

MOTORS IDENTIFYING

Before an analysis can be made, information about each system is needed to determine how the system operates. The accuracy of the analysis depends on the quality of the information used. At some facilities the level of documentation can be poor. The effort taken to compile this information can also be used to set maintenance programs, plan resource optimization, allocate costs, check the spare parts inventory, review equipment specification sheets and analyse productivity flows to remove bottlenecks.

Single line diagrams can be helpful in organizing data. Energy consumption and performance and process requirements need to be shown. These should be assessed over a one-year period because changes in temperature, humidity, seasonal production and product mix will occur. It is not critical to have all the information, however when estimates are used they should be noted as such, along with the assumptions made. The purpose of data gathering is to establish specific operating points that match the output capabilities of the system with the process requirements.

Information can be gathered from:

- nameplate data on each component in the system;
- manufacturer's specifications and performance charts;
- production records, utility bills, operations charts showing power consumption, flow rate and pressure for a one-year period;
- data on each process or piece of equipment using resources from the system;
- process and instrumentation diagrams including the control system strategy; and
- field measurements.

Some of the information may not be available and will require measurement. Using equipment often already installed, information can be obtained about the system. Drawings should be checked to ensure they have included the latest field changes. Data gathering in typical pump, compressor and fan systems should include:

- power supply – voltage, conductor size, breaker rating, transformer capacity and tap settings, switchgear rating, phase balance, power factor and peak current;
- motor controller – type, overload setting, starting characteristics and safety interlocks;
- motor – type, horsepower, efficiency, manufacturer, voltage, peak current, frame size, hours of operation, model number, rpms, multi-speed capability and NEMA design rating;
- power transmission – type, adjustable speed capability, speed ratio and torque rating;
- driven load – type, efficiency, power and speed rating, manufacturer and model;
- system effects – flow restrictions, valves, dampers and inlet and outlet conditions;
- process load requirements – flow, pressure, temperature, speed and hours operated; and
- control methods – automatic, manual, measuring devices and operating techniques.

OPPORTUNITIES FOR FAN, PUMP AND COMPRESSOR SYSTEMS

It is necessary to understand how fans, pumps and compressors are applied, if one is to design an efficient motor system. The following charts identify possible opportunities for motor system optimization. The term "fluid" is used to represent both gases and liquids.

| OPPORTUNITY | EXCESSIVE FLOW AND PRESSURE |
|------------------------|---|
| Excess Flow | <ul style="list-style-type: none"> • bigger is not always better; flow controlled by throttling valves and dampers may be controlled in a more efficient manner • it is important to understand the exact process demands and match the system output to these requirements |
| Flow Wastage | <ul style="list-style-type: none"> • some process cycles have periods where there is no need for the “fluid,” so it is recirculated in a bypass loop or returned to a sump • system running while the rest of the process is shut down • some systems with a multi-port distribution arrangement may have ports left open unnecessarily or that are no longer required • excessive leakage of fluid due to damage, poor fit or corrosion • mismatched impellers to casing |
| Pressure Losses | <ul style="list-style-type: none"> • pressure loss increases exponentially with flow velocity • smooth transitions, especially at the suction side, reduce pressure losses • some piping/ducting system constrictions result from construction methods used to avoid existing structures or plant equipment • valves and dampers should be checked to ensure they have not “frozen” in a partially closed position • clogged filters, corroded piping and infrequent equipment service |

| OPPORTUNITY | OVERSIZING AND INEFFICIENT CONTROL |
|------------------------------|--|
| Continually Throttled | <ul style="list-style-type: none"> • some machines operate continually with throttling dampers or valves partially closed, wasting energy • an analogy can be made to driving down the highway with the accelerator to the floor and controlling speed with the brake • reasons this condition occurs include: <ul style="list-style-type: none"> • original safety margins too great • the machine may be operating in a different application • a component may have been removed, reducing pressure drop |
| Unnecessary Operation | <ul style="list-style-type: none"> • the machine was sized to handle a worst-case upset condition since focus is so highly directed to production in industrial facilities; sometimes simple energy measures go unnoticed • sometimes the addition of simple control sequencers can simply turn the turbomachine off when it is not required • feedback controls set to the maximum setting or are disconnected |

| OPPORTUNITY | INEFFICIENT SYSTEMS |
|-----------------------------|--|
| Poor Selection Point | <ul style="list-style-type: none"> • due to process changes, systems operate at a different point on their performance curve, resulting in a drop in efficiency • systems operating with a large range of turndown ratios due to production changes and seasonal temperature swings • oversized machines that continually operate in a throttled mode |
| Age | <ul style="list-style-type: none"> • older equipment was generally designed with little thought for energy consumption or efficiency • machines that have been overhauled a number of times • modern machinery uses new materials and maintains closer tolerances |
| Alternative Methods | <ul style="list-style-type: none"> • some applications can be performed with other more efficient equipment, upgraded tools or other manufacturing techniques • adjust maintenance intervals to reflect new operating conditions for filter replacement and check that heat transfer surfaces are clean, that proper lubrication is maintained, and that linkages are adjusted and functioning correctly |

Reference:

http://oee.nrcan.gc.ca/infosource/pdfs/M92-165_1999E.pdf