

# CLARAGE

INDUSTRIAL FANS & SERVICES

CUSTOM IS OUR STANDARD



## PRODUCTS & SERVICES





# CLARAGE

INDUSTRIAL FANS & SERVICES



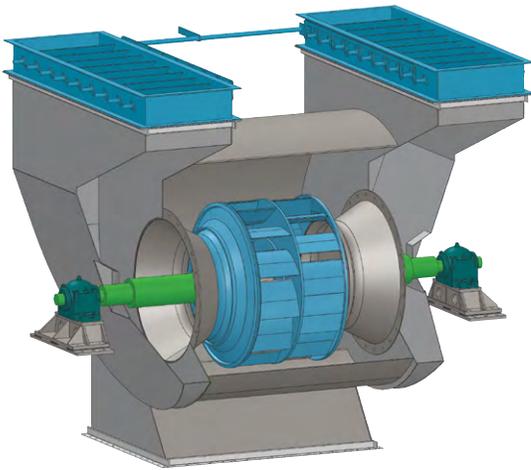
## CUSTOM IS OUR STANDARD



### WHO WE ARE

Clarage is the heavy-duty division of Twin City Fan Companies Ltd. that specializes in designing and manufacturing custom heavy duty fans, axial fans and dust collectors. And with over 140 years of experience, Clarage's long-standing reputation and market expertise has made us the industry-leading manufacturer for countless industries and thousands of process applications. That is why our customers continually turn to us for project-specific solutions regardless of the size, scope or complexity.





**WHY WE DO IT BETTER**

We set ourselves apart from the competition because of several key items that provide unmatched value to our customers including: the fastest turnaround times in the industry, the most experienced project management teams, on-time and high quality documentation submittal and management from start to finish, proprietary in-house configuration and engineering software and industry-leading testing services.



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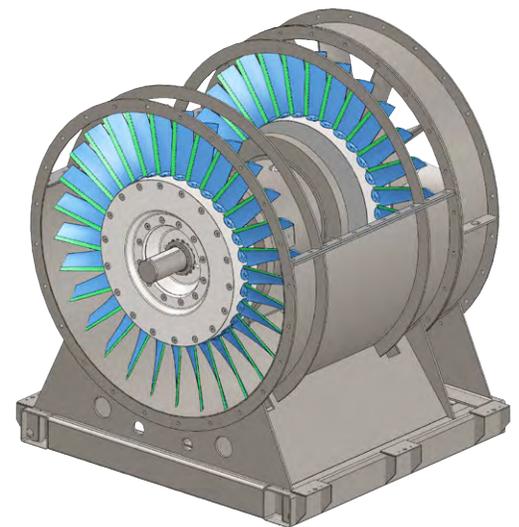
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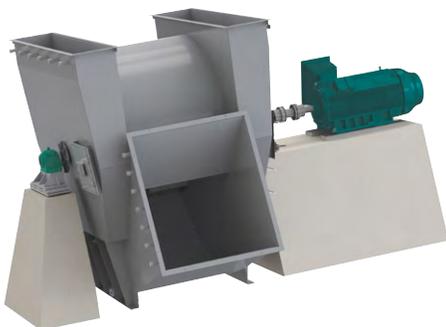


### PRODUCTS FOR EVERY MARKET

We pride ourselves on the fact that we support an extremely diverse range of industrial markets by delivering products that can meet the most stringent specifications. With thousands of successful installations worldwide, Clarage continues to support emerging technologies in the global market by pushing the boundaries of fan design. While other manufacturers can build a fan, Clarage has the collective technical engineering, manufacturing and testing capabilities needed to serve our customers at the highest level.



- > Automotive
- > Biomass
- > Cement/Lime
- > Chemical
- > Coal/Coke
- > Emission Control
- > Ethanol
- > Foundry
- > Fertilizer
- > General Manufacturing
- > Glass
- > Heavy Industrial
- > Industrial Processes
- > Iron & Steel
- > Metals & Minerals
- > Mining
- > Petrochemical
- > Pollution Control
- > Power Generation
- > Pulp & Paper
- > Tunnel Ventilation
- > Wind Tunnels
- > Water Treatment

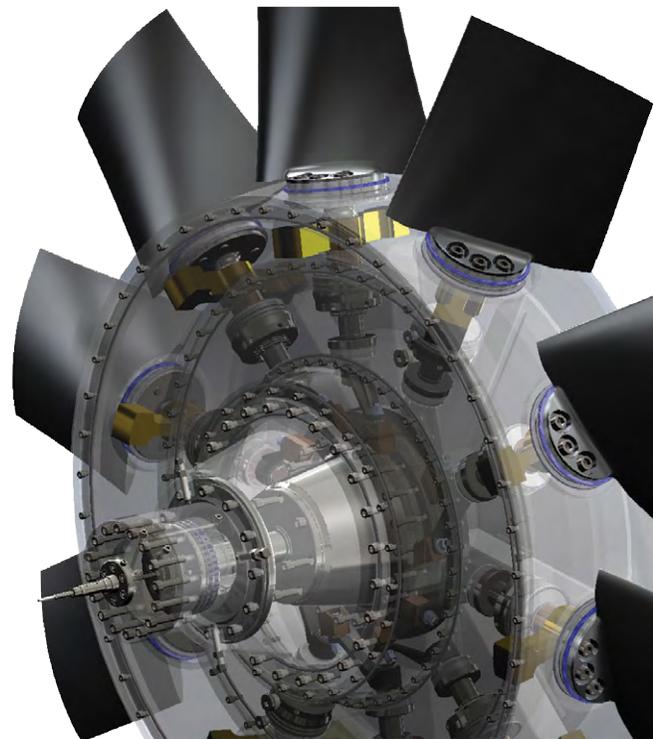


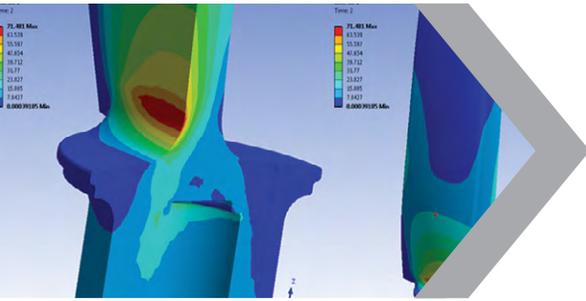


**BROAD RANGE OF APPLICATIONS**

Clarage has the engineering and manufacturing capabilities to accommodate virtually every conceivable application. Our customers frequently leverage our broad application expertise because we can custom design our products for their exact process. By offering a partnership that extends from design to installation, Clarage can provide the project-specific support needed to thrive in today's competitive market.

- > Boilers
- > Coal Drying
- > Desulfurization & Pelletizing
- > Fired Heaters - FD & ID
- > High Temperature
- > Kiln Dryers
- > Mining Ventilation
- > Paper Machine Exhaust
- > Process Ventilation
- > Rotary Dryers & Exhaust
- > Steam Exhaust
- > Underground Railways & Stations
- > Biomass
- > Coal Mill Ventilation
- > Dry Scrubbers
- > Flue Gas Recirculation
- > Incineration
- > Material Handling
- > Oil & API 560 & 673
- > Potash
- > Pulverizers
- > SCR Processes
- > Thermal Oxidation
- > Clean Coal Gasification
- > Combustion Air
- > Dust Collection
- > Flare Stacks
- > Jet Fans
- > Mechanical Draft Fans
- > Oil Sands
- > Power & Utilities
- > Road Tunnels
- > Sintering & Pelletizing





**FINITE ELEMENT ANALYSIS**

Clarage has been engineering special fan applications for more than 125 years and has maintained our engineering standards current for the day. The dynamic nature of custom fans, the greater acceptability of variable frequency drives, and the variety of industrial applications into which the fans are placed gives engineering a significant role in determining the final quality and operational life of the product.

Clarage sizes our fans exactly for the duty point that is required. Where other manufacturers pick a fan close in size, we custom design and engineer a fan down to an eighth of an inch to match the exact wheel diameter that meets the performance you require.



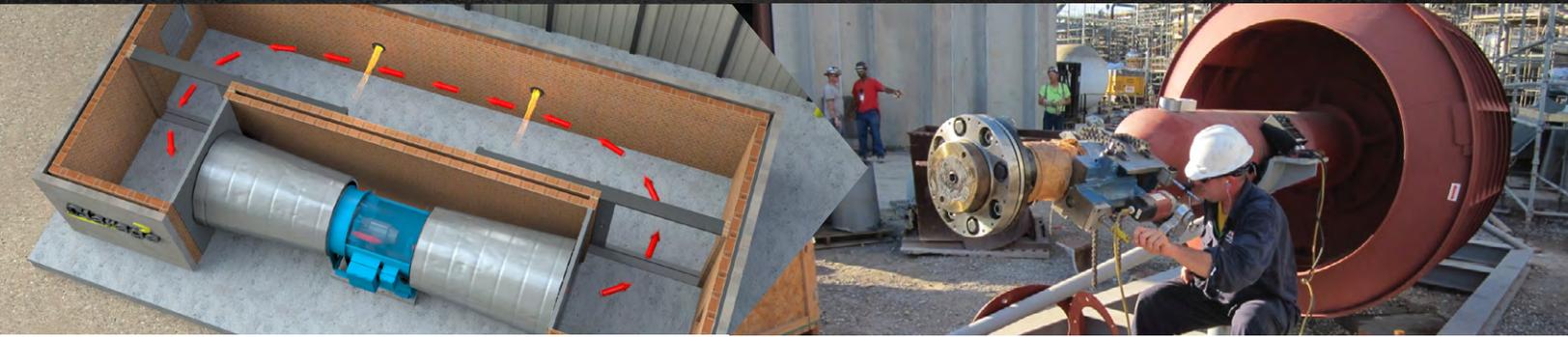
**PRODUCT REDESIGN**

**ENGINEERING SERVICES INCLUDE:**

- > Finite Element Analysis
- > Non-Destructive Testing (NDT)
  - Magnetic Particle Testing
  - Dye Penetration Testing
  - Radiographic Testing
  - Ultrasonic Testing
- > Torsional Analysis
- > Transient Torsional Analysis
- > Bearing Analysis
- > Computational Fluid Dynamics (CFD)
- > System Model Evaluation



**SYSTEM EVALUATION**



## IN-HOUSE TESTING SERVICES

The scope of Clarage's testing capabilities are very broad and cover a wide spectrum of testing services. With this level of technology, we can continue to provide our customers with proven solutions to their particular air movement needs while ensuring that they receive the highest quality product for their exact requirements and structural needs. This includes the evaluation of existing systems to optimize performance and reduce power consumption. With the most sophisticated research and development testing laboratories in the industry, only Clarage has the collective experience and knowledge needed for tackling the most technically complex testing requirements for the most demanding environments.

### IN-HOUSE

- > AMCA 204 Balance & Vibration Testing
- > AMCA 210 Performance Testing
- > AMCA 250 Jet Fan Thrust Testing
- > AMCA 300 Sound Testing (Modified)
- > Impact (Bump) & Overspeed Testing
- > Seismic Testing
- > High Temperature/Survivability Testing
- > Mechanical Run Testing
- > Narrow Band Sound & Vibration Testing
- > Strain Gage Testing & Analysis
- > Modal Analysis Testing
- > Vibration Analysis & FFT Spectrum Analysis

## FIELD SERVICES

Having the peace of mind that your fan is installed and operating properly prior to start-up is crucial. That is why Clarage offers a wide range of field services, including inlet and wheel operational clearances, torque verification, shaft alignment, balance and vibration testing. As part of our standard start-up services, Clarage field personnel will conduct a variety of inspection checks to ensure that the fan is ready for start-up — all the way from the foundation bolts to the lubrication of the fan.

### ON-SITE

- > Installation & Commissioning
- > AMCA 203 & 803 Performance Testing
- > Sound Testing
- > Vibration Analysis & FFT Spectrum Analysis
- > Balance & Alignment Testing
- > Modal Analysis Testing & Operation Deflection
- > Shape (ODS) Analysis
- > Technical Services
- > Inspection
- > Operational Training
- > Performance Testing
- > Vibration Analysis
- > Troubleshooting
- > Balance & Laser Alignment
- > Motor/Turbine Alignment
- > Preventive Maintenance
- > Inlet Cones
- > Coupling Alignment





## CLARAGE AFTERMARKET SOLUTIONS

Clarage's Aftermarket Solutions team specializes in evaluating existing equipment and providing long-term solutions to yesterday's problems. We approach the aftermarket from the perspective of building partnerships with our customers and taking extra steps to ensure that we understand what happened to the previous fan in the system prior to making new recommendations. Simply put, we do not operate just to sell our customers equipment once their originals break down or wear out.

By offering a unique combination of system expertise, engineering services and the latest in 3D scanning technology, we can provide a proven solution to help reduce costs and improve performance. From troubleshooting and diagnostics to energy audits and efficiency upgrades, Clarage Aftermarket Solutions is a true one-stop-shop for all fan applications, including the extremely complex projects that other fan manufacturers can't touch.



## 3D SCANNING

Clarage Aftermarket Solutions uses a combination of 3D technology and fan design know-how to bring you creative solutions to existing equipment needs. We are backed by design standards that have been perfected since Clarage started building fans in 1874. Point clouds created by 3D field scanning are converted to models that help us to accurately determine crucial interface dimensions as well as access for installation. This allows us to bring a 21st Century approach to 20th Century equipment! Give us 15 minutes with your existing fan and we will provide you with a lifetime of competitive replacements!



## EFFICIENCY & PERFORMANCE UPGRADES

Words like “green” and “energy efficient” have taken on lives of their own in today’s vernacular. At Clarage Aftermarket Solutions, we try to morph these buzz words into something that adds value to our customers - cost savings. As a manufacturer, we understand that sometimes when fan equipment is originally specified as part of a larger package, there may have been liberties taken with the required sizing to ensure no shortage in performance. This method of specifying fans can be referred to as “better to have and not need.” Today, these over-sized fans present a conundrum – low efficiencies leading to higher operating costs.

Clarage can analyze your equipment performance to determine what your true needs are. By “right-sizing” these fans and returning them to peak efficiency, our customers have seen tremendous savings in operating costs. Our first path is always to look for a retrofit option that involves minimal to no changes to fan casings and surrounding foundations or auxiliary equipment. Contact us today to see how we can help you lower your plant operating costs. Remember, 1 HP saved is worth \$450/year!



## TURNKEY FAN INSTALLATION

We understand the pressures that equipment downtime brings. Whether it’s a planned outage or an unexpected shutdown, the demands of modern plant maintenance can be overwhelming. Adding to that pressure is the minefield that comes with dealing with separate equipment vendors and installation contractors. Let Clarage Aftermarket Solutions alleviate some of that burden by providing you with a turnkey solution. We will design, build and install the equipment for you so that you will only need one point of contact. Our installation teams have decades of fan-specific experience, exemplary safety records and on-site quality control. You no longer have to worry about being a conduit for information between your equipment vendor and your on-site contractor.





## CENTRIFUGAL FANS

Clarage offers a variety of centrifugal fans designed to tackle a wide range of applications. Whether you have a dirty, abrasive application or are looking for an ultra-efficient fan design, Clarage can provide a fan solution tailored to your exact needs. Centrifugal fans are commonly used in power generation, manufacturing and petrochemical industries just to name a few. Boiler units often require high temperature fans, where special materials are used to operate in excess of 1200°F. Some manufacturing processes require extremely high pressure and Clarage has fan designs that can achieve 200 inches of water gauge. Furthermore, the ability to design fans with inlet volume control and a variable frequency drive allow users to achieve a wide range of performance points necessary for their applications.

### WHEEL SIZES

Up to 160 inches (4,065 mm)

### AIRFLOW

SWSI Fans: Up to 900,000 CFM (1,529,100 m<sup>3</sup>/hour)

DWDI Fans: Up to 1,500,000 CFM (2,548,500 m<sup>3</sup>/hour)

### STATIC PRESSURE

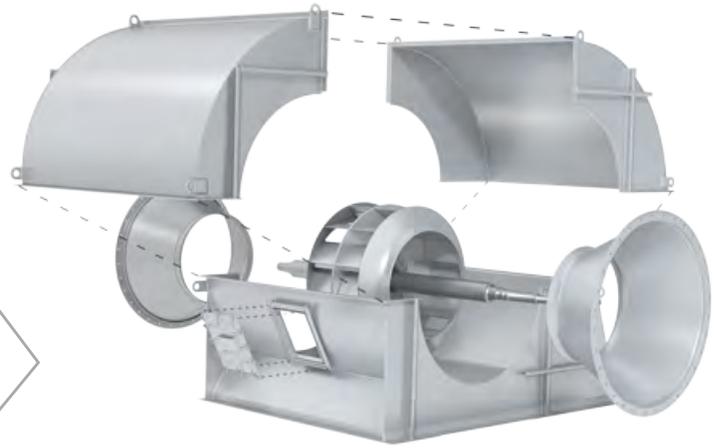
Single-Stage Fans: Up to 120 inches w.g. (29,850 Pa)

Two-Stage Fans: Up to 240 inches w.g. (59,650 Pa)

**TEMPERATURE RANGE:** Up to 1,500°F (815°C)

**MOTOR SIZES:** Up to 15,000 HP (11,185 kW)

**ARRANGEMENTS:** 1, 3, 7, 8





## AIRFOIL

The airfoil blade design delivers the highest static efficiencies of all centrifugal fans. The Clarage AF, AFM and RHM fan models are the perfect choice in applications requiring heavy-duty fans operating at low energy cost.

Since the Clarage airfoil fan can be used in applications where particulate is present, our design is used extensively in many different industries. A solid nose bar and blade liners can be built into each blade and provide maximum abrasion resistance along the leading edge and on high wear areas of the blade. Blades are also reinforced to meet the exact duty requirement.

- > Best airfoil fans in the industry
- > Highest static efficiencies of all centrifugal fans
- > Reinforced blades
- > Solid nose bar and blade liners are available to provide maximum abrasion resistance



AF WHEEL



RHM WHEEL

## BACKWARD CURVED SINGLE SURFACE AIRFOIL

The backward curved single surface airfoil achieves static efficiencies slightly less than an airfoil. Clarage engineers can assist you in selecting between the RHS, BCS and CHS styles to find the perfect fit to achieve your performance criteria.

Applications requiring higher static pressure impose extreme stress on the wheel components due to high tip speeds. The Clarage backward curved wheel is designed specifically to meet this challenge. When required, these fans can also be equipped with full or partial blade liners for severe duty applications.

Clarage's unique "S" shaped blade profile delivers higher efficiencies with the ruggedness of the radial tip fan. Typical applications include coal-fired boilers, electric arc furnaces and cement kilns.

- > Designed specifically for applications requiring high static pressure
- > Full blade and housing liners available for severe duty applications
- > Hard surface weld beads are added to break up abrasive dust patterns



CHS WHEEL



BCS WHEEL





## BACKWARD INCLINED

The backward inclined BIM fan is a straight bladed design that is ideally suited for clean and abrasive airstreams. The high wear and abrasive nature of induced draft and kiln dryer fans can wear the blades of a fan very quickly. The backward inclined design sheds particulate and can be designed with high brinell wear liners to prevent erosion of the wheel.

Clarage's custom engineered backward inclined fan model BIM can achieve the highest levels of efficiency, and are perfect for high static pressure applications. Whether you are exhausting high temperature, dirty or corrosive gases, we can design the fan at the peak of efficiency to meet your needs.

- > Designed to shed particulates, such as dust in the airstream
- > Suited for both clean and dirty airstreams
- > Great for all temperatures

## MODIFIED RADIAL

The Clarage HMF modified radial wheel design is a slightly backward inclined shrouded radial. It combines the best of the radial design with the efficiency of the BI design. A slight backward incline to the blades combined with the radial blade design makes it the best solution for dirty or particulate-laden airstreams.

Designed for coal conveying, the HMF is available with blade liners for wear protection and a variety of specific speeds to meet all design requirements. Whether you are conveying pulverized coal, sand or steel sinter, the HMF can stand up to the toughest environments.

- > High efficiency design ideally suited for material handling
- > Designed to withstand the most demanding environments



BIM WHEEL



HMF WHEEL



HMF WHEEL



## RADIAL BLADE

The Clarage radial blade XLR fan is the first choice for severe duty applications, especially those involving hot, abrasive or sticky particulate. The flat radial blade design is self-cleaning, which makes it very cost effective by reducing downtime in critical and continuous service applications. Clarage's radial blade fan is designed to sustain very high tip speeds to meet your high static pressure needs.

- > First choice for severe duty applications
- > Self-cleaning flat radial blade design
- > Sustains very high tip speeds to meet high static pressure needs



XLR WHEEL



## RADIAL TIP

Clarage radial tip fans are used extensively in many industries. The ruggedness of our RT and RTC radial tip wheel makes it especially suitable in severe duty service areas, such as cement plants, flue gas recirculation and boiler induced draft fans. It can be armored with full blade and housing liners for the most abrasive applications.

- > Rugged design makes it suitable for severe duty service areas
- > Full blade and housing liners are available for the most abrasive applications



RTC WHEEL



RT WHEEL

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## AXIAL FANS

The Clarage family of axial fans is custom-designed for specific applications including, but not limited to, tunnel and metro, mining, wind tunnels and the power industry. For the tunnel and metro market, the key is smoke control. Various air movement control methods are employed and the equipment must operate at an elevated temperature. In mining, the need is to provide clean air to the shaft or extract the noxious gases, typically at ambient temperatures. Wind tunnel applications are all about the high velocity profile and in the power industry, the axial fans need to provide high volume at high pressures.

### IMPELLER SIZES

Up to 315 inches (8,000 mm)

### AIRFLOW

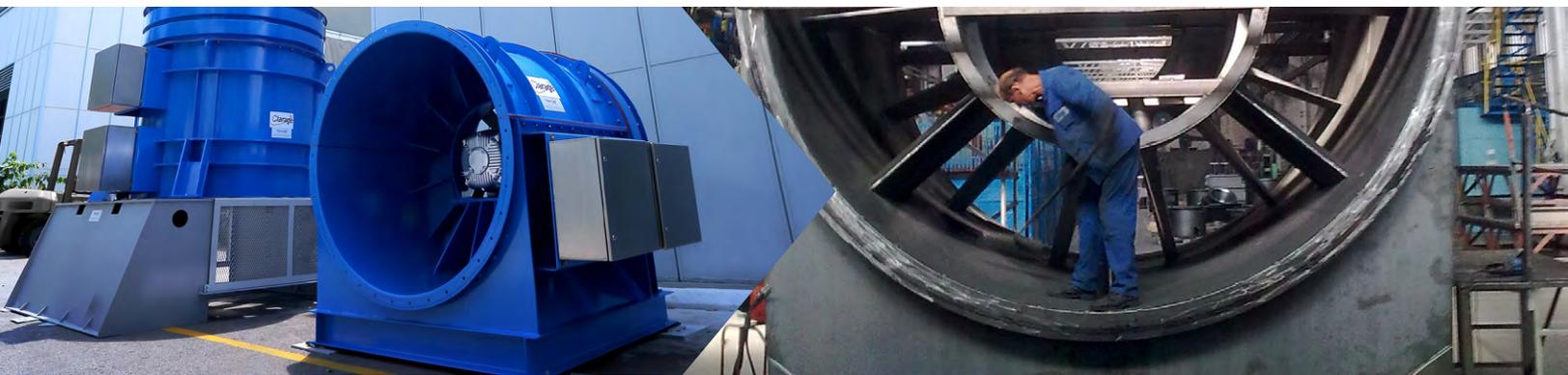
Single- and Two-Stage Fans: Up to 1,500,000 CFM (2,548,500 m<sup>3</sup>/hour)

### STATIC PRESSURE

Single-Stage Fans: Up to 36 inches w.g. (8,950 Pa)  
Two-Stage Fans: Up to 72 inches w.g. (17,901 Pa)

**TEMPERATURE RANGE:** Up to 1,500°F (815°C)

**MOTOR SIZES:** Up to 15,000 HP (11,185 kW)





## VARIABLE PITCH ON-THE-FLY

Clarage's variable pitch axial design uses multiple blades attached to a center hub to adjust air performance while in operation. The highly engineered center hub linkages are designed to rotate the blades open and closed to increase or decrease the airflow of the system without ever having to shut the fan off. Variable pitch axial fans are perfect for induced draft and forced draft fans in the power and mining industry. As airflow requirements change in the system, let the fan do the work. The seamless transition from low to high flow allows the system to adjust while the fan is running.

- > Automated adjustments can be made to the blade angles while the fan is running
- > Available in six blade designs to fit the fan to the exact duty
- > Engineered with high quality components for years of dependable, low maintenance operation



## ADJUSTABLE-AT-REST

Clarage's adjustable pitch axial design uses multiple blades attached to a center hub to adjust air performance while in operation. These fans are perfect for Induced draft and forced draft fans as required by all industry segments. The equipment can be coupled with variable speed drives to enable operation across a wide spectrum of performance requirements. As airflow requirements change in the system, let the fan and drives do the work. The seamless transition from low to high flow allows the system to adjust while the fan is running by adjusting the fan speed and power consumption.

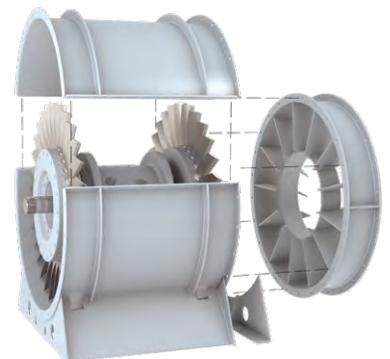
- > Available in six blade designs to fit the fan to the exact duty
- > Engineered with high quality components for years of dependable, low maintenance operation



## TWO-STAGE

These units are designed for specific contract requirements and would be tailored to the customer's needs. A two-stage axial fan provides high volume at high pressures efficiently. The arrangement of the impellers and motors would be coordinated with the site situation to provide the best solution for the customer.

The concept is a simple one – two fans in series can generate a higher pressure than a single unit at the same volume. Depending on the restrictions of a given site (size and power limitation) the two-stage unit may be the best solution for any of the axial family situations.





## TUNNEL VENTILATION

The need for tunnel ventilation is critical for the life and safety of any person utilizing the metro, rail or road tunnels throughout the world. Typically, the equipment is used for smoke extraction or control for the time it takes people to evacuate the tunnel under emergency conditions. They are also utilized to control exhaust fumes and to provide standard ventilation when required. There are three basic types of control that can be utilized: portal to portal, shaft to shaft and portal to shaft. These are used independently or in conjunction with each other. Fans utilized are both axial, reversible and uni-directional as well as centrifugal.



### IMPELLER SIZES

Up to 315 inches (8,000 mm)

### AIRFLOW

Up to 1,500,000 CFM (2,548,500 m<sup>3</sup>/hour)

### STATIC PRESSURE

Up to 36 inches w.g. (8,950 Pa)

**TEMPERATURE RANGE:** Up to 752°F (400°C)

**MOTOR SIZES:** Up to 1,500 HP (1,118 kW)



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INDUSTRIAL FANS & SERVICES





## PORTAL TO PORTAL

The concept of portal to portal is typically completed with the use of Jet Fans. These specially designed units are inclusive of an attenuator on either end and direct the air from one portal to the other by inducing the air to move. These units are rated on the thrust that they can impart to the surrounding air in the tunnel. This air movement is sustained by the thrust being energized repeatedly down the length of the tunnel by various banks of Jet Fans. The principal objective is to have the air contaminated with smoke move in the opposite direction of the evacuation route. This will allow the people to exit with fresh air blowing in their face.



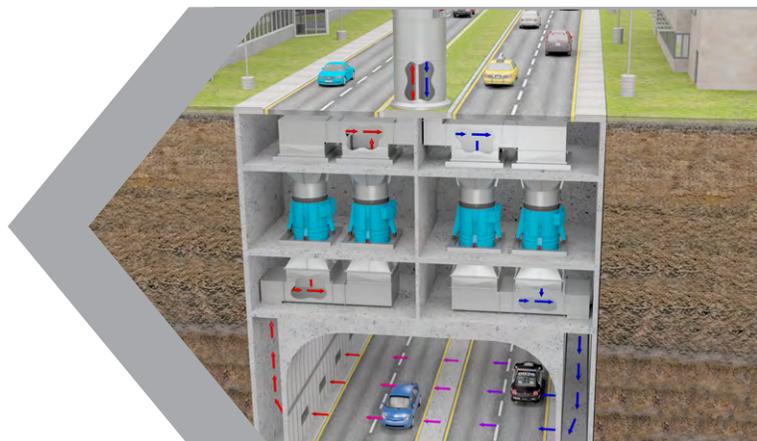
## SHAFT TO SHAFT

The concept of shaft to shaft is a push pull system. The air is forced in the direction required by either a single unit or a station of fans on either side of the fire event. It is standard for the air to be injected from one station and extracted at the other. Thus the equipment for utilized for this type of arrangement must be reversible. The principal objective is to have the air contaminated with smoke move in the opposite direction of the evacuation route. This will allow the people to exit with fresh air blowing in their face.



## PORTAL TO SHAFT

The concept of portal to shaft is a combination of portal to portal to shaft to shaft. The air is forced into the tunnel and then extracted out of the portal via Jet Fans. Or depending on the location of the fire event the airflow may be reversed. Hence, the equipment for utilized for this type of arrangement must be reversible. The principal objective is to have the air contaminated with smoke move in the opposite direction of the evacuation route. This will allow the people to exit with fresh air blowing in their face.





## DUST COLLECTORS

Clarage's unmatched experience and flexible engineering has made us the best choice in the industry for your dust collection needs. With a full line of mechanical collectors and custom fans designed for clean air to heavy particulate loading, we can provide a range of solutions unmatched in the industry. Practical uses for Clarage collectors range from helping a system meet its required air quality emission levels, to extending the life of the system's Induced Draft Fan and connecting ductwork. Careful attention to housing design details, such as inlet and outlet proportions, collecting tube spacing and dust discharge boot design, assures uniform gas distribution and proper flow to each individual collecting tube for maximum design efficiency. Clarage offers standard sizes up through 2 million CFM, 6"/9"/11.5" tube availability and standard or totally accessible (TA) designs.



### CUSTOM ENGINEERED DUST COLLECTORS

- Standard Sizes up Through 2 Million CFM
- 6", 9" and 11" Availability
- Standard or Totally Accessible (TA) Design

### REPLACEMENT PARTS

- Can Retrofit Most Manufacturers
- Most Popular Sizes - 6", 9", 12", 24"
- Flat & Conical Boot Designs
- Cast Iron Construction (High Brinell Option)
- Parts for Standard & Totally Accessible Designs
- Hopper Replacements
- Custom-Fit Ceramic Liners For Additional Wear Protection
- Cut To Length Carbon Steel Outlet Tubes
- .120" Wall Or Optional ¼" Wall
- Type A & XD Turning Vanes - One Piece Or Split Design





## DAMPERS

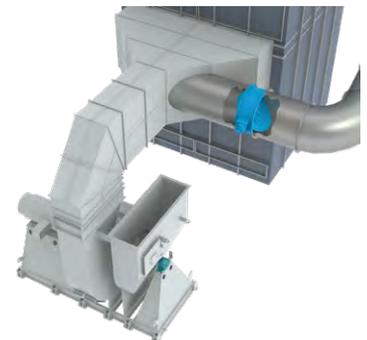
Variable inlet vanes are highly efficient at maintaining volume control, offer more control than box dampers and lower part load power consumption. These radial inlets have control dampers that can be used with open inlet fans or fans with inlet boxes. For high temperature fan applications, such as ID fan service, the mechanism can be isolated from the gas stream. Variable inlet vanes are available in Nested and Split designs. External linkage radial vane dampers are also highly efficient at maintaining volume control. Having the bearings and linkage outside of the casing promotes longer life and allows for operation in particulate-laden applications. Routine maintenance can also be performed on the bearings and linkage while the fan is in operation. Clarage designs and manufactures both opposed blade (MLOB) and parallel blade (MLPB) multi-louver dampers. MLOB dampers are commonly used on fan outlets. MLPB dampers, when used on fan inlet boxes, provide increased fan efficiency at reduced loads. Rugged construction is a featured quality of these types of dampers.



VARIABLE INLET VANES



LOUVERED DAMPERS



BUTTERFLY DAMPERS

## NEED REPLACEMENT PARTS?

### WE'VE GOT YOU COVERED!

Whether you need replacement parts or a backup supply of spare parts, Clarage's ability to manufacture, repair, replace and redesign OEM parts is unmatched in today's fan industry. Our team of fan experts will work side-by-side with you to ensure that we have all of the right information prior providing any parts for your fan.

Not sure where to start? Contact our Aftermarket team at (931) 424-2500 and let us show you why we are the go-to fan manufacturer for providing replacement parts.



### **CUSTOM ENGINEERED CENTRIFUGAL & AXIAL FANS**

Forced Draft | Induced Draft | Process Fans | Pressure Blowers | Industrial Exhausters | Material Handling  
2-Stage | Adjustable-At-Rest & On-The-Fly Variable Pitch Axial Fans

### **DUST COLLECTORS**

Standard Sizes Up Through 2 Million CFM | 6", 9" and 11.5" Tube Availability  
Standard or Totally Accessible (TA) Design

### **DAMPERS**

Opposed Blade | Parallel Blade | Nested Variable Inlet Vane | Bolt-On Radial Blade | Butterfly | Shut-Off

### **TESTING SERVICES**

Performance & Mechanical Run Testing | Seismic Testing | Non-Destructive Testing | Rotor Balancing  
Aerodynamic Performance Testing | Thrust Testing | Sound Surveys | High Temperature Testing  
Overspeed Testing

### **FIELD SERVICES**

Installation Advisors | Inspection | Performance Testing | In-Field Balance & Laser Alignment  
Operational Training | Vibration Analysis | Troubleshooting

### **TURNKEY SERVICES**

Installation & Commissioning | Retrofits - All Brands | Demolition | Repair & Rebuild | Duct Work Modification  
Damper Installation | Inlet Cones | Motor/Turbine Alignment | Coupling Alignment  
Preventive Maintenance | Technical Services | Material Upgrades



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