Industrial Ventilation – Fans – Fact Sheets

HOW MANY TYPES OF FANS ARE AVAILABLE?

There are two main types of exhaust fans:

1. Axial Fans: These fans look like propellers and draw air straight through the fan.
2. Centrifugal fans: These fans look like “squirrel cages” that draw air into the centre of the fan and exhaust it at a 90-degree angle.

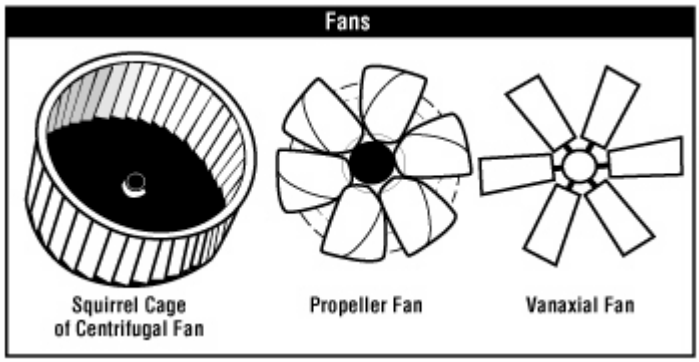

Figure 1

Types of fans

Axial or propeller fans

There are three basic types of axial fans: propeller, tubeaxial, and vaneaxial. Propeller fans are most commonly used for dilution ventilation or cooling. These fans are often mounted in a wall or ceiling. Common examples are your automobile radiator fan or a free standing room fan. The basic characteristics of these fans include that they:

- can move large amounts of air if there is little resistance, and
- are not suited for local exhaust ventilation because they do not provide enough suction to draw air through the system.

Tubeaxial and vaneaxial fans are essentially propeller fans made to fit in a

duct. They are usually limited to “clean air” applications such as exhaust ducts going through the roof.

Centrifugal fans

There are three types of centrifugal fans determined by the type of fan blades:

- forward inclined blades,
- backward inclined blades, and
- straight radial blades.

The fans in your home furnace, vacuum cleaner and hair dryer are examples of centrifugal fans. They can operate against a high resistance and are typically used in local exhaust ventilation systems. The rugged radial blade centrifugal fans are the best type for exhausting heavy amounts of dust because they are less likely to become clogged or abraded by the dust.

How do you know if the correct type of fan has been selected?

Selection of the proper fan can be complicated and should be done by a ventilation or fan expert. However, you can make the following observations to determine if the fan selected is appropriate:

Material handled through the fan

- If the exhaust air contains a small amount of smoke or dust, a backward inclined centrifugal or axial fan should be selected.
- If the exhaust air contains light dust, fume or moisture, a backward inclined or radial centrifugal fan would be preferred.
- If the particulate load in the exhaust air is high or when material is handled, the normal selection would be a radial centrifugal fan.
- If the exhaust air contains explosive or flammable material, spark resistant construction (explosion proof motor if the motor is in the air stream) should be selected to conform to the standards of the National Fire Protection Association and provincial governmental regulations.

If the exhaust air contains corrosive contaminants, a fan with a protective coating or made of special materials (stainless, fibreglass, etc.) may have to be used.

Airstream temperature

Fans that handle high temperature exhaust air must be made from materials and parts resistant to high temperatures.

Capacity and physical limitations

You may or may not know how much air has to be moved by the fan. You may also not know the amount of resistance in the exhaust system that the fan has to overcome and what is the fan efficiency. However, the following general information may be helpful:

- Fan size should be determined by performance requirements. Inlet size and location, fan weight and ease of maintenance also must be considered. The most efficient fan size may not fit the physical space available.
- On packaged fans, the motor is furnished and mounted by the manufacturer

(direct-drive). On larger units, the motor is mounted separately and coupled directly to the fan or indirectly by a belt drive.

- Direct Drive fans offer a more compact assembly and assure constant fan speed. Fan speeds are limited to available motor speeds. Capacity is set during construction.
- Belt Drive fans offers flexibility in the adjustment of the fan speed. The speed can be changed by altering the drive ratio. This flexibility may be important in some applications where there is the need to provide for changes in system capacity or pressure requirements determined by modifications of the process, hood design, equipment location or air cleaning equipment.
- It is normally a custom to select a fan that can supply the required airflow (volume and pressure) at no more than 80% of its full rated speed. However, the motor selected should be able to handle the horsepower required to achieve that rated speed (i.e. a speed increase of 20%).

Safety

Safety guards are required for all danger points such as inlet, outlet, shaft, drive and cleanout doors. Construction should comply with applicable provincial governmental safety requirements.

Are there any noise requirements for fan installation?

Except for low speed fan units, fans usually are noisy. Noise can be distracting, irritating, and/or damaging to the ear. Fan noise can be a problem both in the plant and to neighbours outside. Most fan manufacturers publish sound ratings for their products and these levels should be considered when selecting a fan.

What affects fan performance?

Common components of most fans that affect performance are listed below:

Bearings: Fan shaft bearings are often the single greatest source of trouble. Bearing life is reduced by overly tightened or excessively loose fan belts, fan vibration, uneven loading on the fan blades, high ambient operating temperatures, and improper (over or under) lubrication.

Belts (V belts): Improper belt tension can affect the fan performance. Audible belt squealing during start up is a sign of insufficient belt tension. As a rule of thumb, belt tension should be tight enough so that the centre of the span will move one inch (1″ or 2.5 cm) when moderate finger pressure is applied.

Blades & Housing: A buildup of solid material (dusts, fumes, particulate matter) on the fan blades or the housing causes imbalance, vibration, and loss of capacity (reduced airflow).

Connectors and isolation foundations: Flexible connectors and isolation foundations are used to isolate fan vibrations from the building and the rest of the ventilation system. Flexible connectors attach the ventilation system duct to the fan while eliminating fan vibration that may travel through the ventilation system duct. If they are torn or corroded, the fan performance will be affected.

Louvers and dampers: Some fans have inlet or outlet louvers or dampers to adjust airflow. They may be manually, pneumatically or electronically controlled. If the louver linkage connections are not tight and secure, they may affect the fan performance.

Motors: Motor operating voltage must be maintained within 10% of the recommended voltage to ensure proper fan performance. Most motors are permanently lubricated for life and require no further maintenance.

What should I know about inspection and maintenance of fans?

Fans can go “out of balance” because material builds up on the fan blades, or because of wear. Imbalanced fans will vibrate and may cause damage to various parts of the fan (blades, housing, motor, etc.). It is important to keep fans clean and properly balanced, particularly if the air being removed contains abrasive, sticky or wet materials. Scheduled maintenance should check items including:

- bearings (lubrication, vibration),
- belt drives,
- coupling or belt alignment,
- fan blades (impellers) for proper alignment and rotation,
- bolts and screws for tightness,
- condition of impeller (wear or accumulation), and
- safety guards.

What should I know about fan discharge?

Air discharged from a fan should be kept away from inlets (intake) of the make-up air system. In this way the make-up air system will draw only clean, outdoor air into the workplace.

The discharge exhaust stacks should be high enough from the roof so that contaminants do not re-enter the workplace. Generally they should be located no closer than 50 feet from the inlet to prevent recalculation of contaminants. Stacks work best when they are tall, usually at least 10 feet above the roofline.