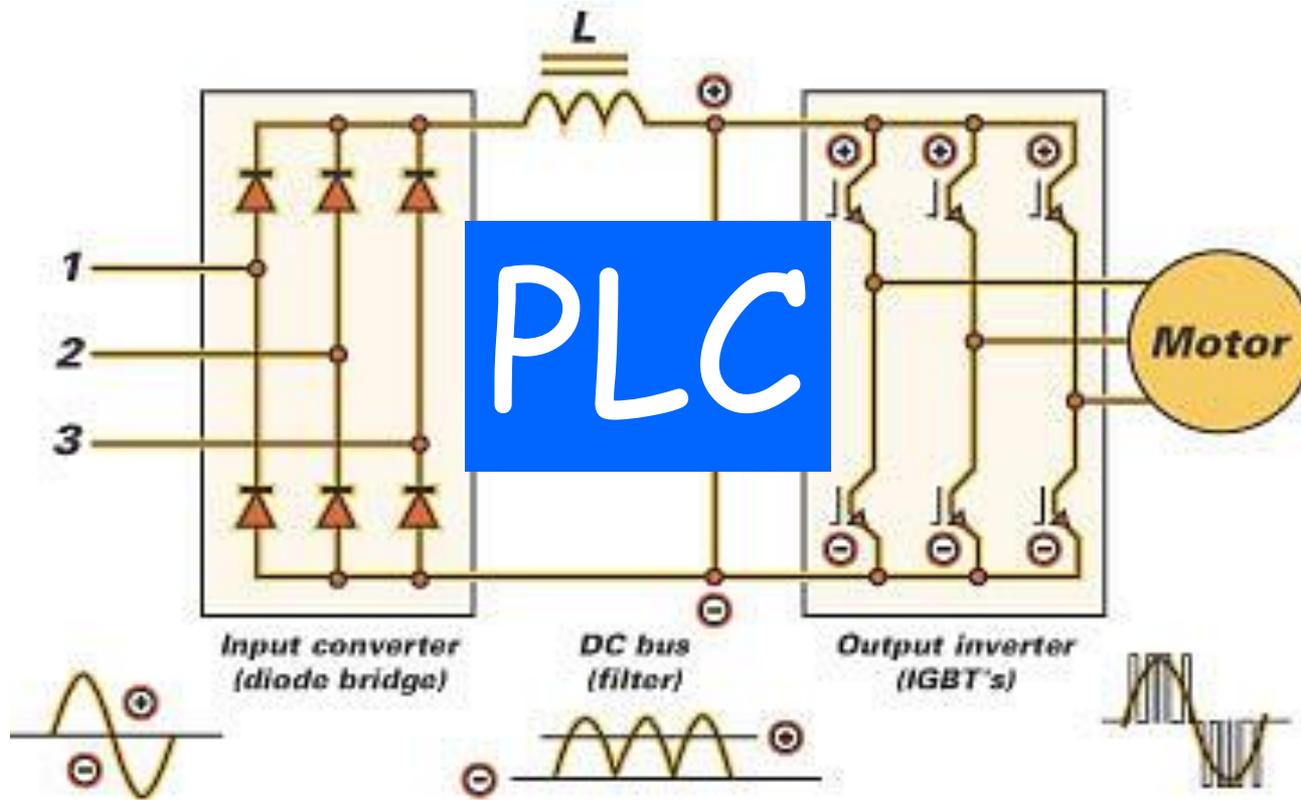
Three Phase, Two Pole Motor



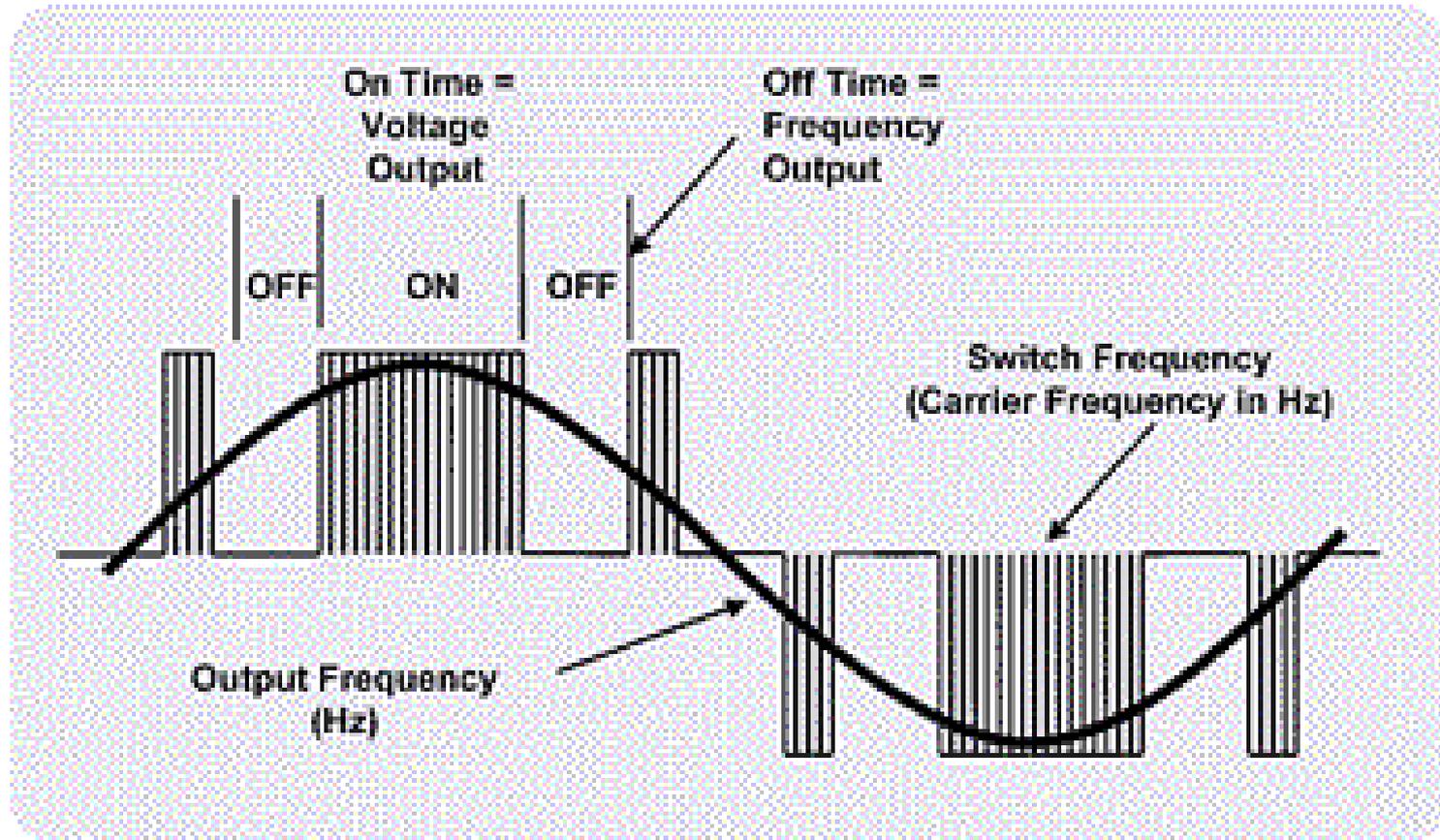
Synchronous Speed
3600 RPM

$$\text{RPM} = 120 \times f / \# \text{ Poles}$$

VFD Components



PWM Inverter Output

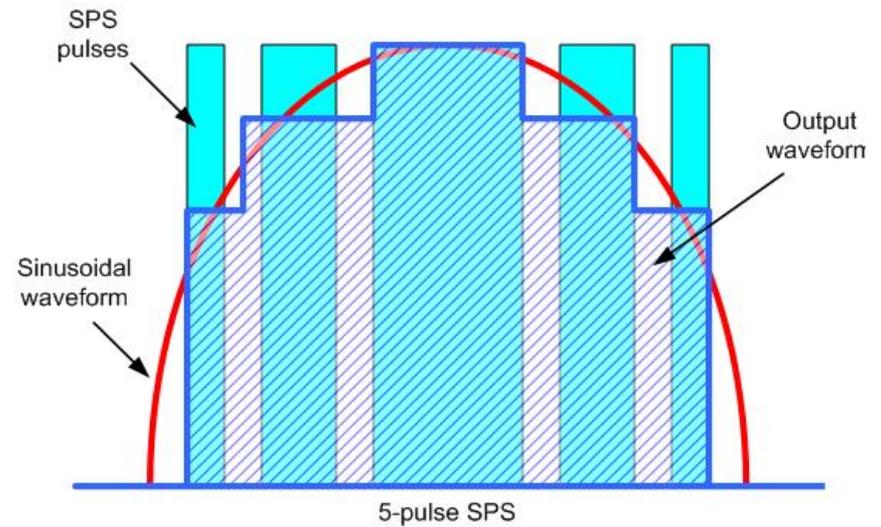
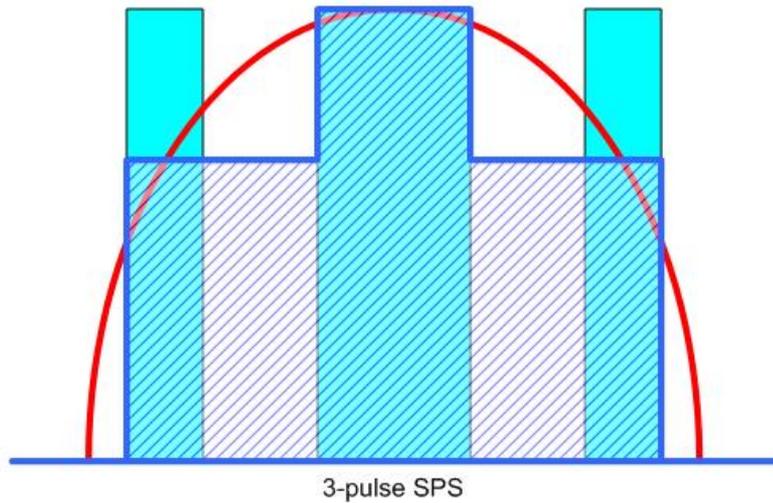


PWM Inverter Output

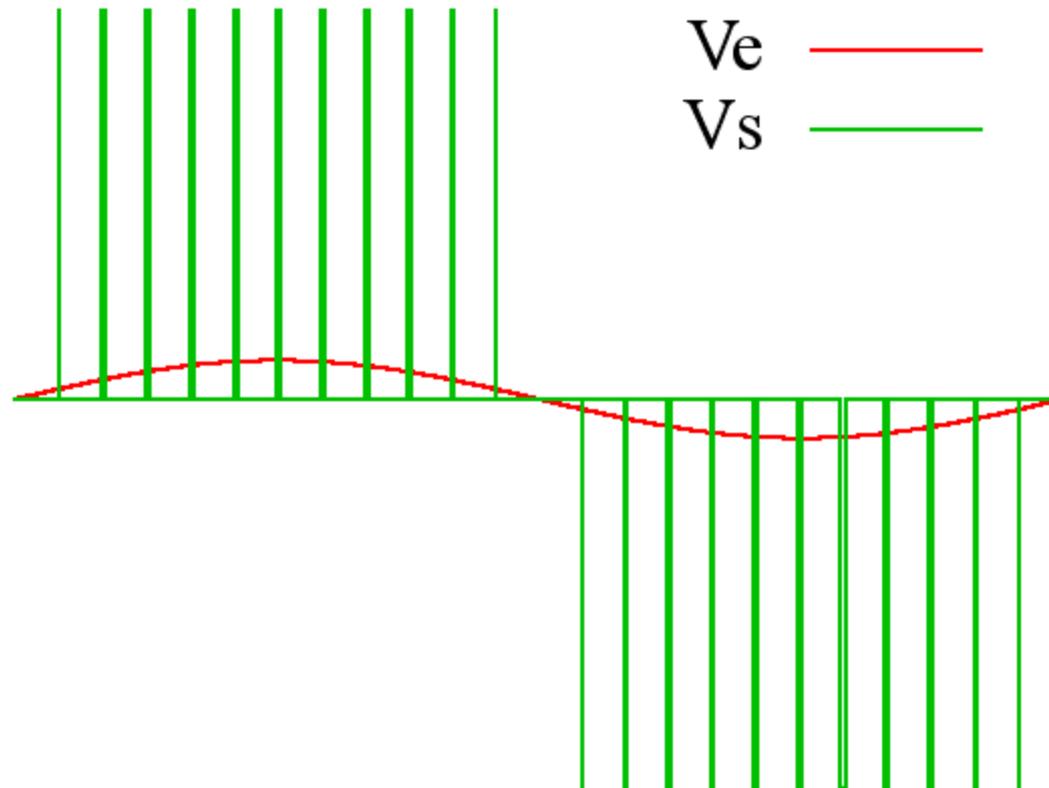
Pulse Width Modulated
Variable Frequency Controller
Output Waveform (Line to Line)



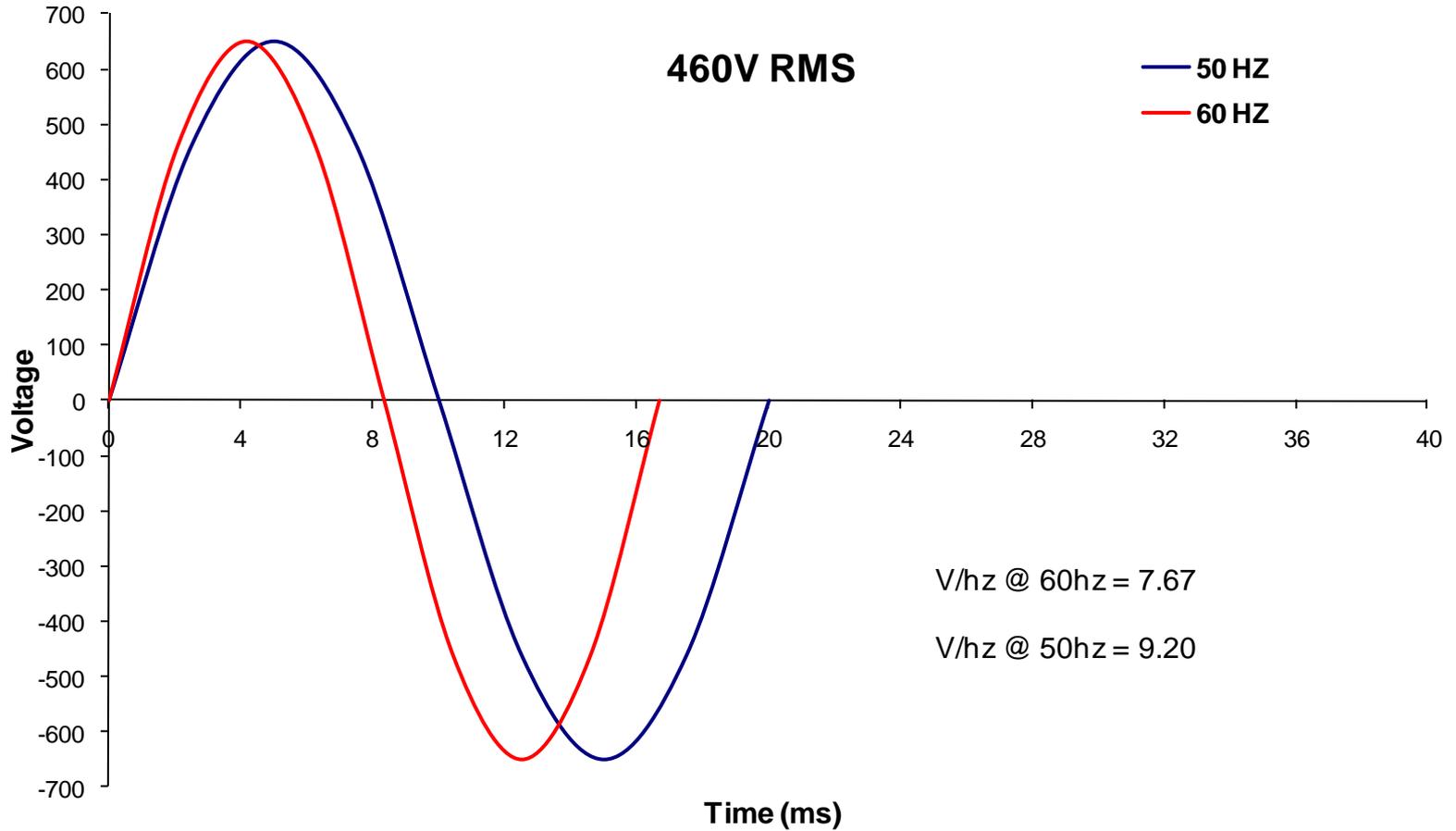
PWM Inverter Output



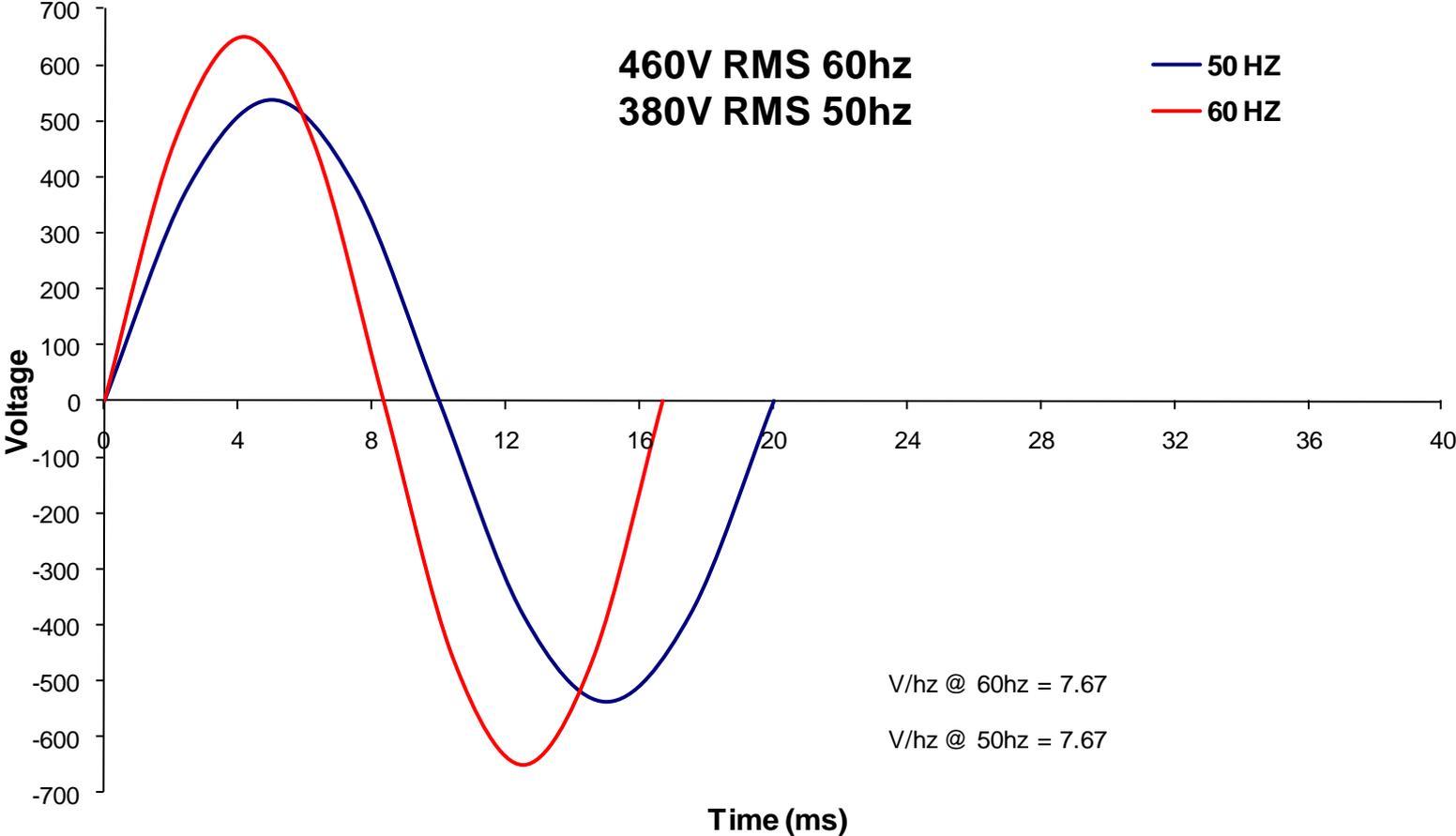
PWM Inverter Output



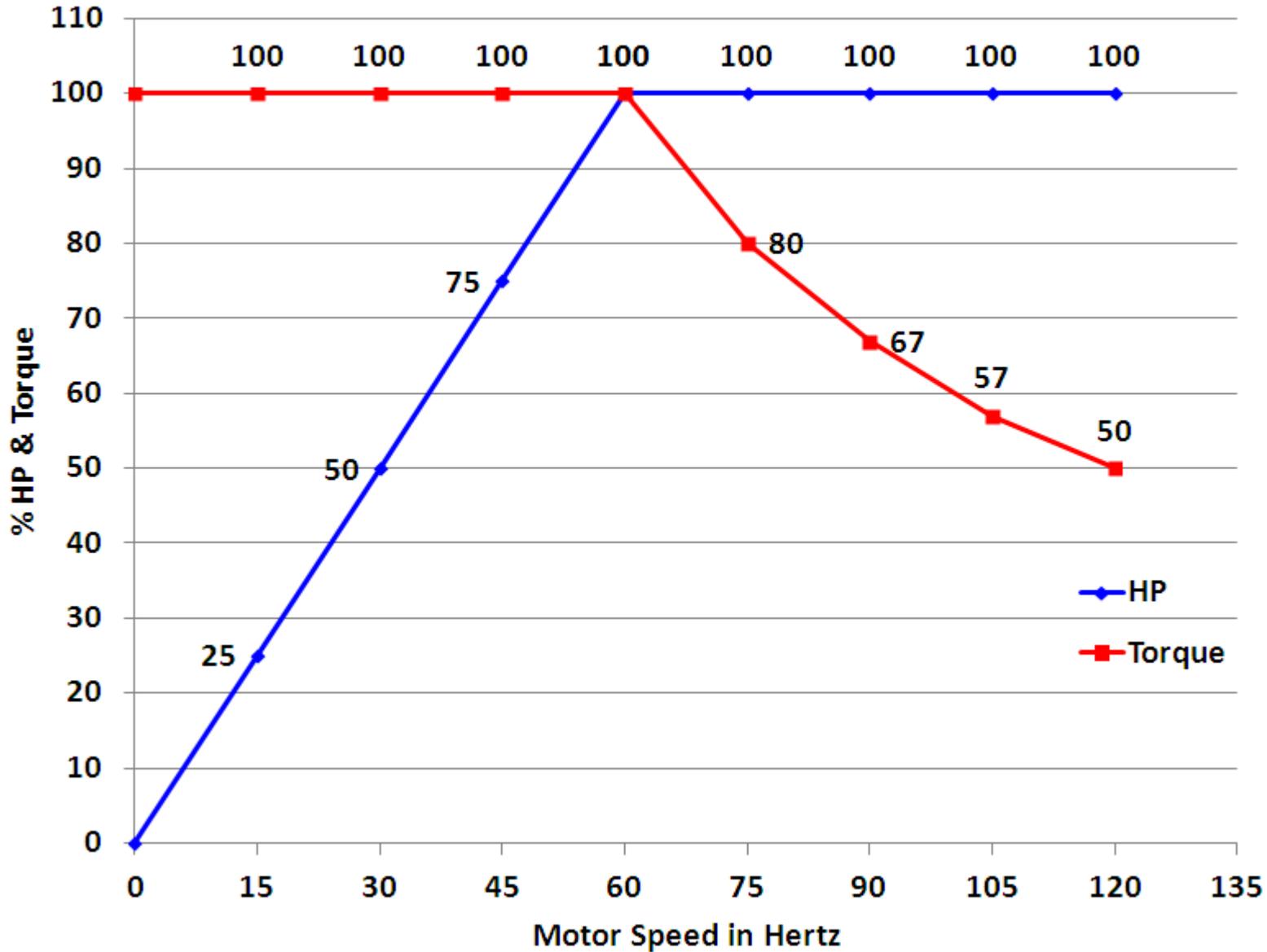
Effective Voltage



Volts per Hertz



% HP & Torque @ Various Frequencies



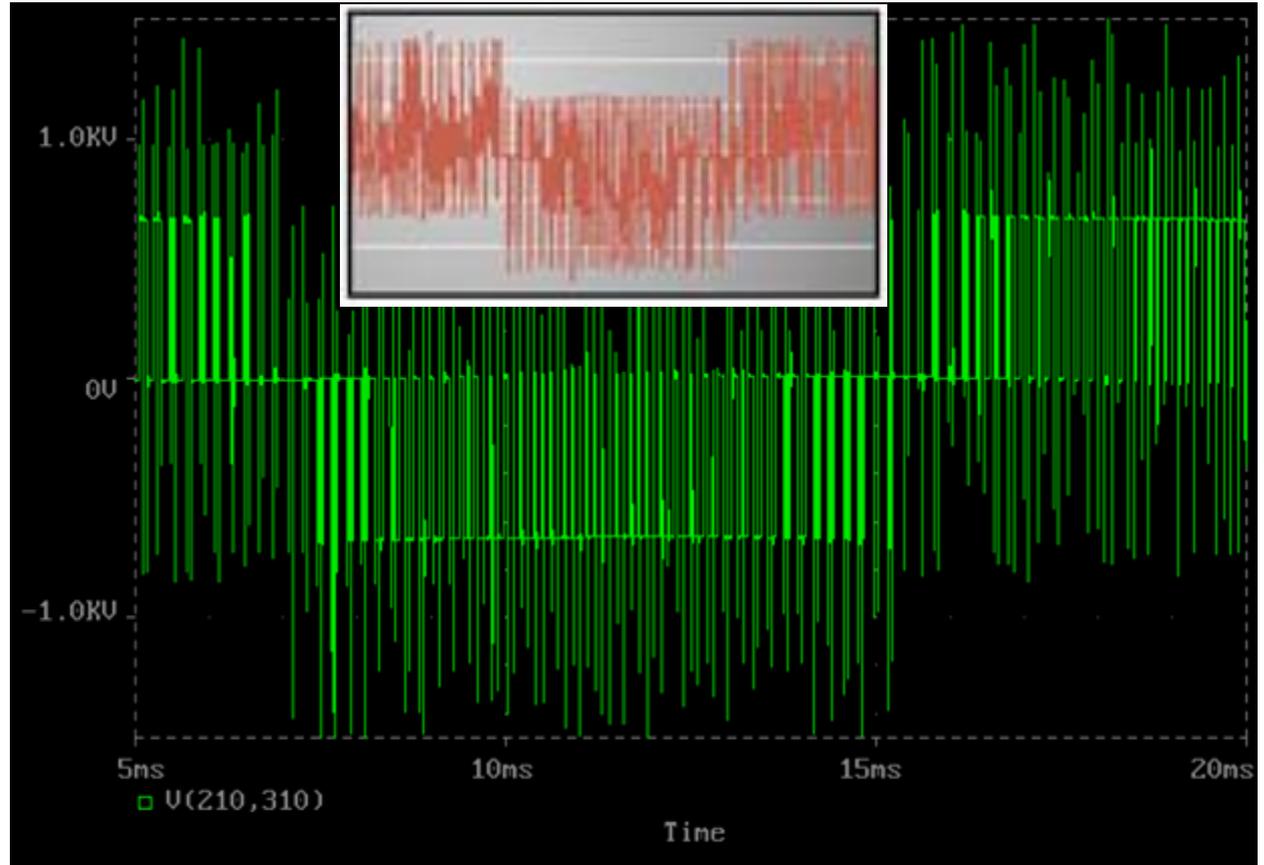
Potential Problems

There is no such thing as a free lunch

- Insulation Stresses
- Harmonic Distortion
- Bearing Currents
- Resonant Frequency

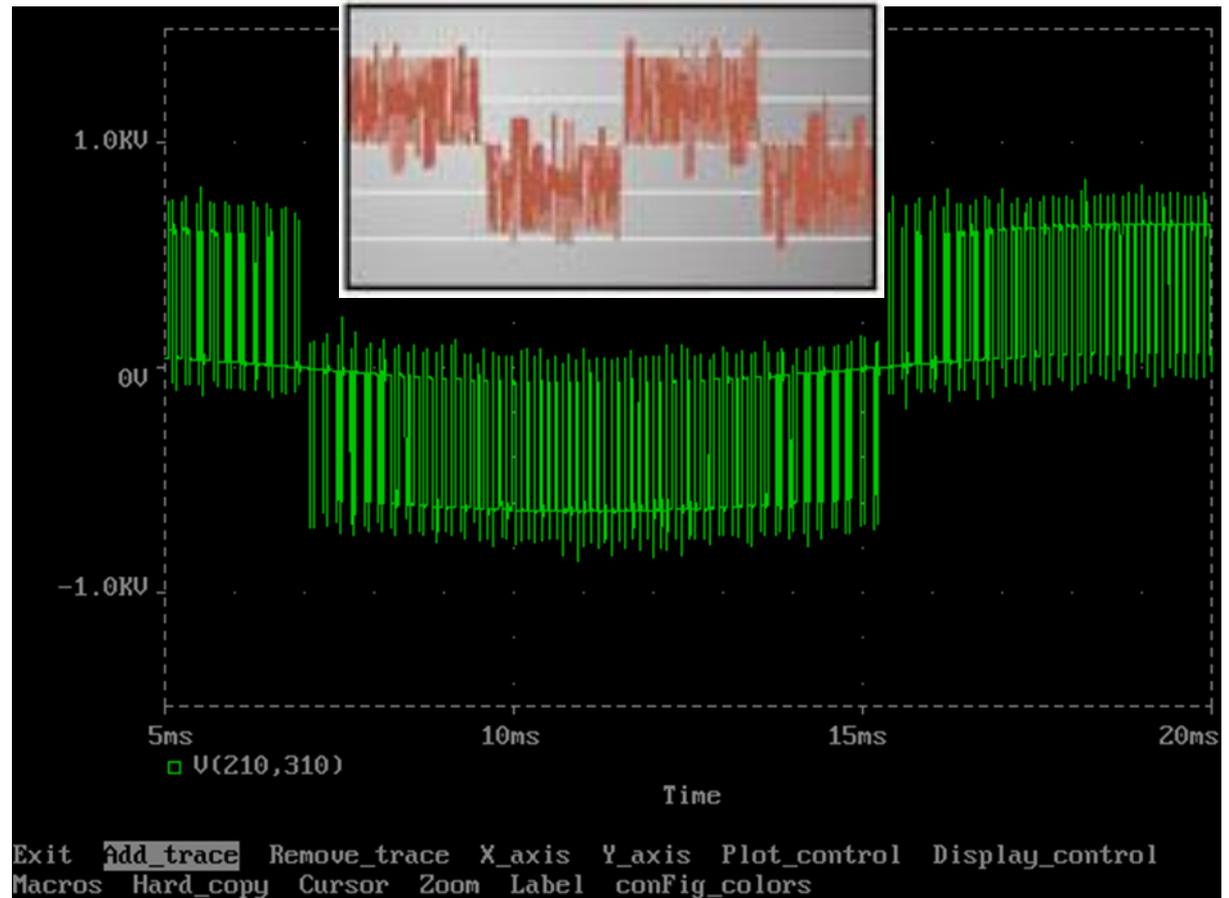
Problems - Insulation Stress

- Causes
 - Thermal Stress
 - Overshoot
 - Reflected Voltage
 - Ringing



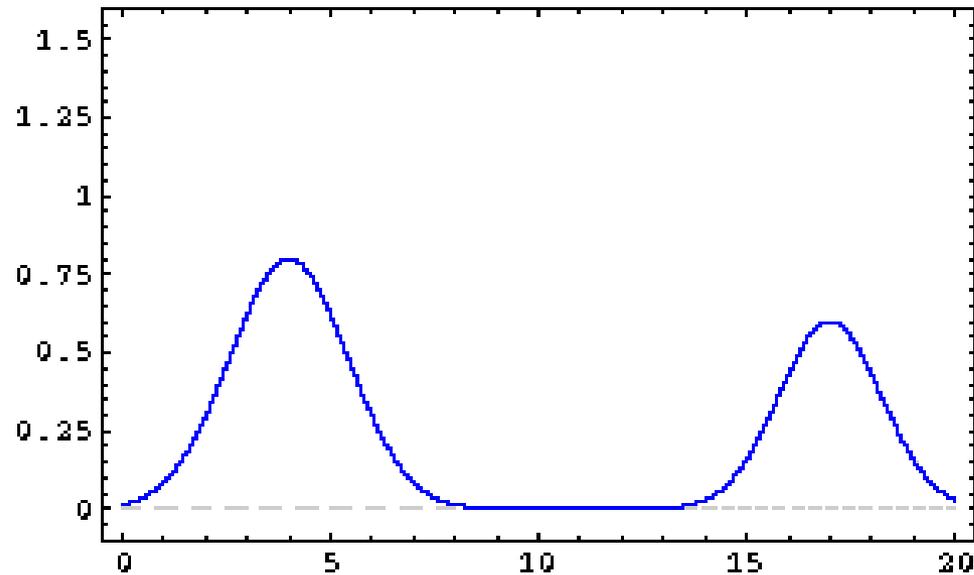
Problems - Insulation Stress

- Fixes
- Cable Length
- Load Reactors
- Load Filters



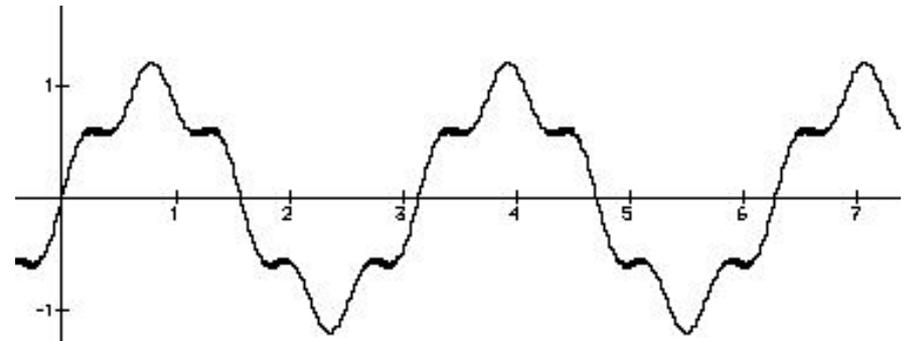
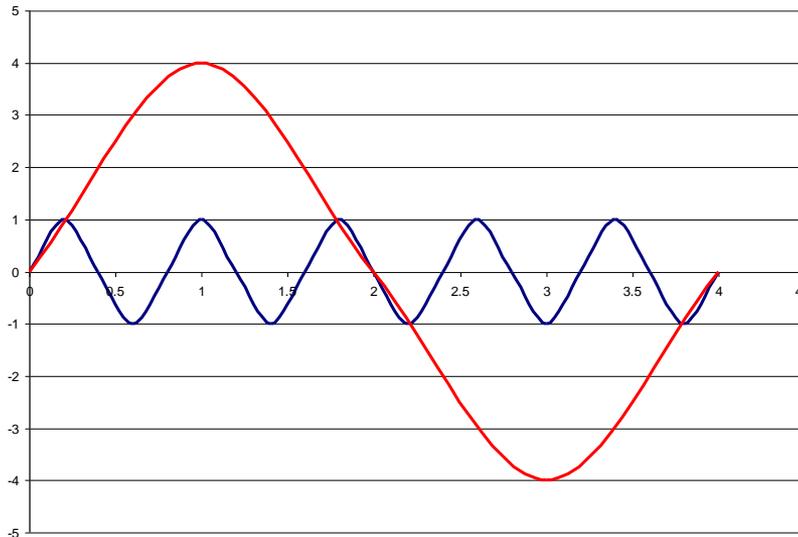
Problems - Insulation Stress

- Reflection



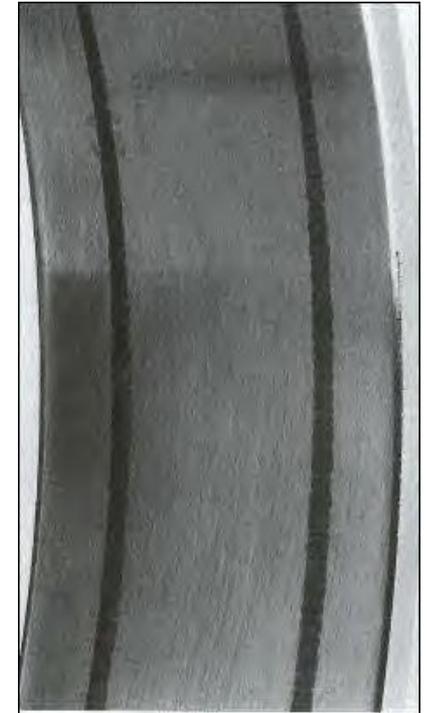
Problems - Harmonic Distortion

What's good for the goose ain't necessarily good for the gander.



Problems - Bearing Damage

- High frequency current forms due to high speed switching
- EDM (electrical discharge machining) causes fluting
- EDM depends upon bearing impedance
- Eliminate by 1) proper cabling, 2) breaking bearing current loop, 3) filtering the high frequency current



Resonant Frequency

- The frequency at which a body begins to vibrate
- Everything in nature has a resonant frequency
- Examples - the wine glass, lineshaft turbines, submersible turbines, centrifugals

First Critical Speed

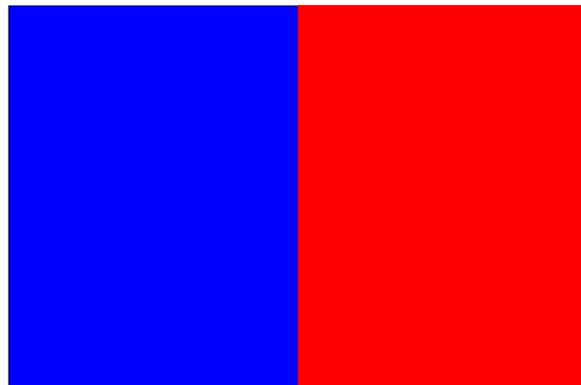
$$N_c = 187.7 / \sqrt{f}$$

N_c is the first critical speed in RPM, f is deflection in inches and 187.7 is a constant. If static deflection is in mm, substitute 946 for 187.7.

At a maximum deflection of 0.006" the first critical speed is approximately 2420 RPM.

VFD Pump Control

Humans are analog
Computers are digital



0.005

0.000025

200X

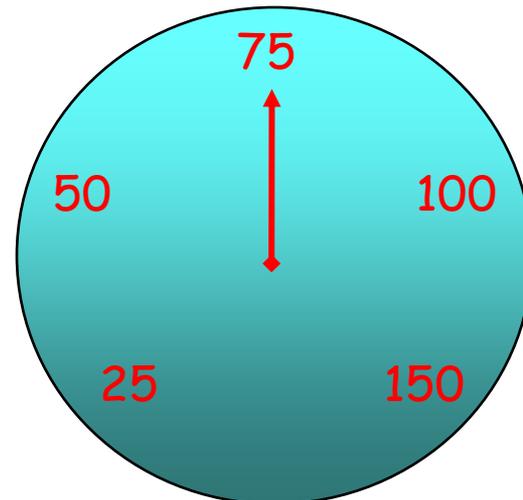
2X

VFD Pump Control

Humans are **analog**
Computers are **digital**

Temperature Control

~~75.0~~



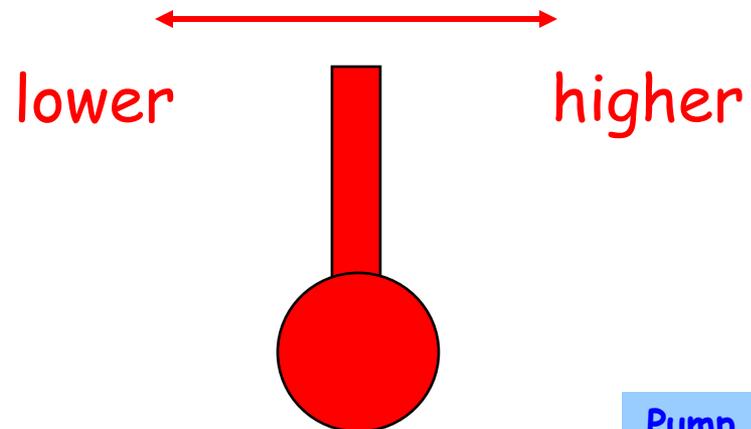
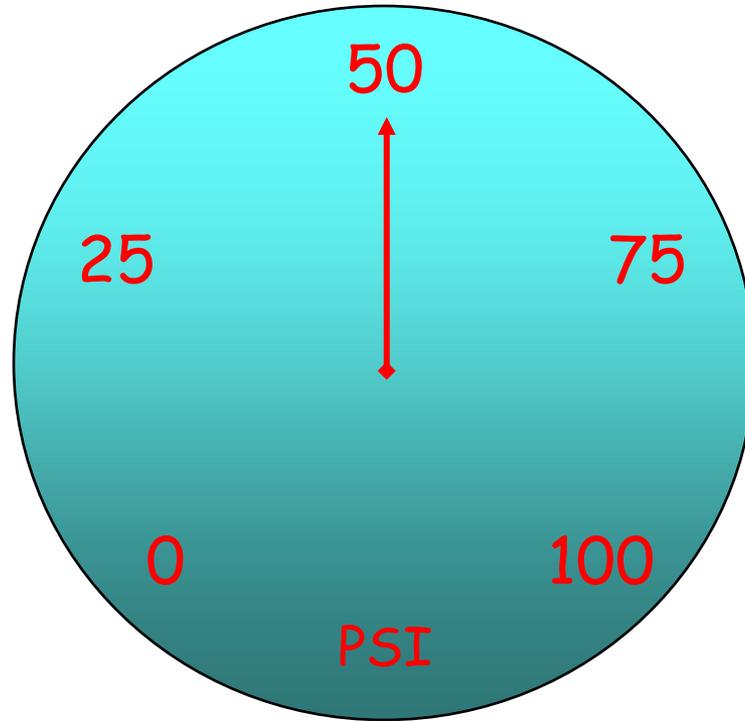
Constant Pressure

The VFD Monitors:

- * Pressure
- * Frequency

The VFD Controls Pressure Via PID:

- * Proportional
- * Integral
- * Derivative



Affinity - The Laws

- Flow is directly proportional to a change in speed

$$F = dS$$

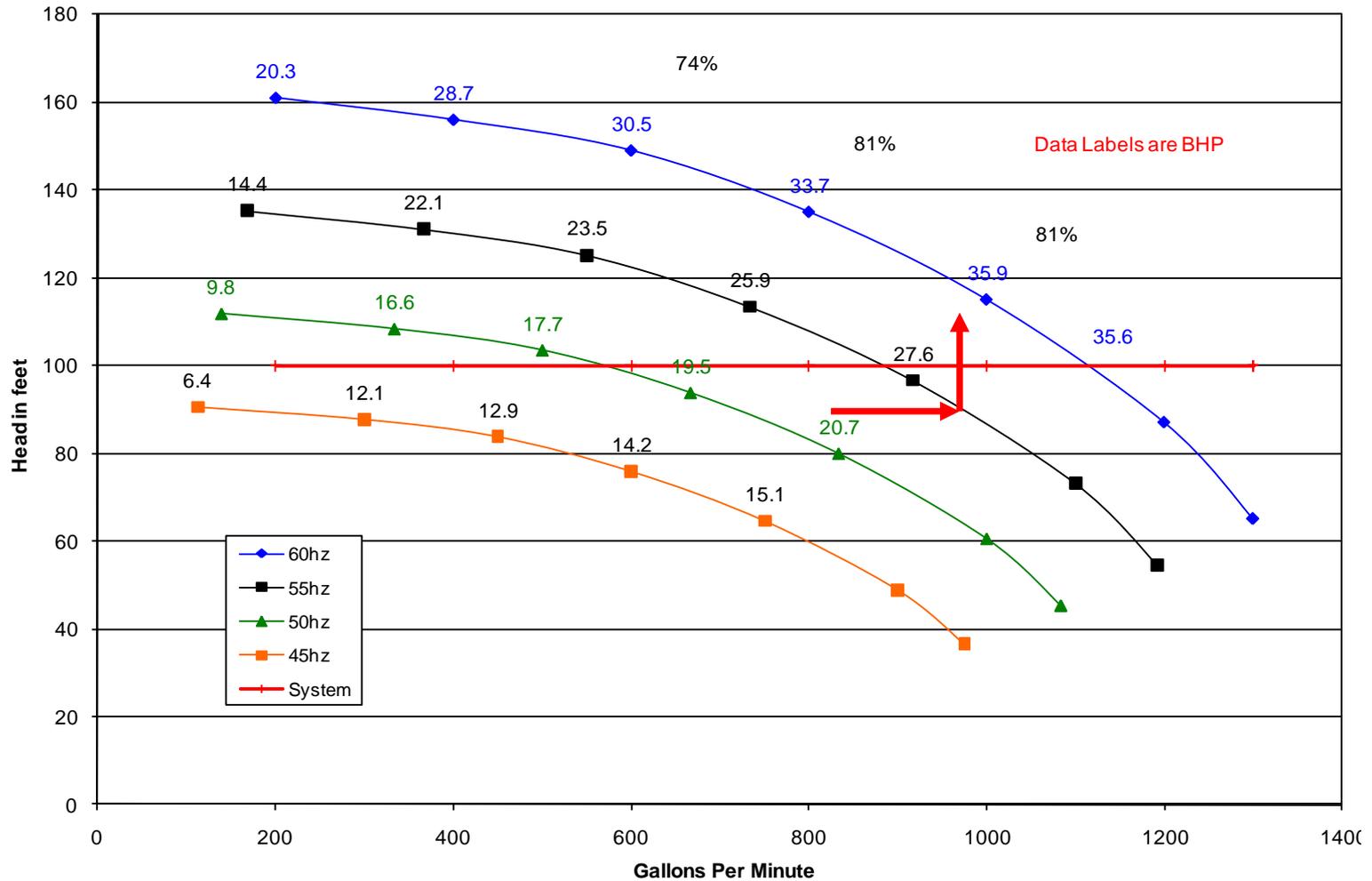
- Head varies as the square of a change in speed

$$H = dS^2$$

- HP varies as the cube of a change in speed

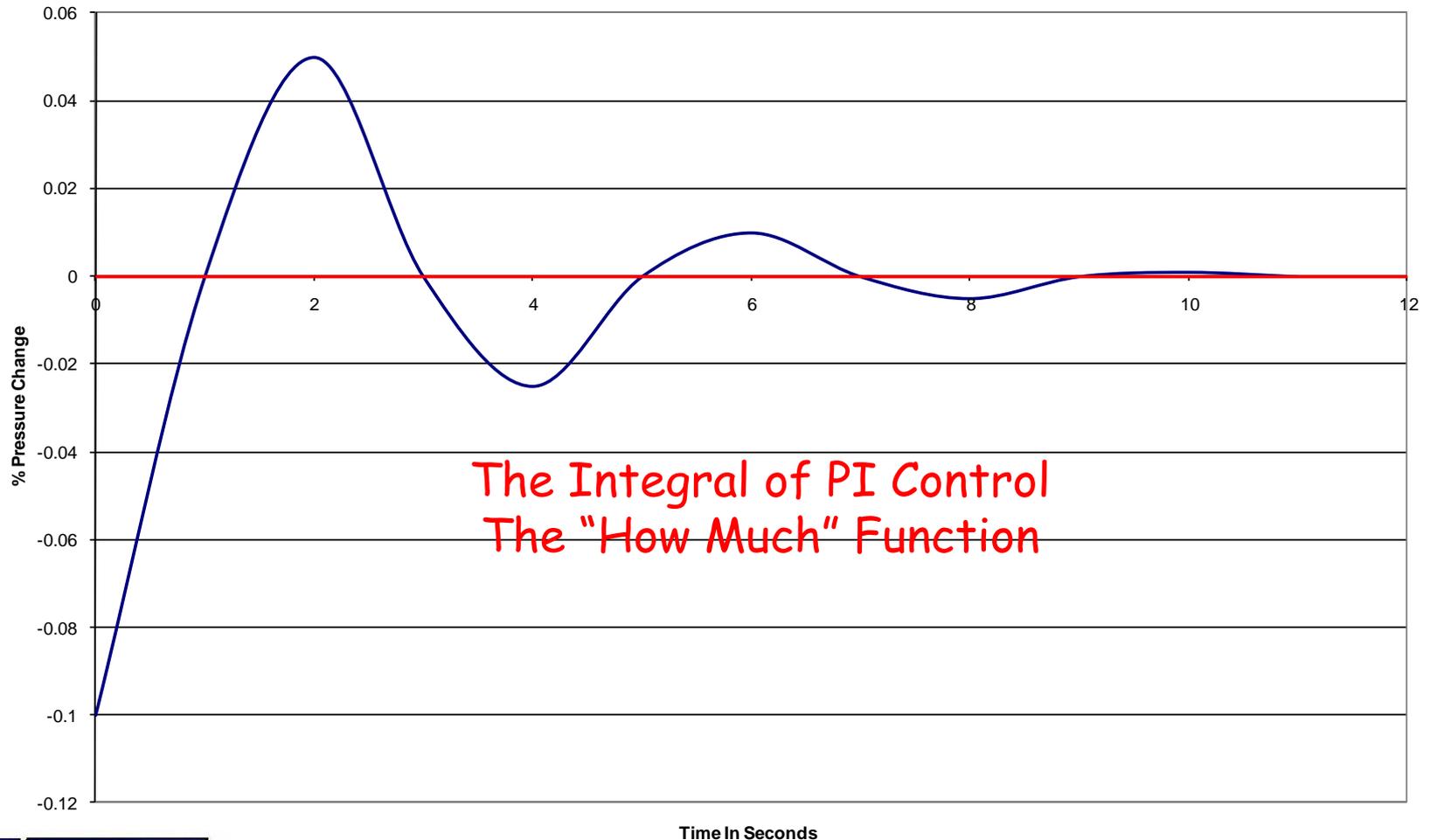
$$HP = dS^3$$

Proportional Control



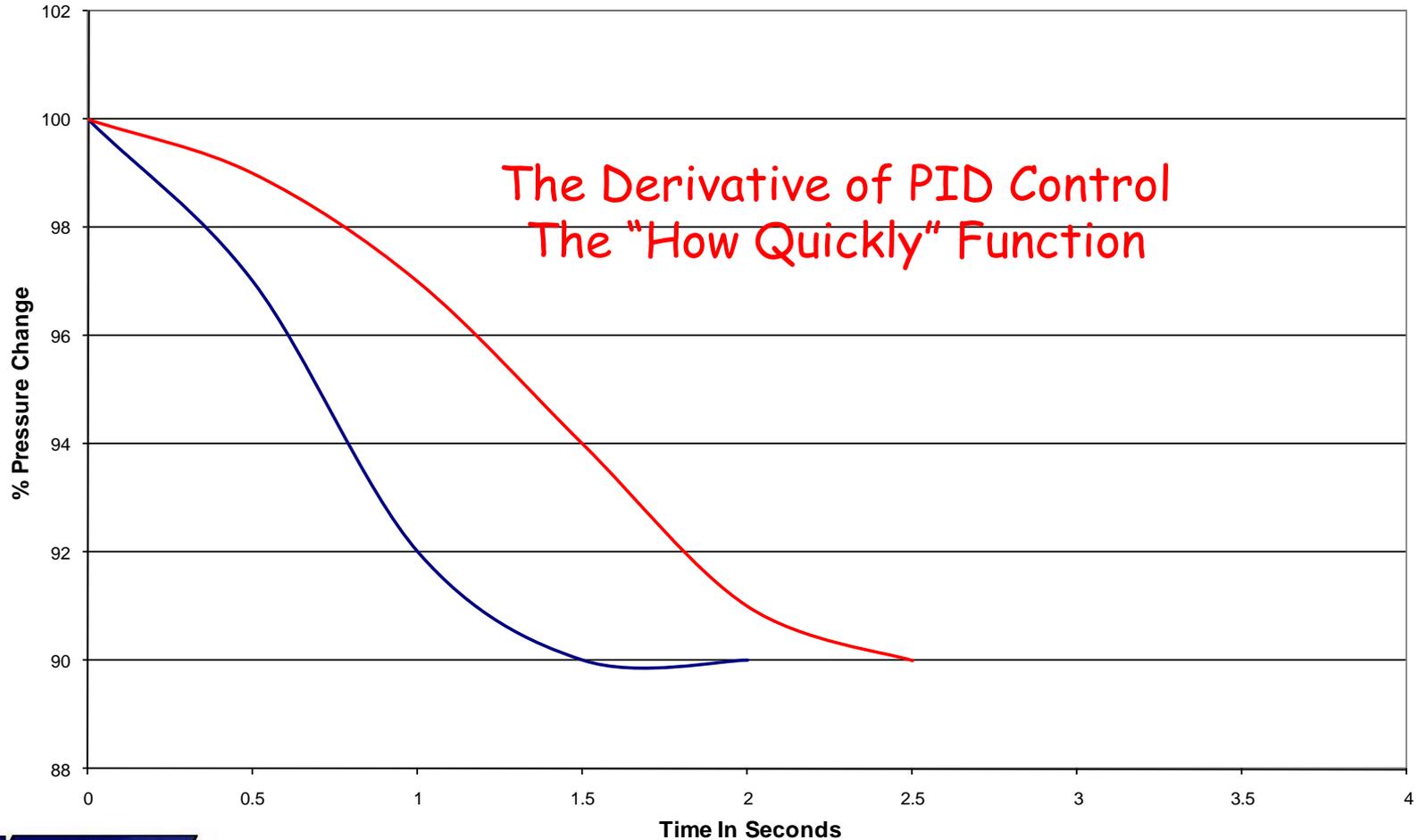
Proportional / Integral Control

Proportional Control Error

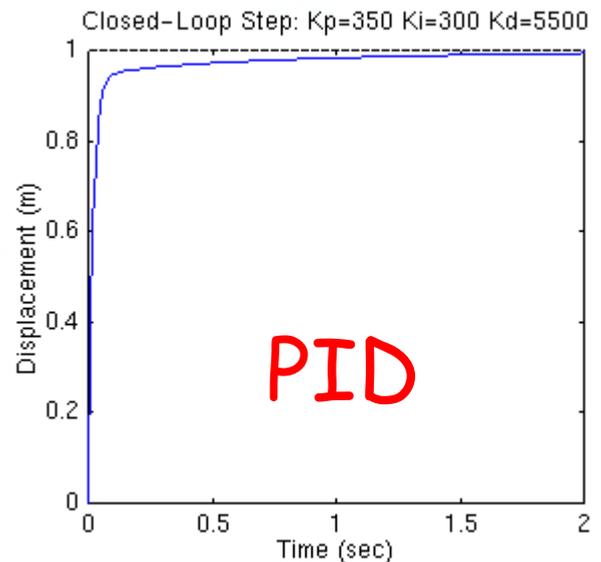
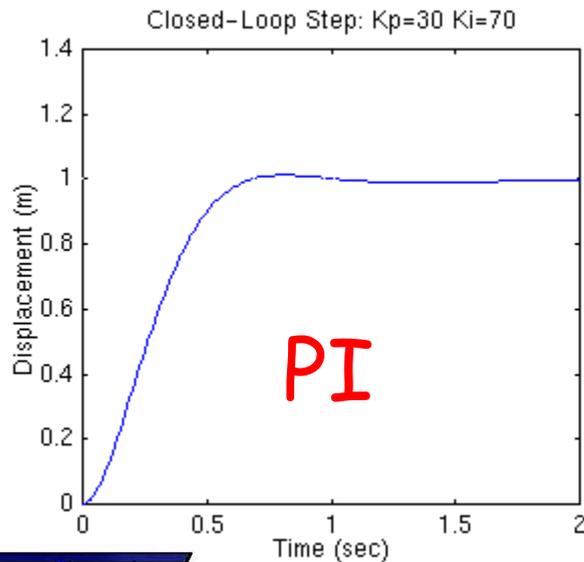
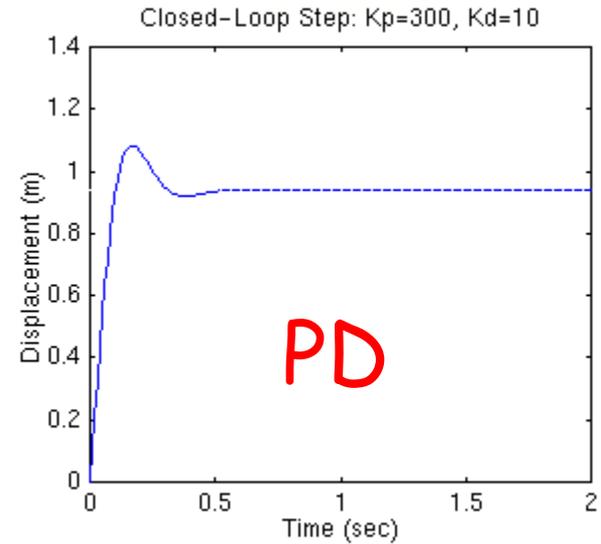
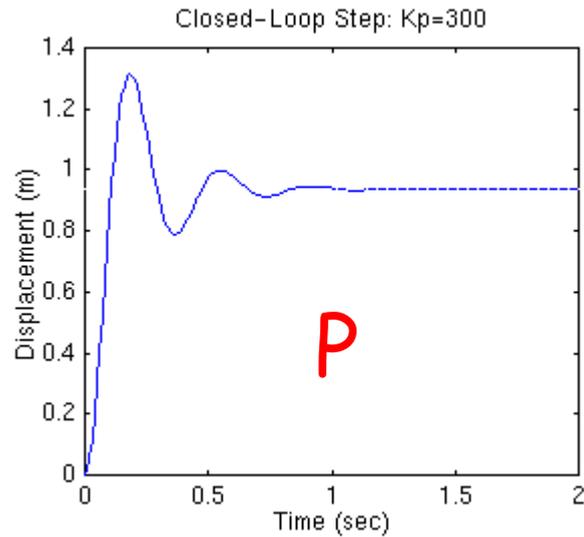


Derivative Control

Derivative Control



P, PD, PI & PID Control

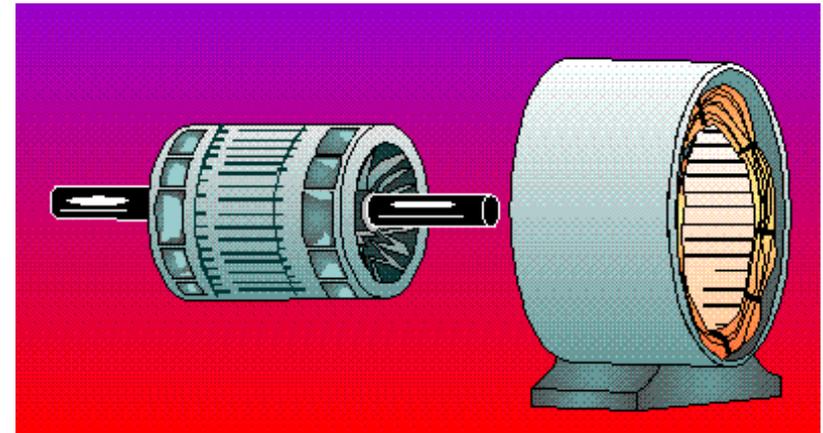


Centrifugal VFD Applications

- Phase Conversion / Current Balance -
Soft Start / Stop
- Constant Pressure cp/vf
- Constant Flow cf/vp
- Variable Flow vf/vp
- Level Control vf/cp
- Growth in Demand (Head & Flow)

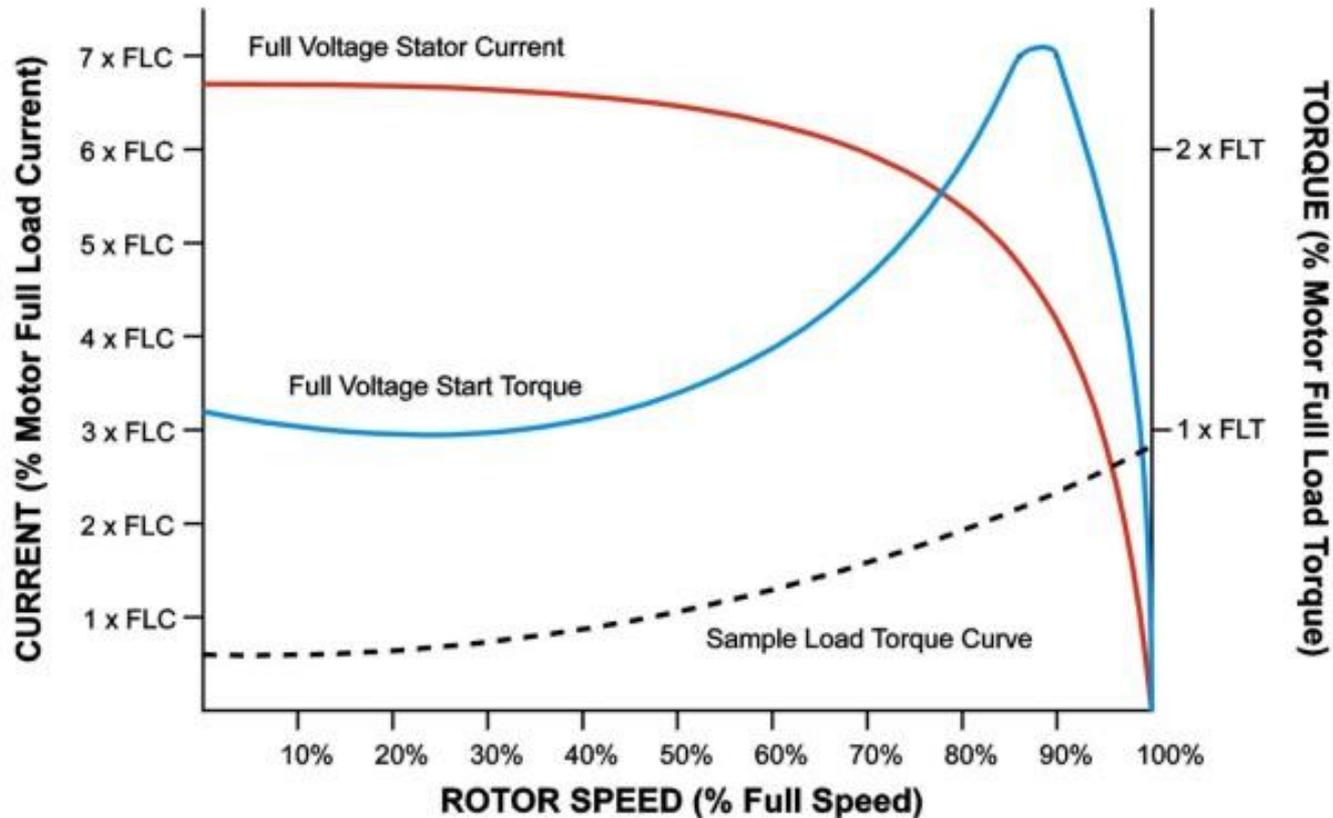
Regardless of the Application

- **Soft Start & Stop**
- Lower Locked Rotor Current
- Lower Mechanical Stress
- Lower Hydraulic Stress
- Longer Life



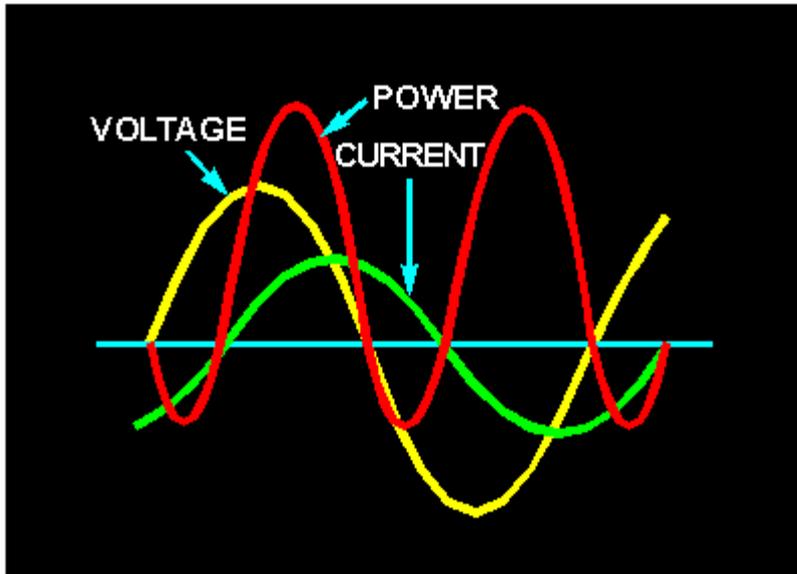
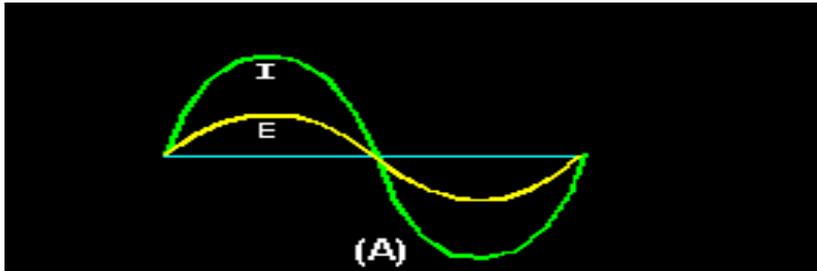
A point on the periphery of a two pole, 11.5" diameter rotor accelerates to 180 fps (123 MPH) in about 1 second.

Three Phase Starting



Regardless of the Application

Power Factor Correction



Balanced Voltage

458 / 458 / 458

versus

462 / 465 / 447

2.4% Unbalance

Variable Frequency 101

Joe Evans, Ph.D

Want to learn more?

Visit www.PumpEd101.com