# Fan System Optimization Checklist

**Instructions**: Use this checklist to qualitatively select the top optimization projects for analysis. Make a copy of this list for each of your major systems, then go through the list and add up the points for the conditions that apply. **Select any control, production & maintenance, or system effect indicators, then add points for size and run hours as follows:** If the system is over 100 hp add a point per 100 hp (200 hp = 2 points, 300 hp = 3 pts, etc.). If the system operates more than 4,000 hours add a point. Also add a point if production or maintenance problems are severe. Two (2) or more points can indicate a good optimization opportunity. Four (4) or more points probably indicate a very good opportunity. ***Note***: Fans with adjustable speed drives usually are not good candidates for optimization.

Fan System

Are there problems with the system?

Points for motor size\* Points for motor operating hours \*\*

1 \_\_\_\_ Motor \_\_\_\_\_\_ hp 1 \_\_\_\_ Operating hours Tally the points

\*If the system is over 100 hp add a point per 100 hp (200 hp = 2 points, 300 hp = 3 pts, etc.).

\*\*If the system operates more than 4,000 hours add a point.

|  |  |  |
| --- | --- | --- |
| Control | Production & Maintenance | System Effect |
| Points  2 \_\_\_ Motor overloads unless damper restricts flow  2 \_\_\_ Spill or bypass  2 \_\_\_ Discharge damper  1 \_\_\_ Inlet damper  1 \_\_\_ Variable inlet vane  1 \_\_\_ System damper  1 \_\_\_ Damper is mostly closed  1 \_\_\_ System runs longer hours than required | Points  2 \_\_\_ Too much flow or pressure for production  2 \_\_\_ Unstable or hard to control system  2 \_\_\_ Unreliable system breaks down regularly  1 \_\_\_ Not enough flow or pressure for production  1 \_\_\_ System is excessively noisy  1 \_\_\_ Buildup on fan blades  1 \_\_\_ Need to weld ductwork cracks regularly  1 \_\_\_ Radial fan handling clean air | Points  2 \_\_\_ 90o turn *right at* fan outlet or inlet  1 \_\_\_ 90o turn *near* fan outlet or inlet  2 \_\_\_ Dirt leg at bottom of inlet duct  1 \_\_\_ No outlet duct  1 \_\_\_ Restricted or sharp inlet |

Facility/Contact/ phone/fax: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NOTES**

# Volt-Ammeter Method Worksheet

Directions: Complete this worksheet for each fan or operating condition.

### Step 1: Calculate electrical power drawn by the motor

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *From the Fan System Data Sheet, enter average amps and volts in Boxes 1 and 2.* | **Average Current Iavg** |  | **amps** | **Box 1** |
|  | **Average Voltage Vavg** |  | **Volts** | **Box 2** |
| *Enter the power factor in Box 3 in decimal form.*  *Use 0.8 if unknown.* | **Power Factor PF** |  | **Decimal form** | **Box 3** |





|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Use equation above to calculate the power, He.Enter the result in Box 4. (Note: the square root of 3 is 1.732)* | **Power He** |  | **kW** | **Box 4** |

### Step 2: Calculate annual energy use

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Enter the operating hours of your fan system in Box 5.* | **Operating hours** |  | **hrs/year** | **Box 5** |





|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Use equation above to calculate Ea, the annual energy. Enter the result in Box 6.* | **Annual Energy used,**  **Ea** |  | **kWh/year** | **Box 6** |

### Step 3: Calculate annual energy cost:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *From the Fan System Data Sheet, enter the Electric Rate in Box 7.* | **Electric Rate, $ER** |  | **$/ kWh** | **Box 7** |





|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Use equation above to calculate Annual Energy Cost. Enter the result in Box 8.* | **Annual Energy Cost,**  **$EC** |  | **$ / Year** | **Box 8** |

# NOTESFan Power-Law Method Worksheet

Directions: Use the Fan Power- Law to estimate the energy use of an optimized system.

### Step 1a: Calculate brake horsepower (bhp)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *From the Fan System Data Sheet, enter the Flow and Pressure in Boxes 1 and 2.* | **Flow Required Q** |  | **cfm** | **Box 1** |
|  | **Pressure Required P** |  | **in. w.g.** | **Box 2** |
| *Enter the Compressibility Factor drawn from Table (3.1) below in Box 3.* | **Compressibility Factor Kp** |  |  | **Box 3** |
| *Enter the achievable efficiency in Box 4 in decimal form.* | **Fan Efficiency ** |  | **Decimal** | **Box 4** |





|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Use equation above to calculate the shaft power, H.Enter the result in Box 5.* | **Shaft Power H** |  | **bhp** | **Box 5** |

Table 3.1: Compressibility Factor (Estimated)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Pressure (in. W.G.)** | 0 - 12 | 13 - 19 | 20 - 29 | 30 - 39 | 40 –50 |
| **Kp** | 1.0 | .99 | .98 | .97 | .96 |

### Step 1b: Calculate motor input power (kW)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Enter the efficiency of the motor in Box 6 in decimal form.* | **Motor Efficiency m** |  |  | **Box 6** |
| *Enter the efficiency of the belt-drive in Box 7 in decimal form.* | **Drive Efficiency d** |  |  | **Box 7** |





|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Calculate the electrical power He using equation above and enter it into Box 8.* | **He** |  | **kW** | **Box 8** |

**NOTESFan Power-Law Method Worksheet** continued

**Step 2: Calculate annual energy use**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Carry result forward from Step 1b.* | **He** |  | **kW** | **Box 8** |
| *Next, enter the operating hours of your fan system in Box 9.* | **Operating  Hours** |  | **hrs/year** | **Box 9** |





|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Use equation above to calculate Ea, the annual energy used. Enter the result in Box 10.* | **Annual Energy used,  Ea** |  | **kWh/year** | **Box 10** |

### Step 3: Calculate annual energy cost

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *From the Fan System Data Sheet, enter the Electric Rate in Box 11.* | **Electric Rate** |  | **$/ kWh** | **Box 11** |





|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Use equation above to calculate the Annual Energy Cost. Enter the result in Box 12.* | **Annual Energy Cost** |  | **$ / Year** | **Box 12** |

# NOTES