

De Anza ES 73 Electric Motors and Drives – Lecture #3

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Instructor

Logistics

- ◆ Guest Lecturer – Steve Murphy
- ◆ Journals and assignments due 3/18.
- ◆ Deliver to Distance Learning.
- ◆ Include alternate assignment if you missed field trip.
- ◆ Short Oral presentation for those who missed last week...

Review

- ◆ Field Trip
- ◆ Motor Controls
- ◆ Variable Speed Drives
- ◆ MotorMaster 3+

Economics of wire upsizing

- ◆ Wire sizes based on Electric Code
- ◆ Potential Energy Savings
- ◆ Increased flexibility
- ◆ Reduced Voltage Drop

Optimum Pipe Sizing

- ◆ 16% of a typical industrial facility's electricity is used for pumping (USDOE)
- ◆ Address the friction component of the pumping system
 - Pipe roughness
 - Pipe diameter

Motor Poles

- ◆ Assuming an AC motor and 60hz power system the synchronous speed will be:
 - Two pole = 3,600 rpm
 - Four pole = 1,800 rpm
 - Six pole = 1,200 rpm
 - Eight pole = 900 rpm

"Green Plug" or "Nola" Device

- ◆ PFC or Power Factor Controller used to save energy with household appliances
- ◆ Appliances are designed to operate plus or minus 10% of normal voltage

System Efficiency Measures*

- ◆ Reduce system load requirements.
- ◆ Reduce or control motor speed.
- ◆ Match component size to load.
- ◆ Upgrade component efficiency.
- ◆ Maintenance.
- ◆ Motor Downsizing.

*from US Office of Industrial Technologies

Reduce Pumping by Proper Pipe Sizing

- ◆ Pumping effort necessary to overcome the frictional losses in piping systems.
- ◆ Higher first cost for piping.
- ◆ Lower energy cost.
- ◆ Potentially lower pump/motor cost.

Pump Recommendations

- ◆ Reduce Overall System Requirements
 - Equalize flow over production cycle using holding tanks.
 - Eliminate bypass loops and other unnecessary flows
 - Increase pipe diameter to reduce friction
 - Reduce safety margins in design system capacity

Pump Recommendations #2

- Install parallel systems for highly variable loads
- Reduce pump size to fit load
- Replace throttling valves with speed controls
- Replace belt drives with direct coupling
- Replace worn impellers, bearings, seals, etc.

Compressed Air Systems

- ◆ Review system design and compare to current needs
- ◆ Reduce system demand by eliminating poor applications.
- ◆ Review system for special requirements and consider smaller booster or satellite air systems.
- ◆ Use non-conditioned air for supply air where practical.
- ◆ Install improved controls
 - Part load controllers or parallel systems
- ◆ Reduce leaks, change filters, reduce pressure drop.

Fan Systems

- ◆ Review system design and compare to current need.
- ◆ Improve system by eliminating resistance, straightening ducts, and increasing duct size.
- ◆ Reduce fan oversizing.
- ◆ Replace inlet and outlet vanes and dampers with speed controls.
- ◆ Replace standard v-belt with cogged v-belt.
- ◆ Tighten belts, clean fans, change filters.



Additional Resources

- ◆ <http://cutler-hammer.eaton.com/>
 - Go to "Learning"
 - 101 basics series
 - Includes on-line course for motors, drives, etc.
- ◆ More motor formulas:
<http://www.elec-toolbox.com/Formulas/Motor/mtrform.htm>

Course Objectives –A Final Look

- ◆ Understand basic motor technology
- ◆ Examine typical motor applications
- ◆ Examine various strategies to reduce energy usage in motors
- ◆ Assess the importance of sizing motors appropriately
- ◆ Examine the technology and benefits of high efficiency motors
- ◆ Examine variable frequency drives and other motor control devices
- ◆ Calculate life-cycle cost of motor retrofit and new construction options
