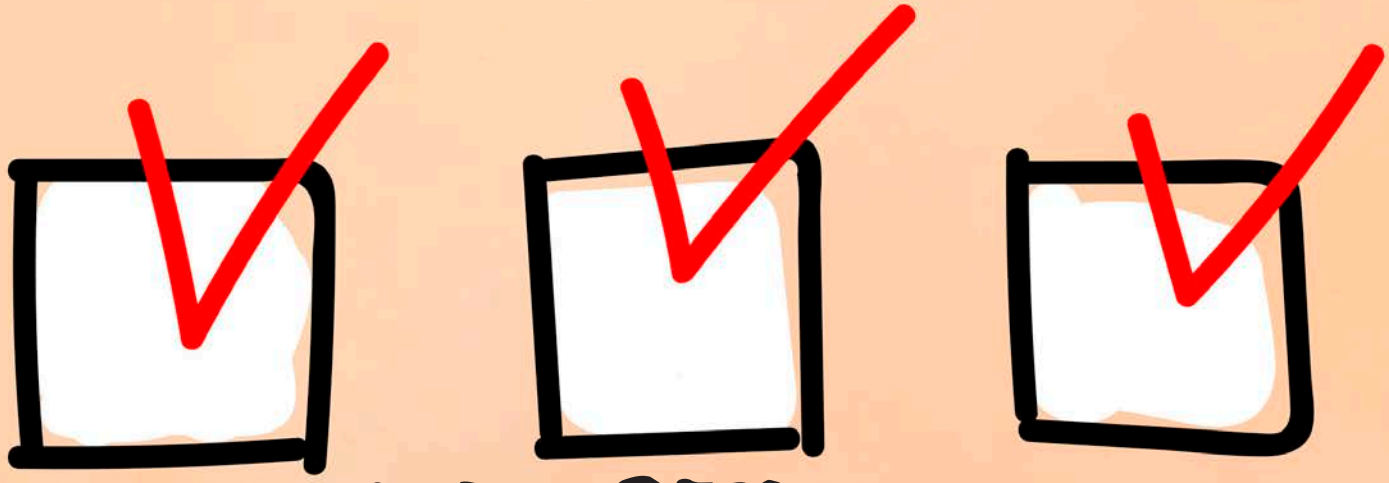


INDUSTRIAL FAN SELECTION REQUIREMENTS

Steve Back, The New York Blower Co., discusses the key considerations that companies need to bear in mind when working with a manufacturer to produce engineered-to-order fans.

Cement is the foundation of the building industry, and with good reason. It offers builders numerous benefits – strength, durability, versatility, affordability, and fire-resistance, among other things. These benefits are why construction companies use cement in projects such as tunnels, bridges, buildings, and dams. Cement production plants produced an estimated 4100 million metric t of cement worldwide in 2018.

But cement production is a challenge. Producing high quality cement requires the help of a wide variety of heavy-duty equipment, including industrial fans. Many of these fans are designed specifically for cement applications and customised to plant environments. These units are typically centrifugal process fans, but it is possible to find a variety of non-process fans in cement production plants as well.

Cement production applications place heavy demands on industrial fans. So, system engineers need to work closely with knowledgeable manufacturers to produce fans designed to meet their specific requirements. Producing engineered-to-order (ETO) fans, however, is hard, even for experienced, knowledgeable manufacturers, without help from plant managers and system engineers.

This article discusses key considerations that need to be taken into account when working with a manufacturer to produce an ETO industrial fan for cement applications. The article covers the following topics:

- User/manufacturer communication.
- Basic application information.
- General specifications.
- Location and environment.
- Installation requirements.

But first, it is worth discussing the typical cement production applications requiring industrial fans and the types of fans used in these situations.

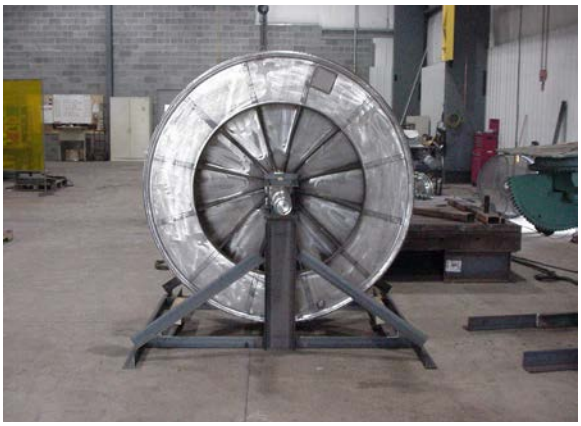
Cement production applications and typical fan types

Producing cement in a plant is not as easy as it sounds – even for the most experienced companies. The process, in fact, has many complexities, like stringent space requirements, high temperatures, dust accumulation, fluid abrasiveness, and high output demand. These complexities

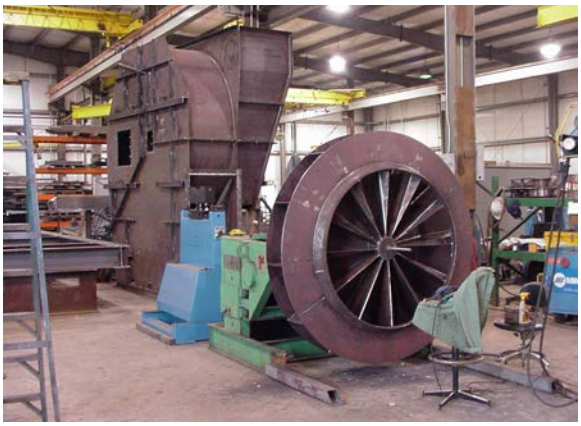
place significant demands on fans. Many units, for example, like clinker cooler and pneumatic conveying fans, are heavy duty, abrasion resistant fans.

Typical cement production applications include fuel supply for burners and boilers, furnace aspiration, treatment of exhaust fumes and emissions processing, application and system de-dusting, grid cooling for mixing operations, pneumatic transport, airslide conveyor systems, and packaging systems. These applications demand a great deal from industrial fans.

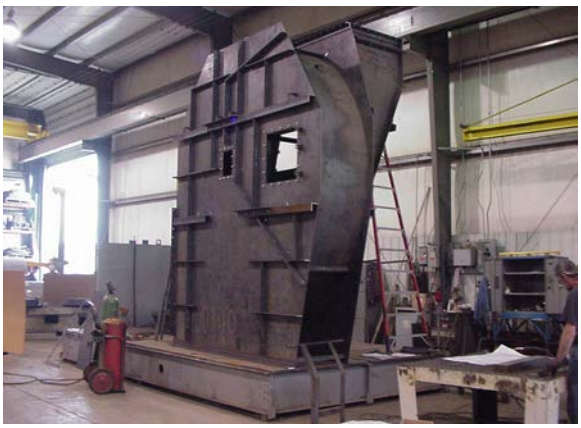
Types of fans used in cement production include the following:



Stainless steel wheel used for abrasive conditions.



Fan housing and balanced wheel for cement application.



Rugged centrifugal fan housing being constructed.

- Raw mill fans – These units carry gas and raw material. If a plant uses a vertical roller mill for grinding, it will usually need to install a larger version of this fan type. These units are typically centrifugal fans.
- Induced-draft fans – Used in the clinker burning system, these fans provide air for combusting fuel in the kiln. They also help with gas flow and fuel combustion, during calcination and during the heat exchange between cold raw material and hot gas. These units are often radial and forward-curved or backward-inclined centrifugal fans.
- Clinker cooler fans – Cooler fans are often used to cool the clinker line, protecting equipment and speeding up quenching. A well-designed industrial fan in these applications boosts clinker quality, cuts power consumption resulting in energy savings, and prevents damage to conveyor systems.
- Raw mill exhaust fans – Also known as de-dusting fans, these fans operate in highly adverse conditions. They are often used to process gases like CO_2, N_2, and NO_x along with dust particles. These fans can sometimes be called upon to handle as much as 2.2 t of exhausted gas to produce 1 t of clinker.
- Coal mill fans – These fans supply air for burning coal and for displacing the exhausted gases generated after burning. They help plants effectively burn coal inside a mill. Plants often use two to three cement mills for a large clinker.
- ID fans – These fans are used to produce a vacuum (or negative air pressure) in a cement production system or stack. These centrifugal fans help maintain high ventilation, which helps boost system efficiency.
- Kiln exhaust fans – Plants usually use two or more of these fans in high volume applications. Often, they have special features, such as a unique blade shape to extend the operation time between maintenance. These fans are used in an air blower unit to prevent caking.

It is important to work closely with fan manufacturers to engineer an individual, flexible, customised fan solution that meets the specific needs for an application. The following are some critical considerations when doing this.

Key considerations when specifying fans

So, what do industrial fans do in a cement production plant? Sometimes, they are called upon to move raw material. But more often than not they provide a large flow of air or gas to various parts of buildings or production systems. Induced-draft fans, for example, support dust abatement systems for treating exhaust fumes and processing emissions.

Other cement applications include air slides, combustion air, dust and oven exhaust, oven recirculation, process heating, and forced draft. Providing the right information to an industrial manufacturer produces fans that not only meet project needs but also boosts efficiency, speeds production, and cuts production costs.

Key fan considerations include the following:

Example of buildup around fan unit in production facility.

Completed heavy industrial fan for cement production.

Communication between companies

Communication with fan manufacturers is paramount. Supplying minimal information about a fan helps manufacturers provide a fan type, basic configuration, and price quote. However, more detailed application information will need to be provided in order to produce a fan tailored to a particular situation. This information includes the following:

- Identifying the engineering units used. When gas streams are involved, standard and normal conditions have different reference temperatures and densities globally.
- Specifying mass flow, actual flow, standard flow, or normal flow. This information eliminates confusion over the use of standard and normal conditions.
- Deciding on pressure rise needs. This information tells the manufacturer whether total pressure rise or static pressure rise is required, and between which physical locations in the ductwork the pressure rise is wanted.

Additional information the manufacturer needs includes things like the challenges experienced with past installations and any concerns about the current fan selection. The person most familiar with the fan's requirements should spearhead communications with the manufacturer.

Type of fan and key features

A second consideration involves selecting the type of fan needed – axial, centrifugal, mixed flow, turbo, and so on – and the application's critical features. For that, some general information about the application itself as well as some in-depth requirements will need to be provided.

Key topics to cover with this consideration include the following:

- Type of gas being moved.
- Number of systems.
- Fans per system.
- Expectations regarding equipment life.
- Application.
- Fan arrangement and control.
- Ancillary items to be supplied by the fan manufacturer.

Nailing down these requirements before speaking with the manufacturer is imperative. Other information that helps when specifying industrial fans include:

- Noise levels to be maintained, as noise emissions affect fan design.
- Driving options such as an electric motor, engine, steam turbine, etc., as well as fan driver connection.
- Fan speed needs, like direct drive, variable speed, constant speed, or belt-driven fans.
- Detailed specifications, if necessary, and whether or not the customer wants to use the manufacturer's specifications.
- Thorough corrosiveness information about the gas stream.
- Dimensions of the ducts, duct bends, splits, headers, and other components, both before and after the fan. This information will help the manufacturer understand the flow pattern and highlights potential stability issues.

Additional information that will need to be provided includes: end-use process, installation details, work schedule, and future operations.

Specific performance requirements

Providing general information on the type of fan needed helps the manufacturer get started. But to tailor the equipment to an application's needs, specific performance requirements will need to be nailed down, including things like:

- Partial load and operating points.
- Mass flow.
- Air density and air analysis at all operating points.
- Barometric pressure at the job site.
- Specific heat ratio.
- Inlet volume per fan.
- Total pressure of inlet and outlet ducts.
- Dimensions and area of inlet and outlet ducts.
- Estimated length of inlet and discharge transitions.
- Inlet temperature.
- Preferred fan speed.
- Future demand/load conditions.

Any special performance requirements involving fan rotating assembly, bearings, couplings, drivers, sound, test, paint requirements, spare parts, and storage will also need to be provided.

Physical location and environment details

A third critical consideration when specifying an industrial fan is geographic location and environmental conditions. This information impacts fan selection and installation activities, among other things. Not all fans, for example, are ideal for corrosive applications. Installing the incorrect fan in a corrosive environment can cause catastrophic failure.

Important location and environmental conditions to consider when specifying a fan include things such as:

- Site elevation above sea level.
- Density.
- Humidity.
- Inlet temperature to the fan.
- Conditions at fan location.
- Concrete on the ground.
- Building beams.
- Building floor.

Finally, there is the site's foundation to consider. This influences critical design features like the shaft, bearings, and couplings.

The fan's geographic location helps identify the options available to the manufacturer to ship fan components. Manufacturers often ship large fans in pieces and then assemble them at the site.

Drawings, photos, digital files

These items are critical considerations to getting the right fan. Providing drawings, photos, or digital files showing the fan's location as well as the ductwork, motor location, and accessories connected to the fan, including dampers, silencers, diffusers, and lubrication units, helps manufacturers greatly.

Use any drawings to mark where the pressure generated from the fan is needed. Write on the drawing Plane 1 (upstream of the fan) and Plane 2 (downstream of the fan). Then, identify the total pressure needed at both locations. This information pinpoints the fan performance required.

Installation guidelines

Installing the fan properly is a must in every application. Basic guidelines for installing fans exist, but each engineered-to-order fan comes with its own set of installation details. Be sure the manufacturer's instructions are understood before installing the fan. Resolve any issues with the manufacturer before starting. For best results, use qualified, experienced technicians to install the fan.

Some fan types come with protective features as standard. With other fans, protective features are options based on the kind of system, fan location, and plant operating procedures. Determine the proper safety devices needed to meet company and government guidelines, and then ensure that workers use them when operating the fan.

For example, make sure that workers do not exceed:

- Maximum design gas stream temperature and speed of fan equipment.
- Maximum allowed bearing temperature. Excessive bearing temperatures will break down lubrication, shorten bearing life, and void bearing warranty.
- Maximum allowed bearing vibration. Excessive bearing vibration, even for short periods, diminishes bearing life and voids the bearing warranty.
- Maximum misalignment allowed with the driver, coupling, belts, etc.

Once the fan is installed, check the bolts for tightness and its drives after the first eight hours of operation. Recheck them in two weeks. Doing due diligence here prevents damage to the fans and worker injuries. The average medical cost for a reported work injury in 2017 was US$39 000, while the average cost per death was US$1 150 000.

These considerations can help to specify the exact engineered-to-order industrial fan needed for a cement production application. Provide the right information and the fan will be reliable, efficient, durable, and cost effective.

Conclusion

Producing cement in a production plant is a challenge. To do the job right, well engineered, heavy-duty industrial equipment is needed – equipment that can take a beating and still perform well. That equipment often includes engineered-to-order industrial fans that can hold their own and provide a solid return on investment.

Providing the fan manufacturer with the right information can help produce a fan that delivers on all expectations. Use the five considerations discussed above as a guide to help produce the right fan for any application. Installing the right industrial fan helps with the production of high-quality cement that can increase profitability, and take a company to the next level. ■

About the author

Steve Back has more than 34 years of experience helping industrial customers tailor heavy industrial fans to their unique applications. Previously, he worked for Babcock and Wilcox, Howden North America, and TLT-Turbo GmbH. Steve has held a wide variety of positions in the industry in technical service, engineering, product management, sales, marketing, and business development. He has also held positions with companies in North and South America, Germany, India, and China.