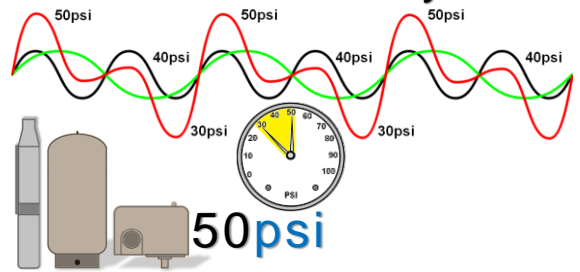


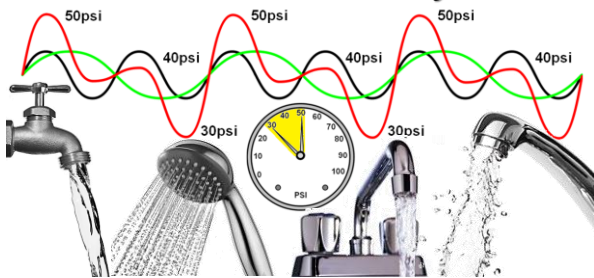
### Variable Frequency Drives...



### Conventional Water System



### Conventional Water System



### Variable Frequency Drives...



### Variable Frequency Drives...



### Variable Frequency Drives...

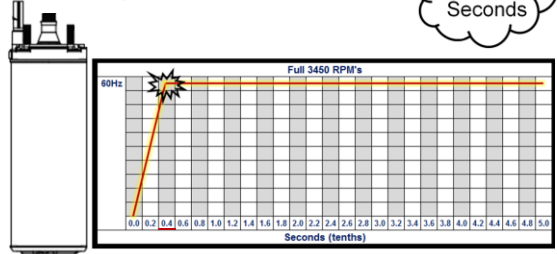


nearly 20% of the energy used by electric motors worldwide

## Pumping Systems

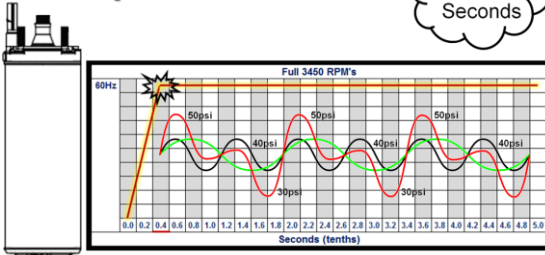
3450 rpm motor

**0.4**  
Seconds



3450 rpm motor

**0.4**  
Seconds



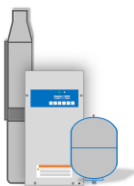
3450 rpm motor

Reducing the speed of a pump motor by

10% results in a 21% savings in energy

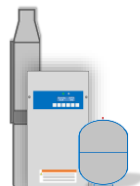
20% results in a 49% savings in energy

### Variable Frequency Drives...




- *control* the speed of the motor
- *varying* the frequency of the power source
- *controlling* the amount of current drawn by the motor

### Variable Frequency Drives...

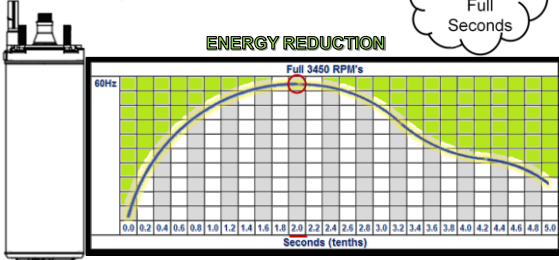


- *control* the speed of the motor
- start & stop cycles  
"soft start / soft stop"
- throughout the "run cycle"

Electric motors  love this

3450 rpm motor

**2.0**  
Full  
Seconds



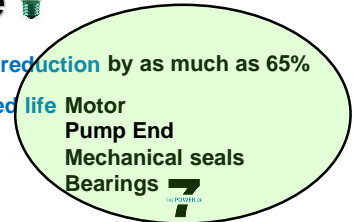
Variable Frequency Drives...

**Value** 💡

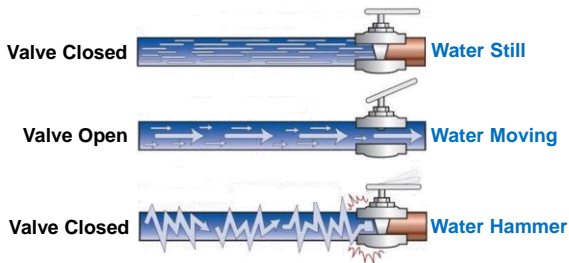


Energy reduction by as much as 65%

Extended life Motor  
Pump End  
Mechanical seals  
Bearings



What about Water Hammer?



0-3450 rpm's = 0.4 seconds



A sudden stop or start of that flow creates a Water Hammer of approximately

**375 psi**

0-3450 rpm's = 2.0 seconds



A "soft" stop or start of that flow reduces the Water Hammer to

**386 psi**

### Variable Frequency Drives...

## Value

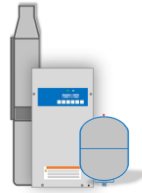


Energy reduction by as much as 65%

Extended life Motor  
Mechanical seals  
Bearings  
No Water Hammer

### Variable Frequency Drives...

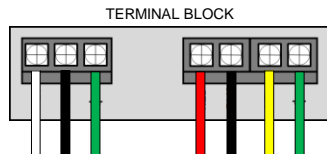
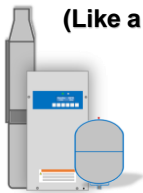
## PRICE IS WHAT YOU PAY VALUE IS WHAT YOU GET



### Variable Frequency Drives...

## Wiring a VFD

(Like a Control Box)



### Variable Frequency Drives...

## Programming a VFD



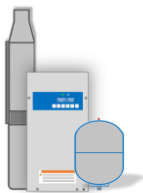
- hp and max amps of motor
- Hz based on matched or mis-matched PMA
- Enter passcode "optional"



(in approximately 90 seconds)

### Variable Frequency Drives...

## ONBOARD DIAGNOSTICS and PROTECTION



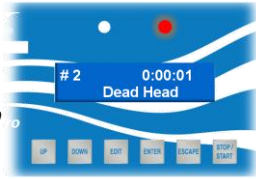
## ONBOARD DIAGNOSTICS and PROTECTION

Will detect "underload" (Dry Well)



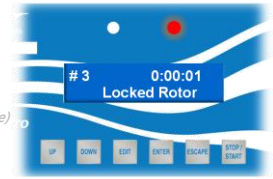
## ONBOARD DIAGNOSTICS and PROTECTION

Will detect "underload" (Dry Well)  
 Will detect "Dead Head"  
 (pump running against a closed discharge)



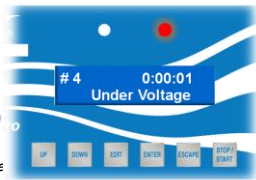
## ONBOARD DIAGNOSTICS and PROTECTION

Will detect "underload" (Dry Well)  
 Will detect "Dead Head"  
 (pump running against a closed discharge)  
 Will detect "Locked Rotor"(bound pump)



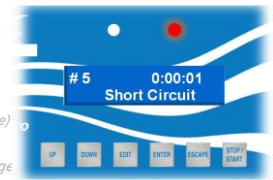
## ONBOARD DIAGNOSTICS and PROTECTION

Will detect "underload" (Dry Well)  
 Will detect "Dead Head"  
 (pump running against a closed discharge)  
 Will detect "Locked Rotor"(bound pump)  
 Will detect "Under Voltage (low line voltage)



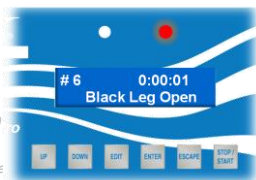
## ONBOARD DIAGNOSTICS and PROTECTION

Will detect "underload" (Dry Well)  
 Will detect "Dead Head"  
 (pump running against a closed discharge)  
 Will detect "Locked Rotor"(bound pump)  
 Will detect "Under Voltage (low line voltage)  
 Will detect "Short Circuit"(motor, cables, wire insulation)



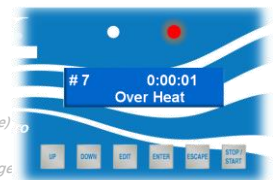
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Will detect "underload" (Dry Well)  
 Will detect "Dead Head"  
 (pump running against a closed discharge)  
 Will detect "Locked Rotor"(bound pump)  
 Will detect "Under Voltage (low line voltage)  
 Will detect "Short Circuit"(motor, cables, wire insulation)  
 Will detect "Broken Wire"(Red, Yellow, Black)



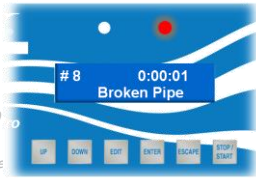
## ONBOARD DIAGNOSTICS and PROTECTION

Will detect "underload" (Dry Well)  
 Will detect "Dead Head"  
 (pump running against a closed discharge)  
 Will detect "Locked Rotor"(bound pump)  
 Will detect "Under Voltage (low line voltage)  
 Will detect "Short Circuit"(motor, cables, wire insulation)  
 Will detect "Broken Wire"(Red, Yellow, Black)  
 Will detect "over heating"(excessive heating of drive)



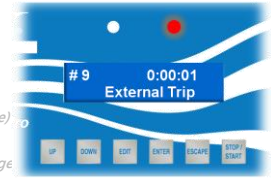
## ONBOARD DIAGNOSTICS and PROTECTION

- Will detect "underload" (Dry Well)
- Will detect "Dead Head" (pump running against a closed discharge)
- Will detect "Locked Rotor" (bound pump)
- Will detect "Under Voltage" (low line voltage)
- Will detect "Short Circuit" (motor, cables, wire insulation)
- Will detect "Broken Wire" (Red, Yellow, Black)
- Will detect "over heating" (excessive heating of drive)
- Will detect "Broken Pipe"



## ONBOARD DIAGNOSTICS and PROTECTION

- Will detect "underload" (Dry Well)
- Will detect "Dead Head" (pump running against a closed discharge)
- Will detect "Locked Rotor" (bound pump)
- Will detect "Under Voltage" (low line voltage)
- Will detect "Short Circuit" (motor, cables, wire insulation)
- Will detect "Broken Wire" (Red, Yellow, Black)
- Will detect "over heating" (excessive heating of drive)
- Will detect "Broken Pipe"
- Will detect "external trip" (contacts closed on alarm-in terminals)



## ONBOARD DIAGNOSTICS and PROTECTION



in all situations the drive will...

- ramp motor speed down
- Shut down, then re-check to see if condition still exists
- Shut down and go into hard fault w/ fault displayed

## ONBOARD DIAGNOSTICS and PROTECTION



*Easy*

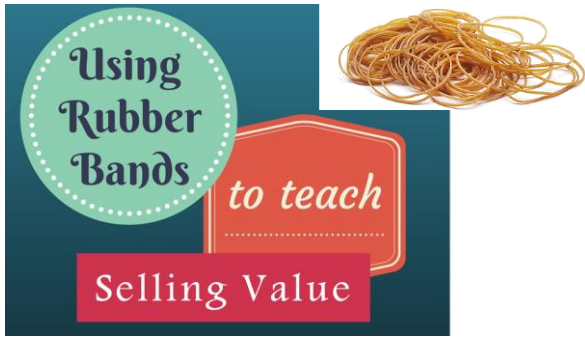
- Installation & wiring
- Programming
- To understand various faults

## Control your VFD from *anywhere* in the world

- Alerts sent via text or email
- System status
- Comprehensive run history
- Fault activity
- Remote access to programming

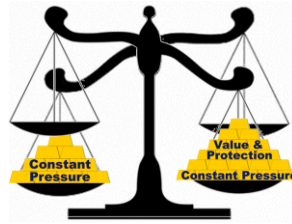


why does any of this matter?



### Features & Benefits

*Constant Pressure*



### Value & Protection

- Energy Reduction*
- Extended life*
- No Water Hammer*
- Dry Well*
- Dead Head*
- Locked Rotor*
- Under Voltage*
- Short Circuit*
- Open Leg*
- Over Heat*
- Broken*
- Phase Trip*

PEOPLE PAY WHEN THE **VALUE** IS HIGHER THAN THE PRICE



CREATE A **VALUE** PRICE WILL FOLLOW

### Variable Frequency Drives...

