FANPEDIA
BY TWIN CITY FAN

TCF
TWIN CITY FAN

FAN BASICS

FAN COMPONENTS

FAN CONSTRUCTION

Accessories

FANPEDIA
BY TWIN CITY FAN

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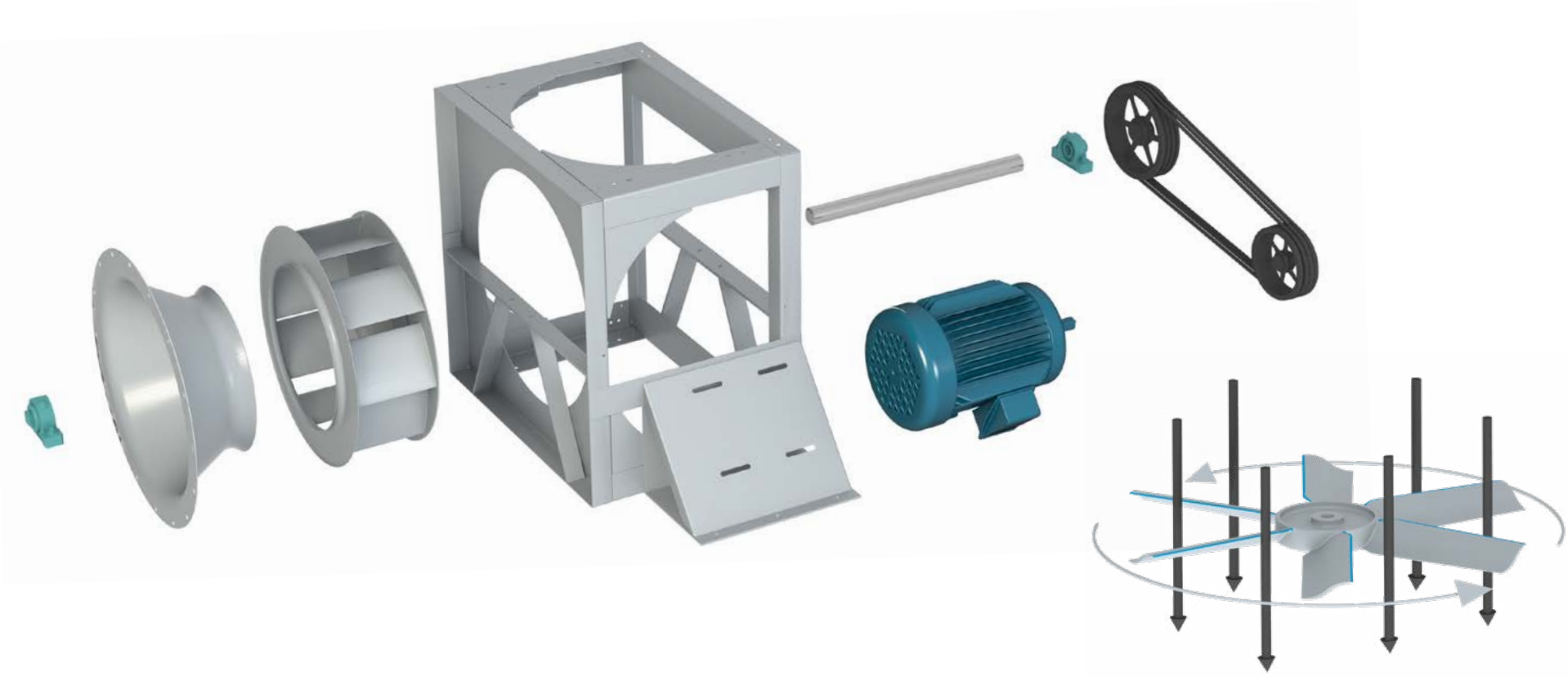


FAN BASICS

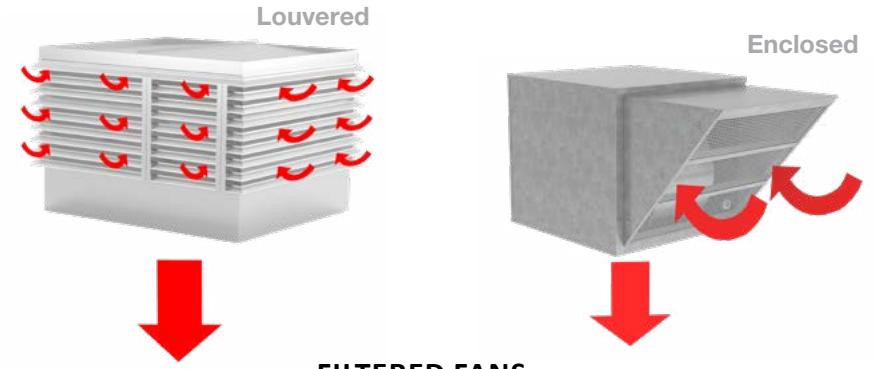
HOUSED CENTRIFUGAL FANS

Housed Centrifugal Fans are built with single or double width scroll housings and move air by a rotating impeller within the housing. Air is drawn through one side (single inlet) or both sides (double inlet) and is discharged at a right angle to the fan shaft. Housed Centrifugal Fans can be constructed with a number of different impeller types, including backward inclined, airfoil, backward curved, radial tip, forward curved and radial bladed. (See *Impeller Types* section for more information.) The size and width of Housed Centrifugal Fan housings and impellers vary based on the application (i.e. pressure blowers have narrower housings and impeller widths compared to standard centrifugal fans).

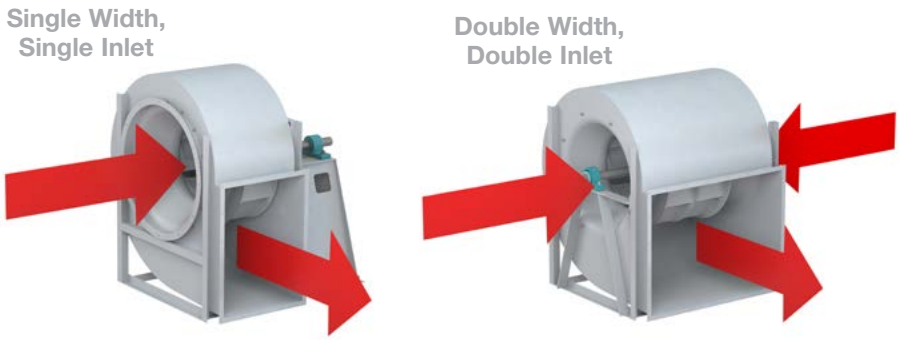
Filtered configurations utilize forward curved and backward inclined impellers and are designed to filter outside air before it enters into a building. These units are roof mounted and pull air through the filters and move it in a downward direction.

Lab Exhaust configurations are designed for exhausting hazardous fumes in a safe and efficient manner. These fans dilute contaminated air by drawing in fresh outside air through a bypass air plenum (bypass flow) and/or the fan's nozzle/windband (entrained flow). The fresh outside air mixes with the contaminated air to help dilute it and exhaust it up and away from the building. Housed centrifugal lab exhaust fans are built with scroll housings and move air through the fan with a rotating impeller located within the housing. Air is drawn through the inlet and is discharged at a right angle to the fan shaft.

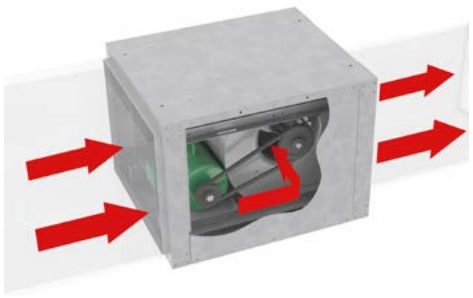
Duct Fan configurations are built with double inlet scroll housings that are mounted inside of an enclosure. These units move air by a rotating impeller within the housing. Air is drawn through the double inlets of the fan and is discharged at a right angle to the fan shaft.



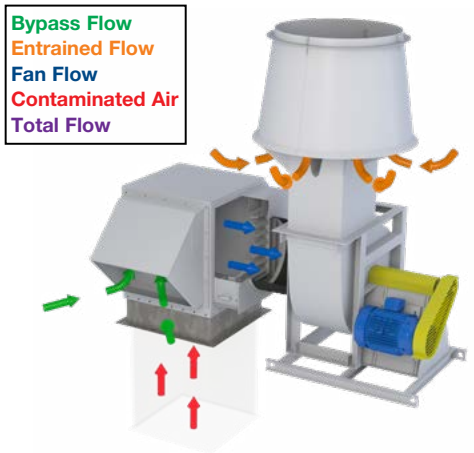
FILTERED FANS



BASIC HOUSED CENTRIFUGAL



DUCT FAN

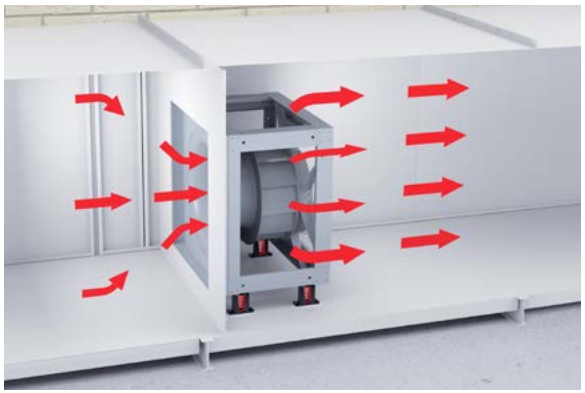


LAB EXHAUST FAN

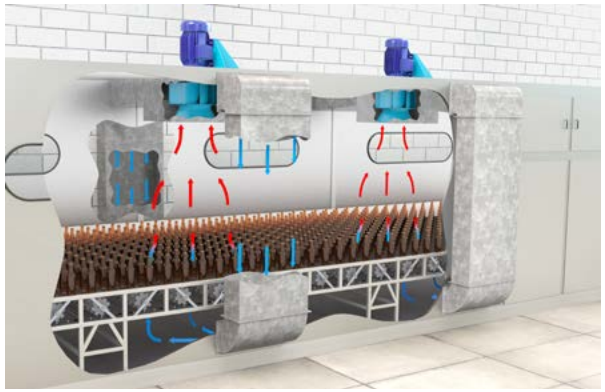
UNHOUSED CENTRIFUGAL FANS

Plenum Type Unhoused Centrifugal Fans are designed for air handling applications where the fan operates within an air plenum. A plenum is an air-filled space within a structure that uses a fan to pressurize the plenum and moves air through the fan as shown below.

Plug Type Unhoused Centrifugal Fans are designed for circulating/recirculating air within a plenum. The fan is "plugged" into the wall of the plenum. The mounting panel is mounted to the outside wall and the impeller inside the plenum wall. The impeller pressurizes the air plenum and moves air through the inlet funnel and impeller as shown below. These types of fans are commonly used for industrial applications, including High Temp Ovens and OEM Paint Booths.



PLENUM TYPE

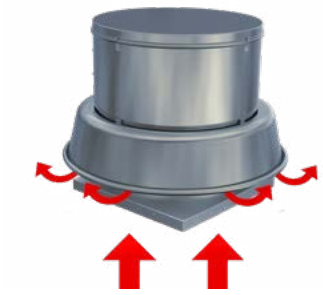


PLUG TYPE

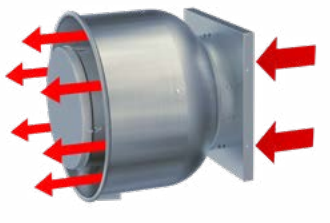
CENTRIFUGAL POWER ROOF VENTILATOR EXHAUST FANS

Centrifugal Power Roof Ventilators (PRVs) utilize a centrifugal impeller to exhaust air in a straight line through the fan for **Upblast** and **Side Wall** rooftop configurations. **Downblast**, **Louvered** and **Hooded** rooftop configurations move up through the fan and deflect air down and outward.

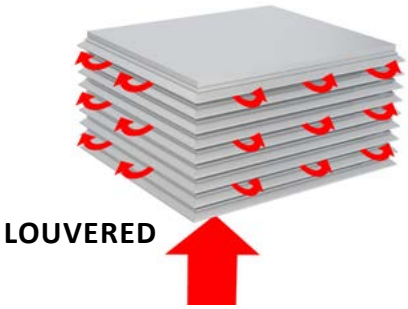
UPBLAST



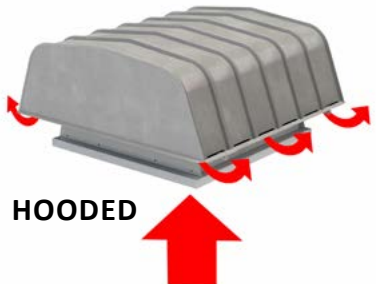
DOWNBLAST



SIDE WALL



LOUVERED



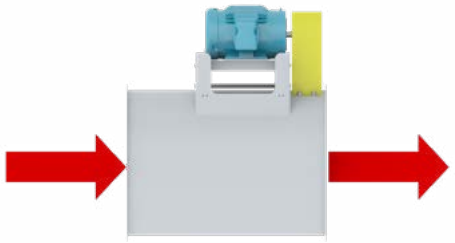
HOODED

INLINE CENTRIFUGAL FANS

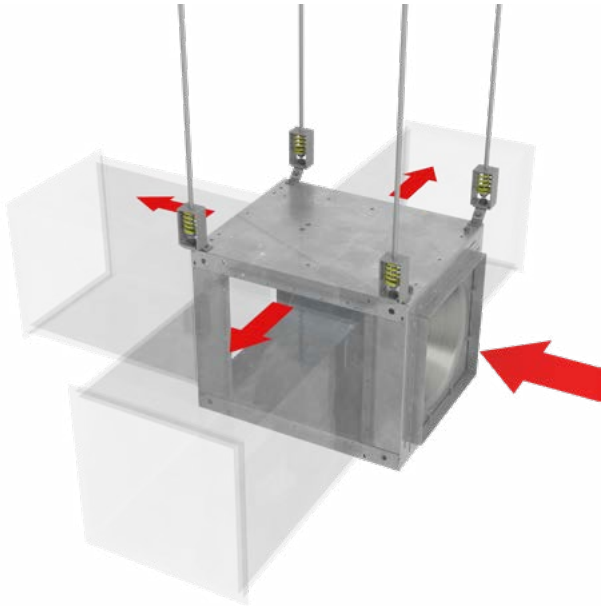
Tubular Inline Centrifugal Fans and Mixed Flow Fans are built with tubular housings and move air straight through the fan with a rotating impeller. Inline Centrifugal Fans use a centrifugal impeller, while Mixed Flow Fans utilize a hybrid axial-centrifugal impeller design. (See *Impeller Types* section for more information.)

Square Inline Centrifugal Fans are built with square housings and removable side panels. These fans can move air through the fan in a straight line and/or at 90 degree turns depending on the configuration of the ductwork.

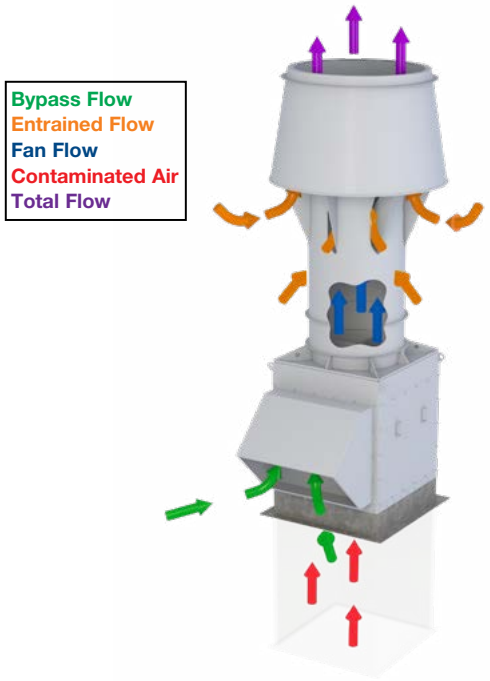
Lab Exhaust configurations are designed for exhausting hazardous fumes in a safe and efficient manner. These fans dilute contaminated air by drawing in fresh outside air through a bypass air plenum (bypass flow) and/or the fan's nozzle/windband (entrained flow). The fresh outside air mixes with the contaminated air to help dilute it and exhaust it up and away from the building. Inline Centrifugal Fans and Mixed Flow Lab Exhaust Fans are built with tubular housings and move air straight through the fan with a rotating impeller.



TUBULAR INLINE CENTRIFUGAL & MIXED FLOW



SQUARE INLINE CENTRIFUGAL

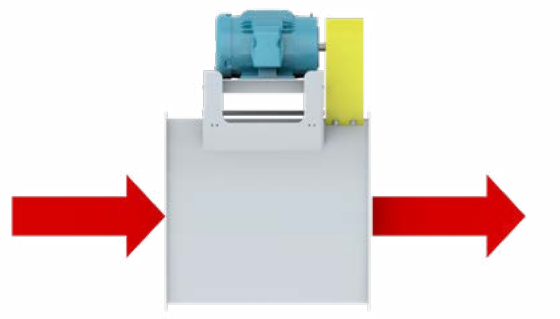


TUBULAR INLINE CENTRIFUGAL & MIXED FLOW LAB EXHAUST FAN

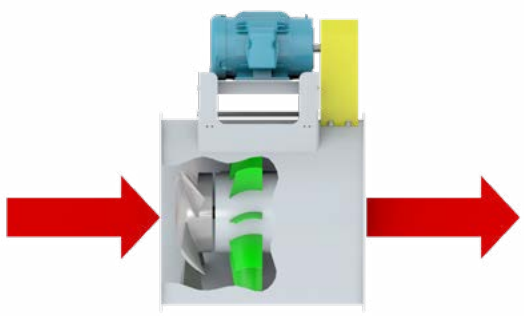
AXIAL FANS

Inline Type Axial Fans are built with tubular housings and move air straight through the fan with a rotating impeller. These fans can be constructed with standard (tubeaxial) housings or housings that are built with vane sections (vaneaxial) to help straighten the airflow as it moves through the fan. Inline Axial Fans can be designed with a number of different impeller types and can be mounted horizontally or vertically for ducted and unducted applications.

Roof Mounted Axial Fans utilize Tubeaxial Fans as a base model and are built with additional accessories. These units move air in a straight line through the fan as shown below.



TUBEAXIAL FAN



VANEAXIAL FAN

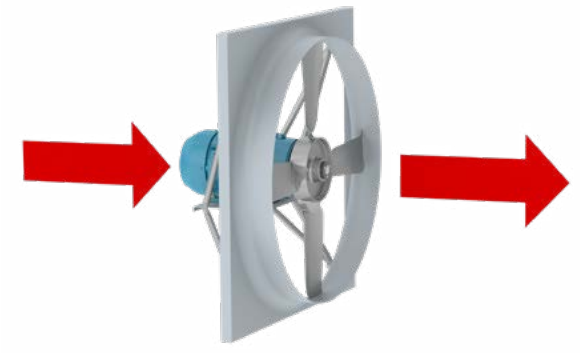
ROOF MOUNTED AXIAL FAN
WITH HOOD AND CURB CAP

ROOF MOUNTED AXIAL FAN
WITH STACK CAP AND CURB CAP

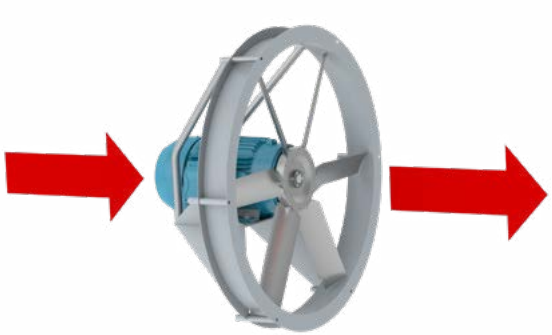
PANEL AND RING FANS

Axial Type Panel Fans and Ring Fans utilize a impeller that is centered inside of a panel or ring shaped housing. These units are typically wall mounted and move air in a straight line through the fan.

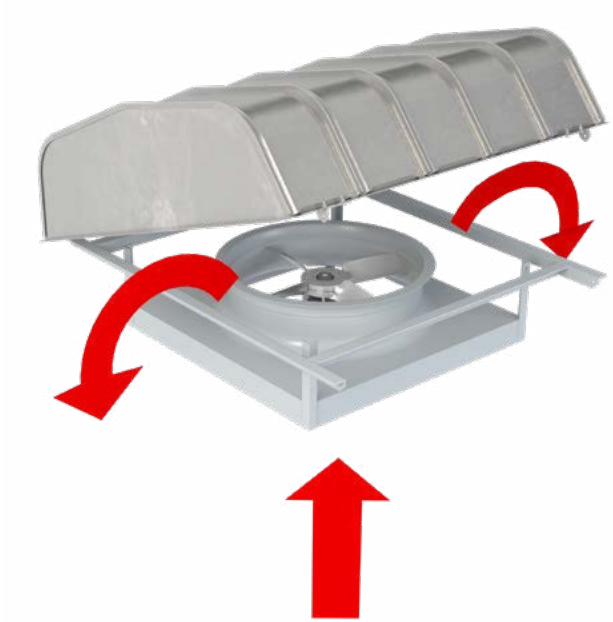
Roof Mounted configurations utilize a Panel Fan as a base model and are built with additional accessories, such as stack caps and hoods. Models configured with a stack cap move air in a straight line through the fan, while hooded models move air straight through the fan and deflect air down and outward for exhaust applications and in the reverse direction for supply applications.



PANEL FAN



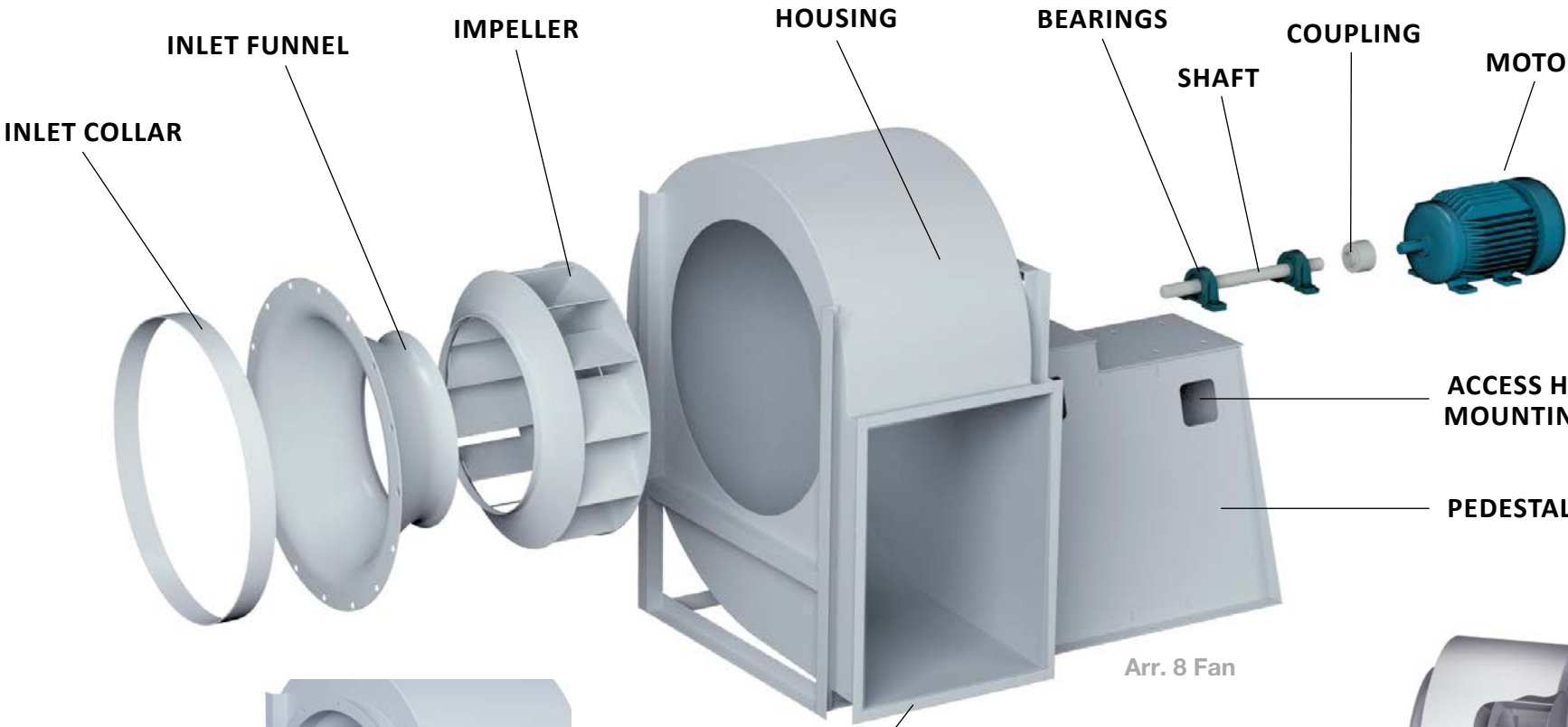
RING FAN



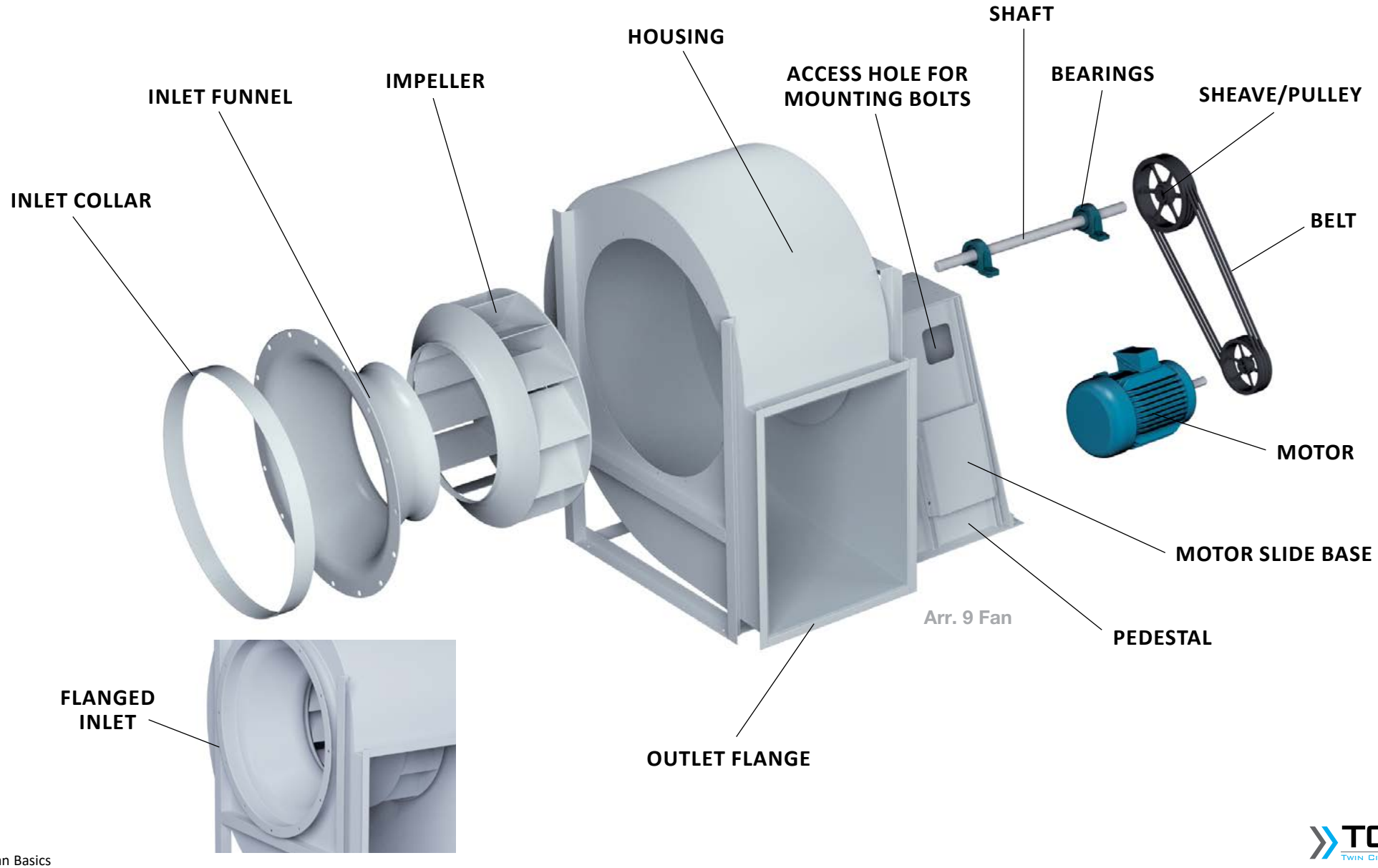
PANEL FAN WITH HOOD

PANEL FAN WITH STACK CAP

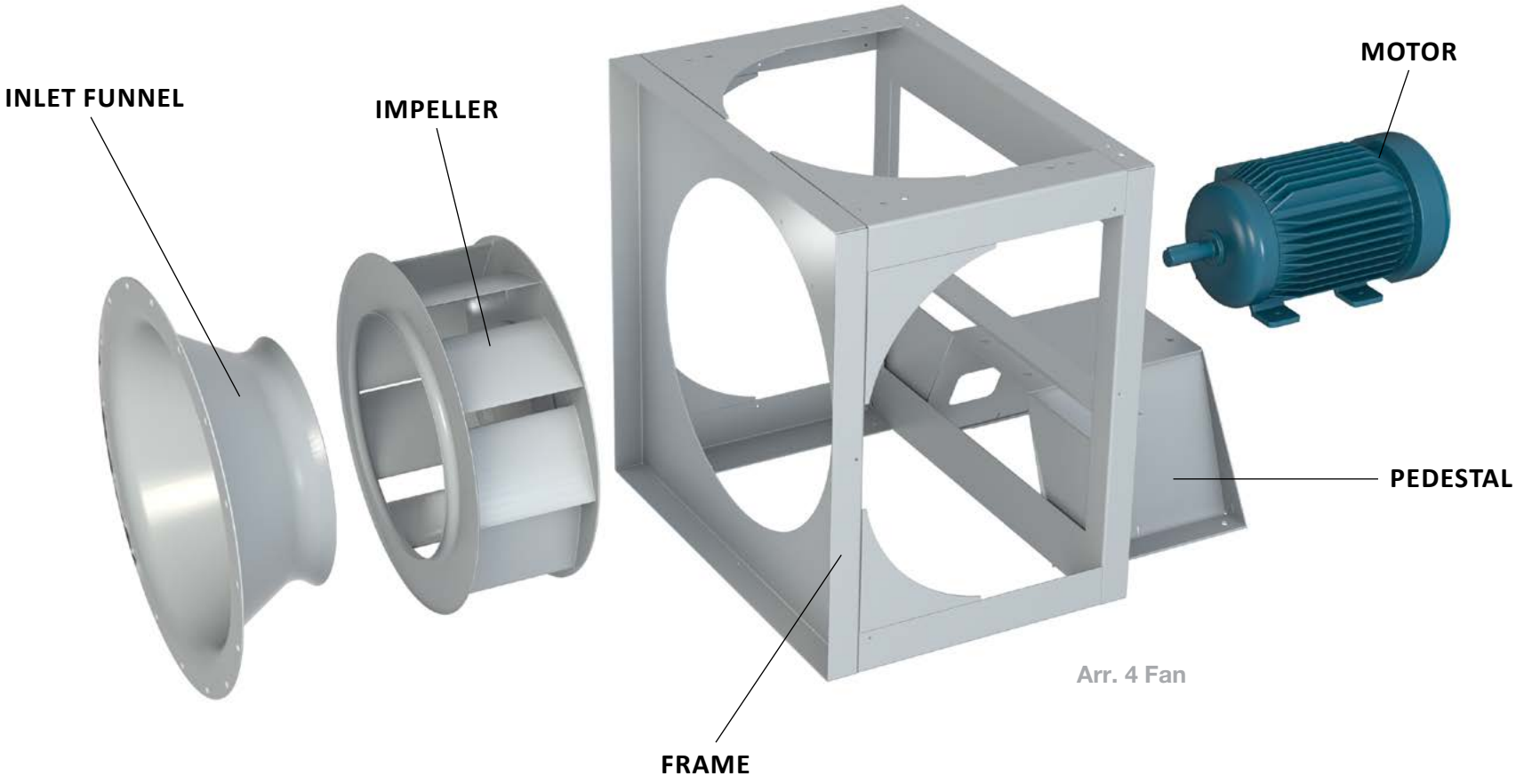
DIRECT DRIVE CENTRIFUGAL FANS



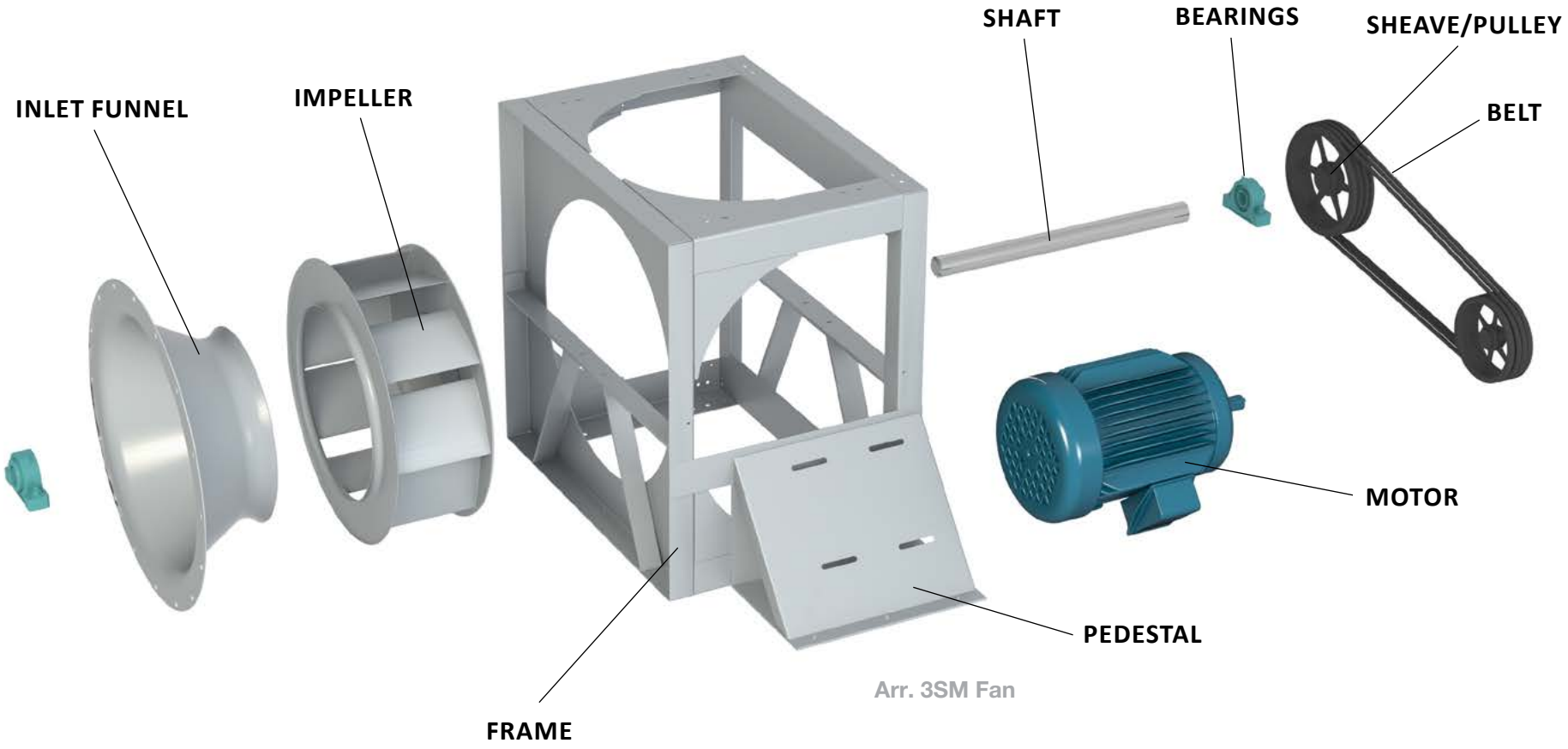
BELT DRIVEN CENTRIFUGAL FANS



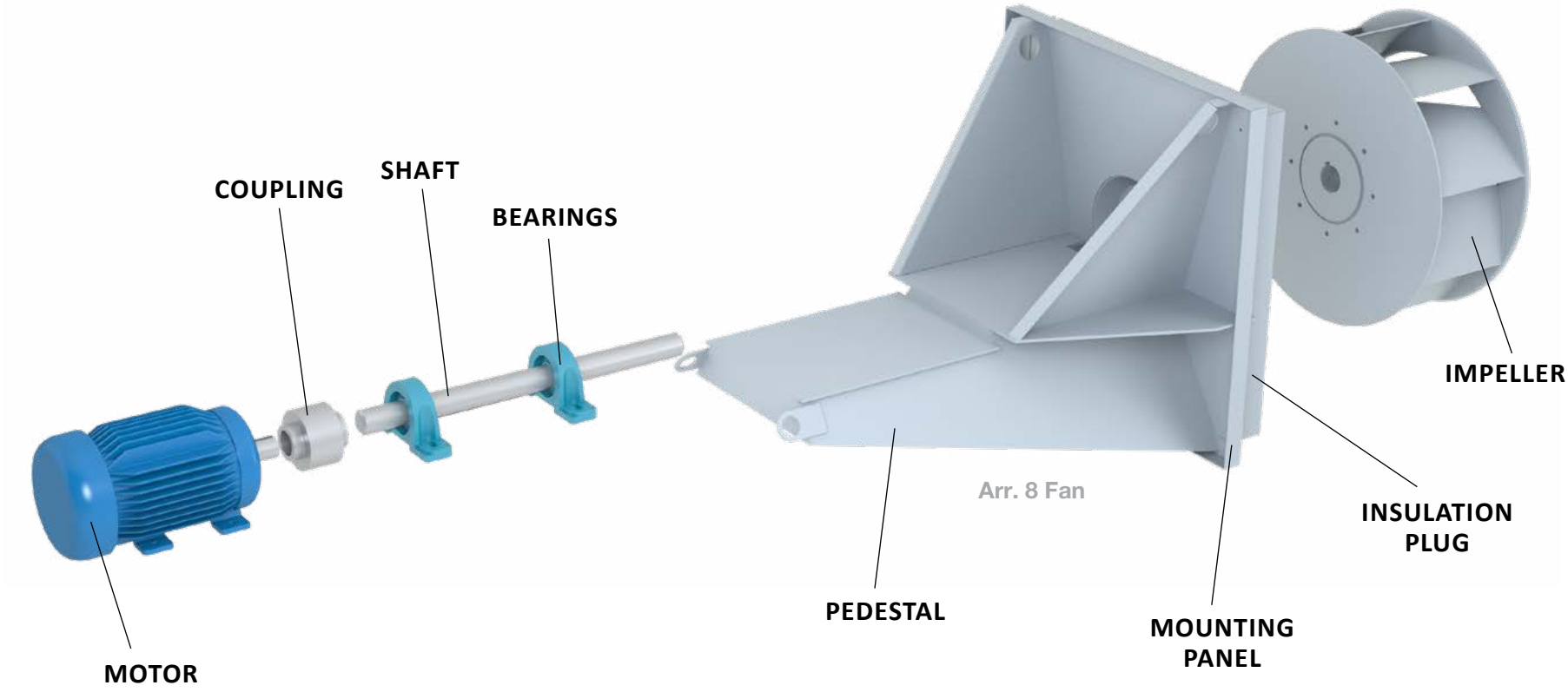
DIRECT DRIVE PLENUM FANS



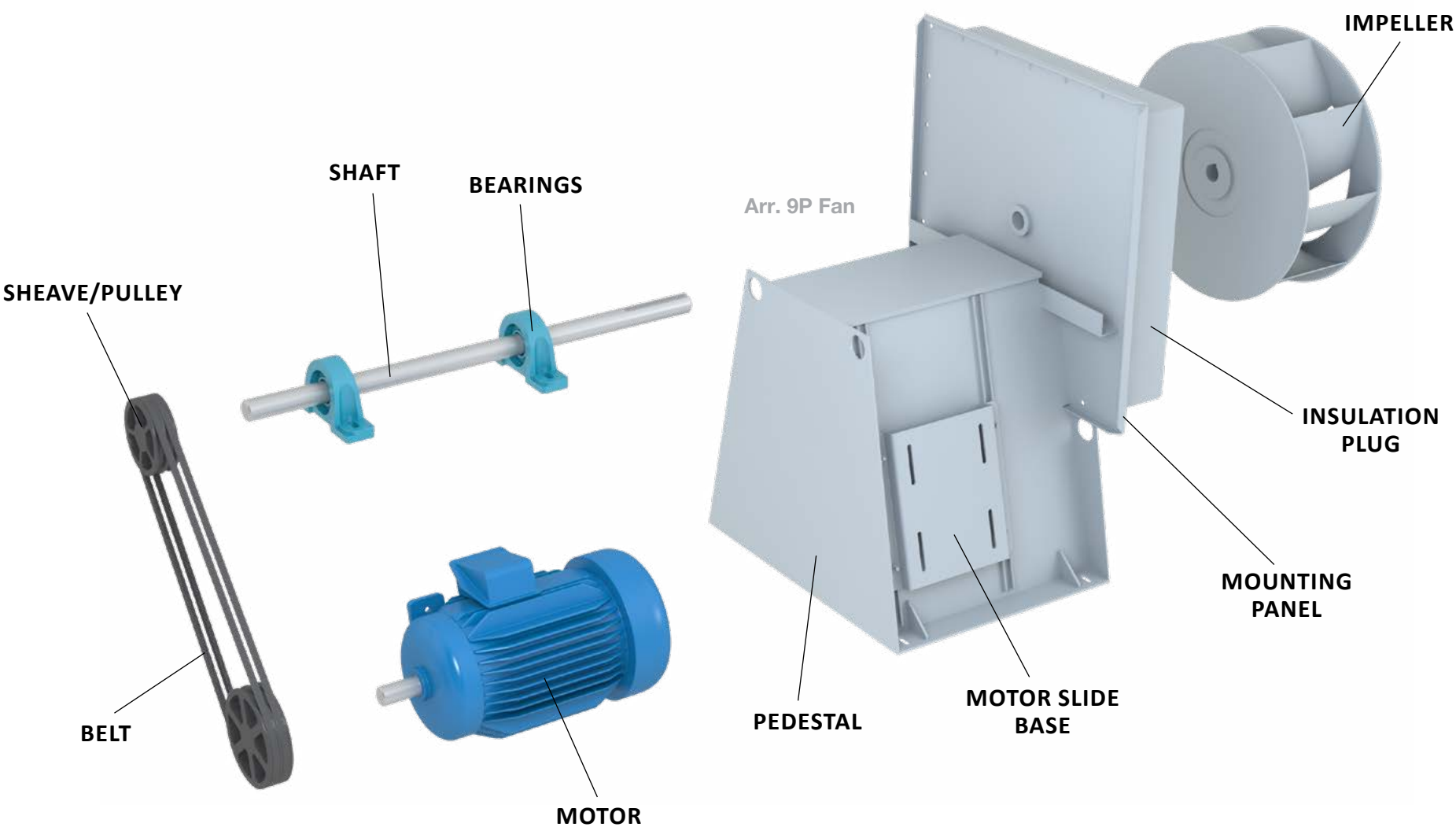
BELT DRIVEN PLENUM FANS



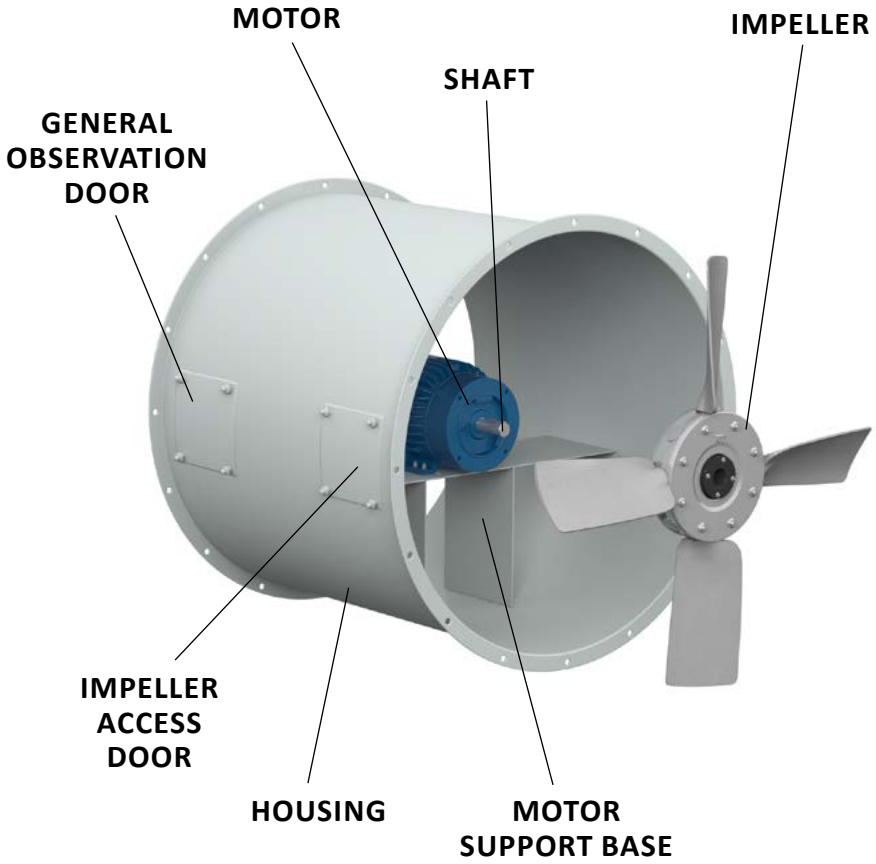
DIRECT DRIVE PLUG FANS



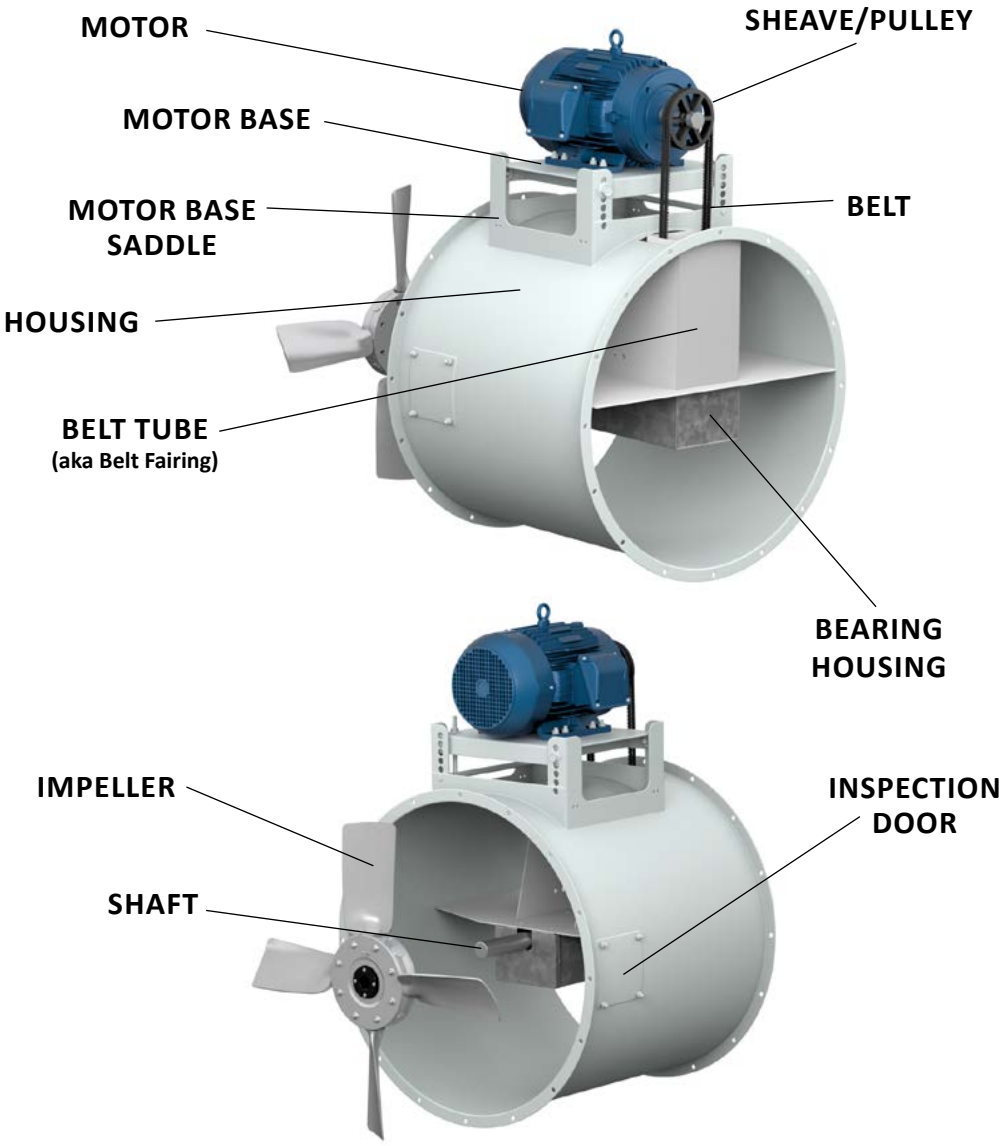
BELT DRIVEN PLUG FANS



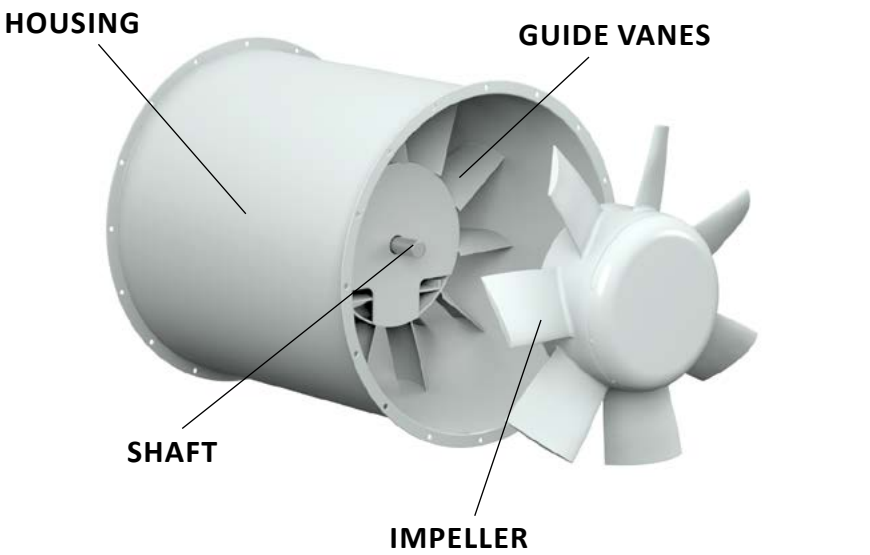
DIRECT DRIVE TUBEAXIAL FANS

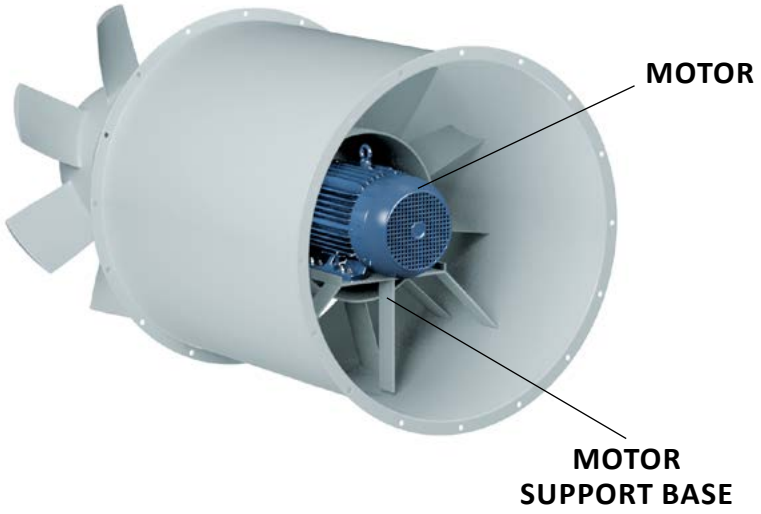


BELT DRIVEN TUBEAXIAL FANS



DIRECT DRIVE VANEAXIAL FANS





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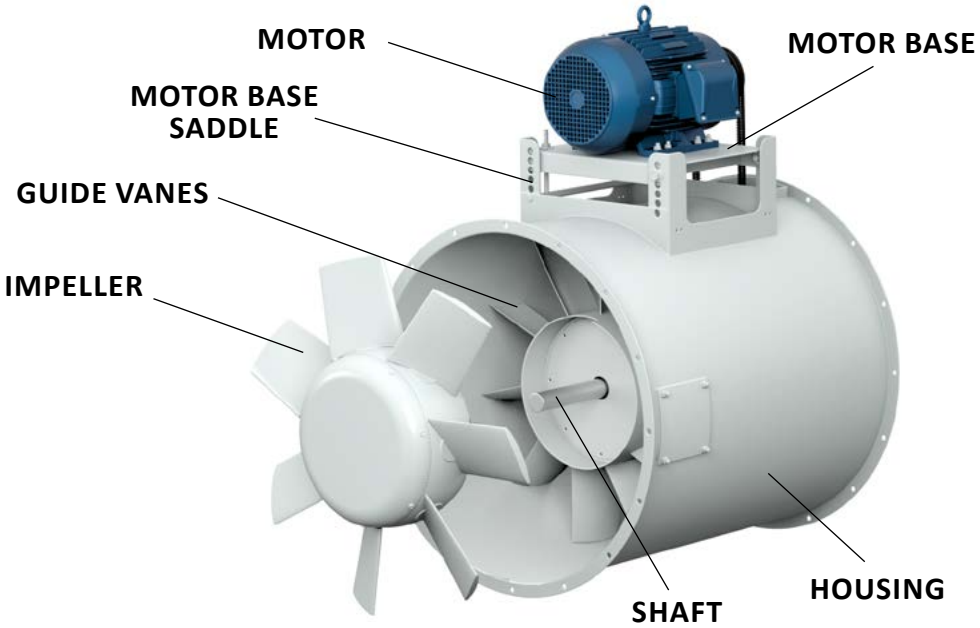
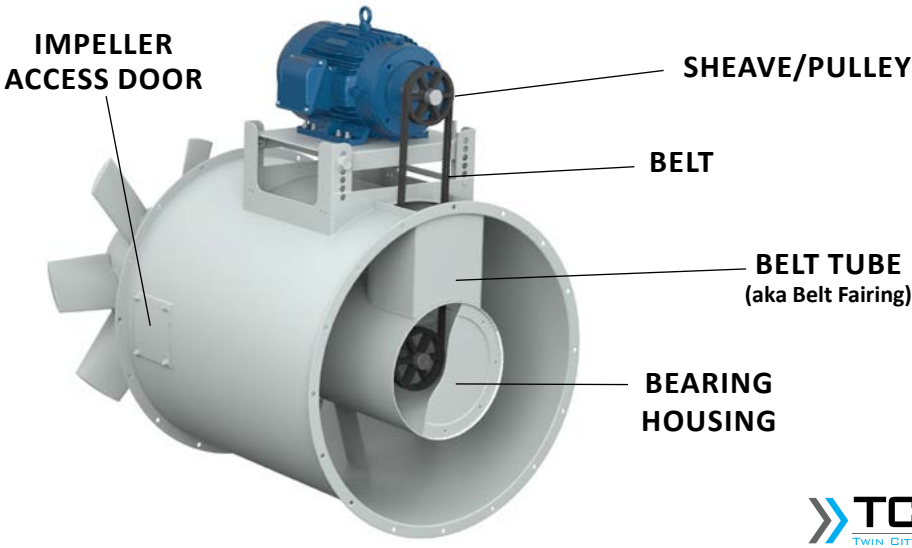
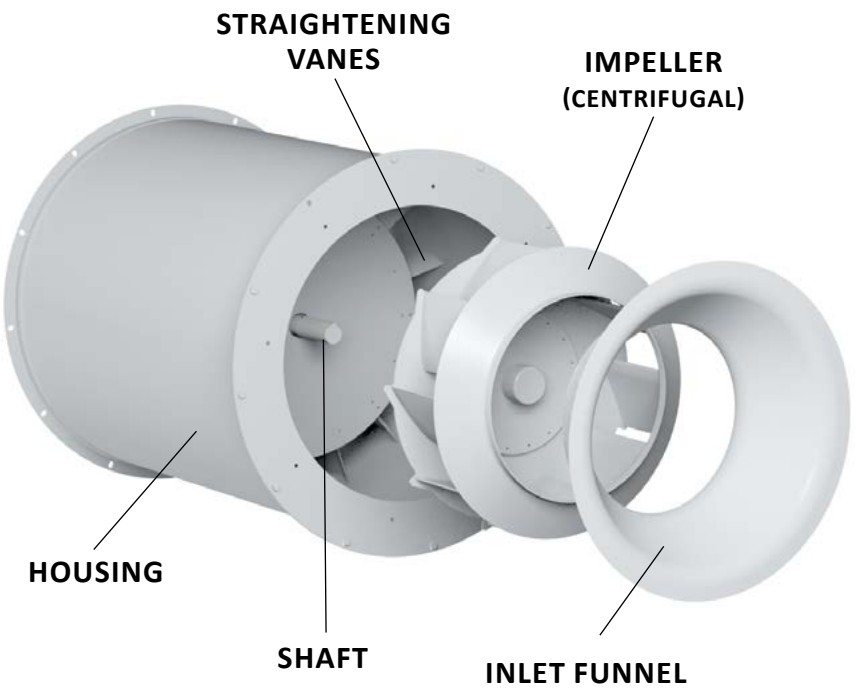
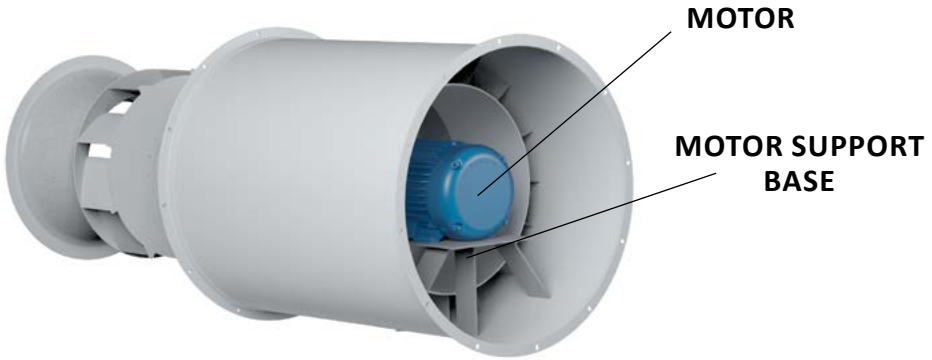




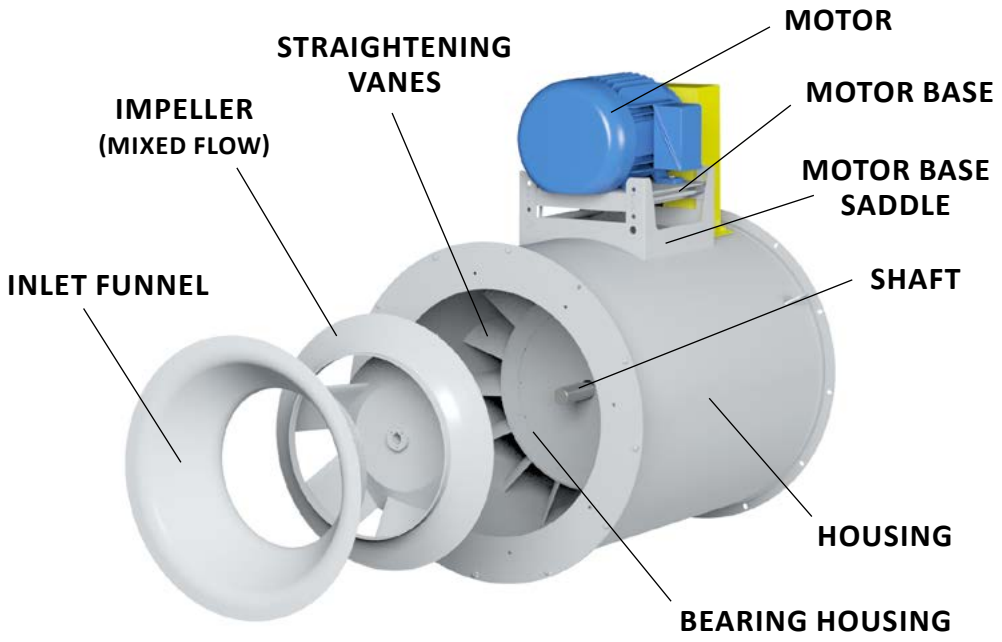
EXPLODED VIEWS
INLINE CENTRIFUGAL & MIXED FLOW FANS

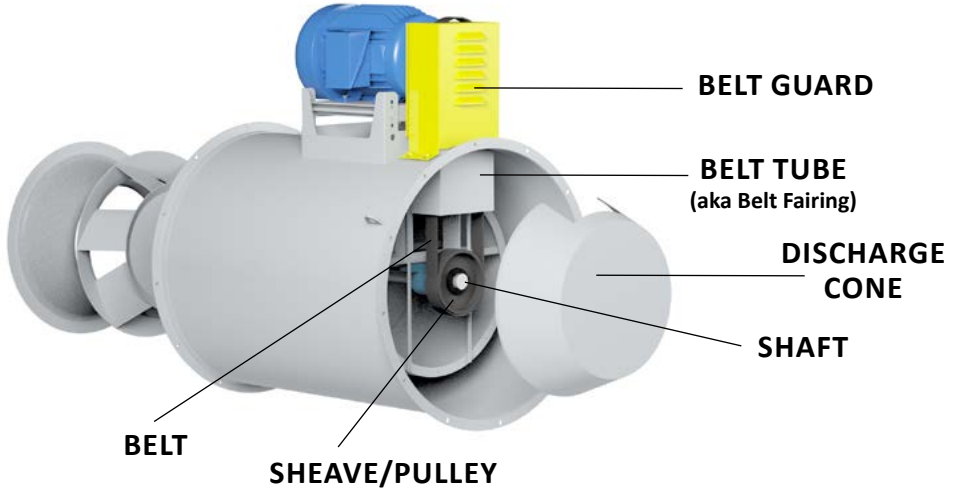
DIRECT DRIVE INLINE CENTRIFUGAL AND MIXED FLOW FANS



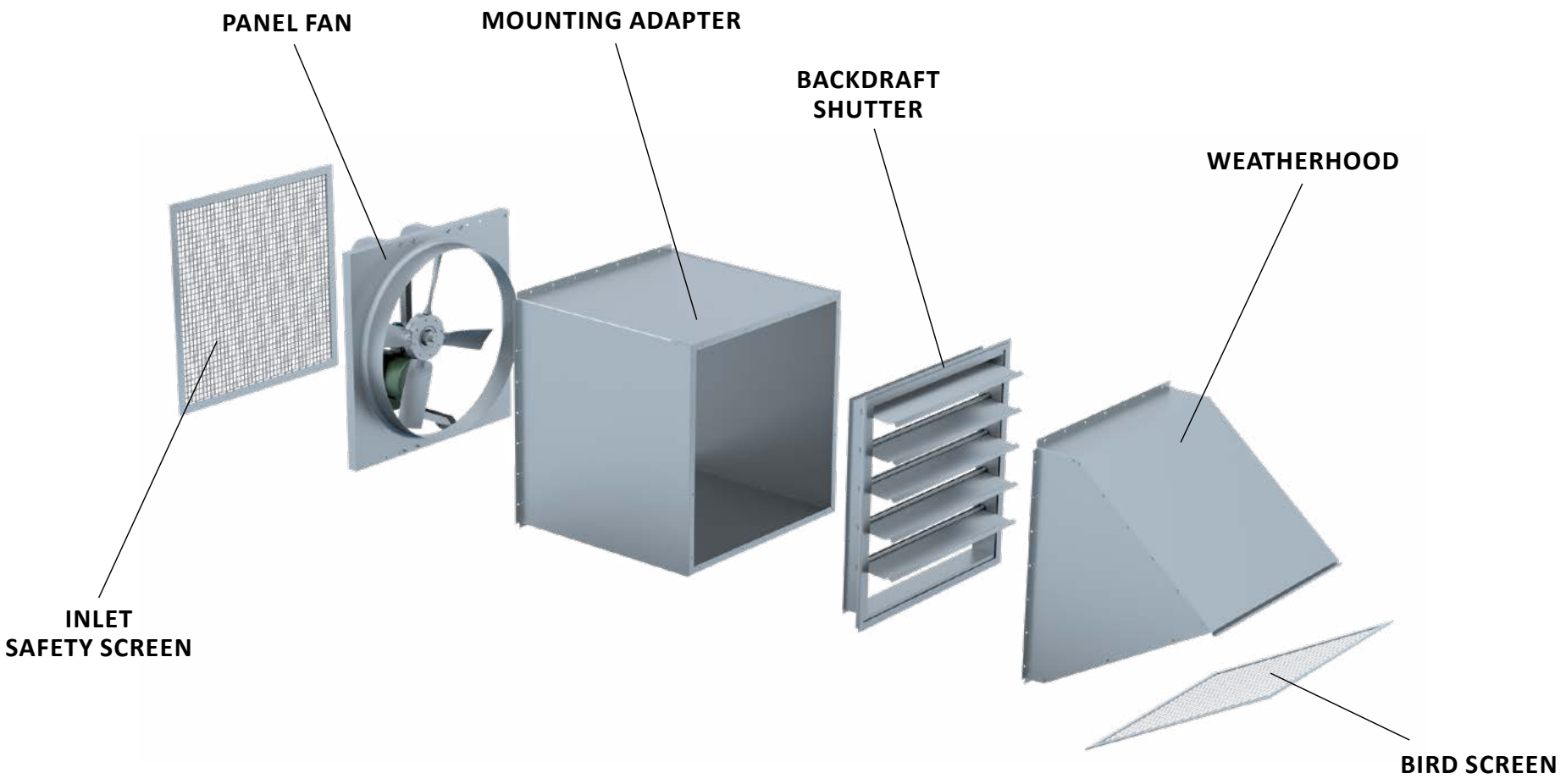


BELT DRIVEN INLINE CENTRIFUGAL AND MIXED FLOW FANS





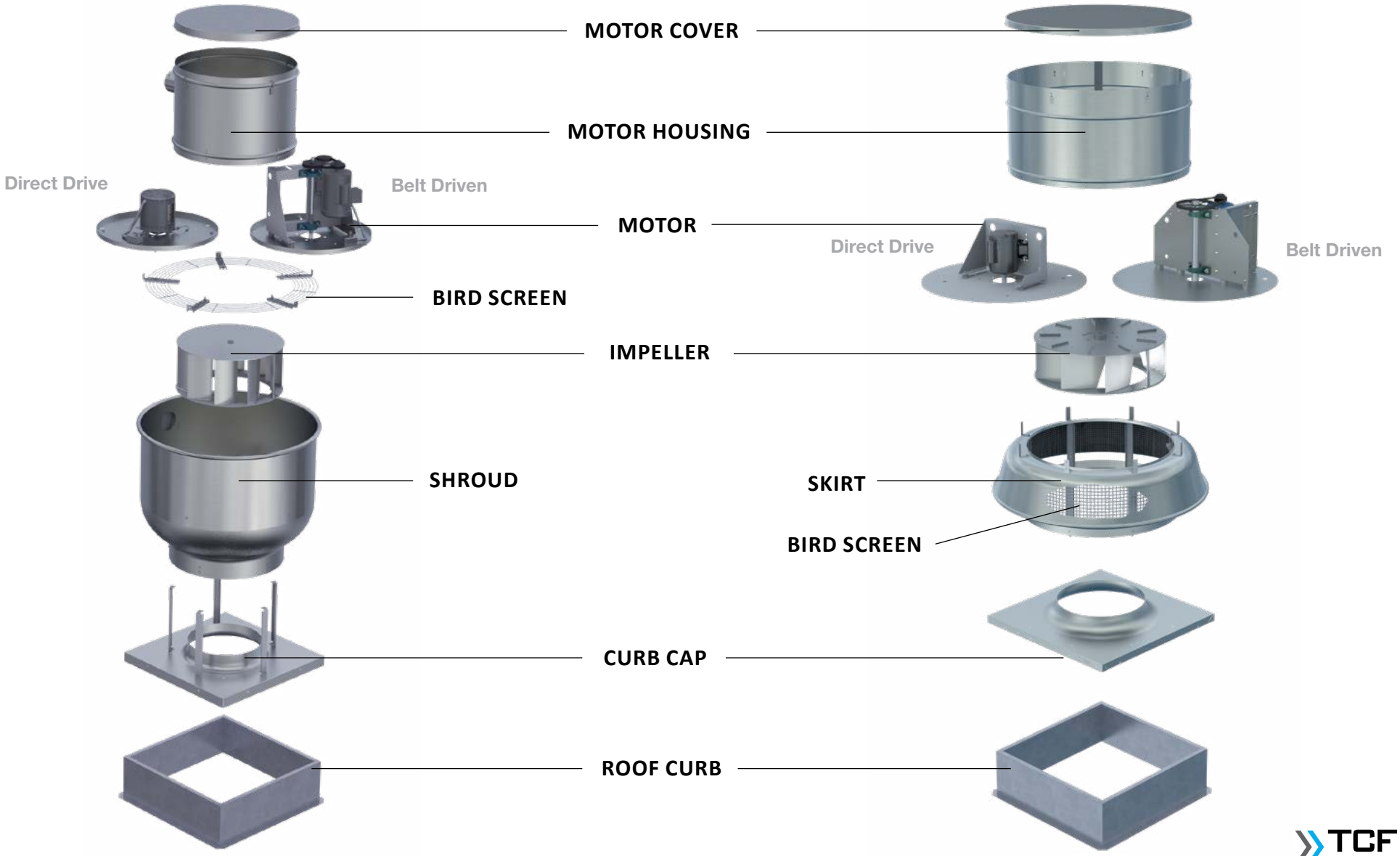
PANEL FANS


PANEL FAN
MOUNTING ADAPTER
BACKDRAFT SHUTTER
WEATHERHOOD
INLET SAFETY SCREEN
BIRD SCREEN

EXPLODED VIEWS
CENTRIFUGAL ROOF EXHAUSTERS

UPBLAST CENTRIFUGAL ROOF EXHAUSTERS

DOWNBLAST CENTRIFUGAL ROOF EXHAUSTERS



ARRANGEMENTS
CENTRIFUGAL FANS

SINGLE WIDTH, SINGLE INLET (SWSI)

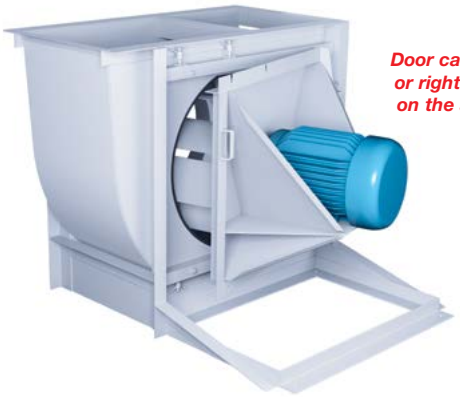
Arrangement 1
Direct Drive or Belt Driven
Motor Mounted on Floor or Fan Base

Arrangement 3
Belt Driven
Motor Mounted on Floor or Fan Base

Arrangement 3F
Belt Driven
Extended Angle Frame to Mount Motor
(Fan welded to frame/base - typically not suitable for spring isolators)

Arrangement 3SI
Direct Drive or Belt Driven
Single Width Fan with
Integral (Attached) Inlet Box
(independent bearing pedestals)

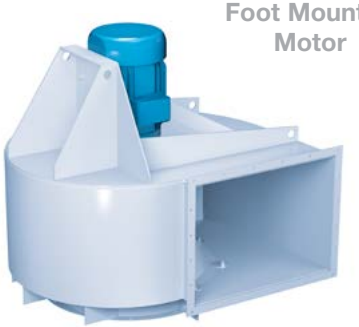
Arrangement 4
Direct Drive
Impeller Mounted to Motor Shaft



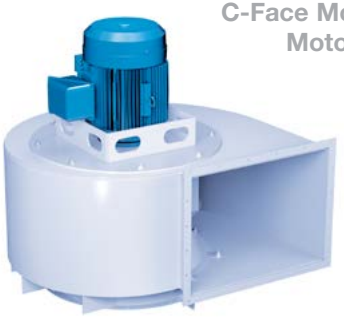
Door can swing left or right depending on the application

Arrangement 4S
Direct Drive - Swingout Construction
Impeller Mounted to Motor Shaft

SINGLE WIDTH, SINGLE INLET (SWSI)



Foot Mounted Motor



C-Face Mounted Motor

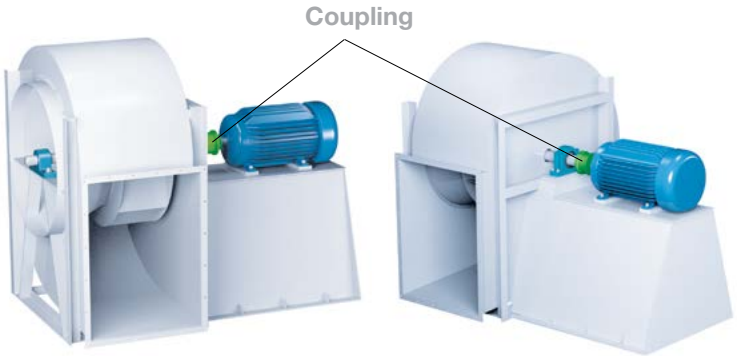
Note 1: Both the 4VI and 4HI can use
- *C-Face mounted motor*
- *Foot mounted motor*
- *Foot /C-Face mounted combo motor*

Note 2: The entire fan is supported by the inlet flange only

Foot/C-Face Combo Mounted Motor

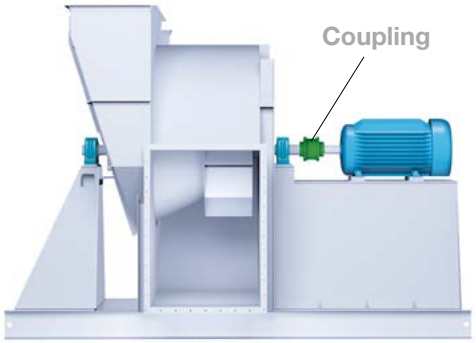
Arrangement 4VI
Direct Drive - **V**ertical **I**nlet Mounted
Impeller Mounted to Motor Shaft

Arrangement 4HI
Direct Drive - **H**orizontal **I**nlet Mounted
Impeller Mounted to Motor Shaft



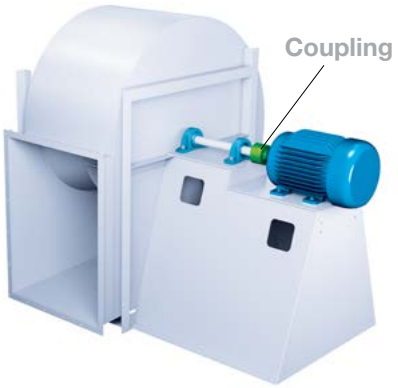
Coupling

Arrangement 7
Direct Drive
Motor Coupled to Fan Shaft
(similar to Arr. 3 but with motor pedestal)



Coupling

Arrangement 7SI
Direct Drive - **S**ingle Width Fan
with **I**ntegral (Attached) Inlet Box
Motor Coupled to Fan Shaft
(common fan base Included)



Coupling

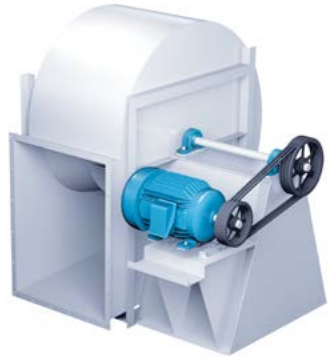
Arrangement 8
Direct Drive
Motor Coupled to Fan Shaft

SINGLE WIDTH, SINGLE INLET (SWSI)

Arrangement 9
Belt Driven
Motor Mounted on Pedestal

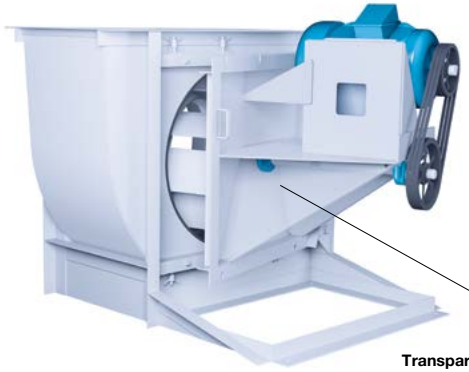
Arrangement 9F
Belt Driven
Extended Structural Frame to Mount Motor
Not suitable for spring isolators

Slide Base
or Rails

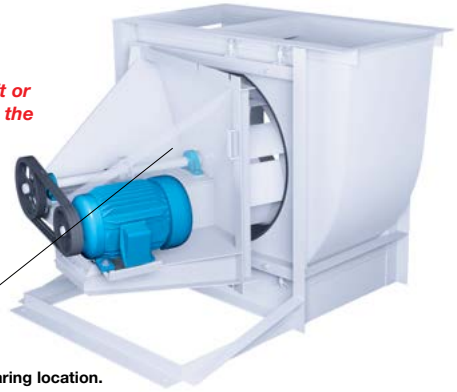


Pivot Base

Arrangement 9H
Belt Driven
Motor Mounted Horizontally on Side of Pedestal



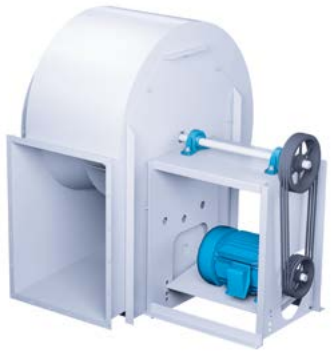
Door can swing left or right depending on the application



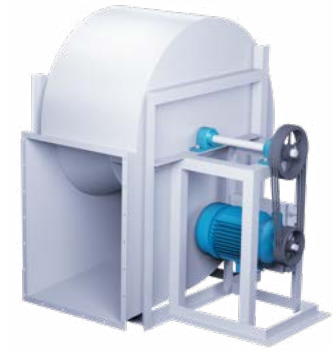
Transparency view for showing bearing location.

Arrangement 9ST
Belt Driven - Swingout Construction
Slide Base Top Mounted Motor

Arrangement 9SS
Belt Driven - Swingout Construction
Pivot Base Side Mounted Motor



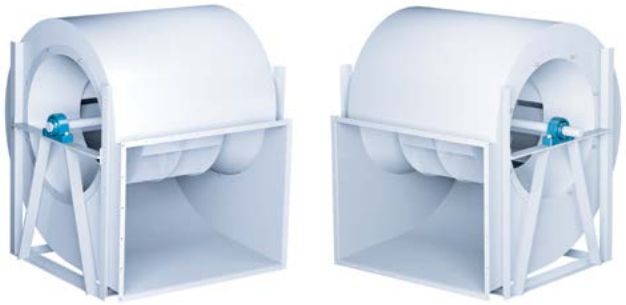
Sizes 122-365 (Vent Sets)
Motor Mounted on Adjustable
Plate on Bottom of Pedestal



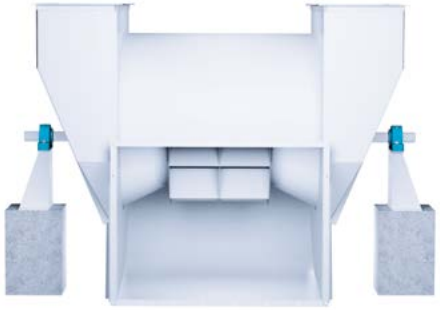
Sizes 402+ (Vent Sets)
Motor Mounted on Slide
Base on Side of Pedestal

Arrangement 10
Belt Driven
Motor Mounted Inside of Pedestal

DOUBLE WIDTH, DOUBLE INLET (DWDI)

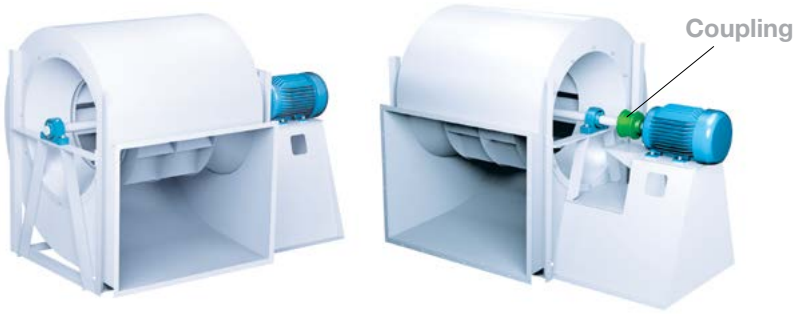


Arrangement 3
Direct Drive or Belt Driven
Motor Mounted on Floor or Fan Base

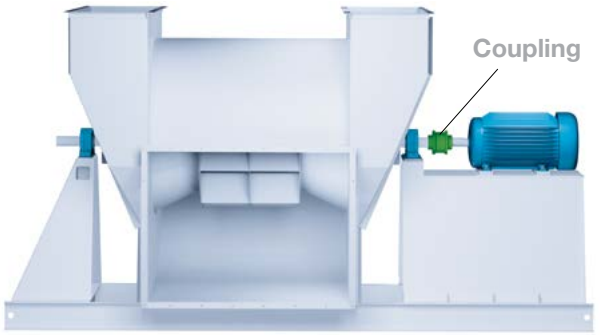


Arrangement 3DI
Direct Drive or Belt Driven
Double Width Fan
with **I**ntegral (Attached) Inlet Boxes
(independent bearing pedestals)

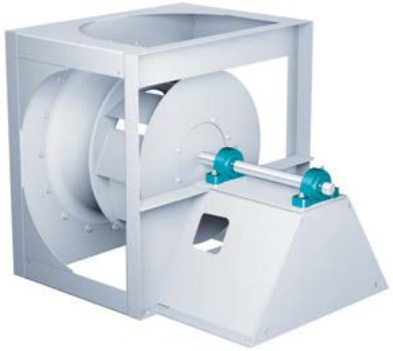
Arrangement 3F
Belt Driven
Extended Structural **F**rame to Mount Motor



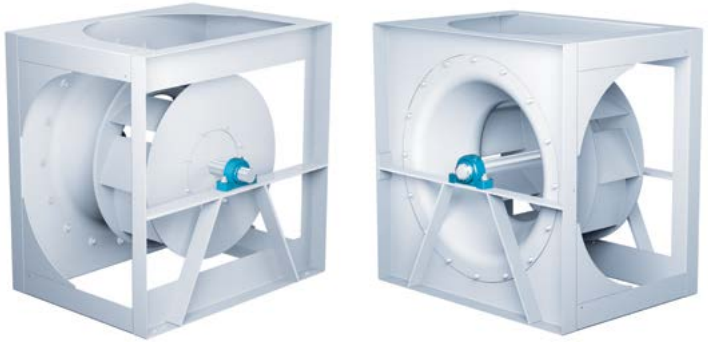
Arrangement 7
Direct Drive
Motor Coupled to Fan Shaft
(similar to Arr. 3 but with motor pedestal)



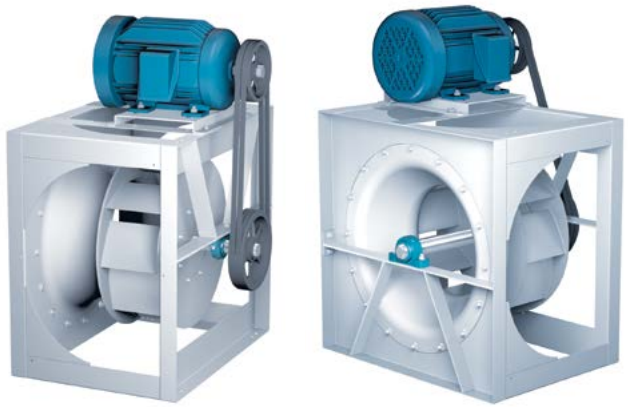
Arrangement 7DI
Direct Drive - **D**ouble Width Fan
with **I**ntegral (Attached) Inlet Box
Motor Coupled to Fan Shaft
(common fan base included)



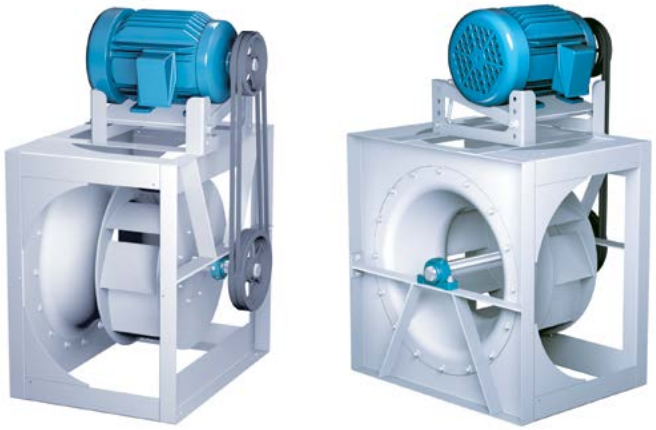
Arrangement 1
Belt Driven - Horizontal Motor
Mounted on Floor or Fan Base



Arrangement 3
Belt Driven - Horizontal
Motor Mounted on Floor or Fan Base

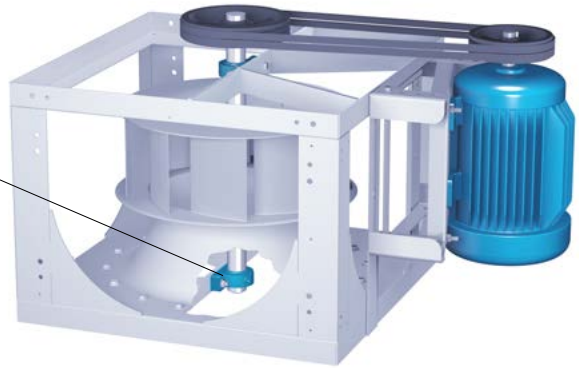


Arrangement 3HS
Belt Driven - **H**orizontal with Top Mounted Motor
with **S**lide Base Motor Mount



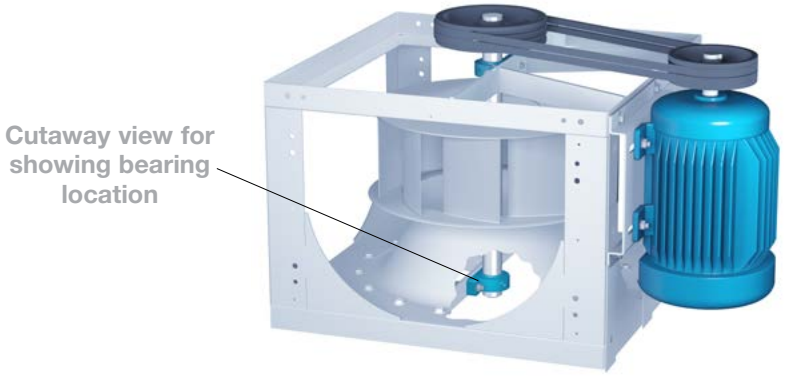
Arrangement 3HA
Belt Driven - **H**orizontal with Top Mounted Motor
with **A**djustable Motor Base

Arrangement 3SM
Belt Driven - Horizontal With **S**ide **M**ounted Motor
with Slide Base Motor Mount



Arrangement 3VA

Belt Driven - Vertical with Adjustable Motor Base



Arrangement 3VS

Belt Driven - Vertical with Slide Base Motor Mount

Arrangement 4

Direct Drive - Horizontal
Impeller Mounted to Motor Shaft

Arrangement 4V

Direct Drive - Vertical
Impeller Mounted to Motor Shaft

Arrangement 1P

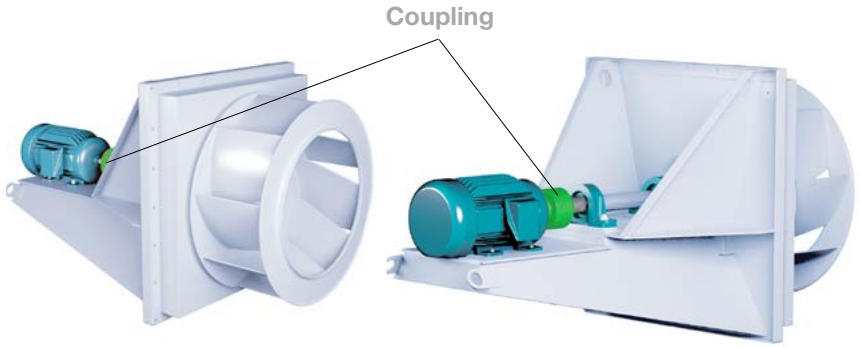
Belt Driven - **P**edestal Plug
Motor Mounted on Floor or Fan Base
Fan is floor mounted

Arrangement 4

Direct Drive
Impeller Mounted to Motor Shaft
Fan is wall mounted

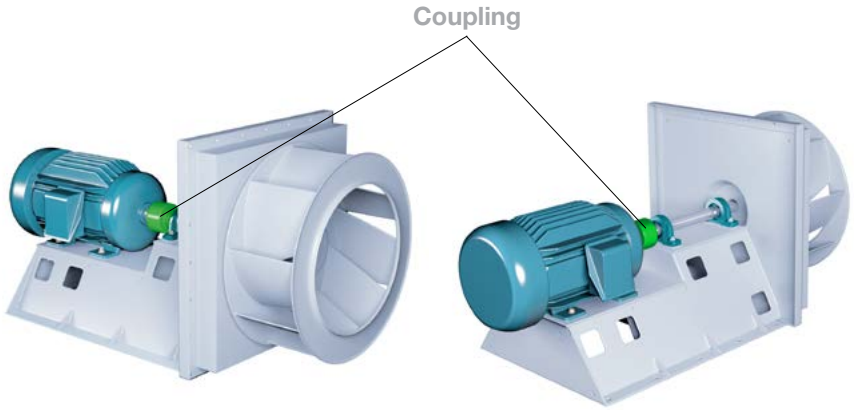
Arrangement 4P

Direct Drive - **P**edestal Plug
Impeller Mounted to Motor Shaft
Fan is floor mounted



Arrangement 8

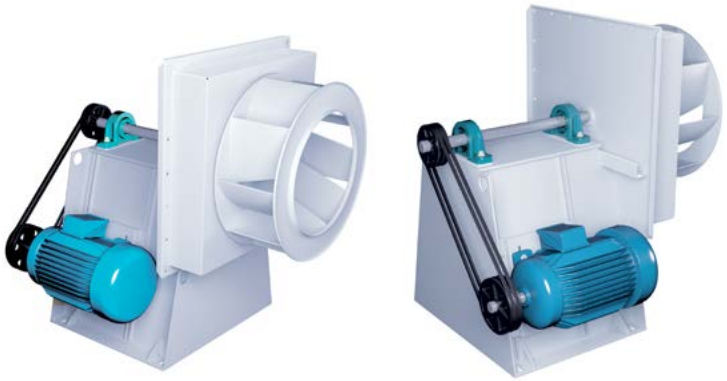
Direct Drive
Motor Coupled to Fan Shaft
Fan is wall mounted



Arrangement 8P

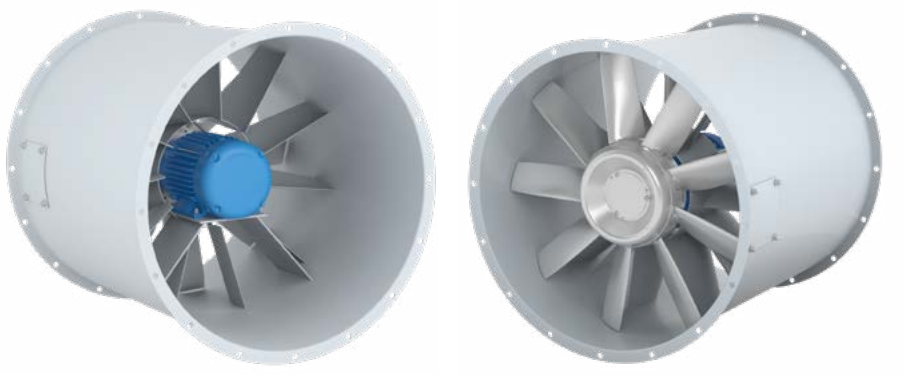
Direct Drive - **P**edestal Plug
Motor Coupled to Fan Shaft
Fan is floor mounted

Arrangement 9
Belt Driven
Fan is wall mounted

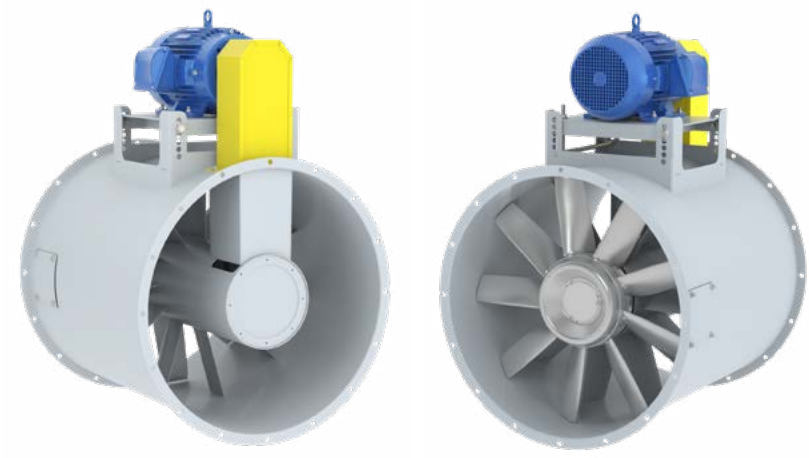


Arrangement 9P
Belt Driven - Pedestal Plug
Motor Mounted on Pedestal
Fan is floor mounted

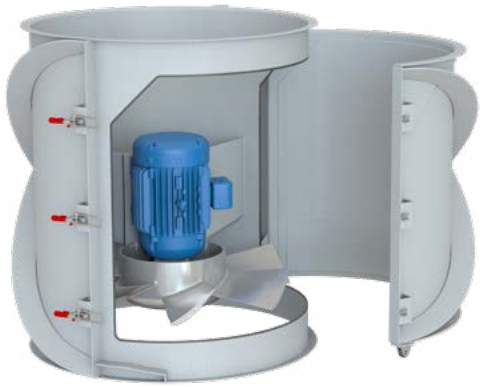
ARRANGEMENTS
AXIAL & INLINE CENTRIFUGAL FANS



Arrangement 4
Direct Drive
Impeller Mounted to Motor Shaft



Arrangement 9
Belt Driven



Arrangement 4CS
Direct Drive - Clamshell Construction

Arrangement 4SO
Direct Drive - Swingout Construction

Arrangement 9CS
Belt Driven - Clamshell Construction

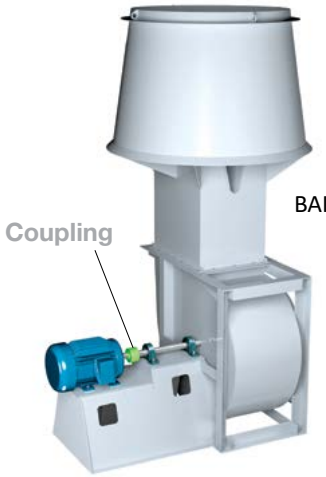
Arrangement 9SO
Belt Driven - Swingout Construction

NOTE: Axial Fans shown. Inline Centrifugal Fans are available with the same arrangements but use different impellers.

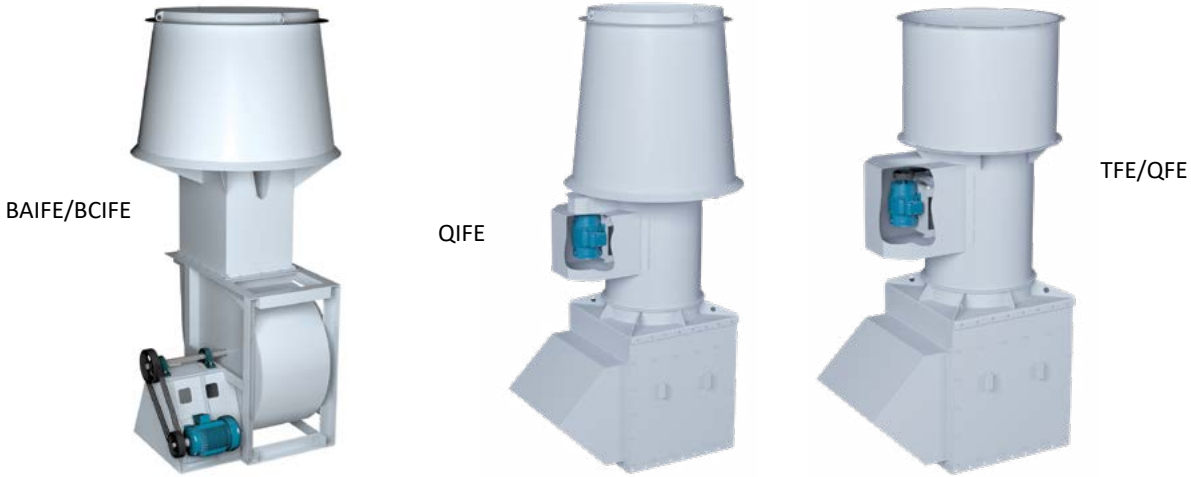
ARRANGEMENTS
FUME EXHAUST FANS

Arrangement 1
Belt Driven

Arrangement 4
Direct Drive



Arrangement 8
Direct Drive

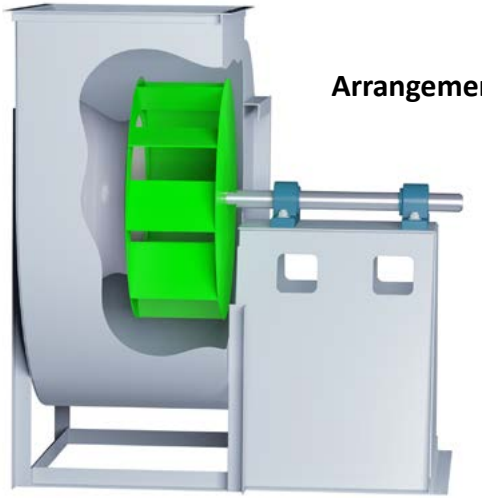


Arrangement 9
Belt Driven

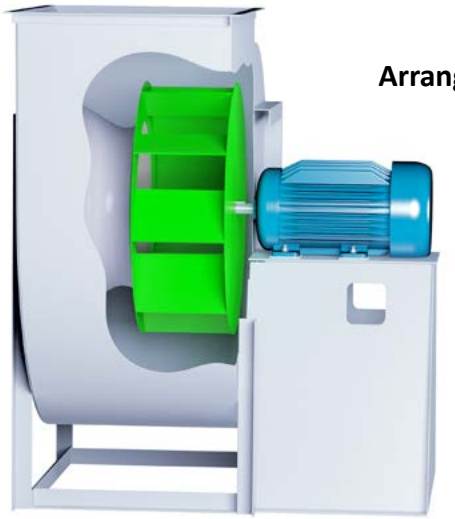
Arrangement 10
Belt Driven

IMPELLER ORIENTATION
CENTRIFUGAL FANS

Overhung Impeller
(impeller overhung on shaft)

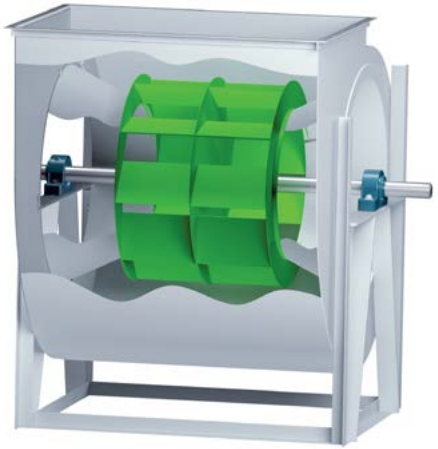


Arrangements 1, 8, 9, 10

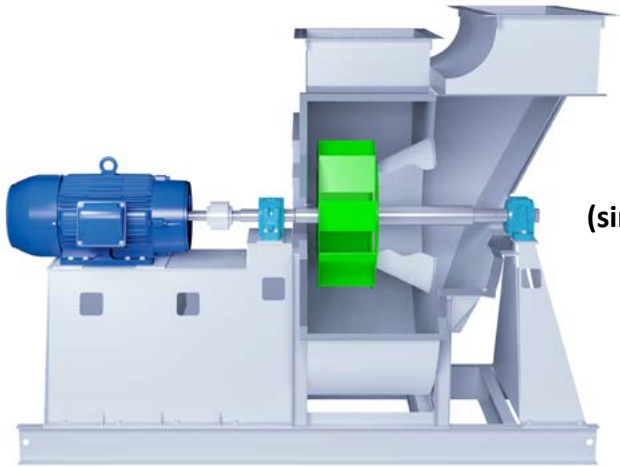


Arrangement 4

Center Hung Impeller
(impeller between the bearings)

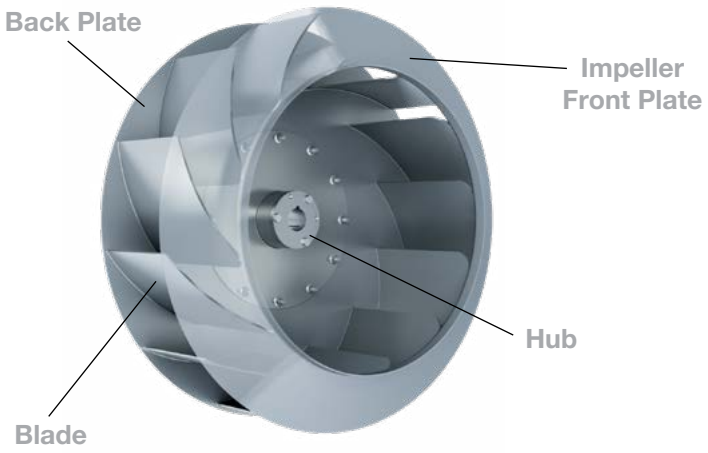


Arrangement 3
(single and double width)

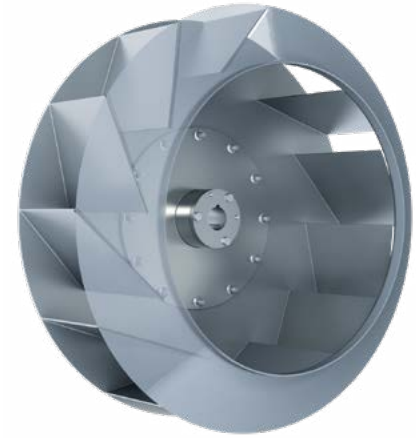


Arrangement 7
(single and double width)

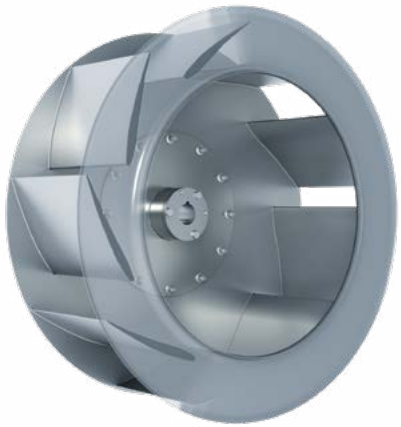
IMPELLER TYPES
CENTRIFUGAL



Backward Curved
Impeller with single thickness,
backward curved blades

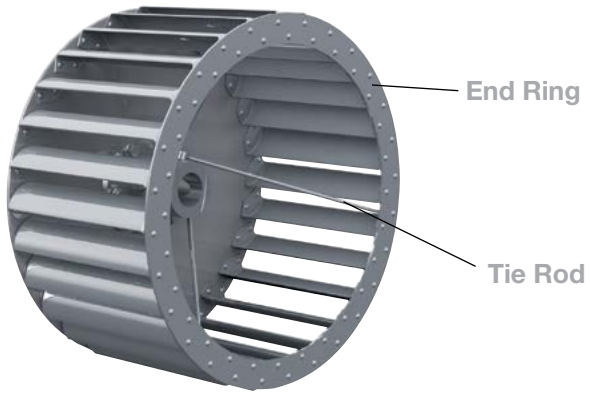


Backward Inclined
Impeller with flat, single thickness,
backward inclined blades



Airfoil
Impeller with airfoil,
backward inclined blades

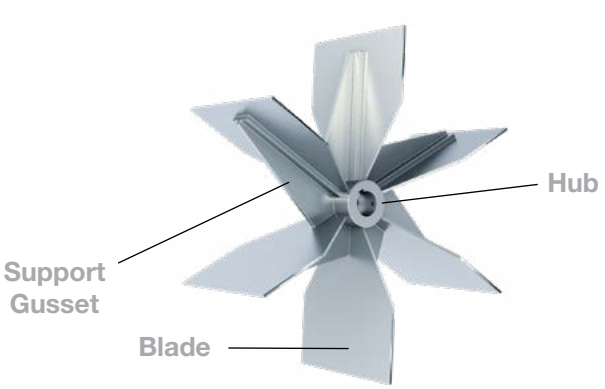
Radial Tip
Impeller with blade design curved forward at the
entering edge and radial at the tip of the leaving edge



Forward Curved
Impeller with single thickness,
forward curved blades

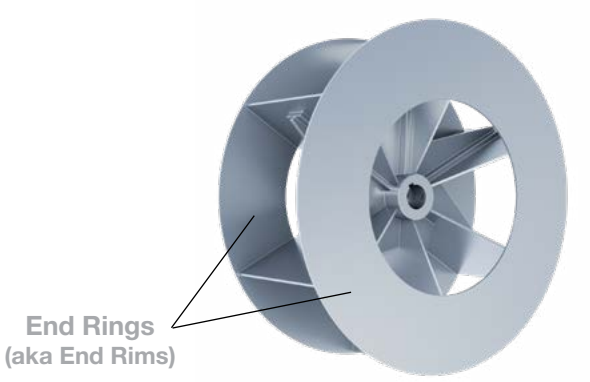
See *Discharges & Impeller Rotation* section for more information.

IMPELLER TYPES
CENTRIFUGAL & MIXED FLOW



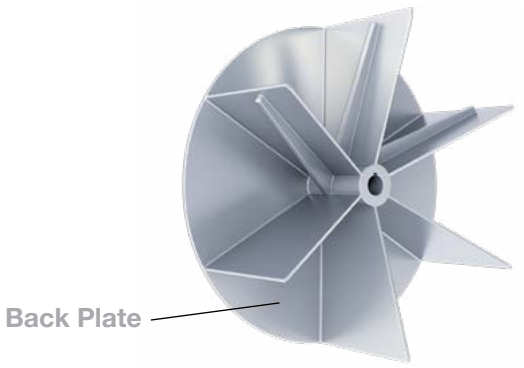
Radial Bladed
Paddle Impeller (Open Type)

Impeller with single thickness, radial paddle type blades



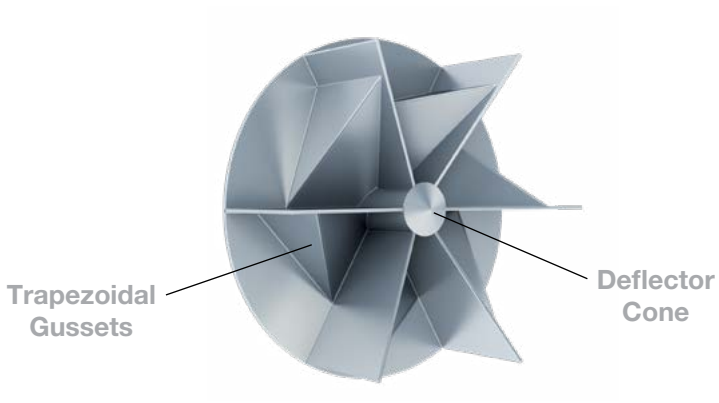
Radial Bladed
Paddle Impeller

Similar to the open type radial impeller design, except with the addition of front and back end rings



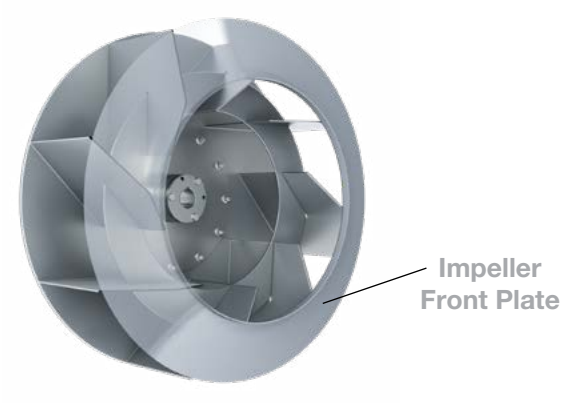
Radial Bladed
Material Handling Impeller (Wool)

Similar to the open type radial impeller design, except with a full back plate



Radial Bladed
Paper Handling Impeller

Constructed with full back plate gussets for extra rugged durability



Radial Bladed
Air Handling Impeller

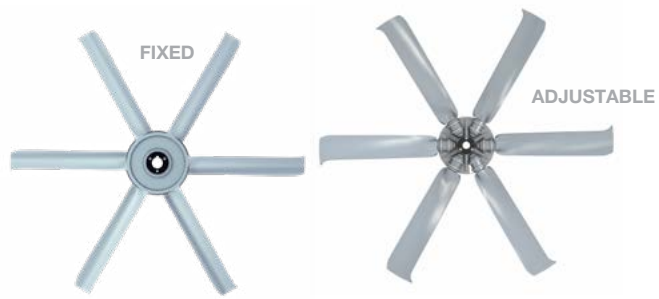
Constructed with heavy-gauge blades welded to both back plate and impeller front plate

Mixed Flow

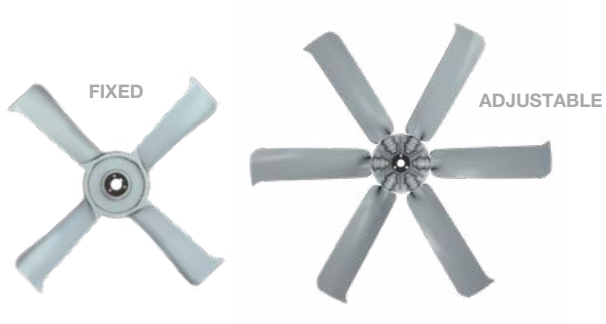
Airfoil blades taper from impeller front plate to hub end resulting in a larger tip width

See *Discharges & Impeller Rotation* section for more information.

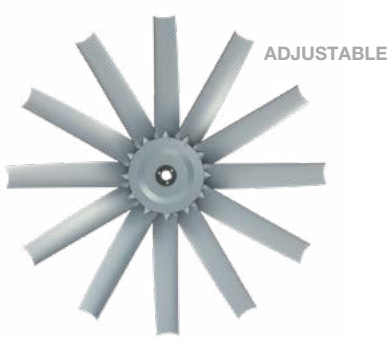
IMPELLER TYPES
AXIAL



"C Series" Impeller (Adjustable only)

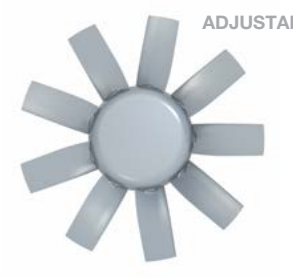


"L" Impeller (Fixed Pitch only)
"C / E" Impeller (Adjustable only)

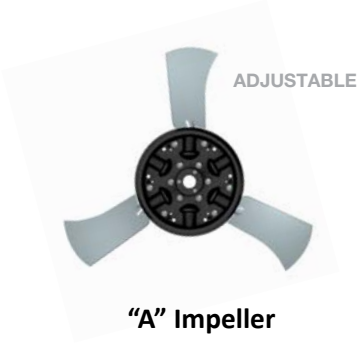


"B Series" Impeller (Backswept)

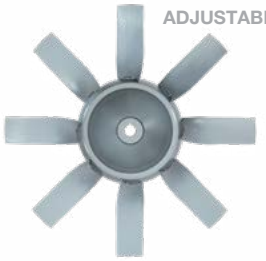
"E Series" Impeller



"TCVX" Impeller



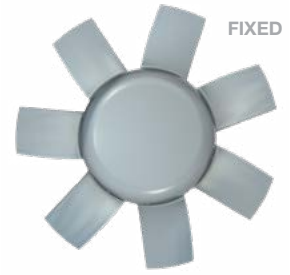
"A" Impeller



"AXIAD" Impeller

IMPELLER TYPES
AXIAL

"TCTS" Impeller



"TCTA" Impeller

"Z Series" Impeller

"L Series" Impeller

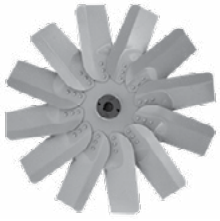
Purchased Impellers

Type "S"

Type "X"

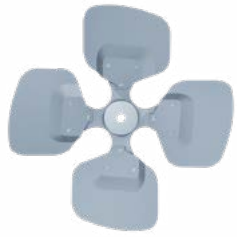
Type "A"

Type "Y" and "ES"



Type "F"

Type "G"

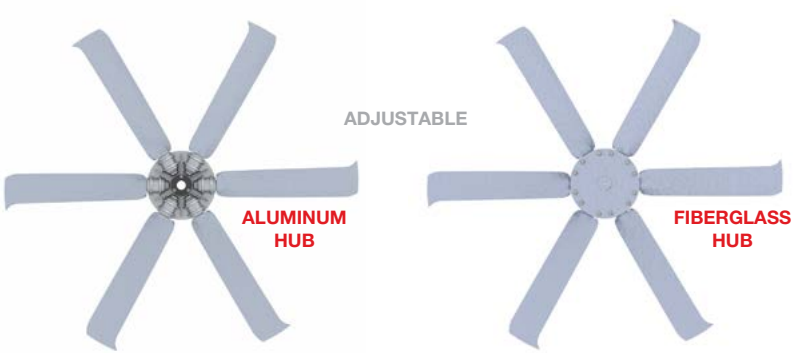


"TCPE" Impeller

FIBERGLASS

"TF" Impeller

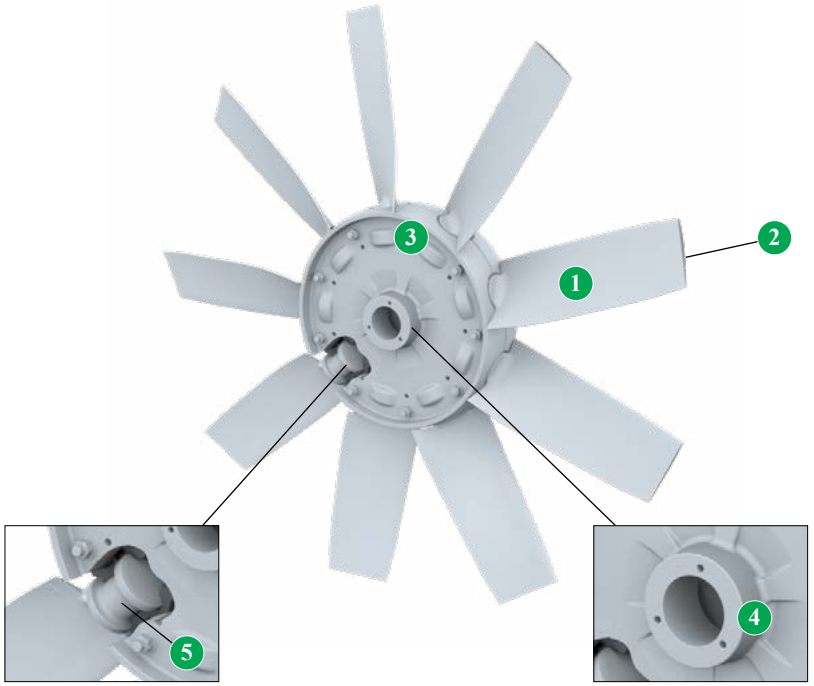
"FG7" Impeller



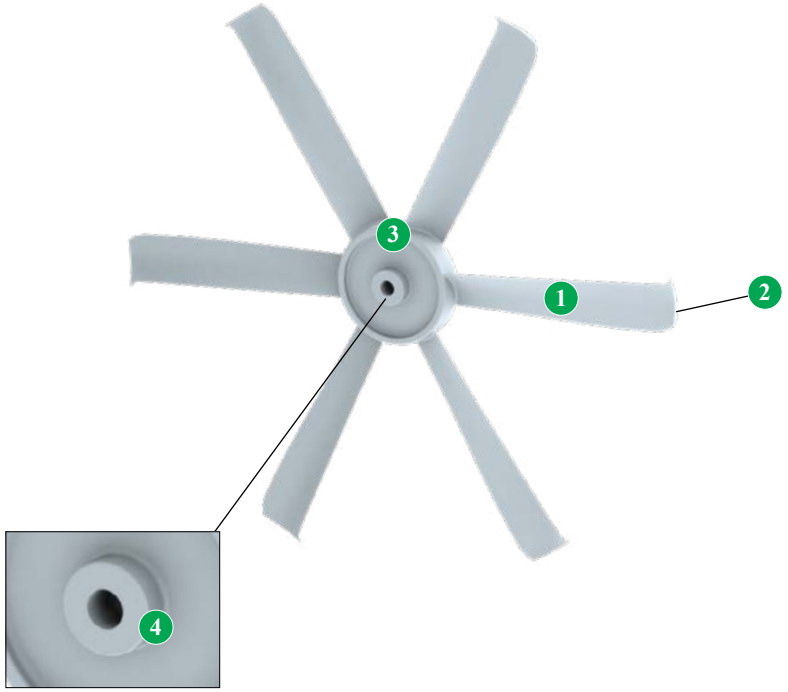
"F4/F6" (Aluminum Hub) and "FG4/FG6" (Fiberglass Hub) Impellers

IMPELLERS OVERVIEW
AXIAL

1 BLADE 2 BLADE TIP 3 HUB 4 HUB BOSS 5 SHANK



Adjustable Pitch Impellers



Fixed Pitch Impellers (Cast or Fabricated)

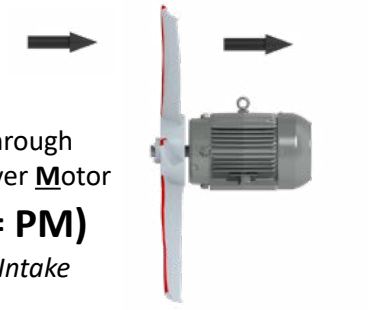
Steps for Configuring an Axial Fan

Step #1

Select the model/impeller type
(i.e. Model TCTA with "TCTA" Impeller)

Step #2

What direction do you want the air to flow?

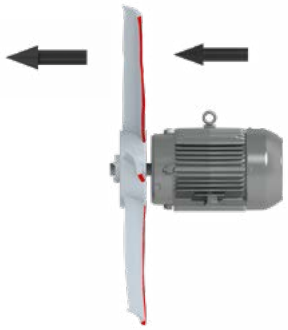


air passing through
ImPeller then over Motor

(Airflow = PM)

aka: Hub on Intake

or



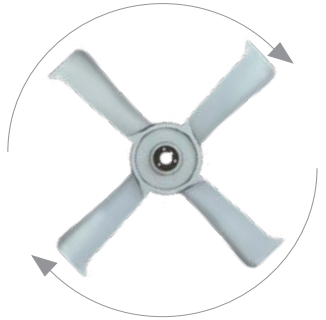
air passing over Motor
then through ImPeller

(Airflow = MP)

aka: Hub on Discharge

Step #3

Which direction does the impeller need to rotate to achieve the desired airflow direction?



See *Impeller Types* section and *Impellers: Airflow & Rotation* section for more information.

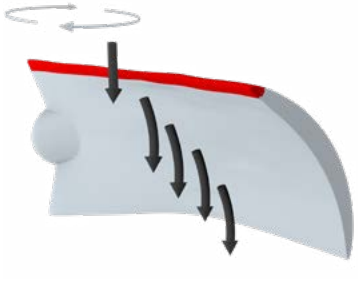
ADJUSTABLE PITCH IMPELLERS *(AIRFLOW = PM)*

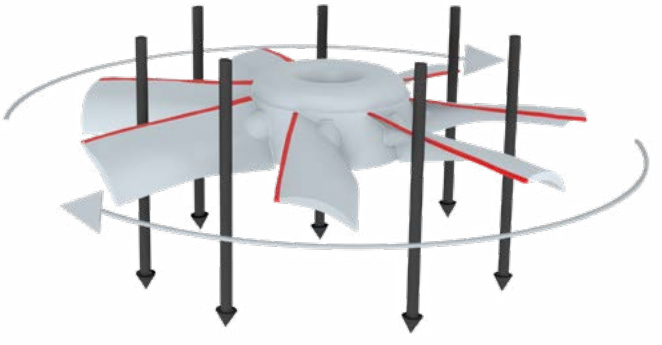
AXIAL

Airflow Direction

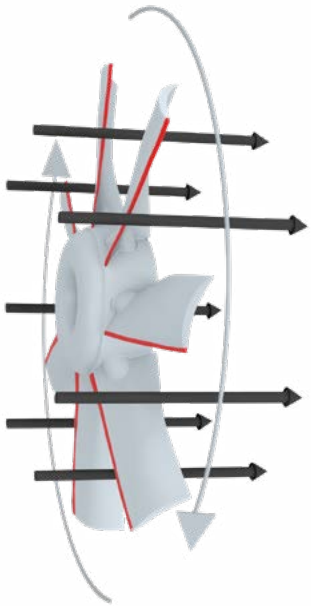
Leading Edge of Blade

- Air is drawn through the impeller from the leading edge of the blades.
- The concave side of the blade cups the air and pushes it away from the impeller.





LH Rotation

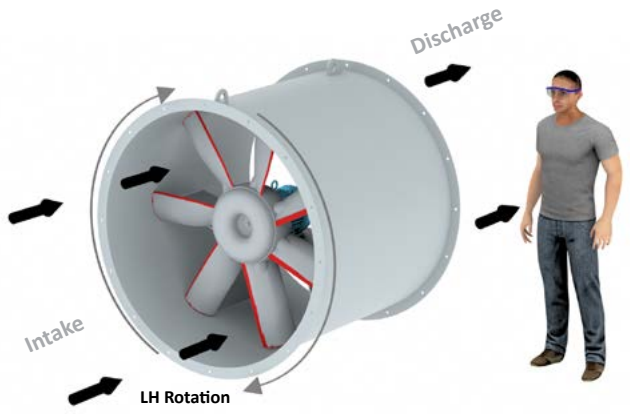


AIRFLOW = PM
(AIR THROUGH IMPELLER THEN MOTOR)

Rotation is determined by viewing the impeller from the discharge side of the fan.

Intake Side

Airflow Direction
air passes through
ImPeller then over Motor
(Airflow = PM)
aka: Hub on Intake



NOTE 1: Airflow direction and rotation must be correct for the fan to operate at 100% performance.

NOTE 2: **If the impeller rotates in the wrong direction, you will not get any airflow in the proper direction.**

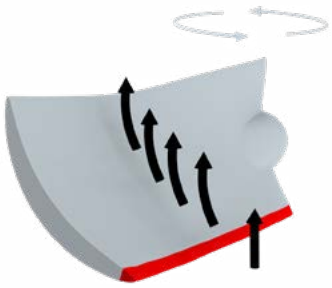
AXIAL

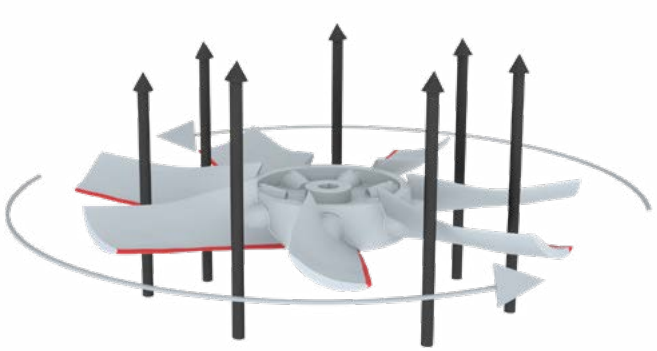
ADJUSTABLE PITCH IMPELLERS *(AIRFLOW = MP)*

Airflow Direction

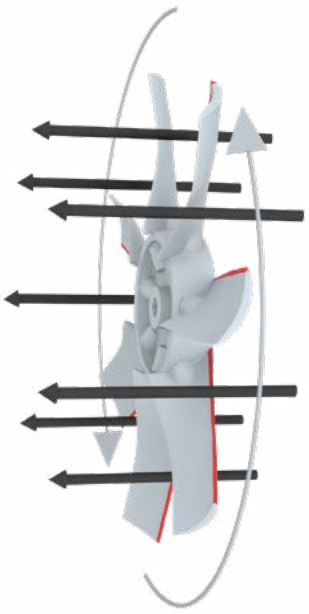
Leading Edge of Blade

- Air is drawn through the impeller from the leading edge of the blades.
- The concave side of the blade cups the air and pushes it away from the impeller.





LH Rotation

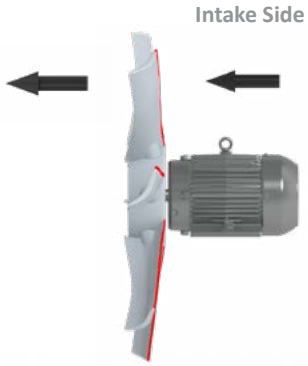


NOTE 1: Airflow direction and rotation must be correct for the fan to operate at 100% performance.

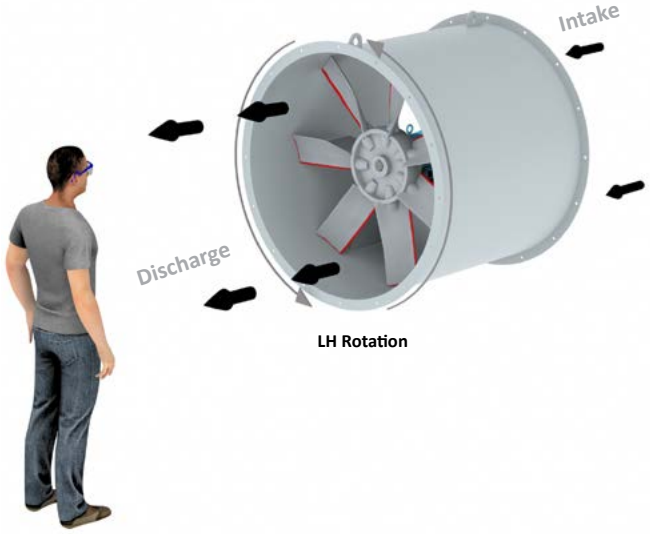
NOTE 2: **If the impeller rotates in the wrong direction, you will not get any airflow in the proper direction.**

AIRFLOW = MP
(AIR OVER MOTOR THEN IMPELLER)

Rotation is determined by viewing the impeller from the discharge side of the fan.



Airflow Direction
air passes over **M**otor then through Im**P**eller
(Airflow = MP)
aka: Hub on Discharge



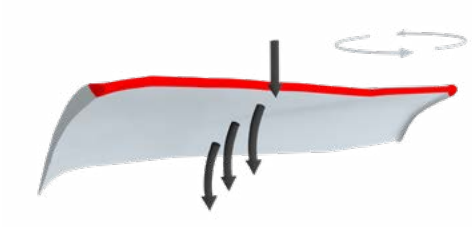
FIXED PITCH IMPELLERS - Cast/Fabricated *(AIRFLOW = PM)*

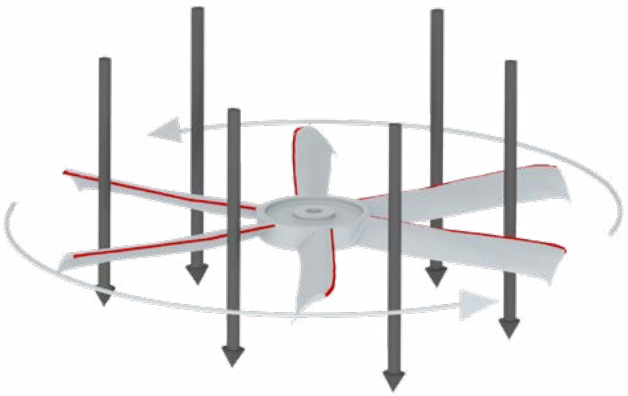
AXIAL

Airflow Direction

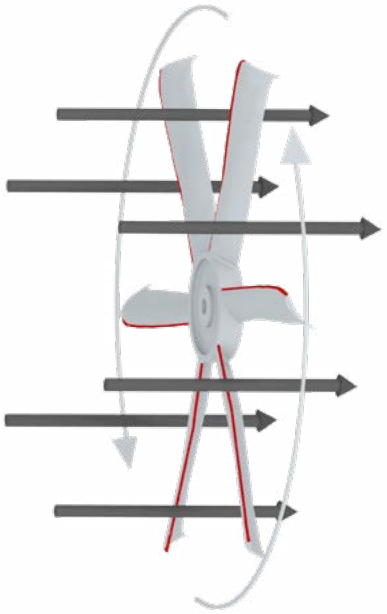
Leading Edge of Blade

- Air is drawn through the impeller from the leading edge of the blades.
- The concave side of the blade cups the air and pushes it away from the impeller.





RH Rotation



NOTE 1: Airflow direction and rotation must be correct for the fan to operate at 100% performance.

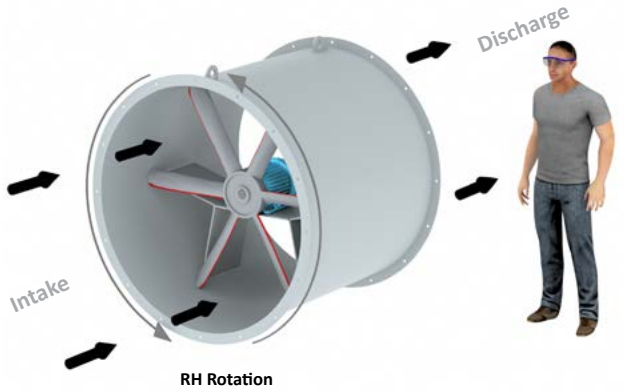
NOTE 2: **If the impeller rotates in the wrong direction, you will not get any airflow in the proper direction.**

AIRFLOW = PM
(AIR THROUGH IMPELLER THEN MOTOR)

Rotation is determined by viewing the impeller from the discharge side of the fan.

Intake Side

Airflow Direction
air passes through
ImPeller then over Motor
(Airflow = PM)
aka: Hub on Intake



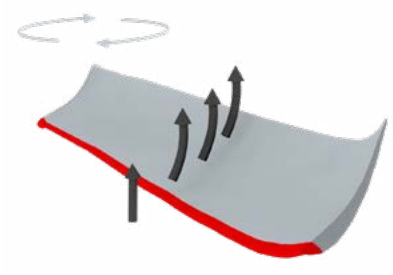
FIXED PITCH IMPELLERS - Cast/Fabricated *(AIRFLOW = MP)*

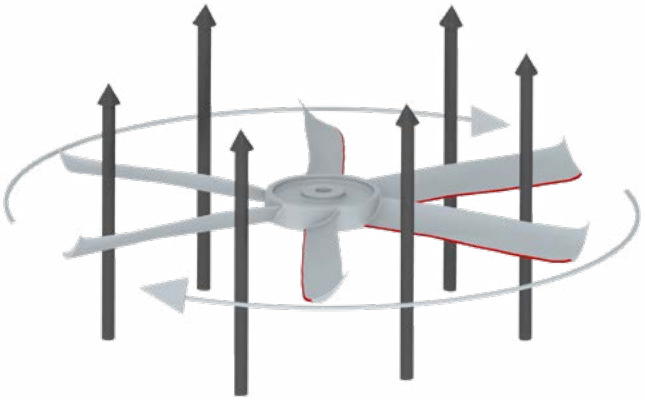
AXIAL

Airflow Direction

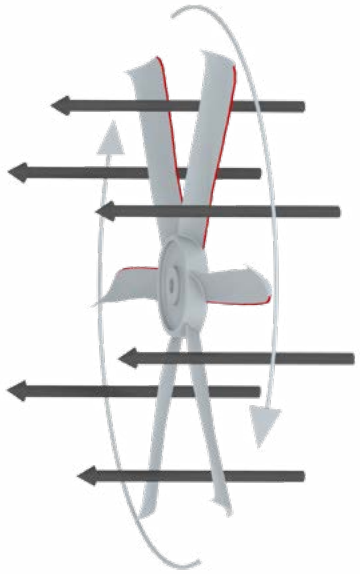
Leading Edge of Blade

- Air is drawn through the impeller from the leading edge of the blades.
- The concave side of the blade cups the air and pushes it away from the impeller.



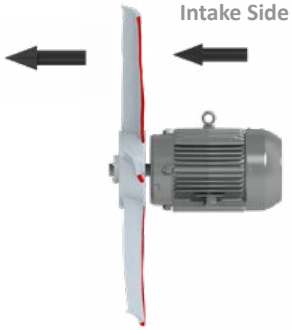


RH Rotation

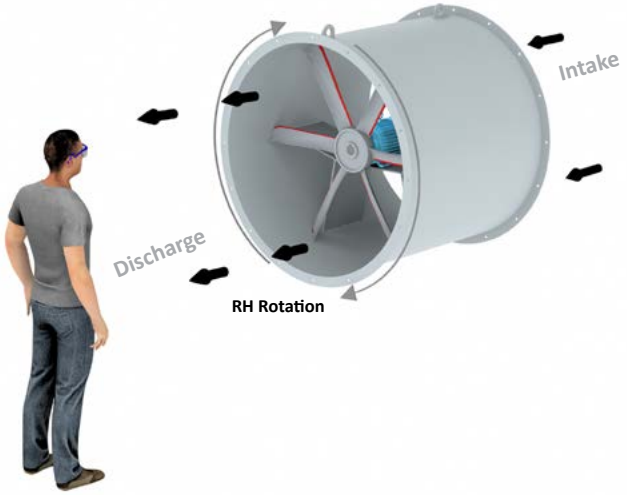


AIRFLOW = MP
(AIR OVER MOTOR THEN IMPELLER)

Rotation is determined by viewing the impeller from the discharge side of the fan.



Airflow Direction
air passes over **M**otor
then through Im**P**eller
(Airflow = MP)
aka: Hub on Discharge



NOTE 1: Airflow direction and rotation must be correct for the fan to operate at 100% performance.

NOTE 2: **If the impeller rotates in the wrong direction, you will not get any airflow in the proper direction.**

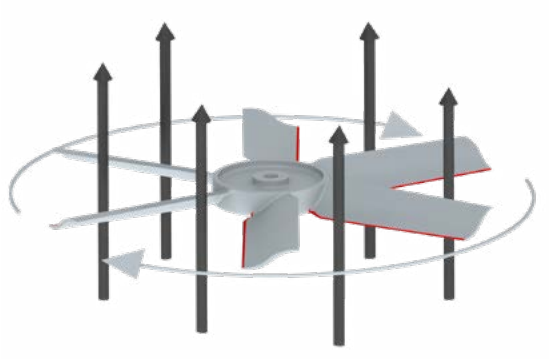
REVERSIBLE IMPELLERS

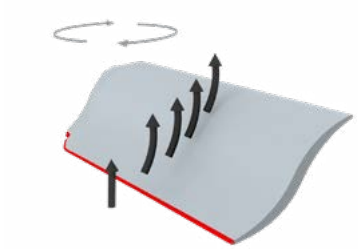
AXIAL

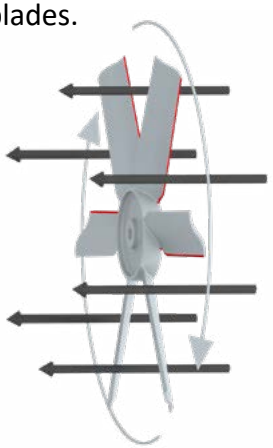
Airflow Direction

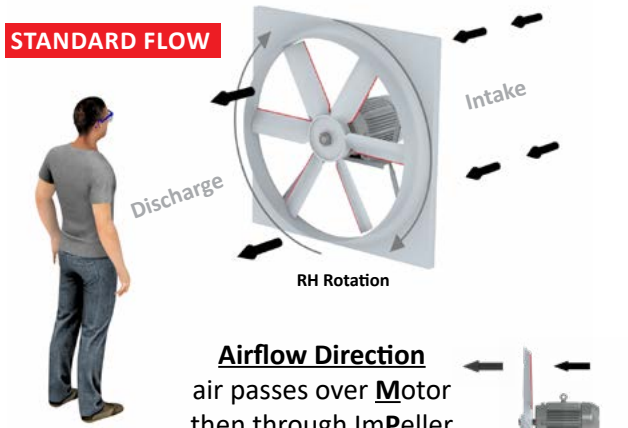
Leading Edge of Blade (Standard Flow)

- Air is drawn through the impeller from the leading edge of the blades.







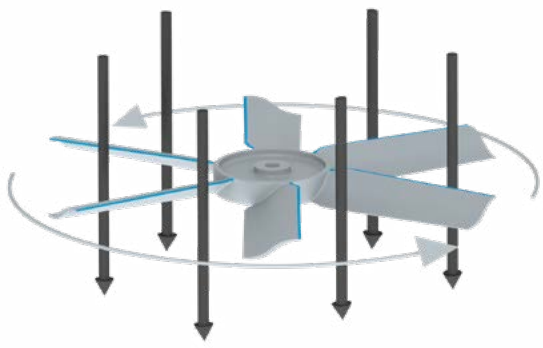


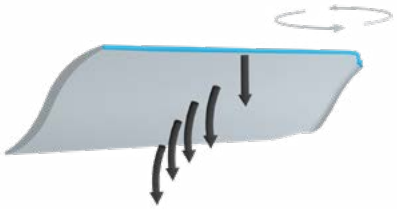
Airflow Direction
air passes over **M**otor
then through Im**P**eller
(Airflow = MP)
aka: Hub on Discharge

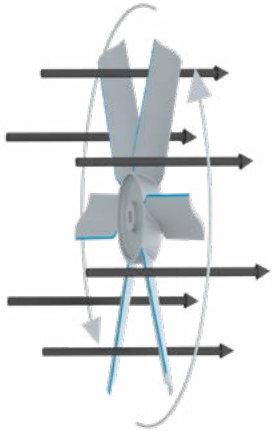
Airflow Direction

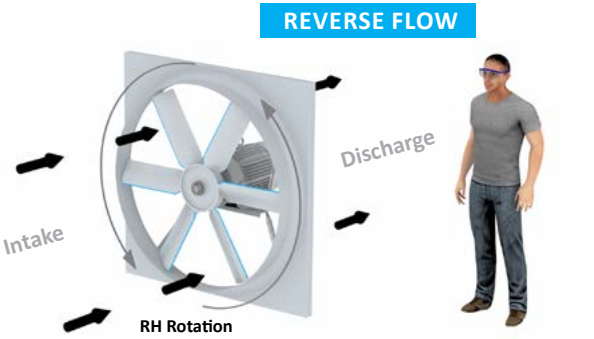
Leading Edge of Blade (Reverse Flow)

- Air is drawn through the impeller from the leading edge of the blades.









Airflow Direction
air passes through
Im**P**eller then over **M**otor
(Airflow = PM)
aka: Hub on Intake

Rotation is determined by viewing the impeller from the discharge side of the fan.

AXIAL

ADJUSTABLE TYPE IMPELLERS

LEFT HAND ADJUSTABLE PITCH IMPELLERS

Left Hand (LH) Rotation
Standard Bore Hub *MP Airflow*

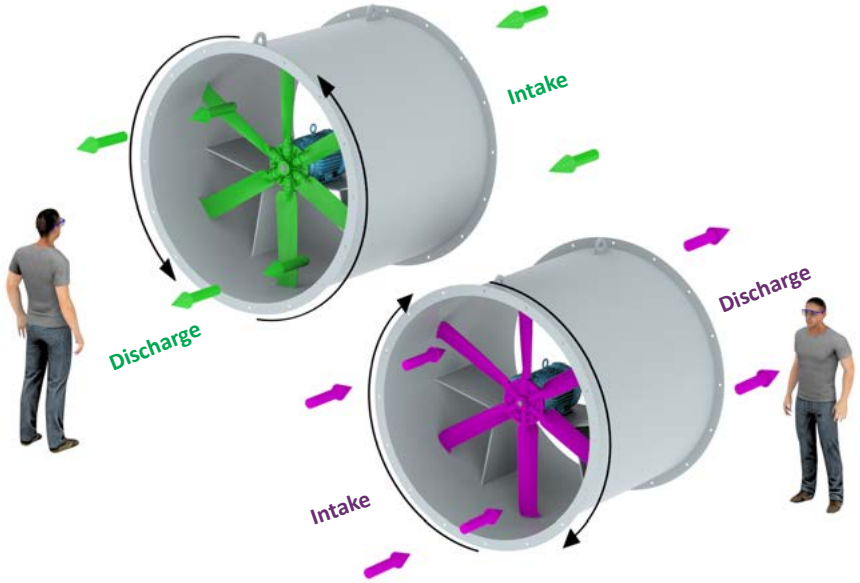
Left Hand (LH) Rotation
Reverse Bore Hub *PM Airflow*

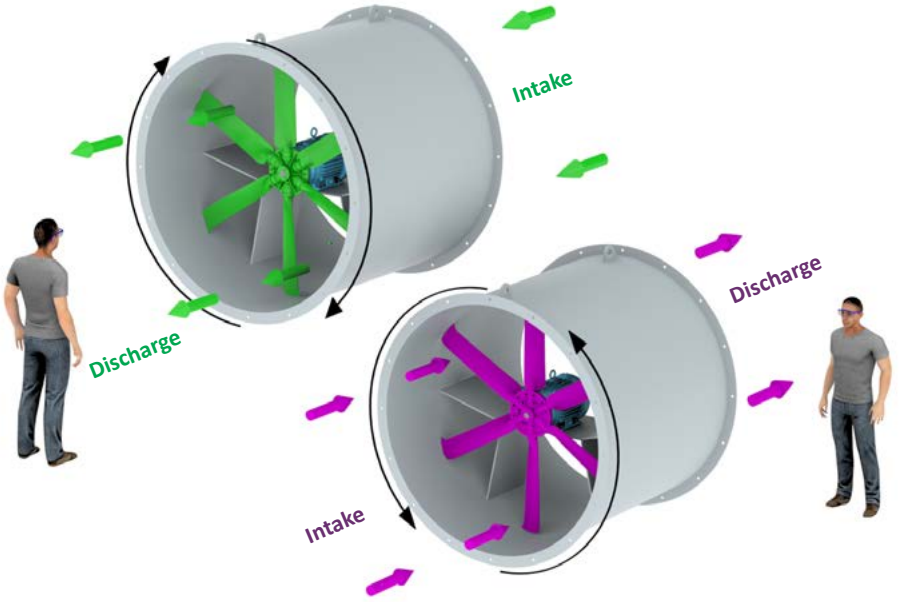
STANDARD AIRFLOW (MP)
air passes over **M**otor then through Im**P**eller
aka: Hub on Discharge

RIGHT HAND ADJUSTABLE PITCH IMPELLERS

Right Hand (RH) Rotation
Standard Bore Hub *MP Airflow*

Right Hand (RH) Rotation
Reverse Bore Hub *PM Airflow*





Rotation is determined by viewing the impeller from the discharge side of the fan.

AXIAL

FIXED TYPE IMPELLERS

LEFT HAND FIXED IMPELLERS (CAST)

Left Hand (LH) Rotation
Standard Bore Hub *MP Airflow*

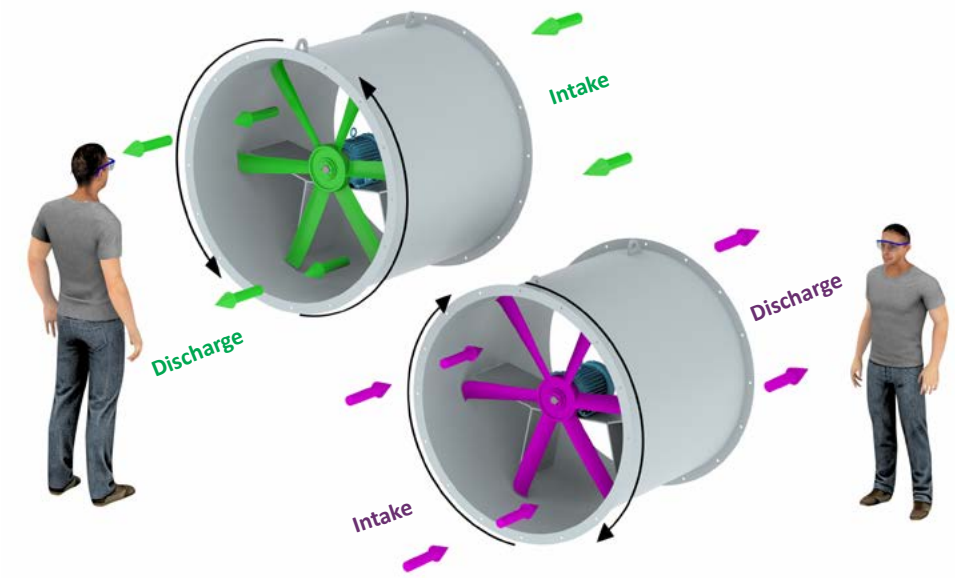
Left Hand (LH) Rotation
Reverse Bore Hub *PM Airflow*

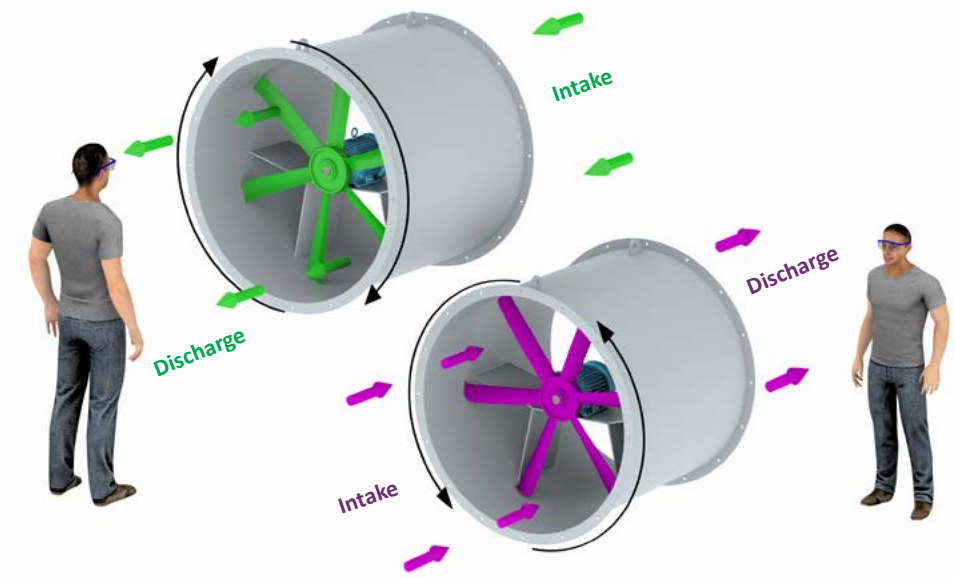
STANDARD AIRFLOW (MP)
air passes over **M**otor then through Im**P**eller
aka: Hub on Discharge

RIGHT HAND FIXED IMPELLERS (CAST)

Right Hand (RH) Rotation
Standard Bore Hub *MP Airflow*

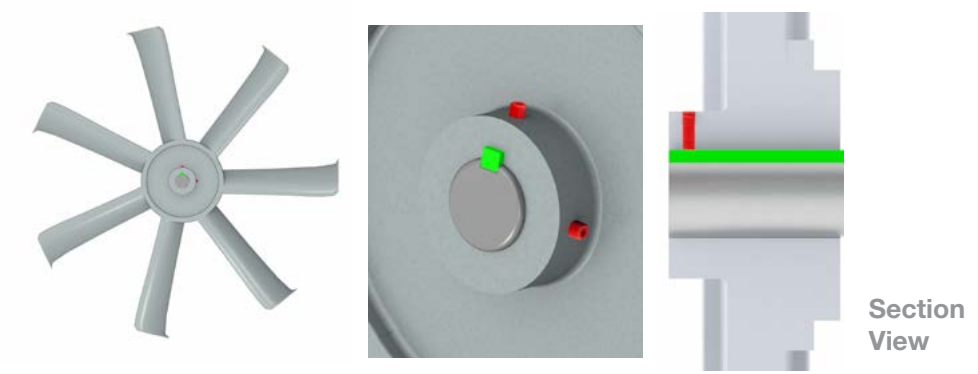
Right Hand (RH) Rotation
Reverse Bore Hub *PM Airflow*



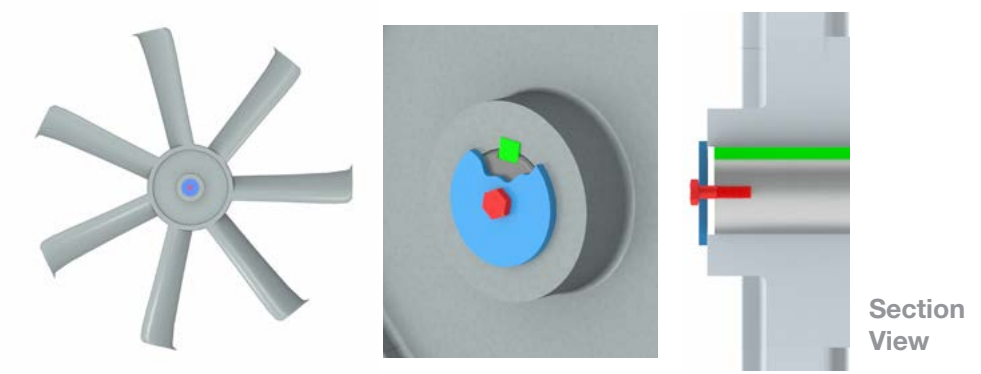


Rotation is determined by viewing the impeller from the discharge side of the fan.

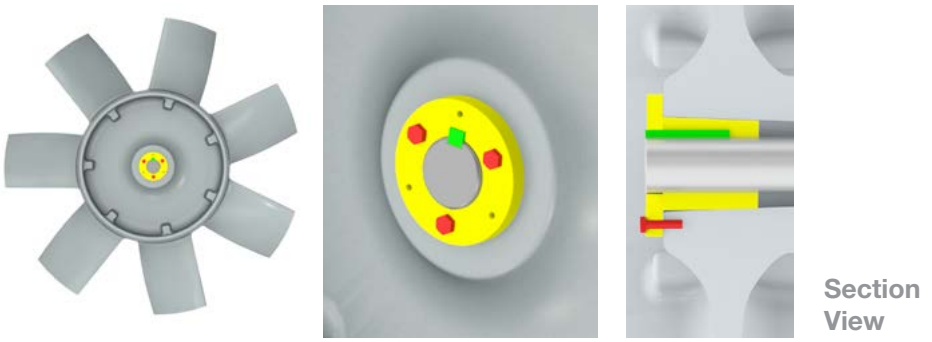
HUB TYPES
AXIAL



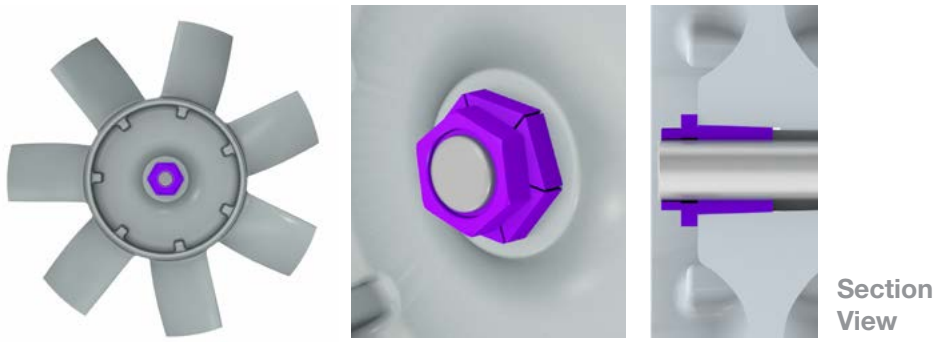
STRAIGHT BORE HUB
(WITH KEY AND SET SCREWS)



STRAIGHT BORE HUB
(WITH KEY, RETAINING WASHER AND BOLT)



TAPER LOCK HUB/BUSHING
(WITH KEY AND HARDWARE)



TRANTORQUE HUB/BUSHING

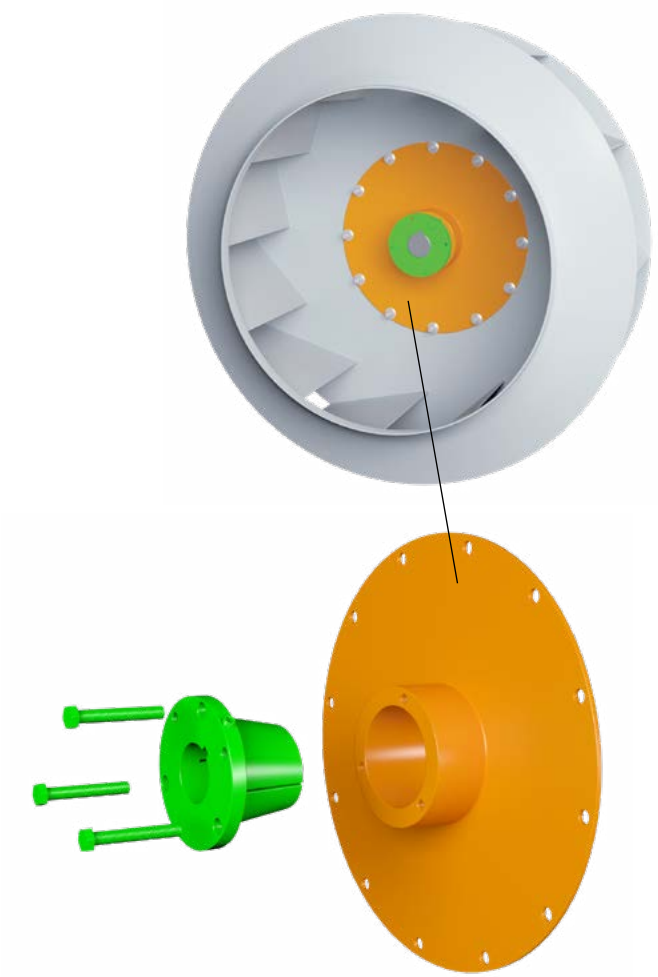
KEY | RETAINING WASHER | HARDWARE | TAPER LOCK BUSHING | TRANTORQUE BUSHING

STRAIGHT BORE HUB
(WITH SET SCREWS)

The bore of the hub is straight through. Shafts are keyed and mounted to the hub.

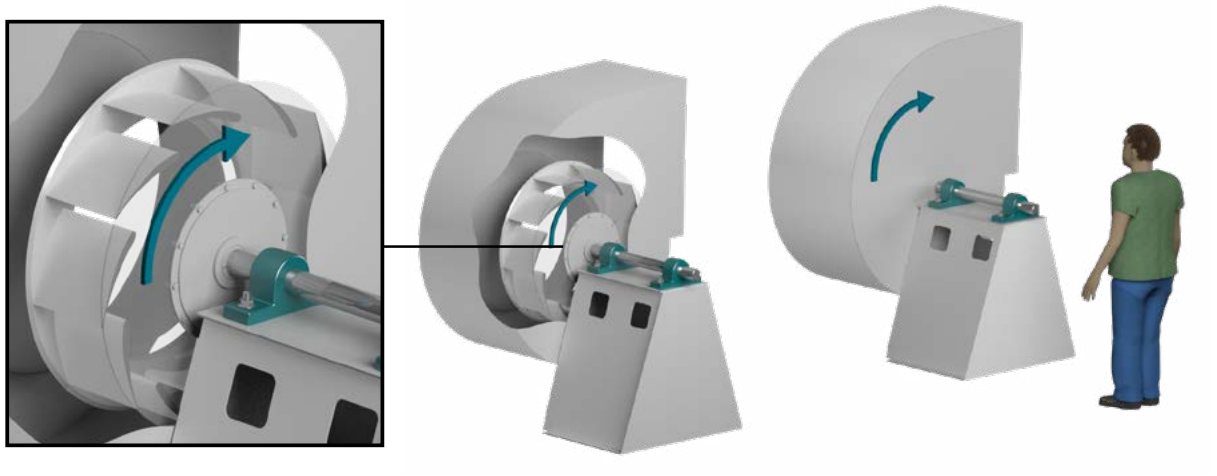
TAPER LOCK HUB
(WITH BUSHING)

The hub bore is tapered with respect to the fan shaft. The hub is locked to the shaft using a tapered bushing.



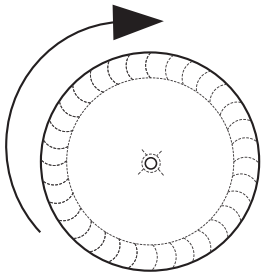
DISCHARGES & IMPELLER ROTATION

SWSI CENTRIFUGAL FANS

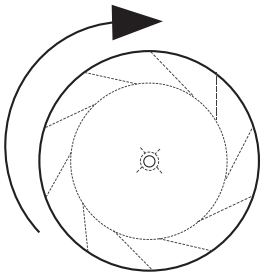


CLOCKWISE (CW)

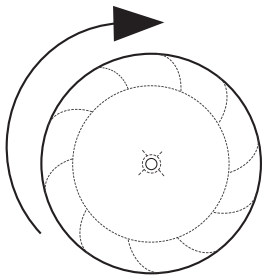
ROTATION VIEW **FROM DRIVE SIDE**



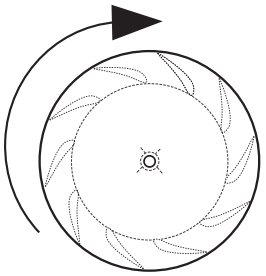
Forward Curved



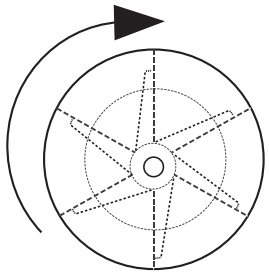
Backward Inclined



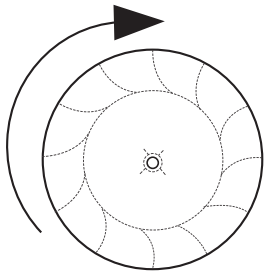
Backward Curved



Airfoil



Radial Bladed



Radial Tip

UBD
Upblast
CW 360

Also known as:
- Clockwise 360°

TAU
Top Angular Up
CW 45

Also known as:
- Clockwise 45°

THD
Top Horizontal
CW 90

Also known as:
- Clockwise 90°

TAD
Top Angular Down
CW 135

Also known as:
- Clockwise 135°

DBD
Downblast
CW 180

Also known as:
- Clockwise 180°

BAD
Bottom Angular Down
CW 225

Also known as:
- Clockwise 225°

BHD
Bottom Horizontal
CW 270

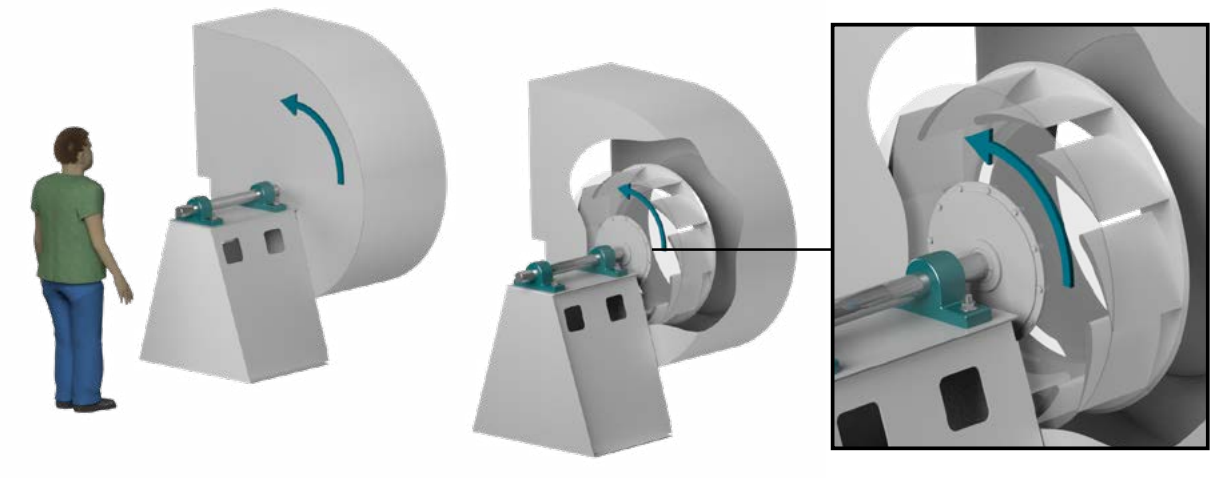
Also known as:
- Clockwise 270°

BAU
Bottom Angular Up
CW 315

Also known as:
- Clockwise 315°

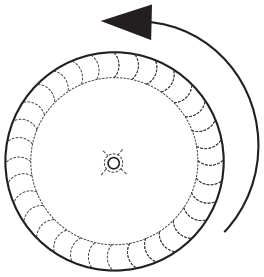
DISCHARGES & IMPELLER ROTATION

SWSI CENTRIFUGAL FANS

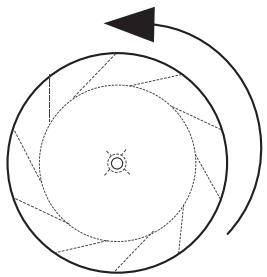


COUNTERCLOCKWISE (CCW)

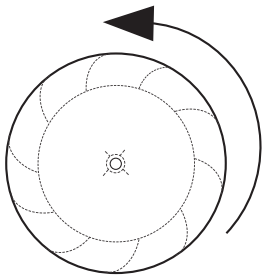
ROTATION VIEW **FROM DRIVE SIDE**



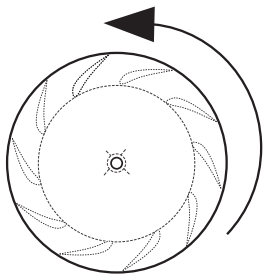
Forward Curved



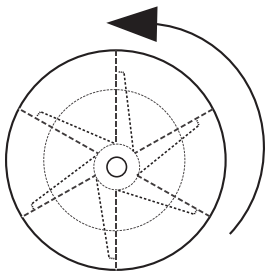
Backward Inclined



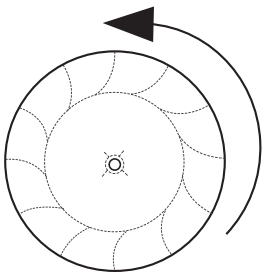
Backward Curved



Airfoil



Radial Bladed



Radial Tip

UBD
Upblast
CCW 360

Also known as:
- Counterclockwise 360°

TAU
Top Angular Up
CCW 45

Also known as:
- Counterclockwise 45°

THD
Top Horizontal
CCW 90

Also known as:
- Counterclockwise 90°

TAD
Top Angular Down
CCW 135

Also known as:
- Counterclockwise 135°

DBD
Downblast
CCW 180

Also known as:
- Counterclockwise 80°

BAD
Bottom Angular Down
CCW 225

Also known as:
- Counterclockwise 225°

BHD
Bottom Horizontal
CCW 270

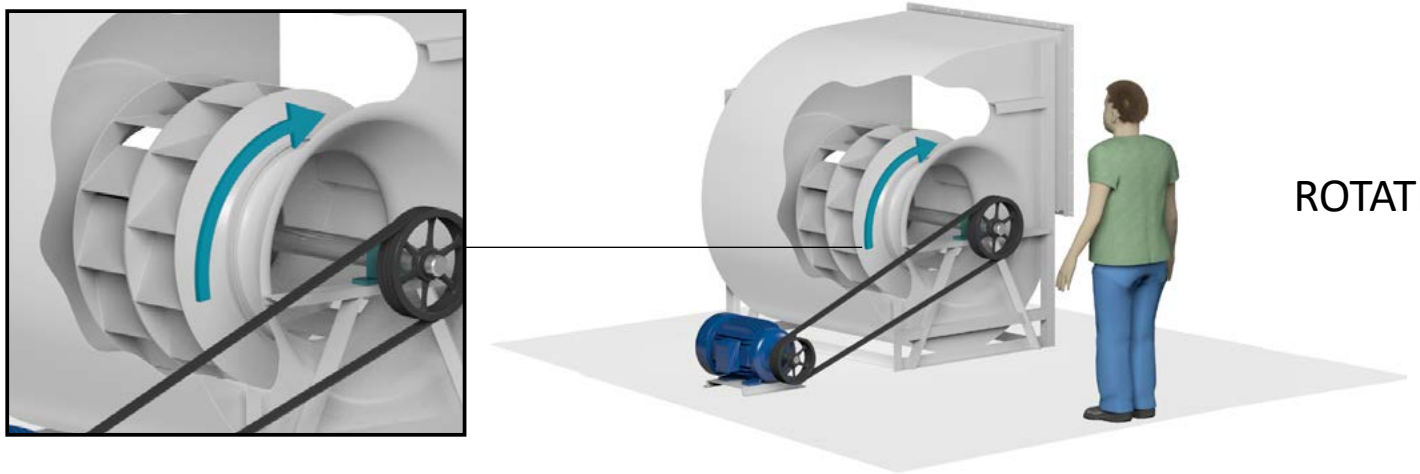
Also known as:
- Counterclockwise 270°

BAU
Bottom Angular Up
CCW 315

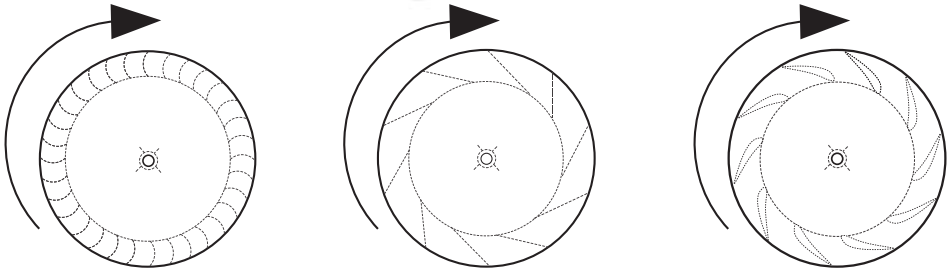
Also known as:
- Counterclockwise 315°

DISCHARGES & IMPELLER ROTATION

DWDI CENTRIFUGAL FANS



CLOCKWISE (CW)
ROTATION VIEW **FROM DRIVE SIDE**



Forward Curved | **Backward Inclined** | **Airfoil**

UBD
Upblast
CW 360
Also known as:
- Clockwise 360°

TAU
Top Angular Up
CW 45
Also known as:
- Clockwise 45°

THD
Top Horizontal
CW 90
Also known as:
- Clockwise 90°

TAD
Top Angular Down
CW 135
Also known as:
- Clockwise 135°

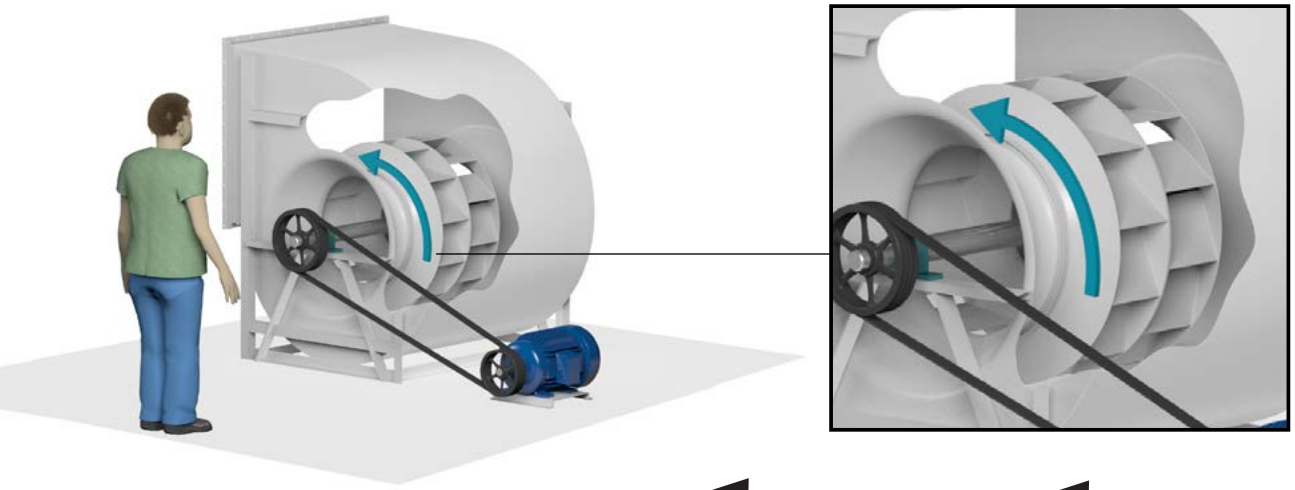
DBD
Downblast
CW 180
Also known as:
- Clockwise 180°

BHD
Bottom Horizontal
CW 270
Also known as:
- Clockwise 270°

BAU
Bottom Angular Up
CW 315
Also known as:
- Clockwise 315°

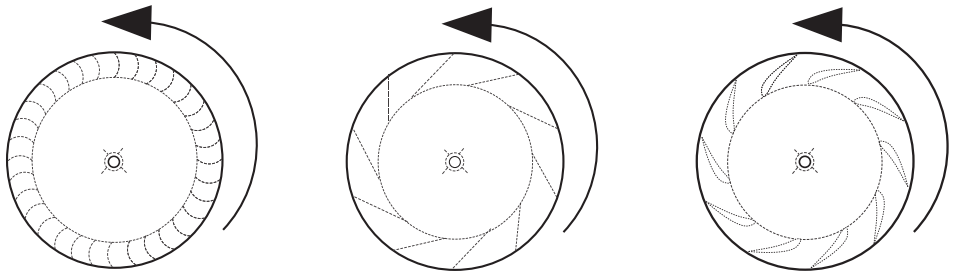
DISCHARGES & IMPELLER ROTATION

DWDI CENTRIFUGAL FANS



COUNTERCLOCKWISE (CCW)

ROTATION VIEW **FROM DRIVE SIDE**



Forward Curved | **Backward Inclined** | **Airfoil**

UBD
Upblast
CCW 360
Also known as:
- Counterclockwise 360°

TAU
Top Angular Up
CCW 45
Also known as:
- Counterclockwise 45°

THD
Top Horizontal
CCW 90
Also known as:
- Counterclockwise 90°

TAD
Top Angular Down
CCW 135
Also known as:
- Counterclockwise 135°

DBD
Downblast
CCW 180
Also known as:
- Counterclockwise 80°

BHD
Bottom Horizontal
CCW 270
Also known as:
- Counterclockwise 270°

BAU
Bottom Angular Up
CCW 315
Also known as:
- Counterclockwise 315°

DISCHARGES
INLINE, MIXED FLOW, AXIAL FANS

HORIZONTAL CONFIGURATIONS

(HOR)
Horizontal
No Brackets

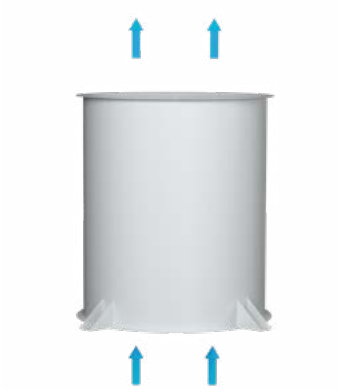
(HCH)
Horizontal
Ceiling Hung

(HBM)
Horizontal
Base Mount

DISCHARGES
INLINE, MIXED FLOW, AXIAL FANS

VERTICAL CONFIGURATIONS

(VUN)
Vertical Up
No Brackets



(VUI)
Vertical Up
Floor Mount Brackets on Inlet

(VUO)
Vertical Up
Ceiling Hung Brackets on Outlet

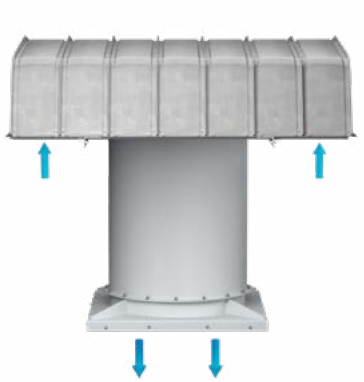
(VUS)
Vertical Up
with Stack Cap

(VUH)
Vertical Up
with Hood

(VDN)
Vertical Down
No Brackets

(VDI)
Vertical Down
Ceiling Hung Brackets on Inlet

(VDO)
Vertical Down
Floor Mount Brackets on Outlet

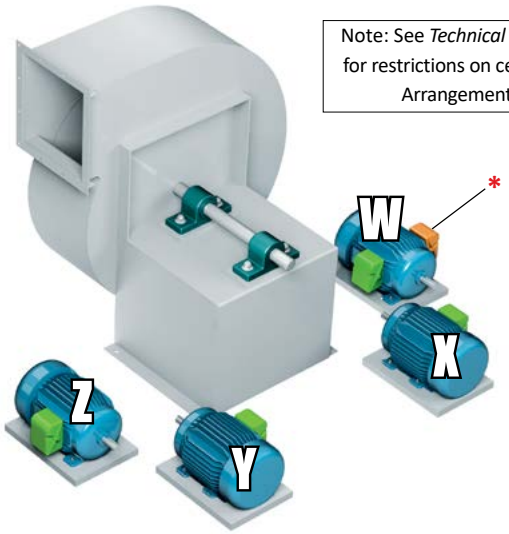


(VDH)
Vertical Down
with Hood

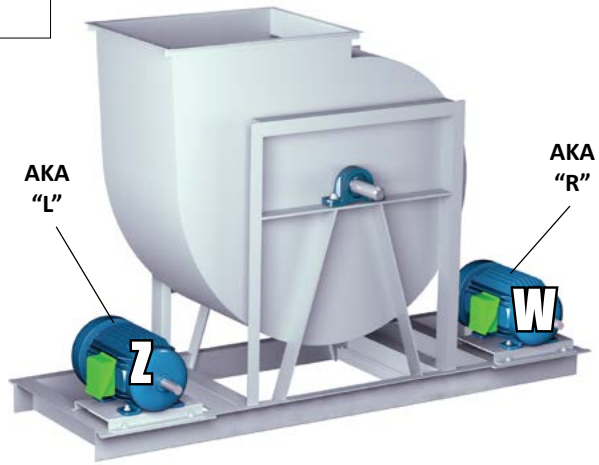
(VRH)
Vertical Reversible
with Hood

MOTOR POSITIONS
CENTRIFUGAL FANS

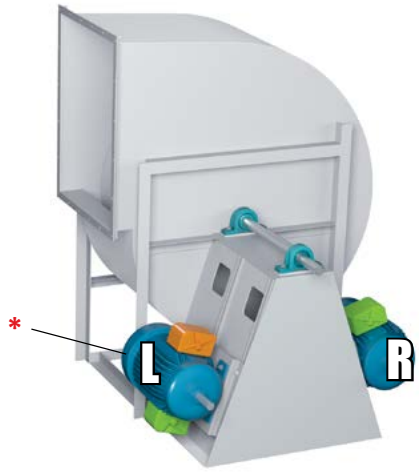
Note: See *Technical Descriptions* section for restrictions on certain discharges for Arrangements 1, 3 and 3F



Arrangements 1 and 3



Arrangement 3F



Arrangement 9
Standard Motor Position: CW (L) / CCW (R)

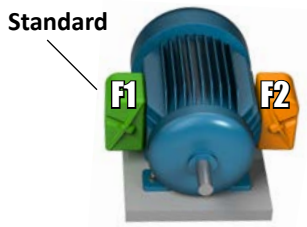
* Motor Position (L) is normally ordered with F1 Conduit Box. *Select F2 if clearance issues.*

Arrangement 9F
Standard Motor Position: CW (L) / CCW (R)

Sizes 122-365 (Vent Sets)
Motor Mounted on Adjustable Plate on Bottom of Pedestal

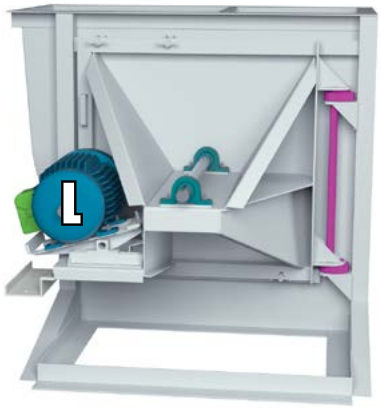
Sizes 402+ (Vent Sets)
Motor Mounted on Slide Base on Side of Pedestal

Arrangement 10
Motor Position Unique to Pedestal Design (No Options)

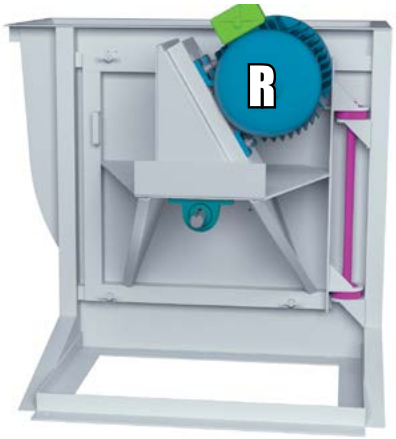


Conduit Boxes
(viewed from drive side of motor, looking at motor shaft)

MOTOR POSITIONS
CENTRIFUGAL FANS

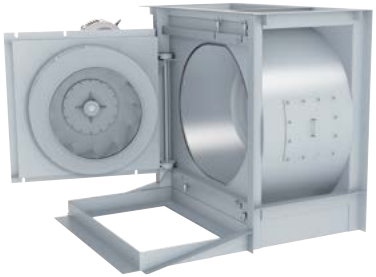


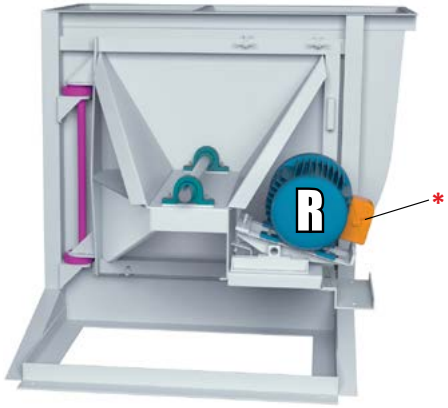
Arrangement 9SS (Right Swing)
CW Rotation and (L) Motor Position Only
Belt Driven - Swingout Construction
Pivot Base Side Mounted Motor



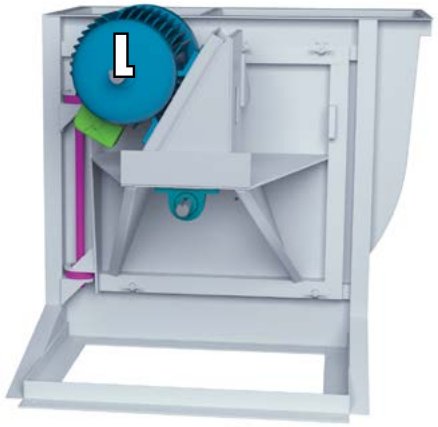
Arrangement 9ST (Right Swing)
Standard Motor Position: (R)
Belt Driven - Swingout Construction
Slide Base Top Mounted Motor

SWINGOUT FANS

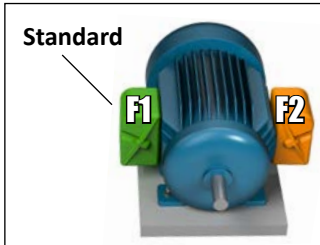




Arrangement 9SS (Left Swing)
CCW Rotation and (R) Motor Position Only
Belt Driven - Swingout Construction
Pivot Base Side Mounted Motor
* Must have F2 Conduit Box for this orientation



Arrangement 9ST (Left Swing)
Standard Motor Position: (L)
Belt Driven - Swingout Construction
Slide Base Top Mounted Motor

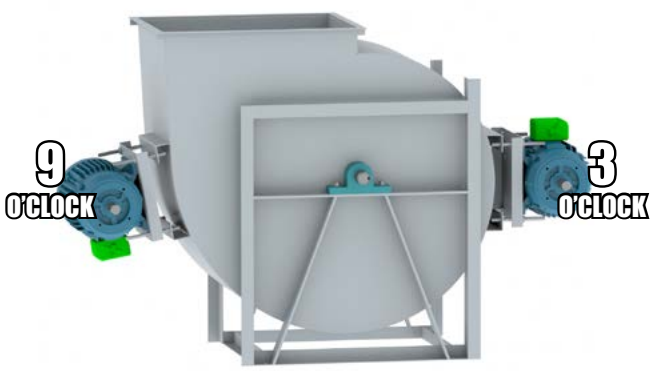


Conduit Boxes
(viewed from drive side of motor, looking at motor shaft)

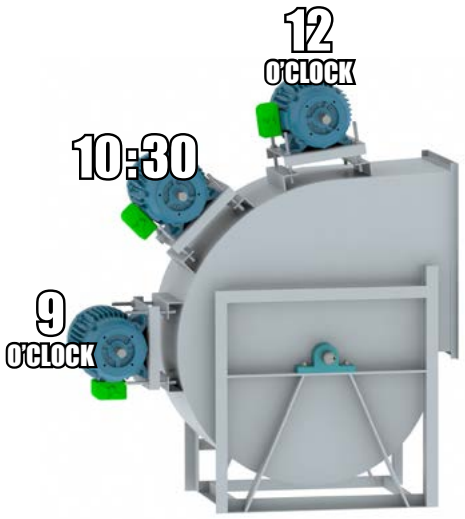
MOTOR POSITIONS
CENTRIFUGAL FANS

"K" Mount Motors

Also known as:
- Piggyback
- Scroll Mounted



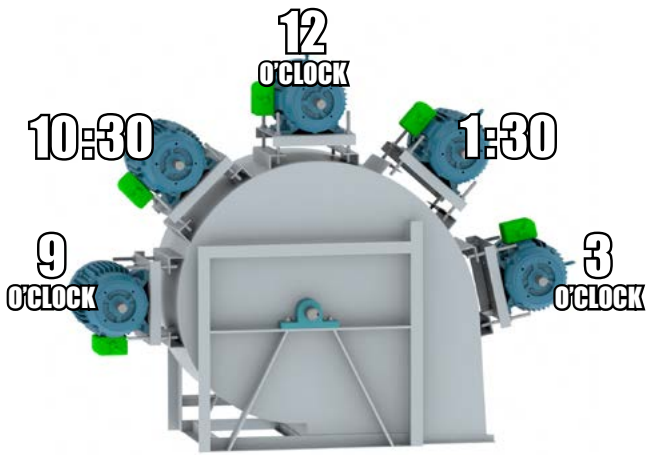
UBD Discharge



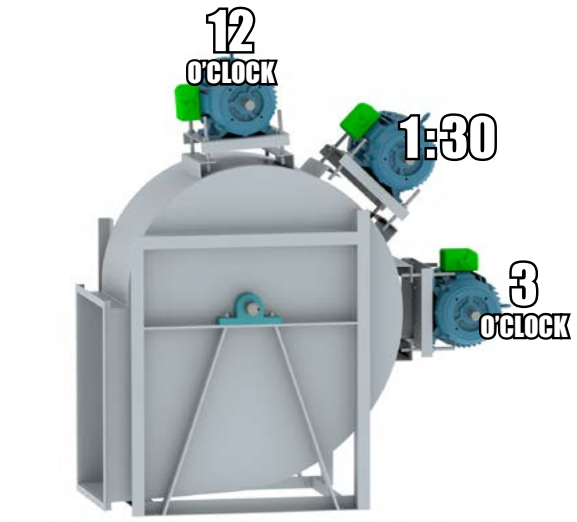
THD Discharge

MOTOR BASES
- Mounted directly on fan housing scroll
- Utilizes an adjustable motor base
  - Post Mount or Pivot/Bolted Design
  - See *Motor Bases* section

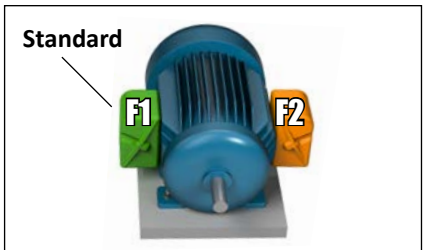
Used on SWSI and DWDI, Arrangement 3 Fans



DBD Discharge

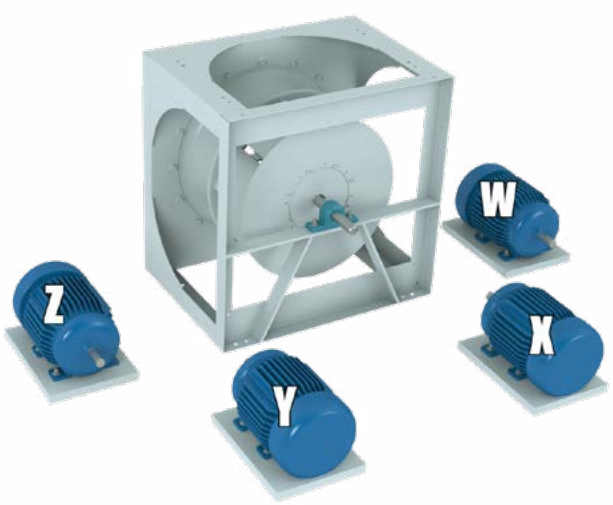


BHD Discharge

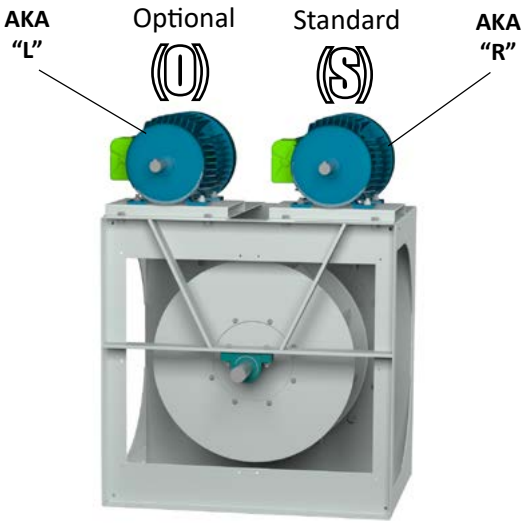


Conduit Boxes
(viewed from drive side of motor, looking at motor shaft)

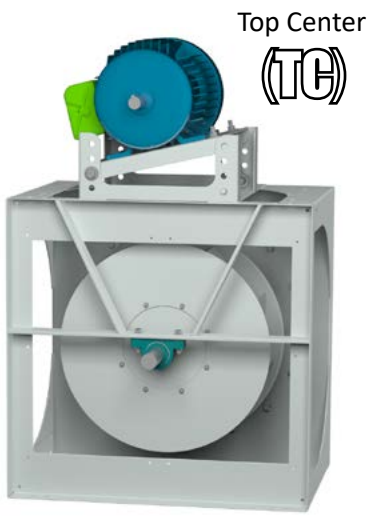
MOTOR POSITIONS
PLENUM FANS



Arrangement 3
Belt Driven - Horizontal
Motor Mounted on Floor or Fan Base

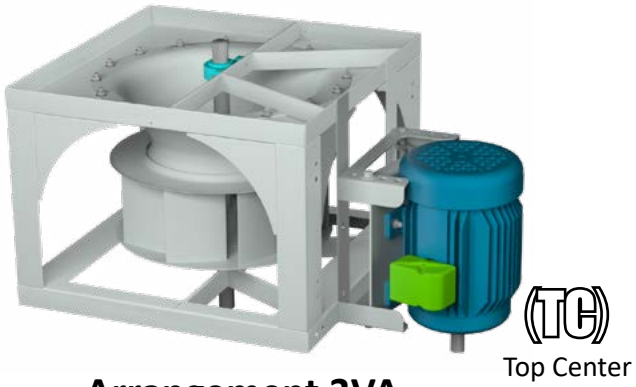


Arrangement 3HS
Belt Driven - **H**orizontal with Top Mounted Motor
with **S**lide Base Motor Mount

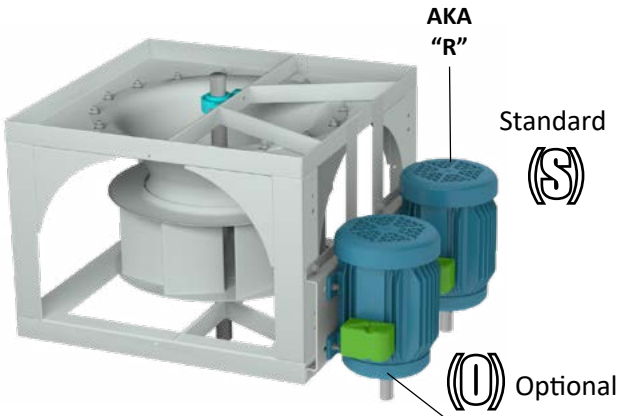


Arrangement 3HA
Belt Driven - **H**orizontal with Top Mounted Motor
with **A**djustable Motor Base

Arrangement 3SM
Belt Driven - Horizontal With **S**ide **M**ounted Motor
with Slide Base Motor Mount
Standard Motor Position: (R)
* Motor Position (L) is normally ordered with
F1 Conduit Box. *Select F2 if clearance issues.*



Arrangement 3VA
Belt Driven - **V**ertical with **A**djustable
Motor Base

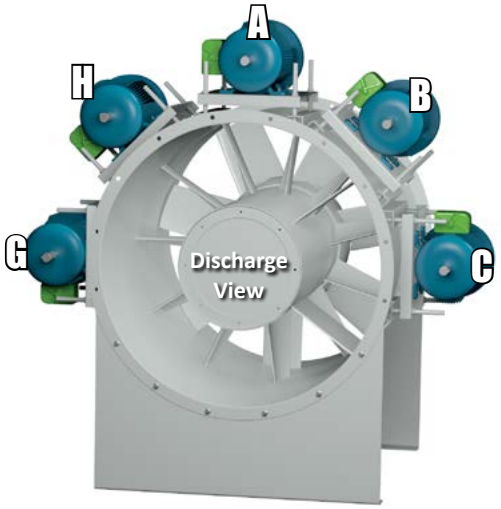


Arrangement 3VS
Belt Driven - **V**ertical with **S**lide Base
Motor Mount

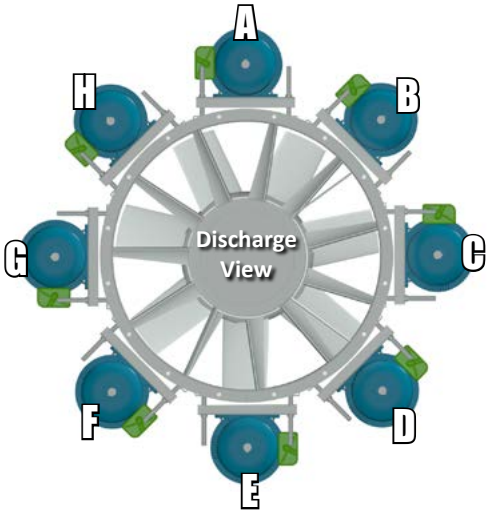
MOTOR POSITIONS
INLINE, MIXED FLOW, AXIAL FANS

HORIZONTAL CONFIGURATIONS

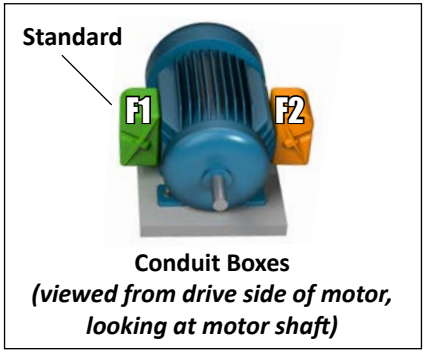
Arrangement 9 only



Floor Mount



Duct or Ceiling Mount



Conduit Boxes
(viewed from drive side of motor, looking at motor shaft)

MOTOR POSITIONS
INLINE, MIXED FLOW, AXIAL FANS

VERTICAL CONFIGURATIONS

Arrangement 9 only

Roof Mounted

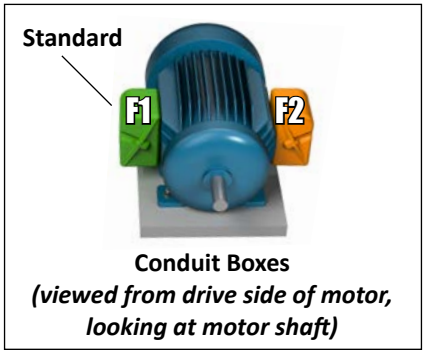
No specified motor position for this configuration.
Motor is centered on curb cap as shown.

Floor Mount

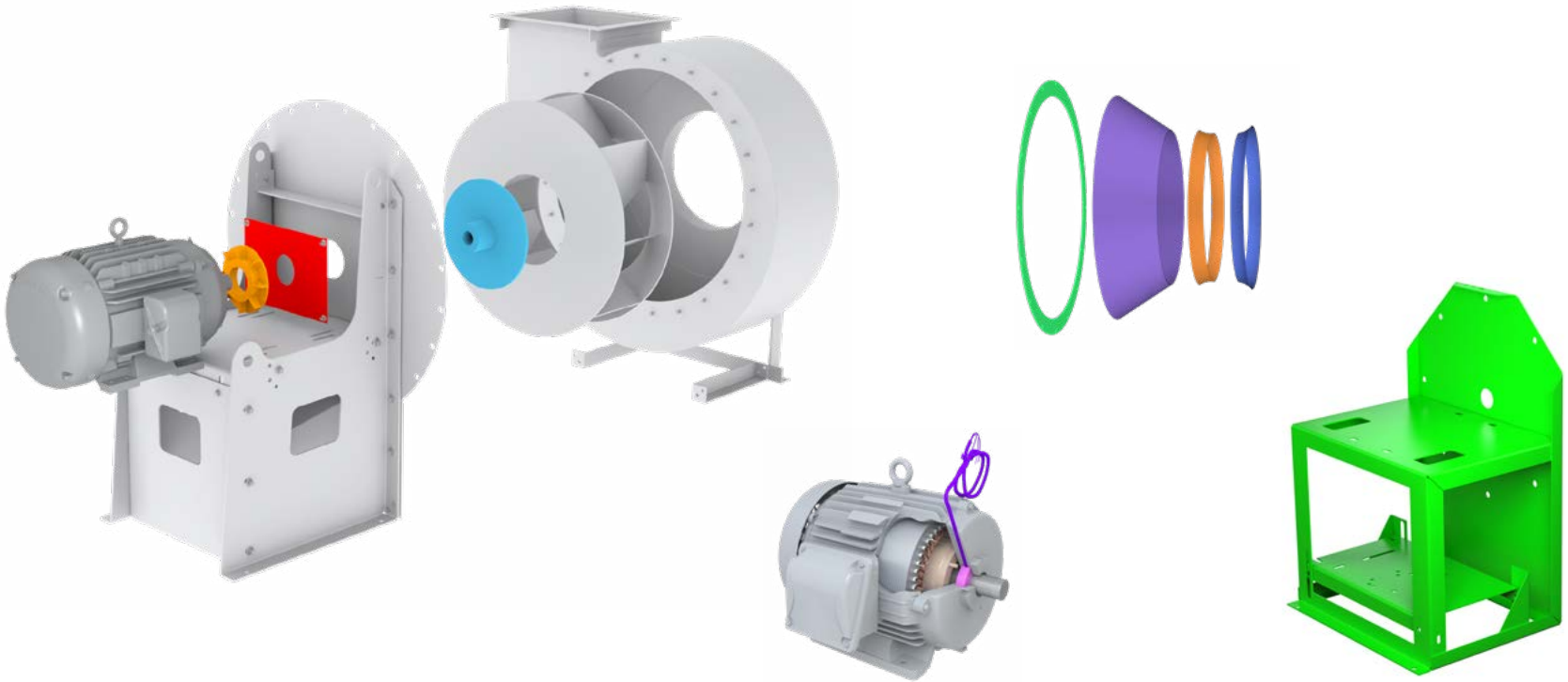
Ceiling Mount

Duct Mount
(no Support Brackets)

No specified motor position for this configuration.
Motor is centered between support brackets as shown.

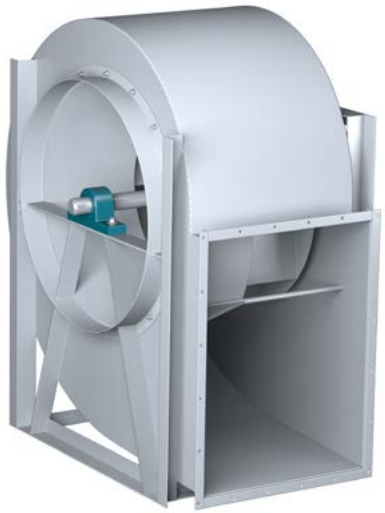


Conduit Boxes
(viewed from drive side of motor, looking at motor shaft)



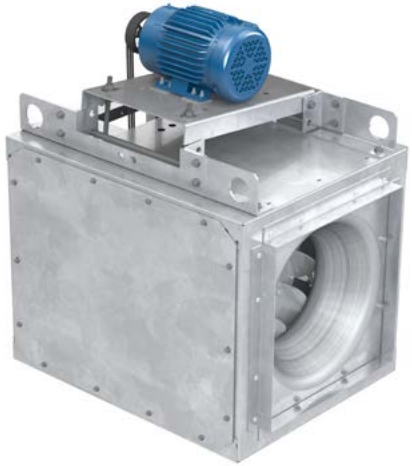
Fan Components

HOUSING CONSTRUCTION

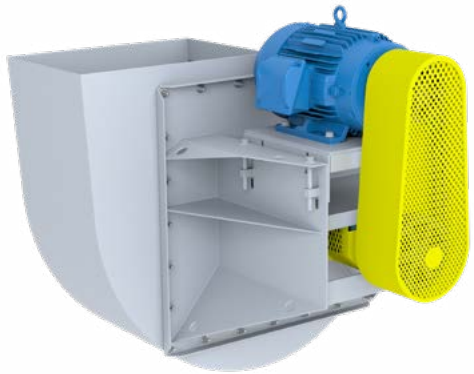


Centrifugal Fan

Tubular Fan



Square (Inline) Fan



Plug Fan
(Housing Optional)

OVERVIEW

Housings provide a means of directing air or particulate through a system. The air or particulate enters through the inlet of the housing and exits through the outlet.

All fans do not require a housing (i.e. plenum fans, plug fans, panel and ring fans).

FEATURES

- **Housing:** Main structure to support other key components such as inlet, outlet, framing and structural supports. Components may be mounted internally and/or externally. Also known as side, scroll or casing.
- **Inlet Opening:** Usually round to support a collar, funnel (cone), flange or combination of any or all.
- **Outlet (Discharge) Opening:** Can be square, rectangular or round based on the requirement
- **Flanges:** Inlet and outlet
- **Inlet Funnel (Cone):** Directs air into the fan impeller
- **Cutoff/Wiper Bar:** Helps to direct air through the housing in the inlet funnel area to prevent turbulence and to increase efficiency.
- **Transitions:** Can either change opening from one shape to another (i.e. square to round, rectangular to round, etc.) or hold the same shape, but may enlarge or reduce the opening at the fan (i.e. round to round, square to square, etc.).

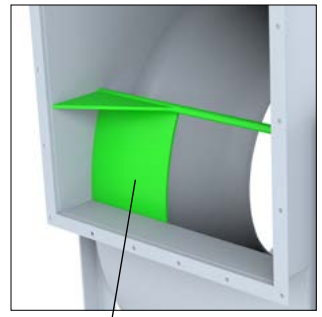
ACCESSORIES

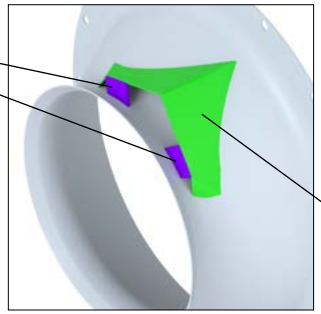
- **Access Door**
- **Companion Flanges (Inlet or Outlet)**
- **Drain/Weep Hole**
- **Evasés**
- **Inspection Port**
- **Split Housings**
- **Transitions**

See *Accessories* section for more information.

HOUSING CONSTRUCTION

CENTRIFUGAL FANS (SWSI)





RUBBING BARS
(Spark Resistant Fans only)

HOUSING SCROLL

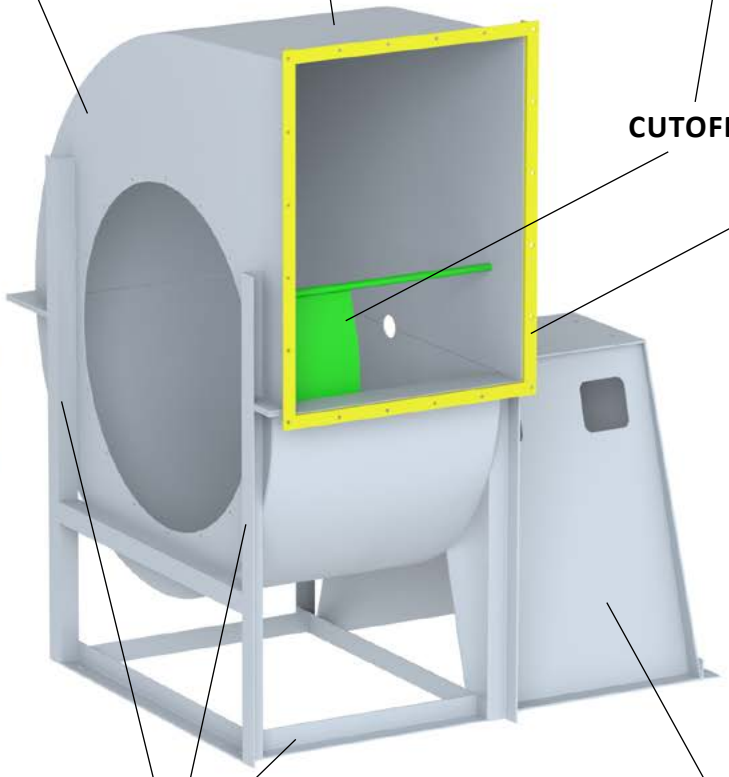
HOUSING SIDE

INLET FLANGE

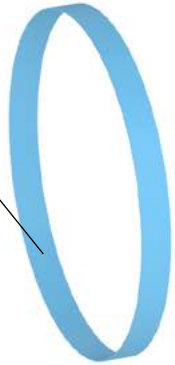
WIPER BAR

CUTOFF

OUTLET (DISCHARGE) FLANGE



INLET COLLAR



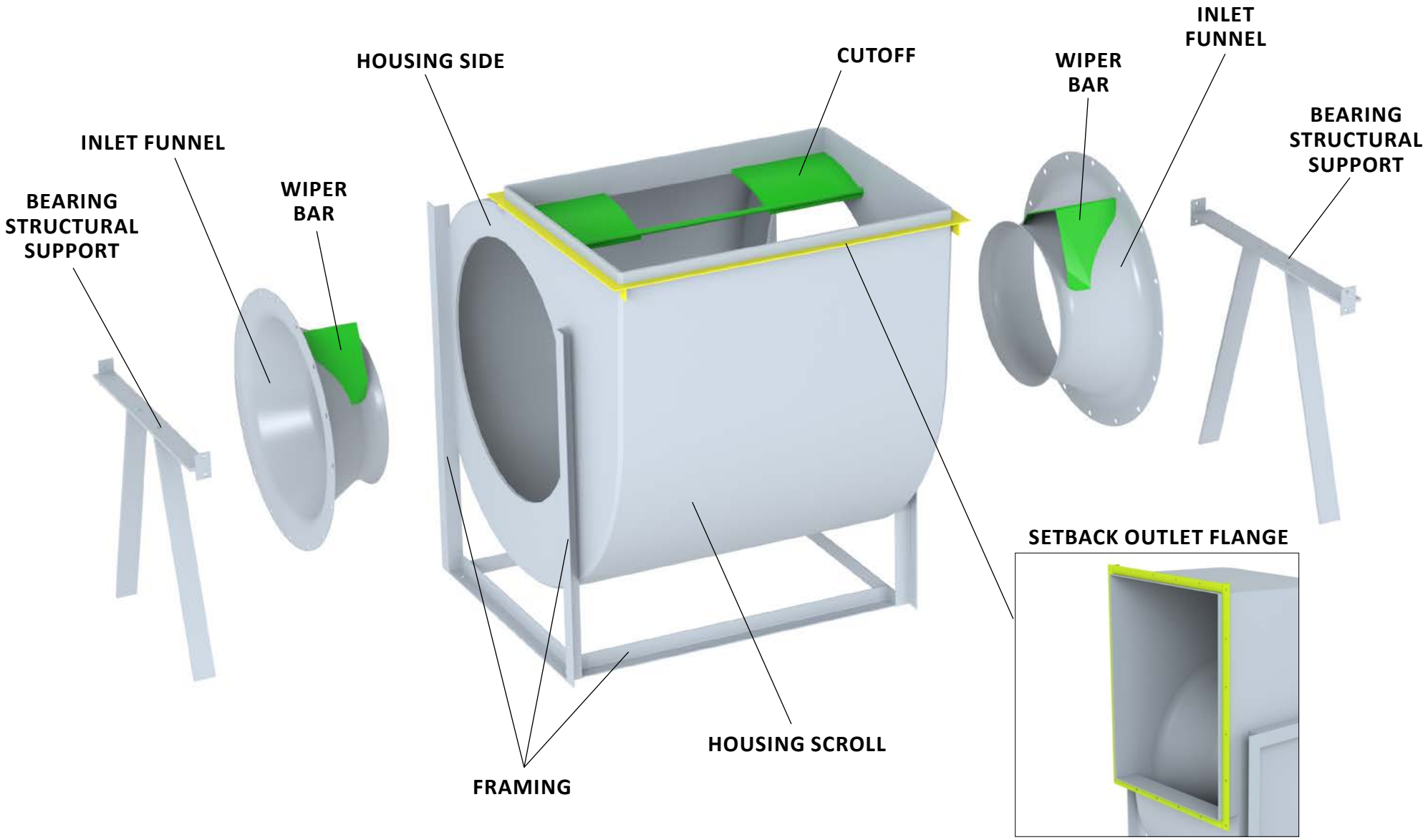
INLET FUNNEL

FRAMING

PEDESTAL
(on some arrangements)

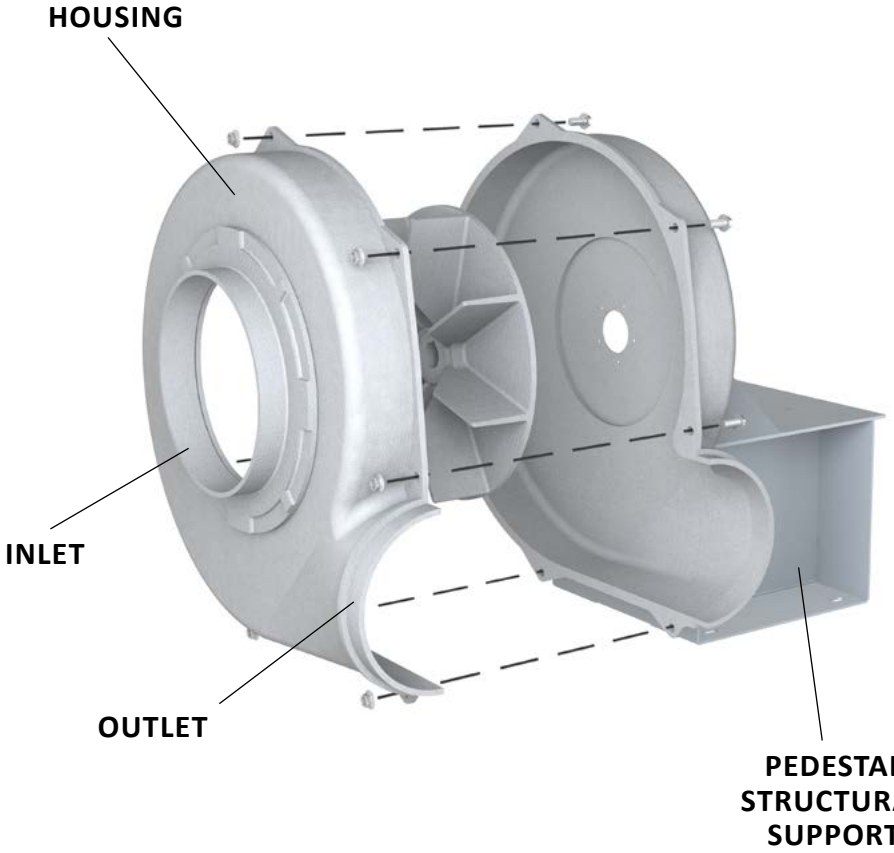
HOUSING CONSTRUCTION

CENTRIFUGAL FANS (DWDI)

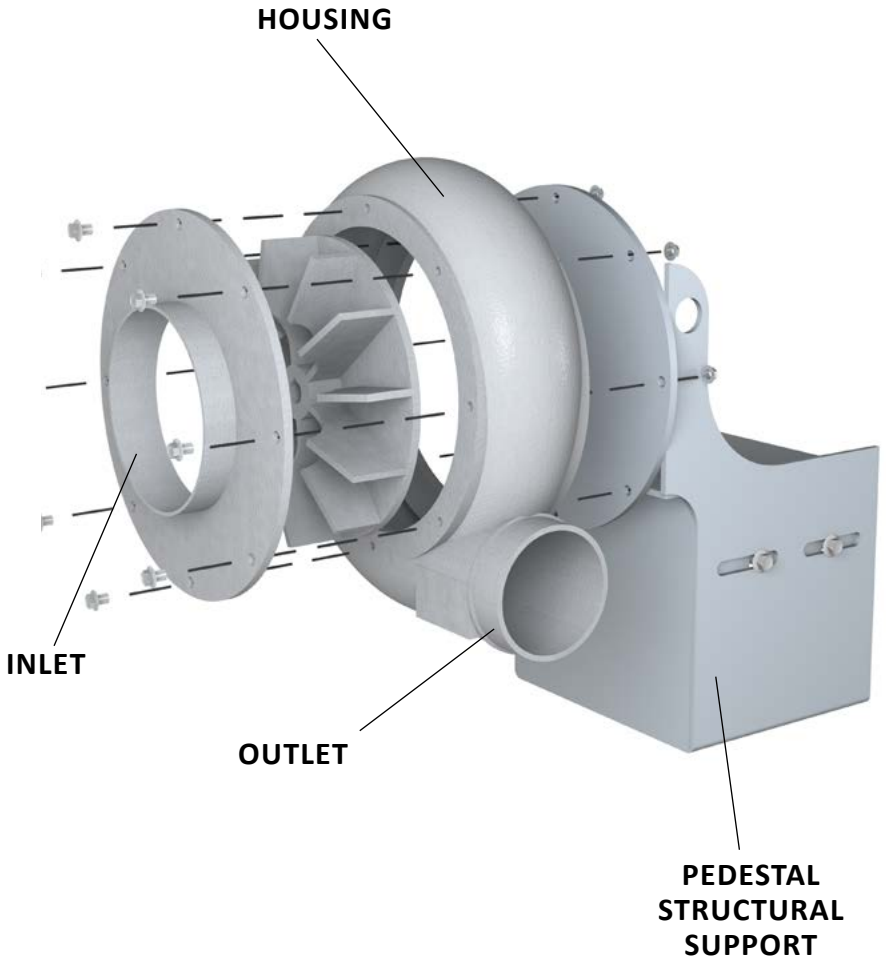


HOUSING CONSTRUCTION

PRESSURE BLOWERS (CAST ALUMINUM)

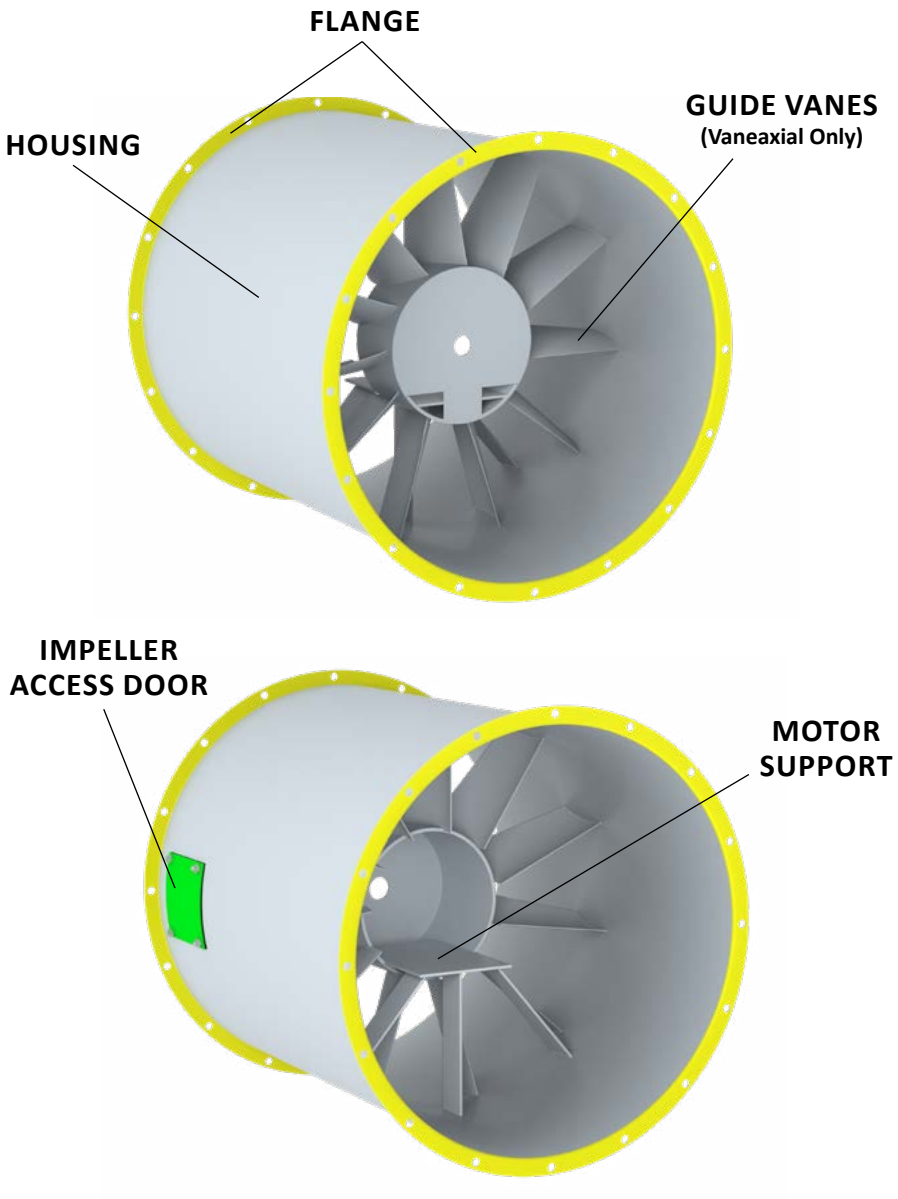


PRESSURE BLOWERS (CAST IRON)

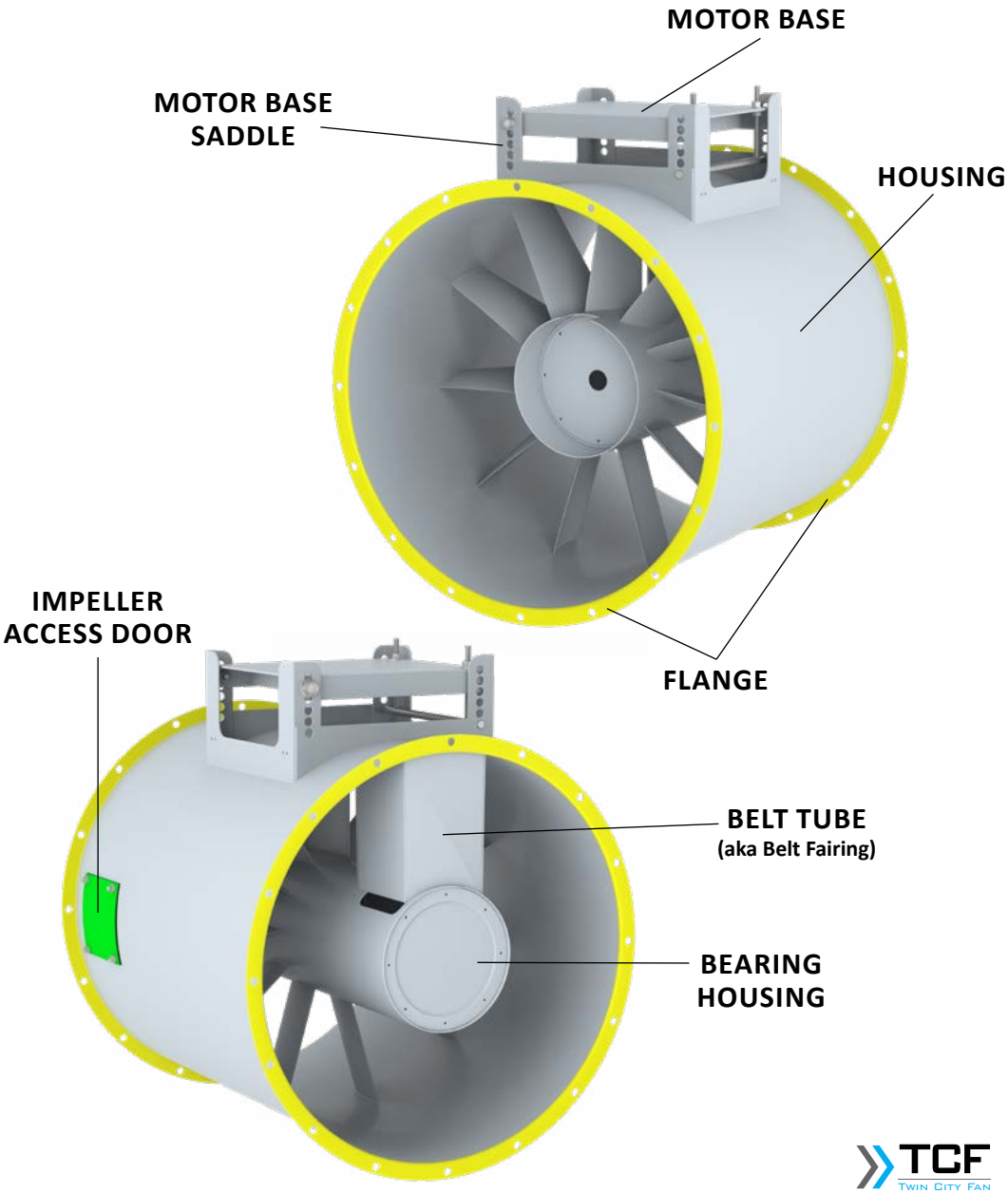


HOUSING CONSTRUCTION

DIRECT DRIVE AXIAL FANS

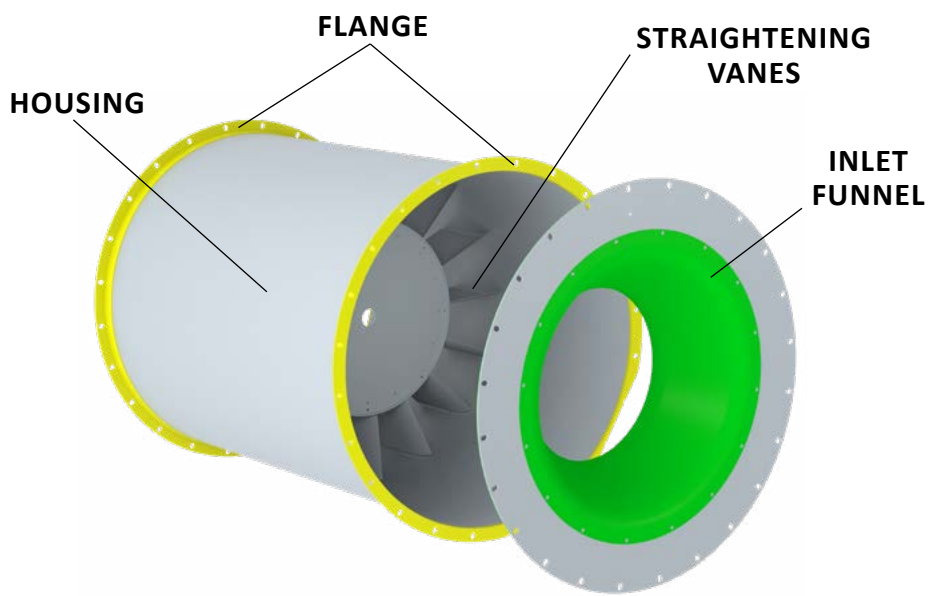


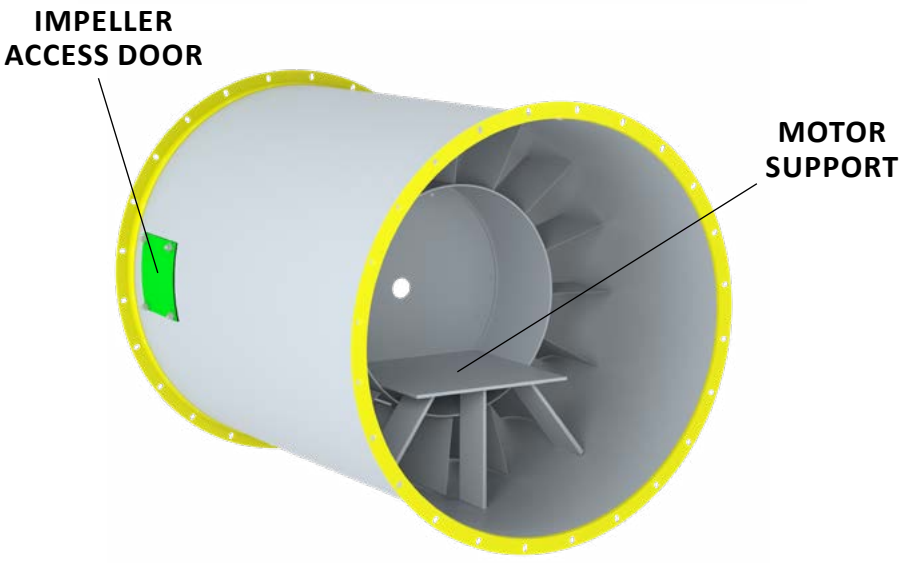
BELT DRIVEN AXIAL FANS



HOUSING CONSTRUCTION

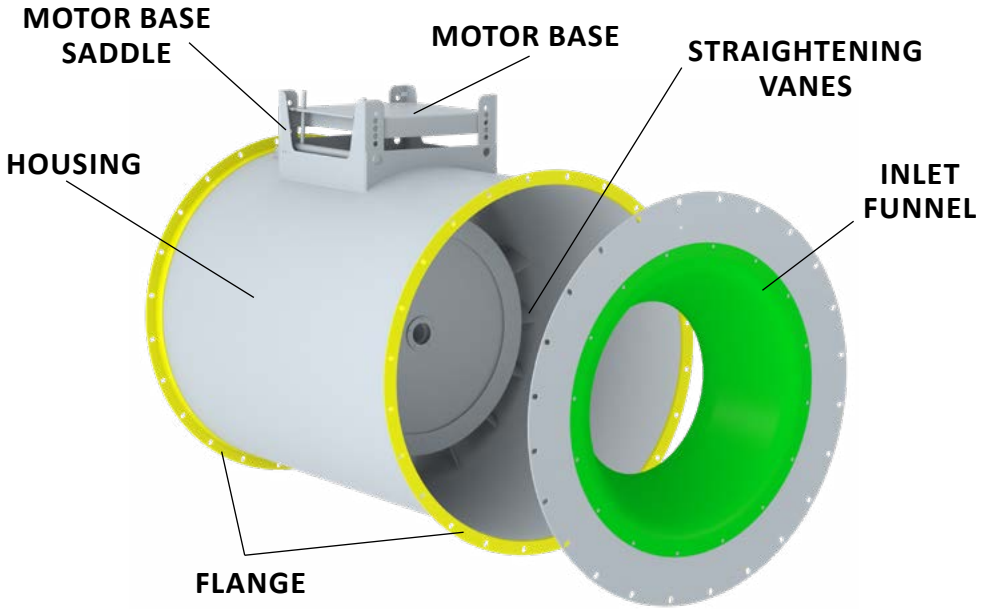
INLINE CENTRIFUGAL FANS

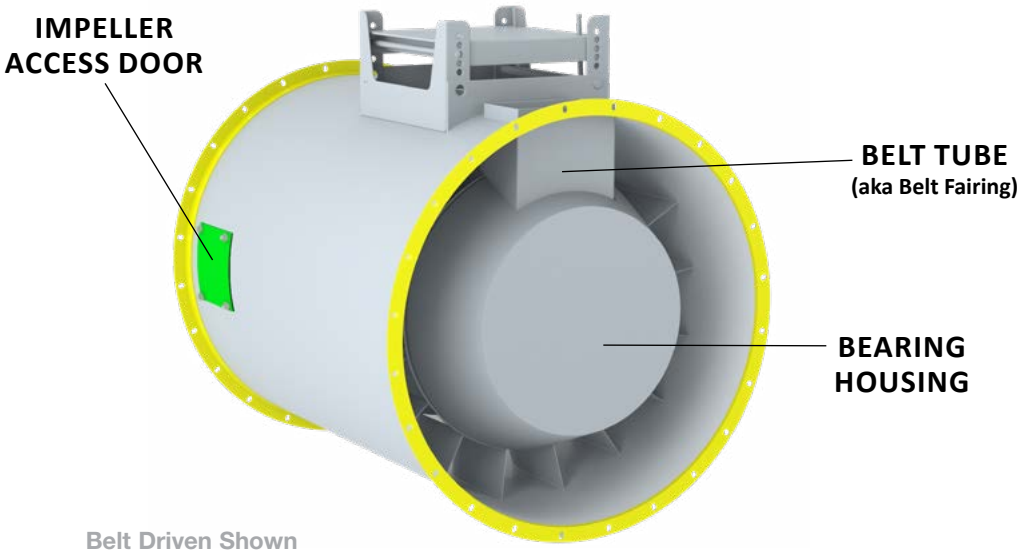




Direct Drive Shown

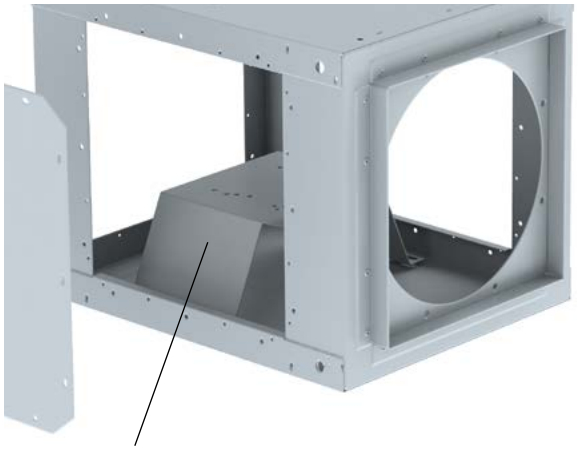
MIXED FLOW FANS





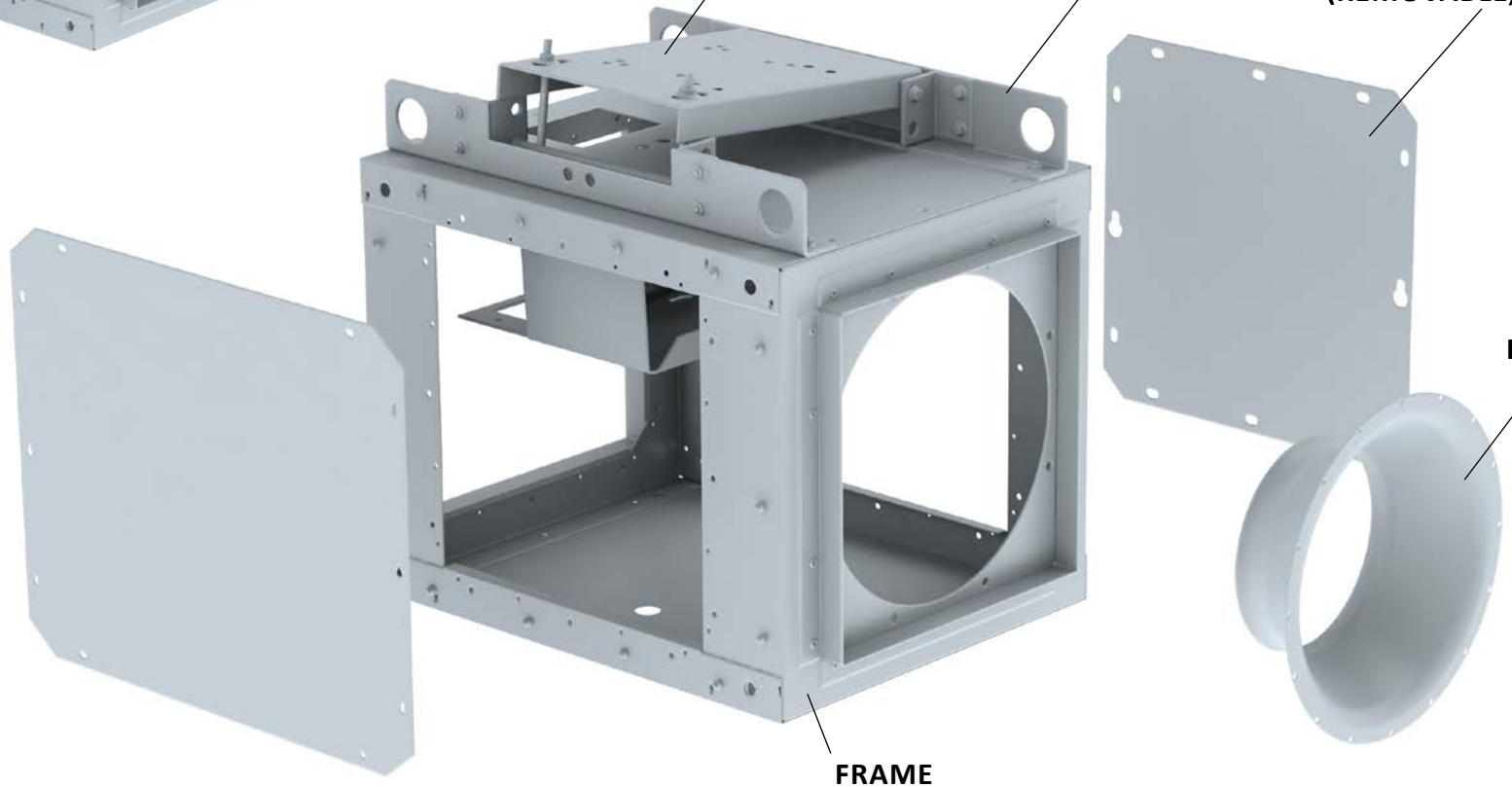
Belt Driven Shown

SQUARE (INLINE) FANS



Direct Drive

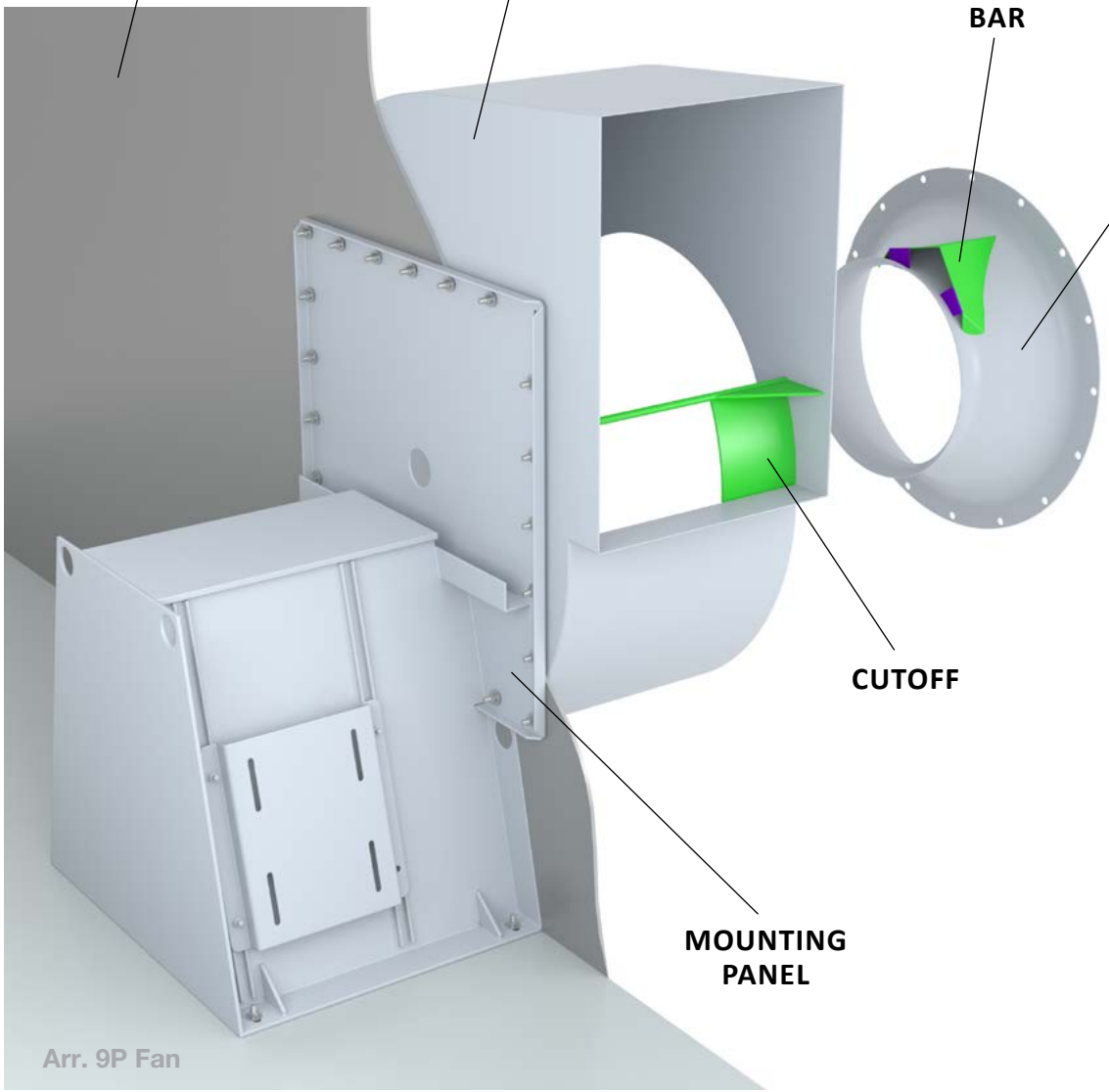
MOTOR BASE

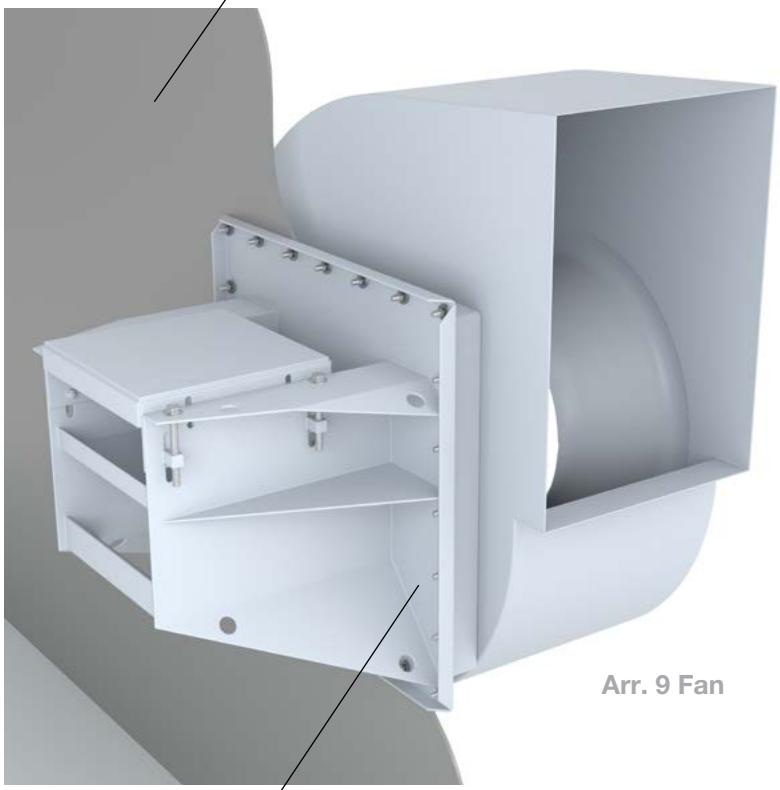


Belt Driven

HOUSING CONSTRUCTION

PLUG FANS





TRANSITIONS

Relieved Inlet Transition
Used to smooth the flow of paper trim and similar material through the fan.

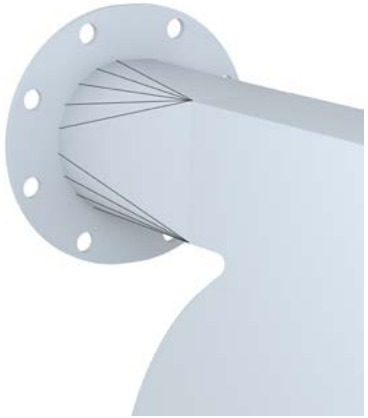
Non-Welded Rectangular/ Square to Round Transition

OVERVIEW

- Used when corresponding ductwork connecting to the fan does not directly match the shape or size of the opening and/or flange bolt pattern.
- Also used on standard fans to enlarge a housing opening to achieve proper fan performance. This would then be called an evasé.

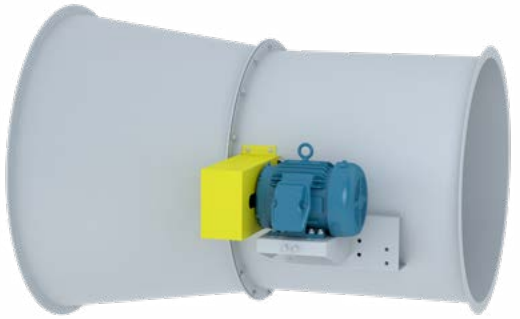
See Evasés in *Accessories* section for more information.

- Can be connected to the fan as a weldment or a separate bolt-on piece.



Welded Rectangular/ Square to Round Transition with Outlet Flange

Welded Square to Round Transition with Slip Connection on Outlet



Round to Round Transition

OVERVIEW

The electric motor provides a method of converting electrical energy into mechanical energy to perform some physical task or work. The electric motor is by far the most common method for powering a ventilating fan today. There are two types of technology used:

- Induction
- Electronically Commutated

Induction Motor

An induction motor is an AC electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding. An induction motor can therefore be made without electrical connections to the rotor.

EXAMPLES OF INDUCTION MOTORS

Electronically Commutated Motor

An electronically commutated motor utilizes on-board electronics to control motor speed. This includes two main parts:

- A rectifier, which converts the AC supply to DC
- A controller, which directs the right amount and right direction of current at the right time, through each of the windings

This develops magnetic poles in the stator, which interact with the permanent magnets in the rotor. The speed can be controlled through a speed controller or the motor can receive a 0-10V signal from an outside source. Controlling the speed in this way allows for highly efficient operation, even at reduced speeds. EC motors also have a larger usable turndown range than a traditional speed controllable motor.

EXAMPLES OF ELECTRONICALLY COMMUTATED MOTORS

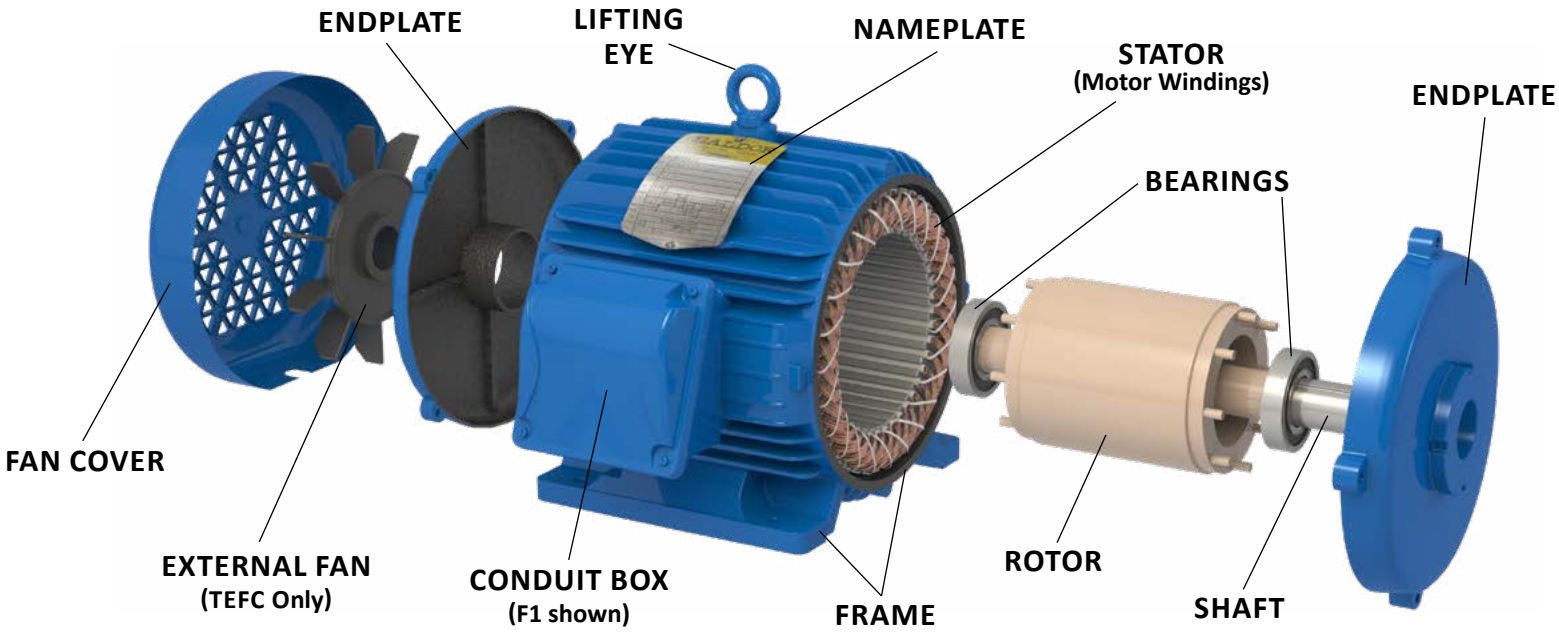
MOTORS
INDUCTION MOTOR TECHNOLOGY

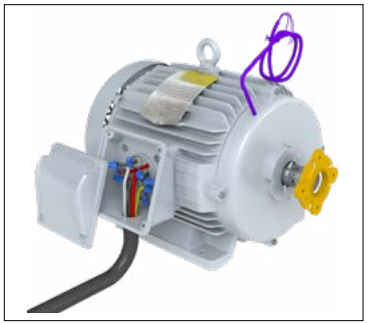
FEATURES

- **Ambient temperature:** Maximum allowable temperature surrounding the motor
- **Conduit Box:** Power connection point
  - Location is usually F1 or F2 (Note: F3 is on top of motor)
- **Frame Housing Type:** Material is rolled steel or cast iron
- **Electric Current** (supplied to motor)
  - AC (Alternating Current) or DC (Direct Current)
  - Most motors in fan industry run on AC
- **Insulation Class**
  - Applies to the insulation, which is a coat of baked-on varnish, around the motor winding wires of the stator.
  - Class A, B, F or H (Class A no longer used by motor manufacturers.)
    > The higher the letter in the alphabet, the higher the temperature capability
  - Typical motor for fans, rated for Class F insulation
- **Nameplate:** Identifies motor (manufacturer, serial number, technical characteristics)
- **Rotor Assembly (Rotor and Shaft):** Rotating portion of motor that transmits power to run the fan impeller.
- **Stator:** Stationary portion that supplies electric current to rotor assembly.
- **Temperature Rise:**
  - Change in temperature from ambient to the steady-state operating temperature of the motor
  - Can affect insulation class of motor
  - Typical motor for fans is rated for Class B temperature rise
- **Service Factor (S.F.):**
  - Percentage above rated HP that the motor may be used
  - 1.15 S.F. with a 100 HP motor = 115 HP operation
    > Other common S.F. are 1.0 (when operated on VFD) and 1.25

Refer to Fan Engineering Letter FE-800 for more information.

TYPICAL ELECTRIC INDUCTION MOTOR COMPONENTS





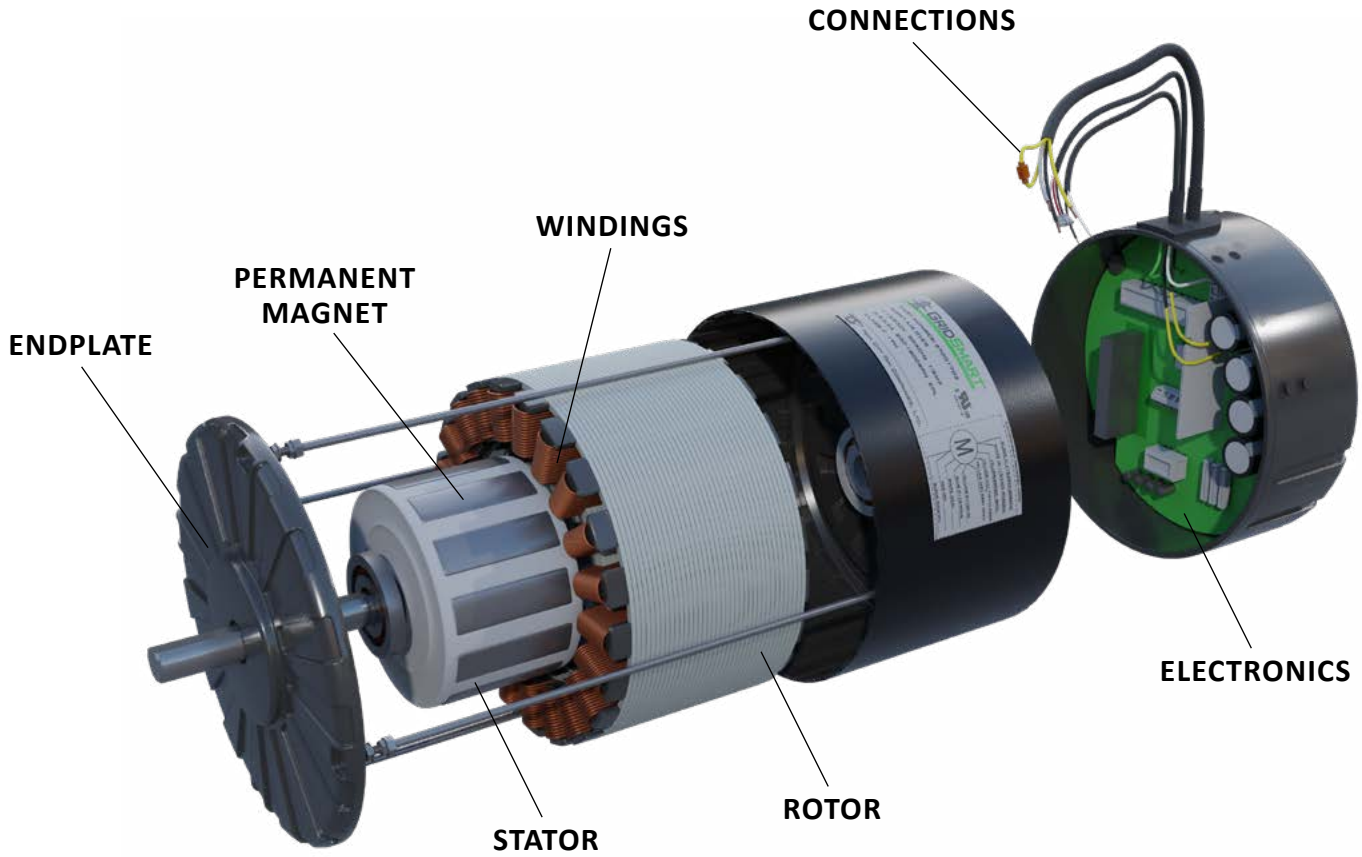
Conduit Wiring on Motor with Nameplate

FEATURES

- **0-10V input:** Allows the motor to receive an external signal in order to vary the speed of the motor.
- **GridPoint Controller:** Plug and play device that can be used to change the EC motor between constant speed mode and 0-10V mode. See box below for more information.

GridPoint EC Motor Controller
The GridPoint EC motor controller works with all TCF second generation line of EC motors. It is a plug and play device that can be used to change the motor between constant speed mode and 0-10V mode. It also allows a user to view and set the operating speed and maximum speed of the motor. Its plug and play functionality allows one controller to be used on multiple fan / EC motor packages.

TYPICAL ELECTRONICALLY COMMUTATED MOTOR COMPONENTS



Refer to TCF&B IM-4055 for more information.

Typical Motor Specifications

50 HP, 1800 RPM, IN, P, 3 Phase, 60 Frequency, 460 Volt, SD, TEFC, 326T

- **Power (HP or kW)**: Measure of the rate at which motors and drives can produce work
- **RPM (Revolutions Per Minute)**: Speed of the motor
- **Technology**: Induction or electronically commutated
- **Efficiency**: Ratio of the useful work performed by a motor to the total energy expended or heat taken in
- **Electric Power**: What is needed to operate the motor
  - Phase
  - Voltage
  - Frequency (aka Cycle, Hz)
- **Intended Duty**: Operating conditions of the motor based on its surrounding environment
- **Enclosure**: Casing style around the internal rotating parts of the motor
- **Frame Standard/Size**
  - Imperial: Standardized by NEMA (National Electrical Manufacturers Association)
  - Metric: Standardized by IEC (International Electrical Commission)

Motor Specifications

(as applied to Twin City Fan)

Power: Horsepower (HP, Imperial) or Kilowatt (kW, Metric)

Typical motor power ratings listed below.

Power Equivalents					
HP	kW	HP	kW	HP	kW
1/6	0.12	–	3	50	37
1/4	0.18	5	4	60	45
1/3	0.25	7-1/2	5.5	75	55
1/2	0.37	10	7.5	100	75
3/4	0.55	15	11	125	90
1	0.75	20	15	150	110
1-1/2	1.1	25	18.5	–	132
2	1.5	30	22	200	150
3	2.2	40	30	250	185

Notes:

1. HPs below and above can also be used (i.e. 1/12, 1/8, 300, 350, 400, 500 and larger)
2. For metric kW values: kW = HP x .7457
3. For imperial HP: HP = kW ÷ .7457

Technology

- Induction (IN)
- Electronically Commutated (EC)

RPM: Revolutions Per Minute, Motor Speed

Typical synchronous speeds by hertz (Hz):

3600 – 60 Hz	3000 – 50 Hz
1800 – 60 Hz	1500 – 50 Hz
1200 – 60 Hz	1000 – 50 Hz
900 – 60 Hz	750 – 50 Hz

Actual nominal motor speeds vary by motor HP and manufacturer.

Motor Specifications
(as applied to Twin City Fan)

Efficiency

- Most electric motors are designed to run at 50% to 100% of rated load. Maximum efficiency is usually near 75% of rated load. Thus, a 10-horsepower (hp) motor has an acceptable load range of 5 to 10 hp; peak efficiency is at 7.5 hp. A motor's efficiency tends to decrease dramatically below about 50% load.
- Efficiency designations:

  TCF designations based on NEMA classification:
  - Standard Efficiency: Compares to NEMA High Efficiency
  - Premium Efficiency: Compares to NEMA Premium Efficiency

  Worldwide designations based on IEC classification:
  - IE1 (Standard Efficiency)
  - IE2 (High Efficiency): Compares to TCF Standard Efficiency
  - IE3 (Premium Efficiency): Compares to TCF Premium Efficiency
  - IE4 (Super Premium Efficiency): Future designation, not currently used

NOTE: Precautions may need to be taken to eliminate or reduce shaft currents that may be imposed on the motor by the variable frequency drive (VFD) as stated per NEMA MG-1 Part 31.

Electric Power

- Fan industry generally uses AC type of power for induction motors and DC type of power for electronically commutated motors
- Frequencies (Cycle, Hz) can vary by country or region used in
- Dual voltage motors available (i.e. 115/230, 208/230, 230/460, etc.). Customer needs to indicate the actual voltage that the fan will need if the motor has any add-ons provided (i.e. disconnect switch, speed controller, etc.).
- DC type of power is also used on some light commercial accessories/damper motors

Power	Phase	Frequency	Voltages
AC	Single	60	115, 230 or 277
AC	Single	50	220 or 240
AC	Three	60	200, 208, 230, 400, 440, 460, 575, 2300, 4160 or 4300
AC	Three	50	190, 380, 415 or 4000
DC	–	–	12, 24, 28, 36, 48, 72, 90, 150, 180, 240, 300 or 500

Motor Specifications
(as applied to Twin City Fan)

Enclosure

- ODP, TEFC/EXPL, TENV, TEAO

ODP (Open Drip Proof)
Internal fan pulls air in, blows air across windings, inside motor and air exits opposite the drive end. Should not be used in dirty and wet atmospheres.

TEFC (Totally Enclosed Fan Cooled)
External fan pulls air in through fan cover and blows it over the exterior (only) surface of the motor.
+
EXPL (Explosion Proof)
External fan helps cool motor. Internal portion of motor engineered to prevent a potential motor arc or explosion from igniting a dangerous environment that contains flammable dust or gas.

TEAO (Totally Enclosed Air Over)
Motor is in the air stream of the fan mounted on motor shaft or in air stream of belt driven fan or blower.

TENV (Totally Enclosed Non-Ventilated)
Dissipates heat of frame and body of motor only. Run hotter and usually in larger frame size than standard.

Intended Duty

- GD (General Duty): These are general purpose motors used with normal, clean and cool air around the operating area of the motor
- SD (Severe Duty)
  - Used where IEEE 841 motors are not specified but a Severe Duty motor is required (i.e. Mil/Chem Duty, Chemical Duty, IEEE45)
- IEEE841
  - Industry standard started in 1986 for Severe Duty
  - Used in process type industries such as automotive, mining, paper and wood mills, and refining
- DFG: Explosion Proof enclosure motors used in hazardous locations. Specified by the National Electric Code (NEC) by group number. Common groups used by TCF:
  - Group D[1]: Gases
  - Group F[1]: Metal dusts
  - Group G[1]: Food industry dusts

[1] See NEC Code for full details of gases and dusts along with class and division ratings.

- Other Intended Duty motors ordered on a special basis:
  - IEEE45 used for marine applications
  - Washdown Duty used on food applications

Enclosure		Intended Duty	
NEMA	Metric	NEMA	Metric
ODP	IP22	GD	GD
TEFC	IP44	GD	GD
	IP54	GD/SD	GD/SD
	IP55	GD/SD	GD/SD
	IP56	IEEE45/SD	SD
	IP56	IEEE841/SD	SD
EXPL	IP55	DFG	DFG
	IP56	N/A	*
TENV	IP56	GD/SD	GD/SD

* ATEX applications require a special motor.

Motor Specifications
(as applied to Twin City Fan)

Frame Standard/Size (Imperial)
- Standardized by NEMA (National Electrical Manufacturers Association)
- Typical numerical sizes: 42, 48, 56, 143, 145, 182, 184, 213, 215, 254, 256, 284, 286, 324, 326, 364, 365, 404, 405, 444, 445, 447, 449
- Special sizes: 5011B, 5008S, 505U (large HP motors), etc.

Letter designation after numerical size

C = Face mount (C-Face; 56C, 184TC, etc.)
- need to know "with" or without" feet

S = Short Shaft (284TS, 326TS, etc.)

T = post-1964 generation "T-frame foot mount" (std T-frame; 143T, 444T, etc.)
- to standardize the industry

U = 1952-1964 era "U-frame" (before NEMA)
- was used in the automotive industry
- may still see it called out on some orders

TC = Foot and face mounted

D = Flange mount

Y = Special mounting configuration (non-standard base)

Z = Special shaft (longer, shorter, larger diameter, holes, threads, etc.)

(D, Y and Z frame sizes are rarely seen in our industry)

Frame Standard/Size (Metric)
- Standardized by IEC (International Electrical Commission)
- Typical numerical sizes: 56, 63, 71, 80, 90, 100, 112, 132, 160, 180, 200, 225, 250, 280, 315, 365

Letter designation after numerical size

L

S

M

Frame Housing Type

ROLLED STEEL

CAST IRON / CAST ALUMINUM

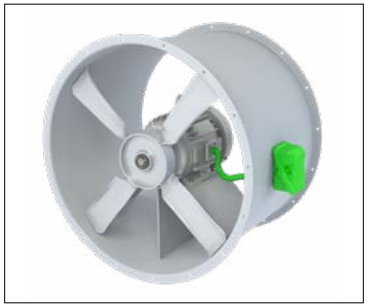
C-FACE FRAME

TC FRAME

ELECTRONICALLY COMMUTATED FOOT MOUNTED FRAME

MOTORS
MODIFICATIONS

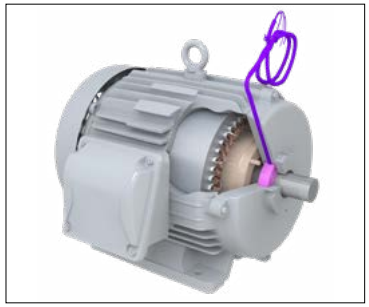
- **Cast Iron Housing:** Requested when a rolled steel motor is the standard offering
- **Class "H" Insulation:** Upgrade from Class "F," which is usually standard
- **Conduit Box:** F1 or F3 is standard. F2 is standard on IEC frames, but is a special modification for NEMA.
- **Extended Leads:** Standard length is 48". Other lengths available.
- **Externally Mounted Conduit Box:** Standard conduit box is mounted to cable opening outside of fan
- **Grease Ports:** Extended
- **Insulated Bearings:** Outer race of the bearing is coated with insulated material (ex. SKF "Insocote") to reduce/eliminate shaft currents imposed on the motor by a variable frequency drive (VFD).
- **Nameplate:** Contains extra information compared to standard
- **RTDs:**
  - Bearings: Senses heat rise of bearings
  - Motor Windings: Senses heat rise in motor windings
- **Roller Bearings:** Upgrade from ball bearings, which are usually supplied with motor
- **Shaft Grounding Ring:** Designed to protect motor bearings from electrical charges induced by variable frequency drive (VFD). Available as internal and external.
- **Space Heater:** Prevents moisture condensation in the motor stator during times it is not running
  - Also known as strip heaters
- **Thermistors/Thermostats:** Protects motor against locked-rotor conditions, continuous overload and high ambient temperature



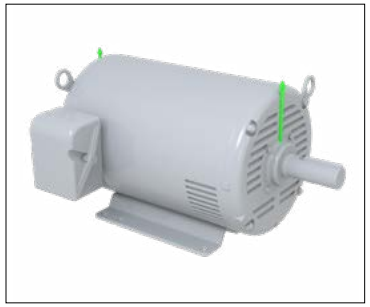
Externally Mounted Conduit Box with Extended Leads

Conduit Boxes
(viewed from drive side of motor, looking at motor shaft)

Conduit Wiring on Motor with Nameplate



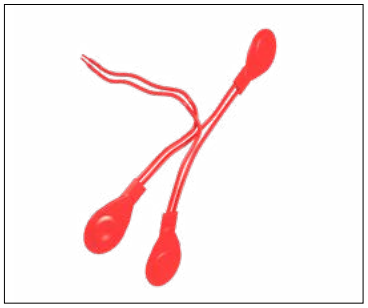
Bearing RTD



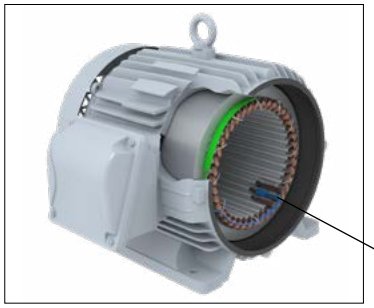
Extended Grease Ports

Shaft Grounding Ring, Internal

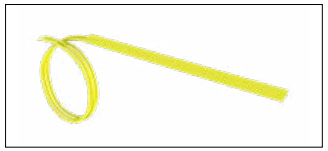
Shaft Grounding Ring, External



Thermistor



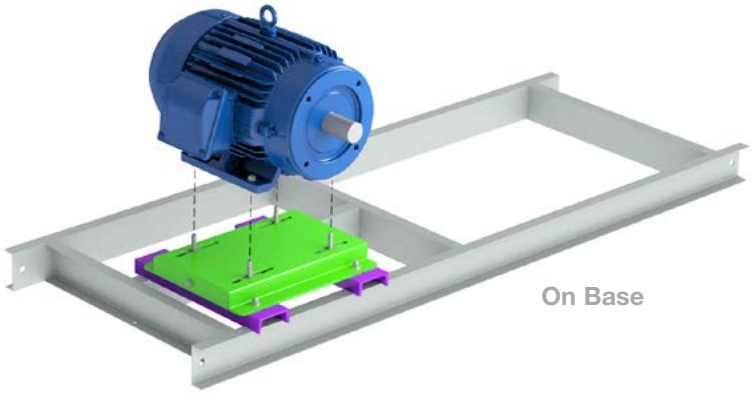
Space Heater (aka Strip Heater)



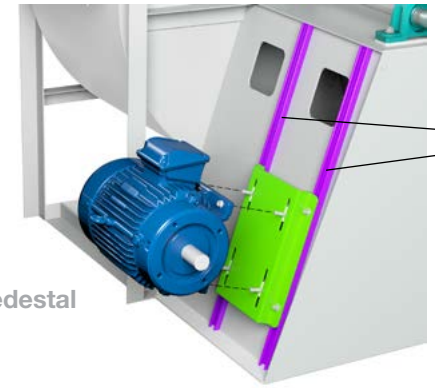
Motor Winding RTD
(embedded into motor windings)

NOTE: Modifications shown are more commonly used on induction motors.

SLIDE BASES



On Base



On Pedestal

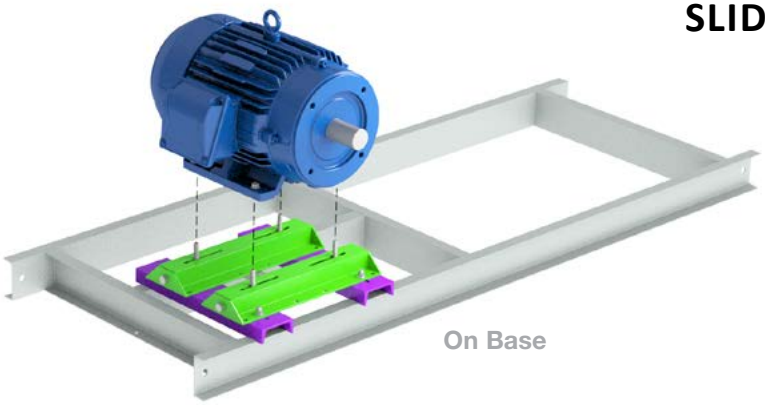
Unistrut Channels used on some fans for additional adjustment of the slide base

NEMA Type Slide Base
Used on small to large motors: 48 to 445 frame

Typical Mounting
- Arr. 1 or 3 (Floor Mounted or on Fan Base)
- Arr. 9, 9F, 9H, 9ST
- Plenum Fans: Arr. 1, 3, 3HS, 3VS, 3SM
- Pedestal Plug Fans: Arr. 1P, 9P

Green = Motor Base/Rails
Purple = Motor Mount Support

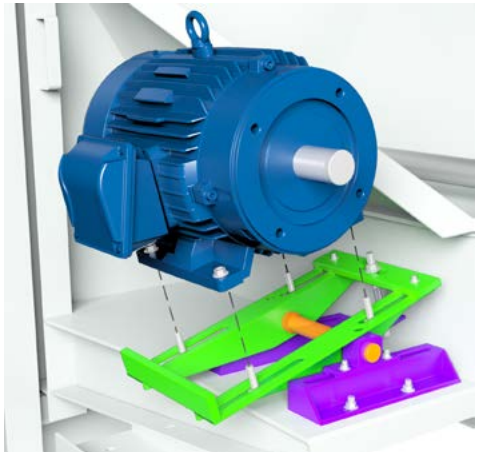
SLIDE RAILS



On Base

On Pedestal
(Arr. 9H only)

Heavy-Duty Slide Rails (two rails per motor)
Used on large to very large motors: 440, 500 and 5000 frame size series



Arrangement 9SS Swingout
Centrifugal Fan

AUTOMOTIVE PIVOT BASES

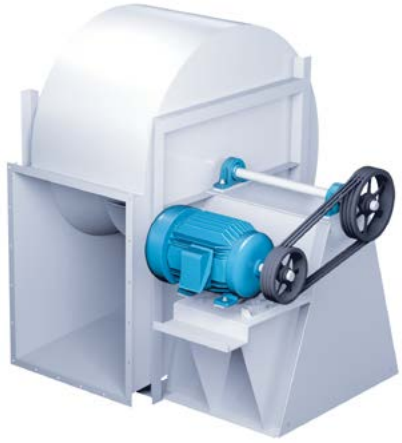
Typical Mounting
Used mostly in Automotive applications
- Arr. 9H Pedestal
- Arr. 9SS Swingout
- Arr. 3 (specially mounted on a fan base)

Green = Motor Base
Purple = Motor Mount Support
Orange = Pivot Point

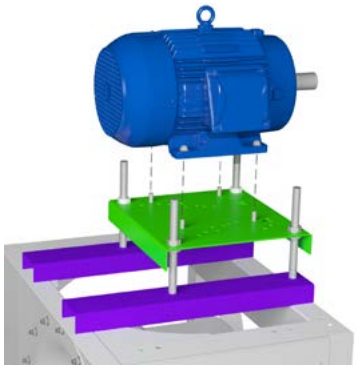
Note: Motor location is restricted based on the fan's rotation.

- Arr. 9H and 9SS - CW rotation and (L) motor position or CCW rotation and (R) motor position
- Arr. 3 - CW rotation and (Z) motor position or CCW rotation and (W) motor position

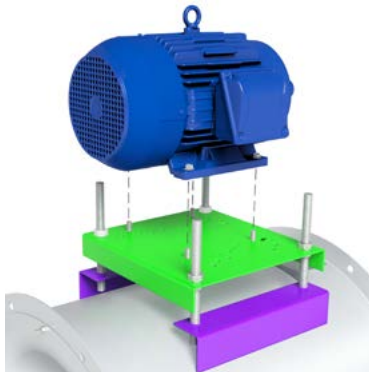
Arrangement 9H
Centrifugal Fan



ADJUSTABLE BASES



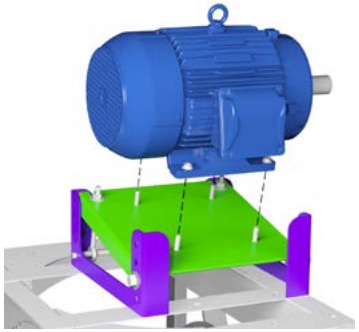
Flat Mount



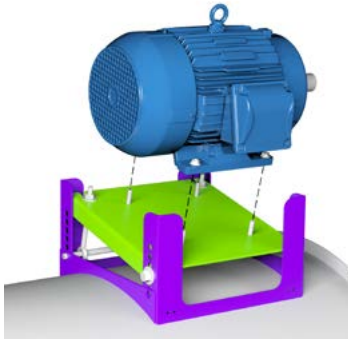
Saddle Mount

Typical Mounting
- Tubular Centrifugal and Axial Fans: Arr. 9
- Plenum Fans: Arr. 3HA, 3VA
- Plug Fans: Arr. 9

Green = Motor Base
Purple = Motor Mount Support



Flat Mount



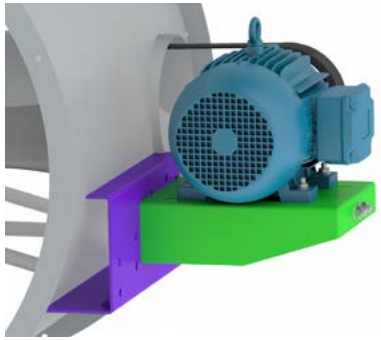
Saddle Mount

Standard Post Mount
- Used on small motors: 48 to 215 frame
- Saddle Mount or Flat Mount

Pivot / Bolted Design
- Used on larger motors: 254 to 445 frame
- Saddle Mount or Flat Mount

Typical Mounting
- Tubeaxial, Vaneaxial
and Centaxial Fans: Arr. 9

Green = Motor Base
Purple = Motor Mount Support



Bolt-On Mount
- Used on small motors: 48 to 286 frame
- Saddle Mount

OVERVIEW

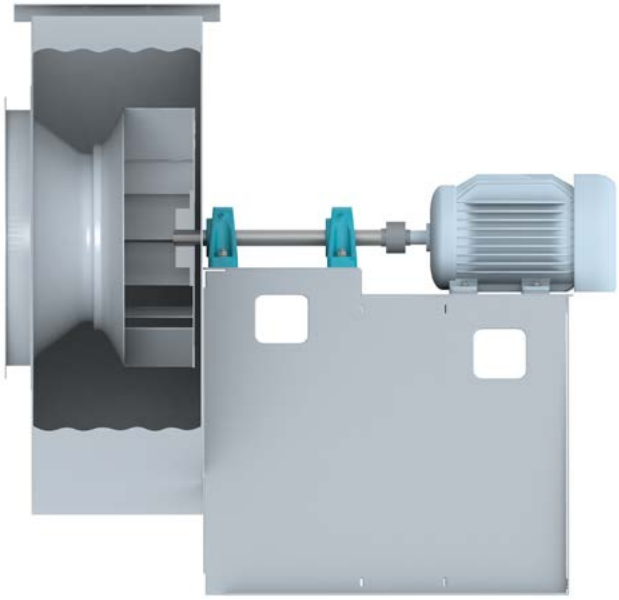
A shaft is the core piece of the rotor assembly (impeller and shaft) of a fan. The shaft is supported by two bearings in one of two basic mounting arrangements:

1. Overhung impeller
2. Center hung impeller

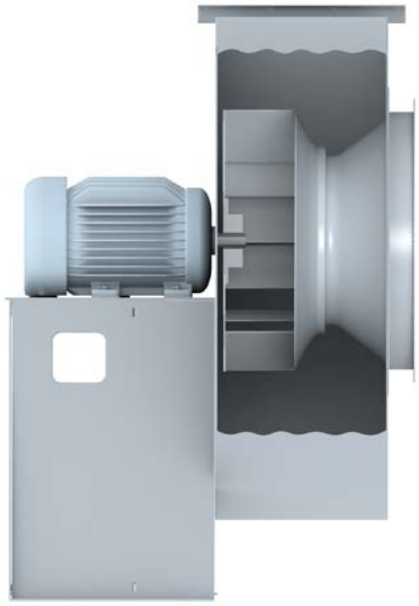
Shafts come in varying diameters to align with the structural, vibration and balance requirements of the fan assembly. Shaft materials vary based on the environment in which the fan assembly is operated.

Overhung Impeller Arrangement

Arrangement 8 shown
(also applies to Arrangements 1, 9 and 10)



Arrangement 4

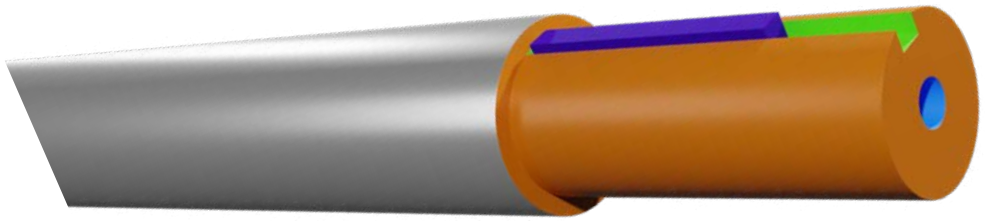


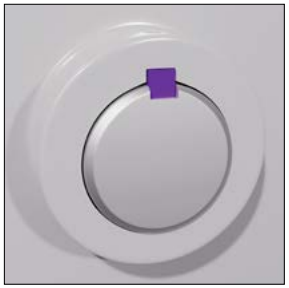
- Two bearings located within motor frame
- Shaft is integral to motor

Center Hung Impeller Arrangement

Arrangement 3 shown
(also applies to Arrangement 7)

SHAFTS
FEATURES & MATERIALS





Typical Square Key

Stepped Key

FEATURES

Keystock: Method of connecting the shaft to the rotating element (i.e. bushing, coupling, impeller, sheave, etc.). A square key is typically supplied. A stepped key is used only when a square key is not possible.

Keyways: Groove cut into the shaft to accept a piece of keystock.

Tachometer (Tach) Hole: Dimple machined into the end of the shaft for use with a mechanical tachometer to read the speed (RPMs) of a shaft during operation.

Turndowns: Shaft turned (machined) down to a smaller diameter on one or both ends.

ACCESSORIES

- **Anti-Rotation Device**
- **Bushing**
- **Coupling**
- **Drive Sheaves**
- **Hub Cap**
- **Set Screw**
- **Shaft Cooler**
- **Shaft Collar**
- **Shaft Sleeve**
- **Zero Speed Switch**

See Shaft Accessories in *Accessories* section for more information.

MATERIALS OF CONSTRUCTION

Mild steel is typically used unless otherwise specified of the following types:
- Grade 1045 TG&P (Turned, Ground & Polished)
- Grade 4140 TG&P (Hot Rolled Annealed)
  - Hot Rolled Stress Relieved can be provided upon special request
- Other special grades used when specified by customer.

Stainless Steel (SST) is used when specified:
- Type 304 and 316 can be used
- Type 2205 Duplex as specified by customer

AMPCO-45 is a nickel-aluminum bronze alloy used on axial fans when AMCA A Sparkproof construction is required in marine applications.

Monel is used for fans with AMCA A Sparkproof construction with a specialty shaft seal is required.

Titanium is used upon special request.

SPECIALTY SHAFTING

Cladded Shafting: Used to save costs when shaft is large diameter (9 inch diameter or more) with special material (i.e. stainless steel) in the airstream.

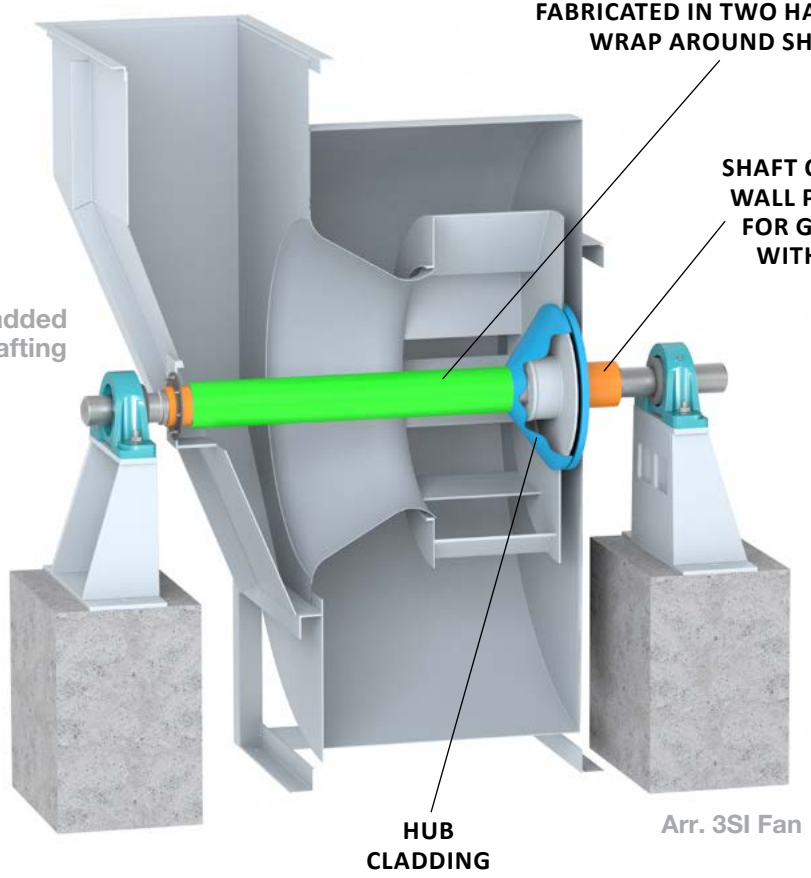
Notes:

1. *Consists of mild steel shaft and hub with special material cladding to match airstream material.*
2. *Common shaft material grades used: 1018, 8620*

Special Turndowns: Some arrangements have multiple turndowns, such as Arr. 3SI/DI or Arr. 7SI/DI.

Note: When required due to design, typical turndown locations are at the hub, at shaft seal(s), at bearings or at coupling.

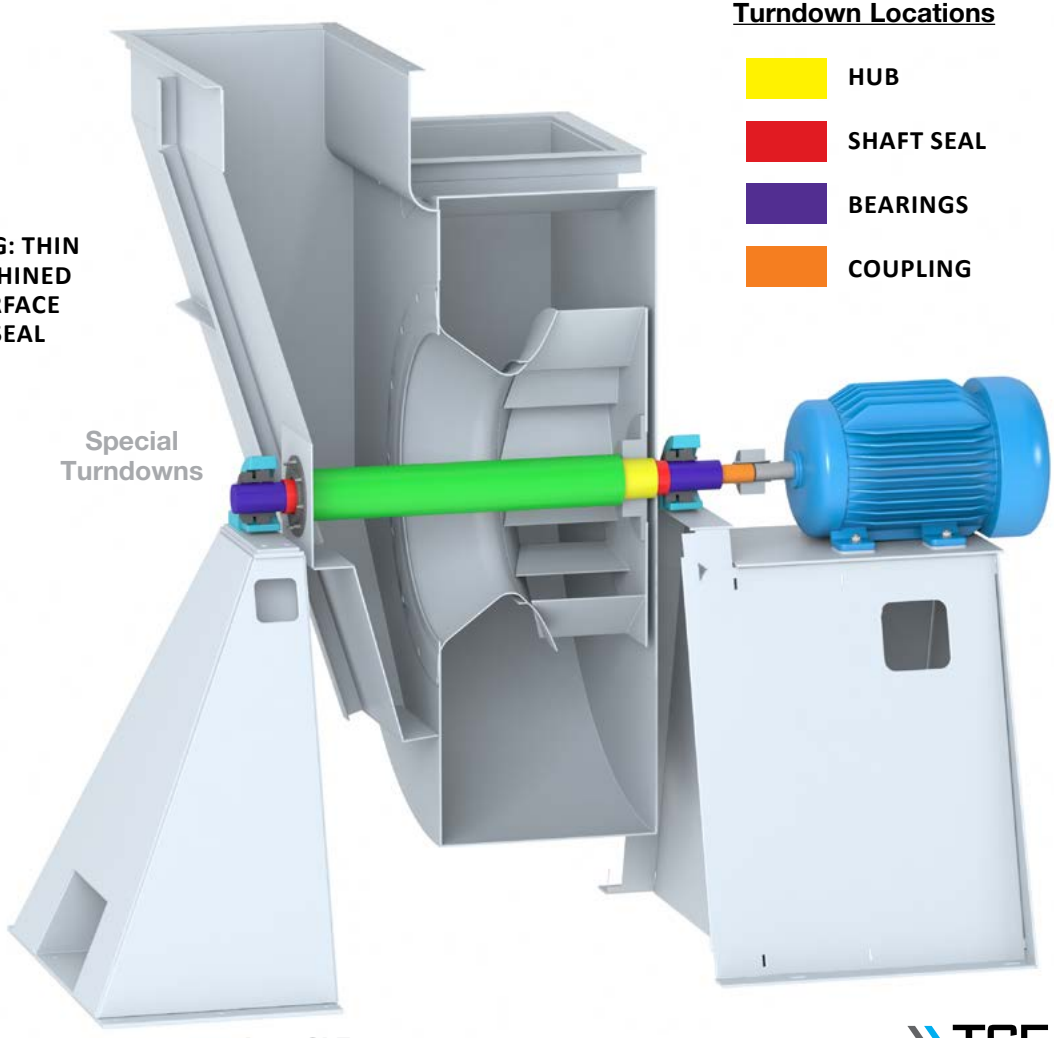
Cladded Shafting



Arr. 3SI Fan

NOTE: All colored sections of shaft and hub are cladded.

Special Turndowns



Arr. 7SI Fan

SPECIALTY SHAFTING

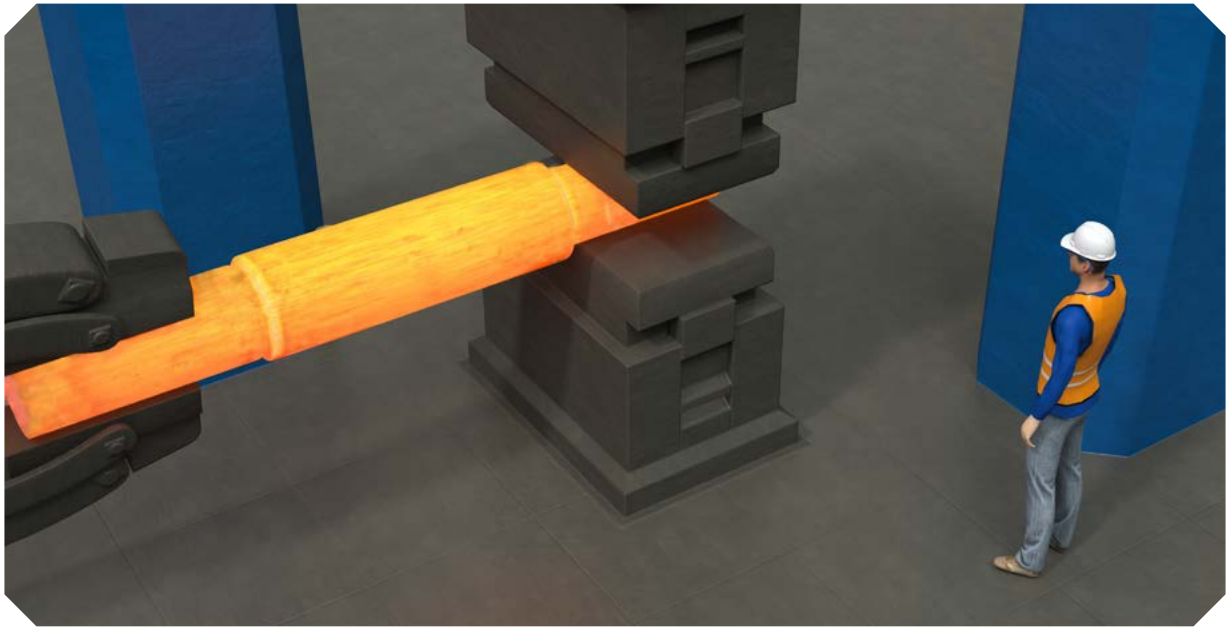
Hollow Shafts: Shaft has a hollow core. This specialty shaft is usually provided by others in the field.

Hollow Shafts

Forged Shafts: Forging is the process of working metal to a desired shape by impact or pressure in hammers, forging machines (upsetters), presses, rolls and related forming equipment. Forging is done hot at approximately 2,200°F.

Forged shafts are commonly used in the following industries: API, Cement, Power and other industries that use very large fans. They are usually used on Arrangement 3DI and 3SI fans, when shaft diameter is large at the major diameter with multiple turndowns for bearings, shafts seals, couplings, etc. This can reduce machining time and cost.

This is a purchased part that is machined to TCF specifications by outside vendors. Machining is done in two stages: rough and final. Additional heat treating may be required after forging to increase the strength of the metal at the surface of the shafting. Forging, heat treating and machining may require multiple vendors and long lead time. Forged shafts are usually supplied by customer request.



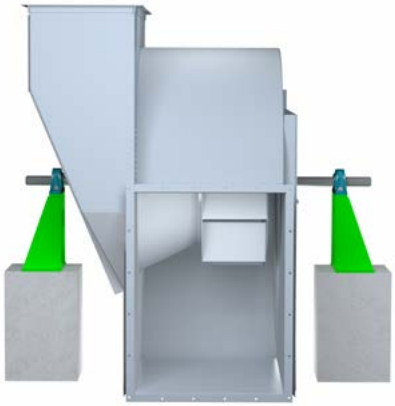
Forged Shaft

OVERVIEW

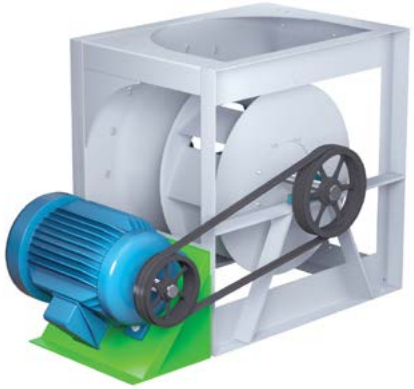
Pedestals provide a means of support for components such as motors, bearings and shafts. These components then provide a way to mount the impeller. The pedestal also provides structural stability to the fan assembly to aid in proper balancing and vibration requirements. The basic parts of a pedestal typically consist of a top, sides, feet, front and sometimes back. (See *Pedestals: Features* page for more information.) Typical construction consists of angled, straight or formed sheet metal.

All fans do not require a pedestal (i.e. Arrangement 3 fans, air kits, etc.) but do require some type of support supplied by TCF or others in the field.

Arrangement 1

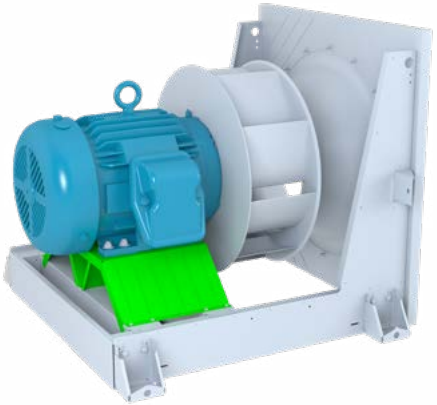


Arrangement 3SI
(with Independent Bearing Pedestals)

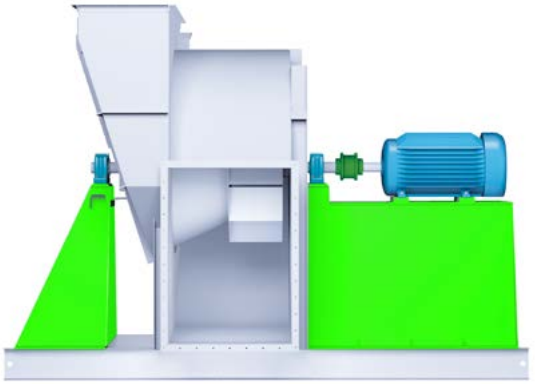


Arrangement 3SM

Arrangement 4
(Housed Centrifugal)



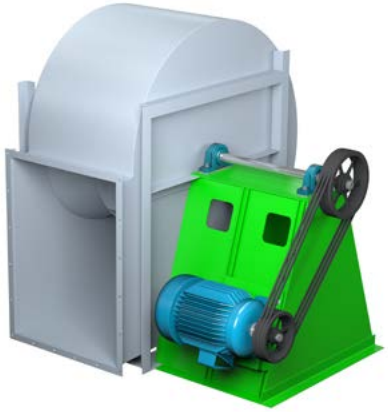
Arrangement 4
(Plenum)



Arrangement 7SI

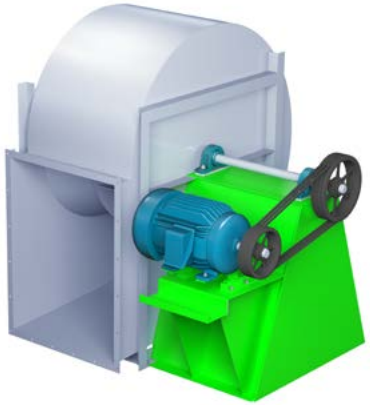
PEDESTALS
OVERVIEW

Arrangement 8



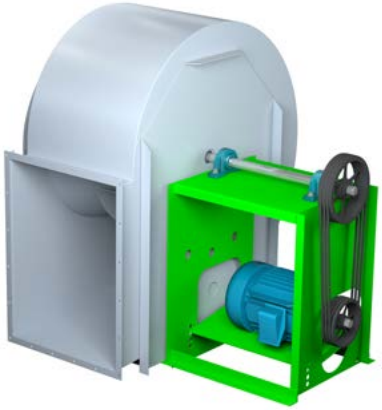
Arrangement 9

Slide Base



Pivot Base

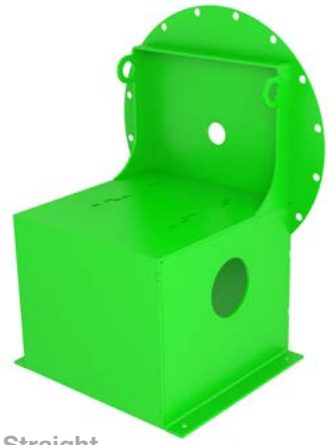
Arrangement 9H



Arrangement 10

Typical Pedestal Construction

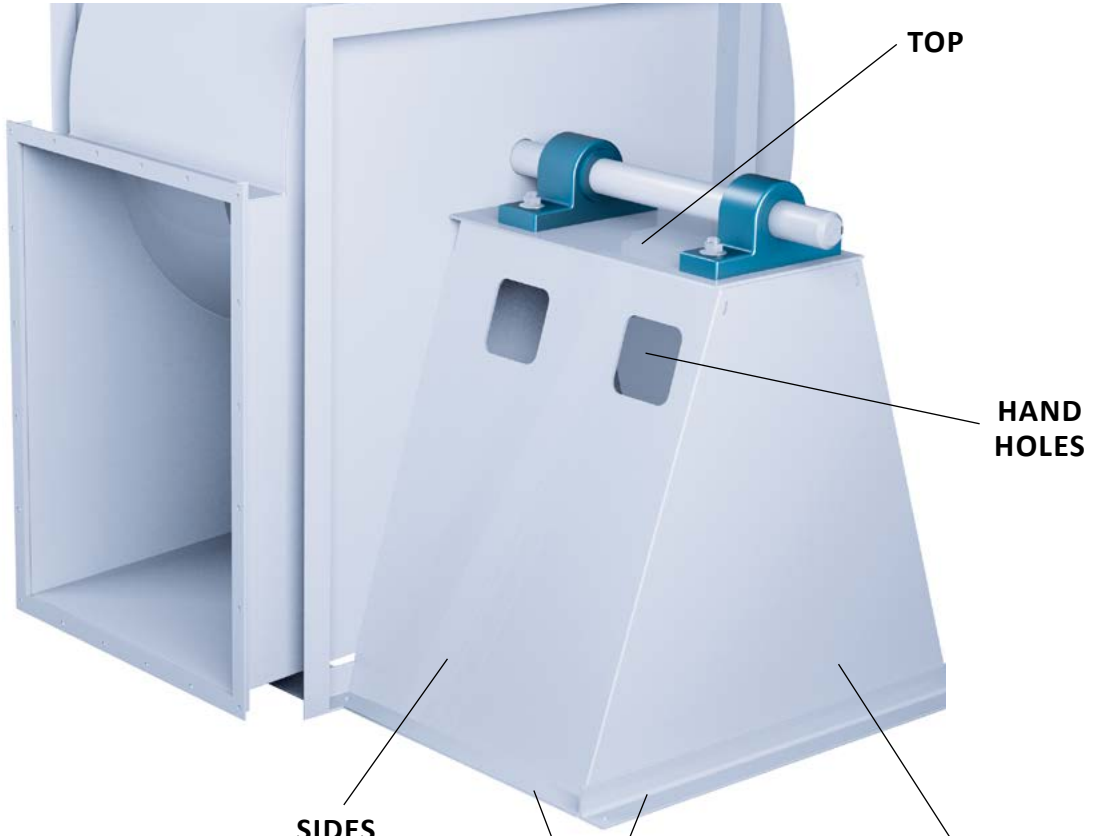
Angled



Straight

Formed
Sheet Metal

PEDESTALS
FEATURES



Bearing or Motor Pads

- **Bearing or Motor Pads:** Put on some pedestals to provide stiffness and/or a flat surface
- **Bolt-On Pedestals:**
  1. Non-Rotatable Fan Pedestal: Used when pedestal needs to be detached from fan housing for various reasons, such as fitting fan through a smaller opening, sending pedestal out for special machining or using dissimilar metals (i.e. SST or aluminum fan housing and mild steel pedestal)
  2. Rotatable Fan Pedestal: Used on specific models of fans that are rotatable to several different discharge positions
- **Buffer Strips:** Used when customer specifies that corrosion resistant (i.e. stainless steel) housing may not be welded to a mild steel pedestal
- **Hand Holes:** Provides access to fasteners of bearings, motor and other necessary components
- **Heat Shield:** Used on high temperature applications
- **Pedestal Reinforcements/Internal Structural Support:** Can be in various forms such as angles, flat bar, channels and gussets
- **Unistrut:** Specialized channel used on some Arr. 9 fans as a means of mounting a motor slide base, which allows for a wider range of belt center adjustment
- **Separated Pedestal:** Used on high temperature applications. This design reduces the fan housing heat that is conducted into the pedestal and bearings. It also provides a gap to allow insulation to be installed.

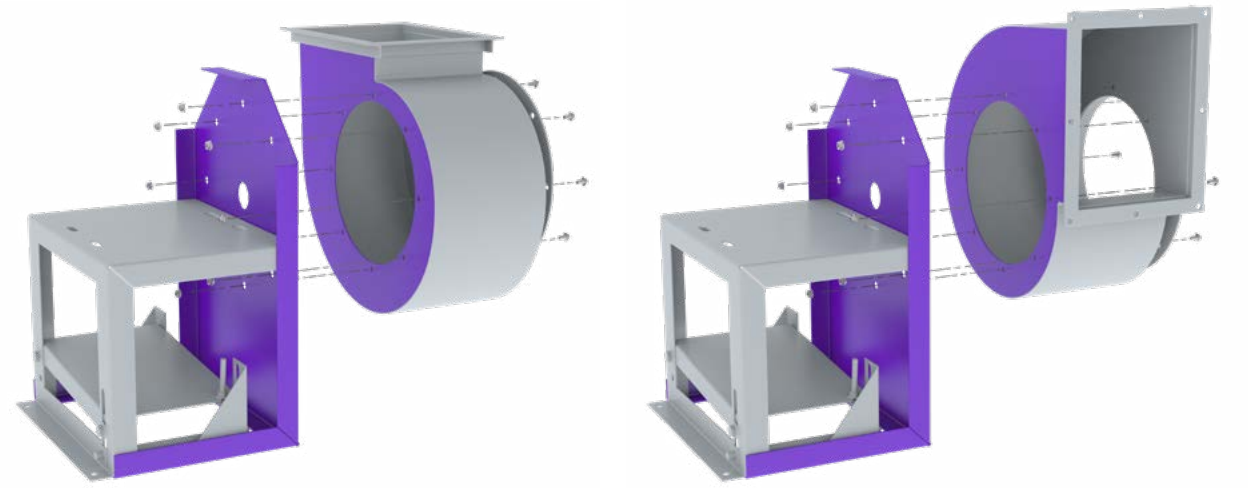
ACCESSORIES

- **Positioners**
- **Machined Top or Pads**
- **Grease Pan**
- **Rebar**
- **Stop Blocks**

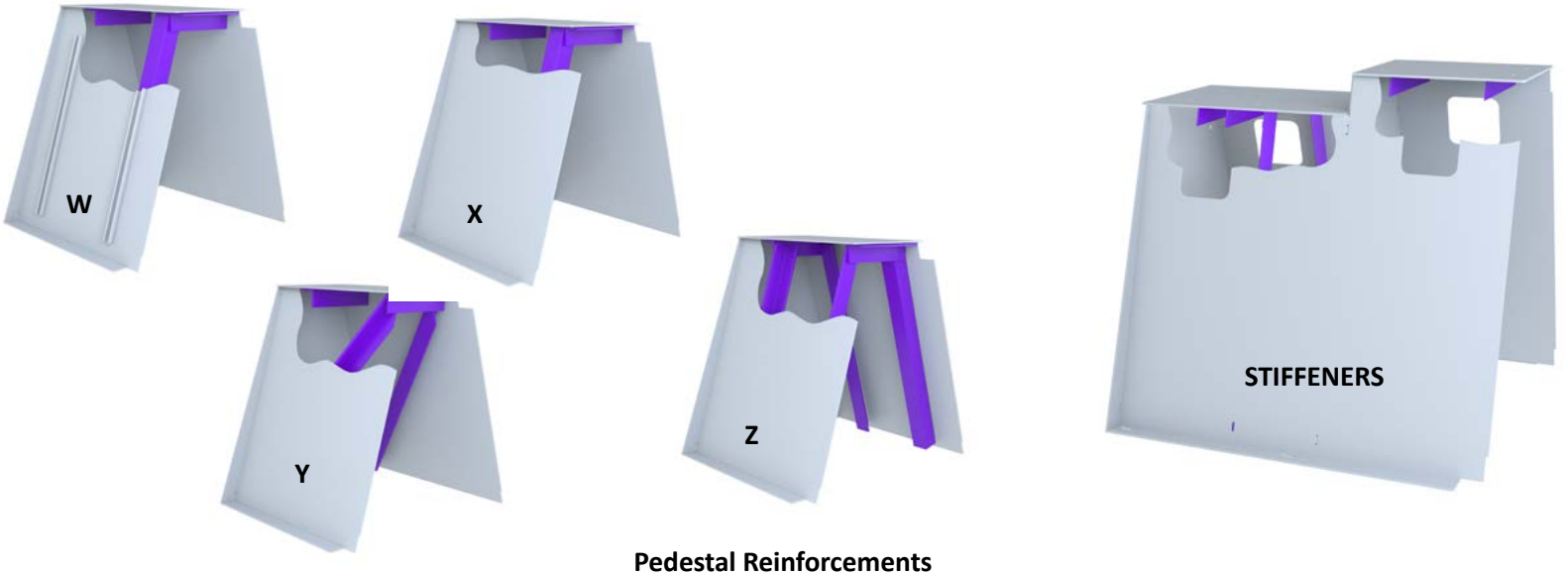
See Pedestal Accessories in *Accessories* section for more information.

PEDESTALS
FEATURES

Bolt-On Pedestal: Non-Rotatable Fan

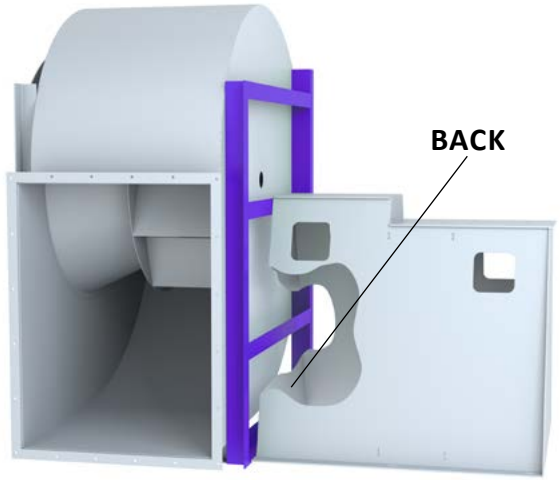


Bolt-On Pedestal: Rotatable Fan

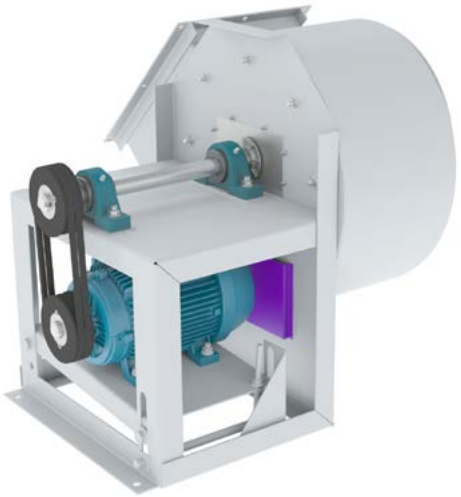


Pedestal Reinforcements

PEDESTALS
FEATURES



Separated Pedestal



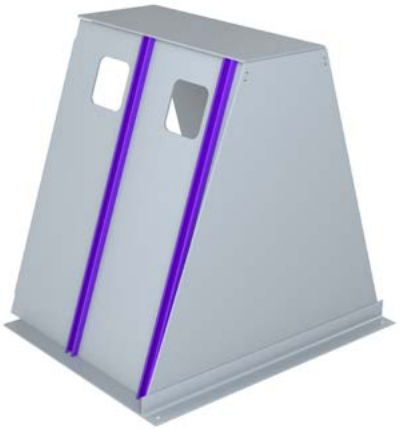
Heat Shield

Buffer Strips

See *Special Construction: High Temperature Construction* section for additional information.

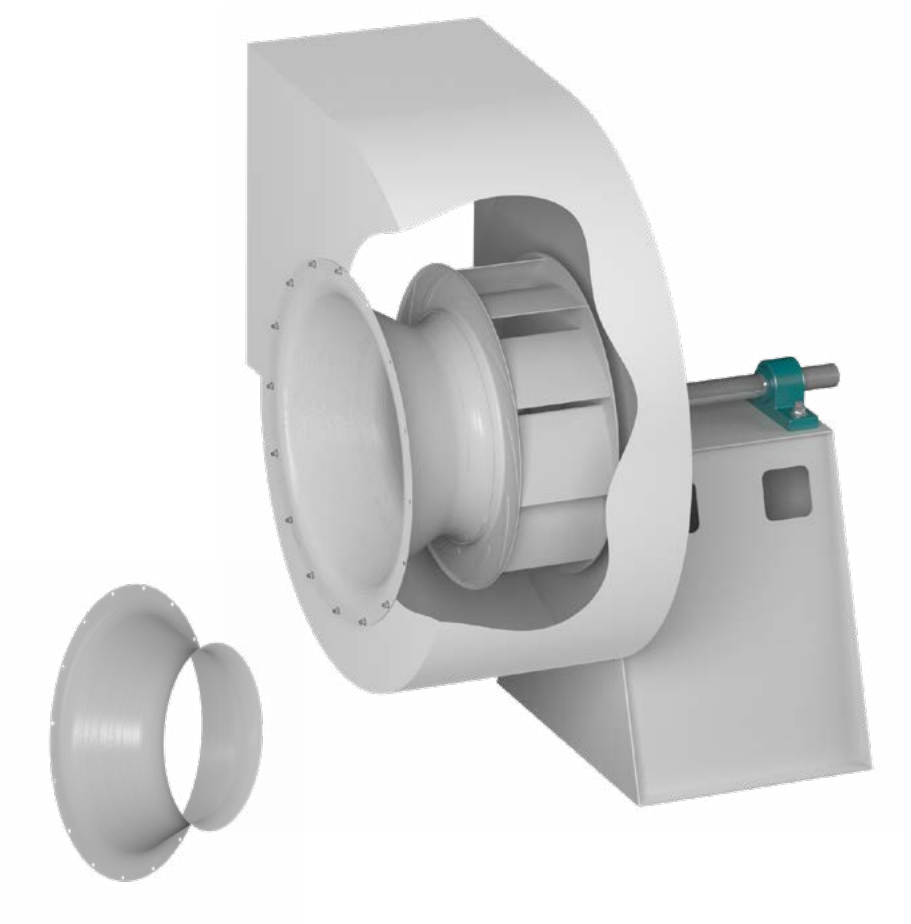
Hand Holes

- **Bearing Access**
- **Used for Mounting of Split Bearings**
- **Motor Access**
- **Access to Outlet Flange Holes (for DBD fans)**



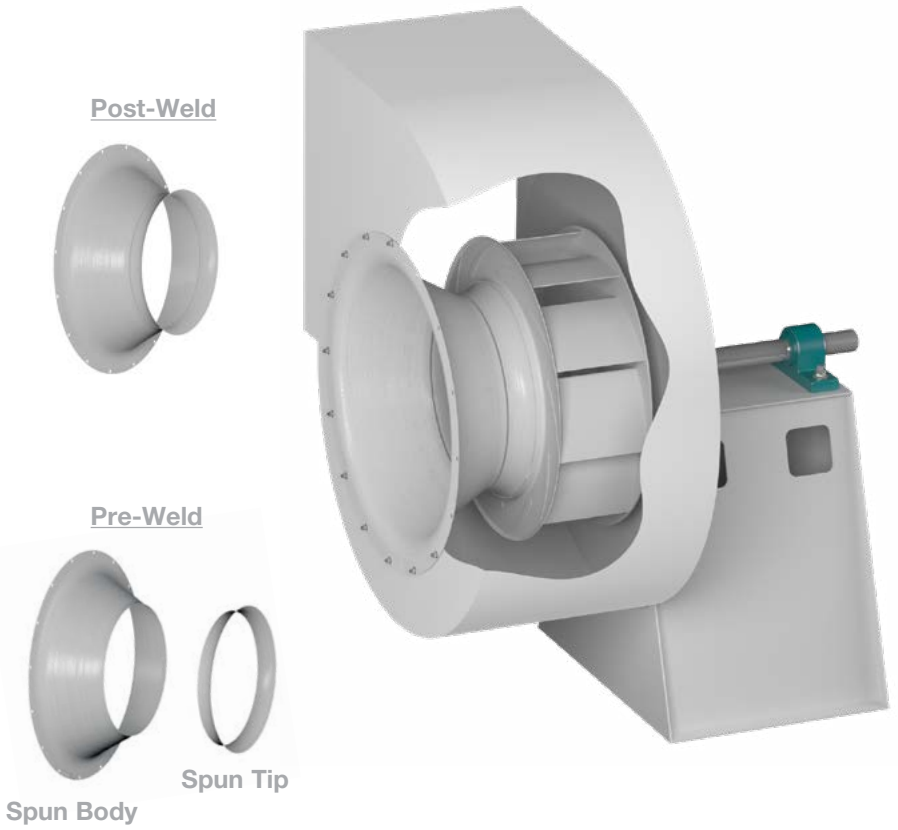
Unistrut Channels

INLET FUNNELS / VENTURIS



INLET FUNNEL
SOLID SPUN

Also known as:
- Inlet Cone
- Funnel
- Inlet Bell



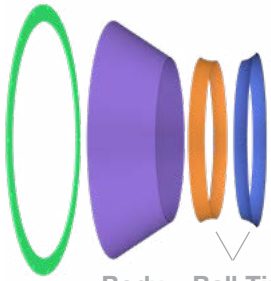
INLET FUNNEL
SPUN BODY, SPUN TIP

Also known as:
- Inlet Cone
- Funnel
- Inlet Bell

INLET FUNNELS / VENTURIS

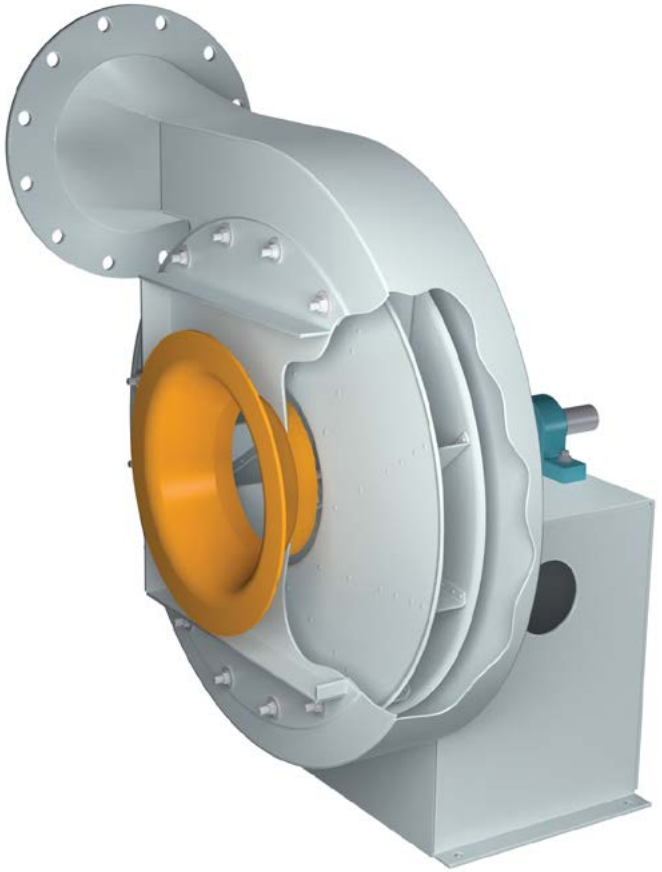
Post-Weld

Pre-Weld



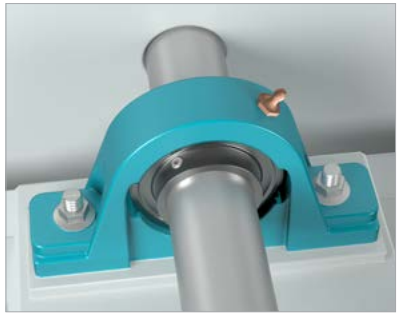
INLET FUNNEL
FABRICATED BODY, BALL ROLLED TIP

Also known as:
- Inlet Cone
- Funnel
- Inlet Bell

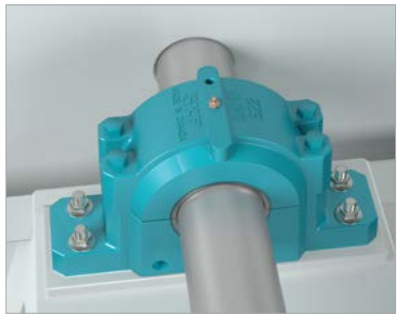


INLET VENTURI

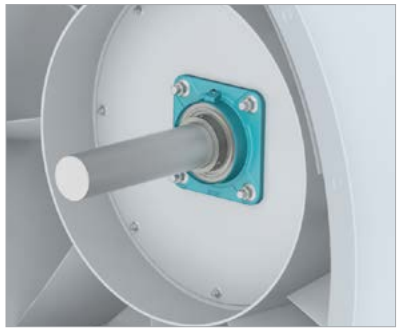
Also known as:
- Inlet Cone
- Funnel
- Inlet Bell



SOLID PILLOW BLOCK BEARING



SPLIT PILLOW BLOCK BEARING



FLANGE MOUNT BEARING

BEARING LIFE

Under laboratory conditions with controlled loads and proper lubrication, bearings fail due to fatigue. Bearing life is a statistical calculation of when a percentage of a population of bearings will fail based on bearing geometry, bearing load and speed. All bearings have a finite life and will eventually fail.

L-10 LIFE

A statistical estimate of hours that 10% of a population of bearings at a given speed and loading condition will fail.

L-50 LIFE OR AVERAGE LIFE

- Occasionally, the term “average life” or L-50 is used. A statistical estimate of hours 50% of a population of bearings at a given speed and loading condition will fail.
- It is calculated by multiplying the L-10 life by five. For example, a bearing with an L-10 life of 40,000 hours has an L-50 life of 200,000 hours.

TCF BEARING LIFE STANDARDS

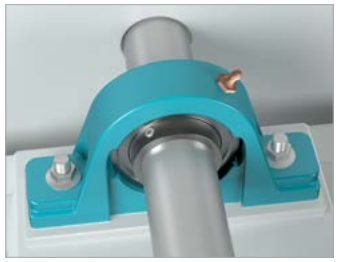
(The examples below depict life in years based on these calculations.)

- Most TCF fan models offer a bearing life of L-10 – 40,000 hours.
- Some models are offered at L-10 – 20,000, L-10 – 40,000, L-10 – 60,000, L-10 – 80,000 and L-10 – 100,000 hours.
- *See the product catalogs for the bearing life specifications by model.*

Example 1		24 Hours / Day 7 Days / Week	24 Hours / Day 5 Days / Week	16 Hours / Day 5 Days / Week	8 Hours / Day 5 Days / Week	2 Hours / Day 5 Days / Week
L-10	40,000 Hours	4.6 years	6.4 years	9.6 years	19 years	77 years
L-50	200,000 Hours	22.8 years	32 years	48 years	96 years	385 years

Example 2		24 Hours / Day 7 Days / Week	24 Hours / Day 5 Days / Week	16 Hours / Day 5 Days / Week	8 Hours / Day 5 Days / Week	2 Hours / Day 5 Days / Week
L-10	20,000 Hours	2.3 years	3.2 years	4.8 years	9.6 years	39 years
L-50	100,000 Hours	11.5 years	16 years	24 years	48 years	193 years

HOW BEARINGS CONNECT TO PEDESTAL



2 HOLE MOUNT

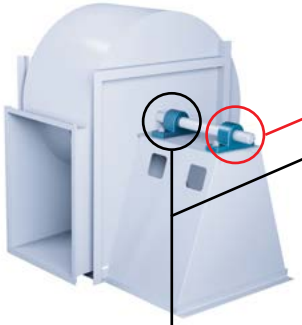
TCF standard 2 hole mount:
Fan shafts 2-15/16 dia. and below

4 HOLE MOUNT

TCF standard 4 hole mount:
Fan shafts 3-7/16 dia. and above

NOTE: Some manufacturers can offer only 2 hole or 4 hole mount beyond these ranges.

BEARING LOCATIONS (CENTRIFUGAL FANS WITHOUT PEDESTAL)

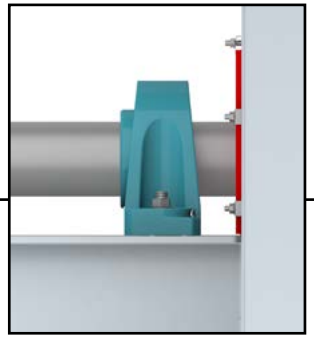


NOTE: Drive end "Outboard" bearing is set 3/4" in from end of pedestal top plate

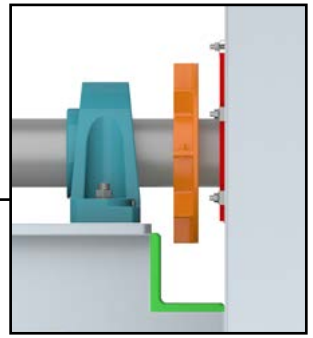
NOTE: Non-drive end bearing is also referred to as an "Inboard" bearing

Shaft Seal **Bearing** **Shaft Cooler** **High Temp Angle**

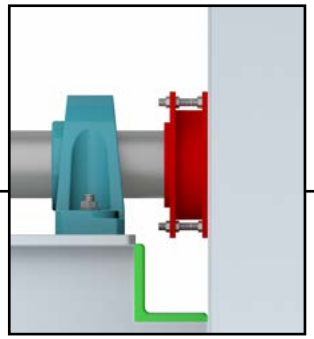
AKA: Heat Angle, Inverted Angle, Spacer Angle



Standard Temp Style Pedestal with Standard Shaft Seal

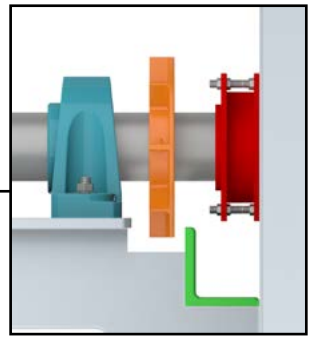


High Temp Style Pedestal with Standard Shaft Seal and Cooler



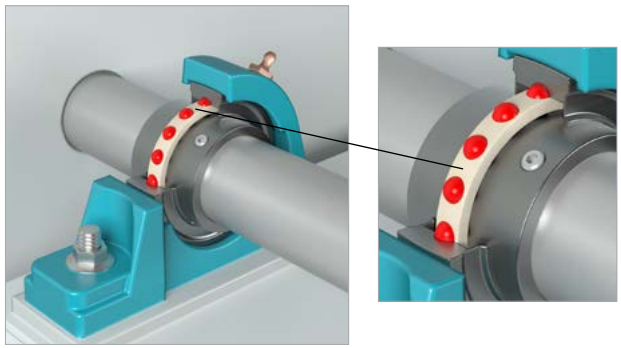
High Temp Style Pedestal Stuffing Box or Mechanical Shaft Seals

NOTE: Used for low temp applications

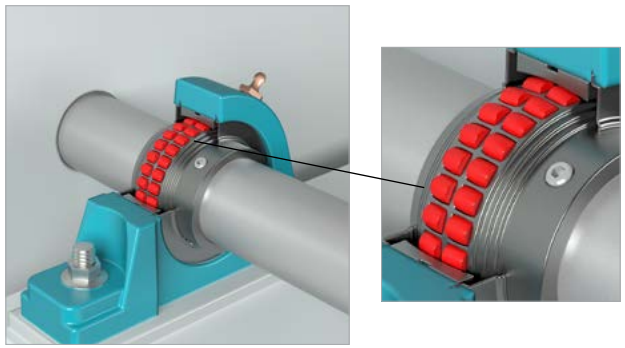


High Temp Style Pedestal With Shaft Cooler and Stuffing Box or Mechanical Shaft Seals

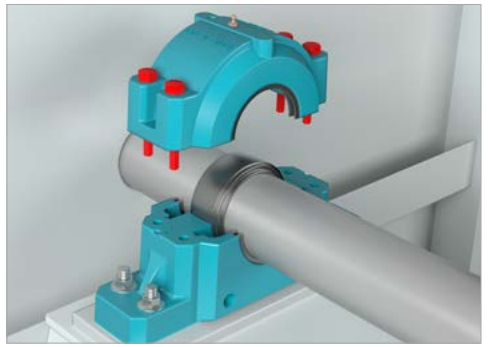
PILLOW BLOCK BEARINGS



SOLID PILLOW BLOCK BEARING
ROLLING ELEMENT: BALL TYPE

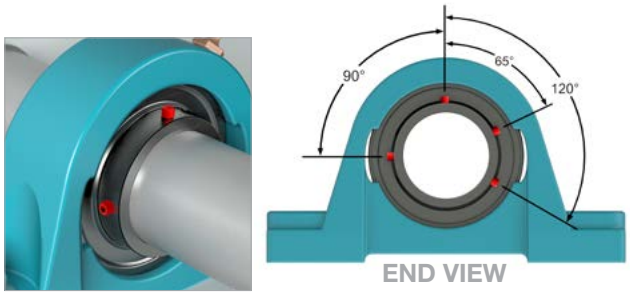


SOLID PILLOW BLOCK BEARING
ROLLING ELEMENT: SPHERICAL ROLLER TYPE



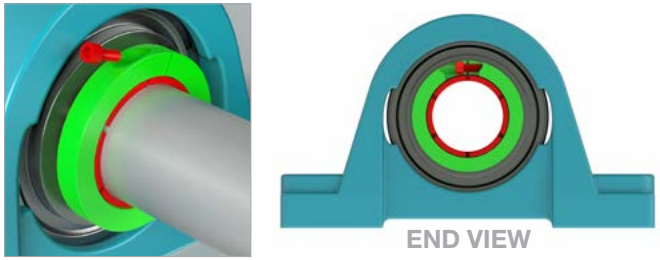
SPLIT PILLOW BLOCK BEARING
ROLLING ELEMENT: OFFERED IN BALL TYPE AND SPHERICAL ROLLER TYPE

HOW BEARINGS CONNECT TO SHAFT



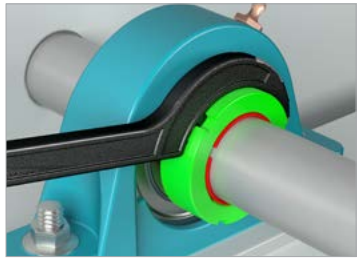
SET SCREW MOUNT

- Two set screws required
- Spacing varies by manufacturer
  Dodge: 65°
  Linkbelt: 90°
  Sealmaster/Linkbelt: 120°



D-LOK / SKEWZLOC
(CONCENTRIC MOUNT)

- Tightens to shaft using a partially segmented inner ring
- Tighten split locking collar with cap screw

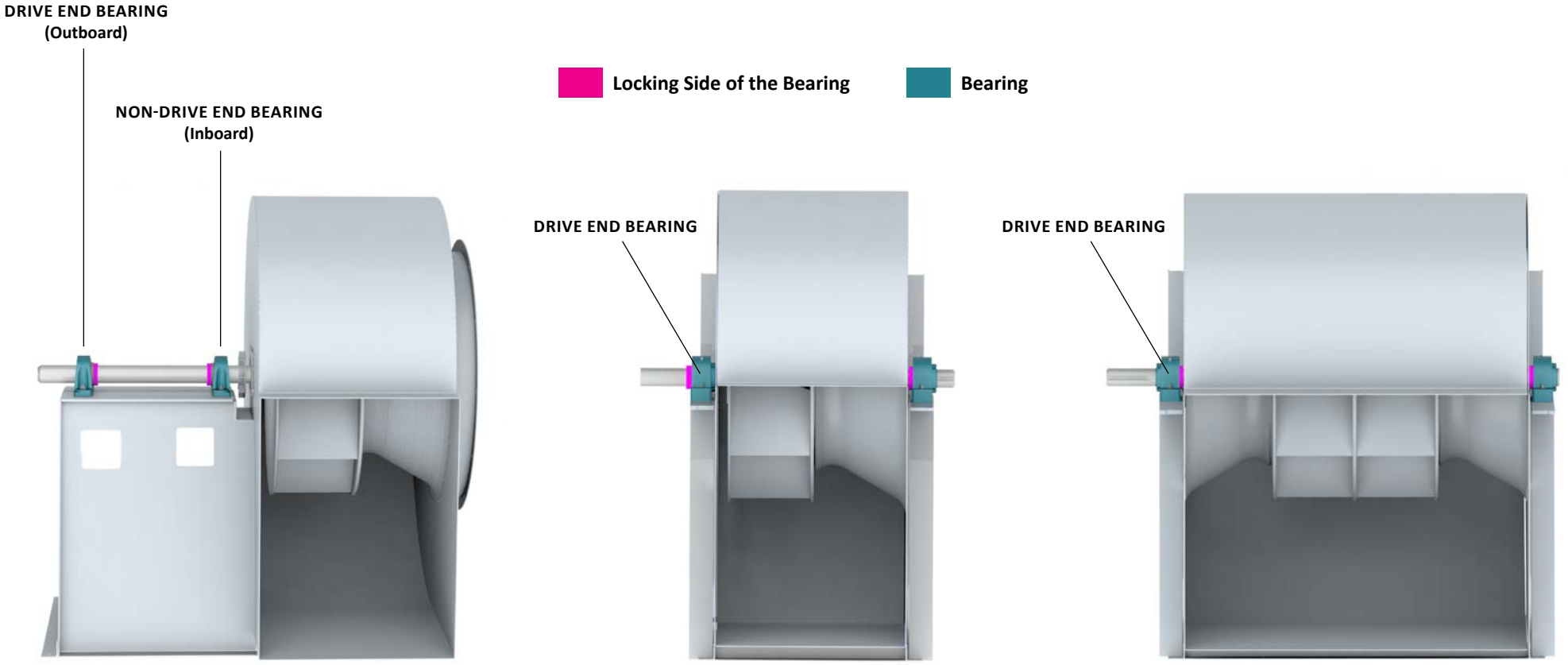


ADAPTER MOUNT
(CONCENTRIC MOUNT)

- Tightens to shaft using a partially segmented inner ring
- Tighten locking collar with spanner wrench. Use for both solid and split pillow block bearings.

NOTE: See *Technical Descriptions* section for detailed descriptions of pillow block bearings.

LOCKING COLLAR ORIENTATION / DRIVE END LOCATIONS



SWSI Arrangements
1, 8, 9, 9F, 10

SWSI Arrangements
3*, 3SI, 7, 7SI

DWDI Arrangements
3, 3DI, 7, 7DI

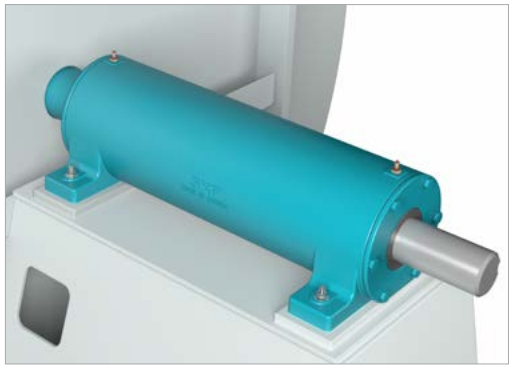
**on Arr. 3 inlet driven fans, the drive end bearing is located on the inlet side of the fan*

NOTE: Includes all Plenum Fan arrangements

NOTE: SPECIALTY BEARINGS ARE USED ON SPECIAL APPLICATIONS ONLY

TOTALLY SPLIT ROLLER BEARING

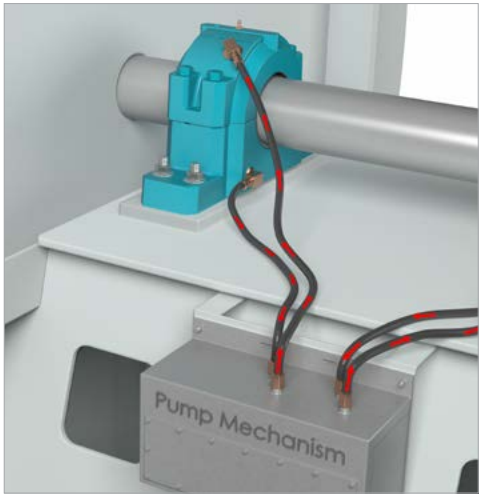
- All internal bearing parts split into TWO HALVES
- Pillow block housing is split
- Allows removal of internal bearing parts without totally removing the shaft



TWO BEARING HOUSING
Also known as Monoblock Bearings

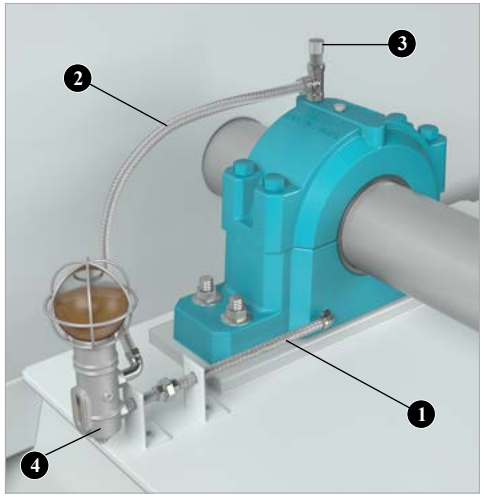
- Pillow block bearings built inside a common housing
- Special shaft required per application
- Preserves precise alignment of bearings

NOTE: OIL LUBRICATED BEARINGS SYSTEMS ARE USED ON SPECIAL APPLICATIONS ONLY



OIL MIST LUBRICATION SYSTEM

- One pump unit for both bearings
- Inlet line on top of each bearing delivers an oil mist
- Outlet line on bottom recirculates liquid oil back to the pump unit



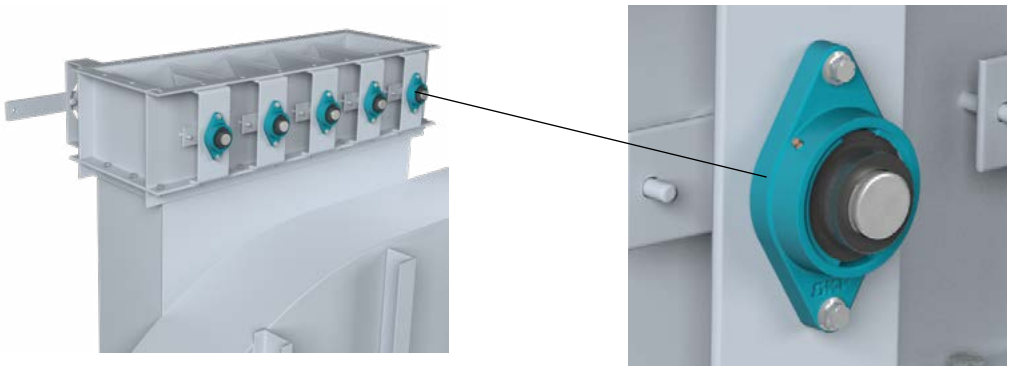
STATIC OIL LUBRICATION SYSTEM (TRICO OILER)

- Separate Trico Oiler unit for each bearing

1. Inlet (Supply) Line
2. Pressure Relief Line
3. Breather Tube/Vent or Connection for Pressure Relief Line
4. Oiler Reservoir based on fan impeller rotation
   - CW: Left
   - CCW: Right

NOTE: See *Technical Descriptions* section for more detailed descriptions.

DAMPER LINKAGE RELATED

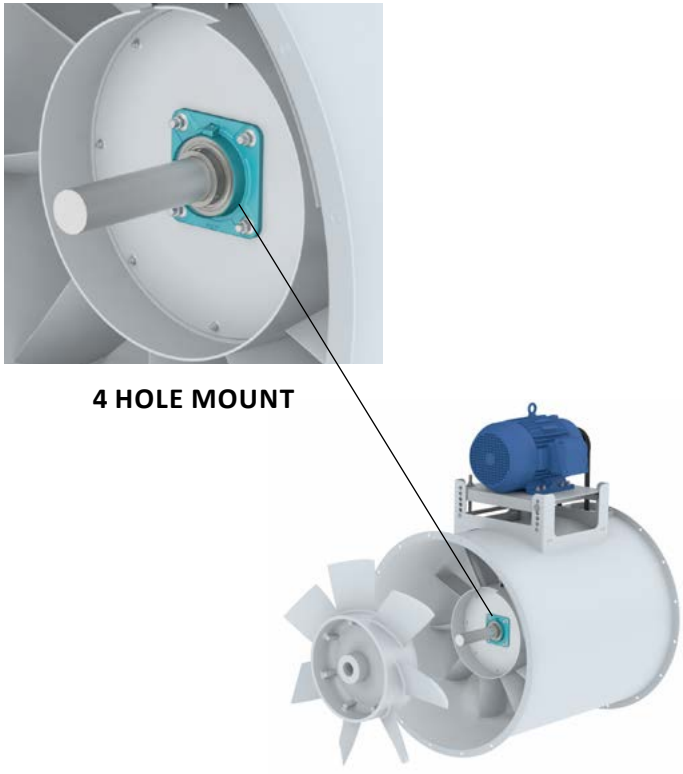


FLANGE BEARING 2 HOLE MOUNT
Used for the following:
- Dampers with Bearing Bridges (shown above)
- Directly Mounted to a Damper without Bearing Bridges
- Control Linkage Rod support for Inlet Vanes

RULON BEARINGS, BRONZE BEARINGS and NEEDLE BEARINGS
- Used to support Blade Rods in Nested and External Inlet Vanes
- Materials of Construction
  - Needle: Stainless Steel
  - Rulon: Teflon
  - Bronze: Bronze Alloys

BUSHING TYPE BEARINGS (FLANGE STYLE)
- Used to support Blade Rods in Outlet Dampers
- Control Linkage for Quadrants for Inlet Vanes and various styles of Dampers

FAN SHAFT RELATED



4 HOLE MOUNT

- Flange Bearings available with Ball Type elements or Spherical Roller Type elements
  (See *Bearings: Pillow Block Bearings* section for definition of Rolling Elements)
- Used mostly in some axial fans and special fan applications

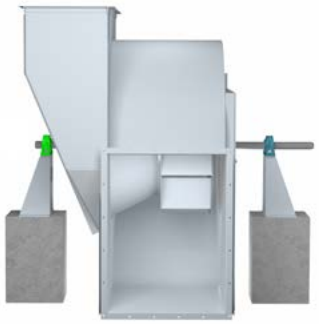
BEARINGS
FIXED & FLOATING BEARINGS

FIXED BEARING IS LOCATED ON THE DRIVE SIDE FOR HORIZONTAL MOUNTED FANS

SINGLE WIDTH CENTRIFUGAL (HORIZONTAL MOUNT)

Arrangements 1, 8, 9, 9F, 9ST, 9SS, 10

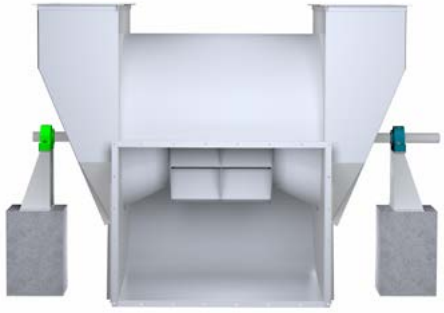
Arrangements 3 and 7



Arrangements 3SI* and 7SI*

DOUBLE WIDTH CENTRIFUGAL (HORIZONTAL MOUNT)

Arrangements 3, 3F and 7



Arrangements 3DI* and 7DI*

* Ball Type Bearings 300°F and below may require one fixed and one floating bearing

OVERVIEW

Two bearings support and locate a shaft axially and radially in relation to the housing, which is stationary. There is a "fixed" side and a "floating" side. The fixed side controls the shaft axially. The floating side has more freedom of movement (floating) to help compensate for thermal expansion or contraction of shaft.

Guidelines for use

300°F and below

Ball Type: Use 2 fixed
Roller Type: (1) fixed; (1) floating
Split Roller Type: (1) fixed; (1) floating

301°F and above

All Types: (1) fixed; (1) floating

FIXED BEARING

Also known as:
Non-Expansion Bearing
Thrust Bearing

FLOATING BEARING

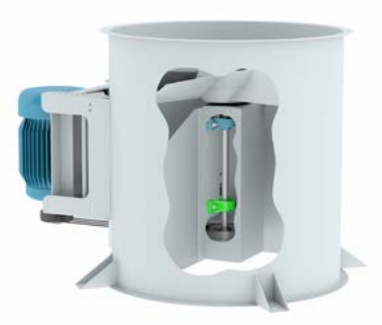
Also known as:
Expansion Bearing
Non-Locating Bearing

BEARINGS
FIXED & FLOATING BEARINGS

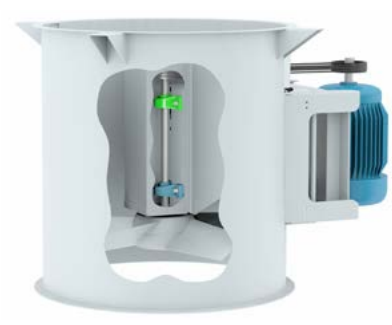
FIXED BEARING IS LOCATED ON THE DRIVE SIDE FOR HORIZONTAL MOUNTED FANS

FLOATING BEARING IS LOCATED ON THE DRIVE SIDE FOR VERTICAL MOUNTED FANS

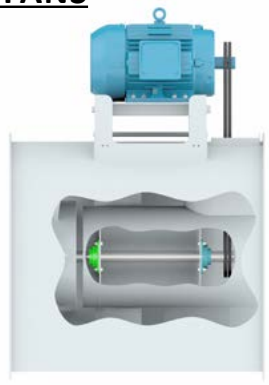
AXIAL, MIXED FLOW, TUBULAR CENTRIFUGAL FANS



Arrangement 9
Axial / Mixed Flow
(Vertical Floor Mount)



Arrangement 9
Axial / Mixed Flow
(Vertical Ceiling Mount)



Arrangement 9
Axial / Mixed Flow
(Horizontal Mount)

PLUG FANS

Arrangement 1P, 8, 8P, 9P
Plug Fan
(Horizontal Mount)

(Horizontal Mount)

(Vertical Up Mount)

(Vertical Down Mount)

Arrangement 9
Plug Fan

OVERVIEW

Two bearings support and locate a shaft axially and radially in relation to the housing, which is stationary. There is a "fixed" side and a "floating" side. The fixed side controls the shaft axially. The floating side has more freedom of movement (floating) to help compensate for thermal expansion or contraction of shaft.

Guidelines for use

300°F and below

Ball Type: Use 2 fixed
Roller Type: (1) fixed; (1) floating
Split Roller Type: (1) fixed; (1) floating

301°F and above

All Types: (1) fixed; (1) floating

FIXED BEARING

Also known as:
Non-Expansion Bearing
Thrust Bearing

FLOATING BEARING

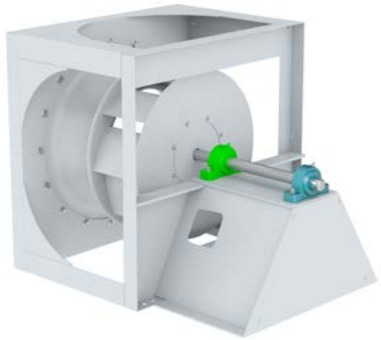
Also known as:
Expansion Bearing
Non-Locating Bearing

BEARINGS
FIXED & FLOATING BEARINGS

FIXED BEARING IS LOCATED ON THE DRIVE SIDE FOR HORIZONTAL MOUNTED FANS

FLOATING BEARING IS LOCATED ON THE DRIVE SIDE FOR VERTICAL MOUNTED FANS

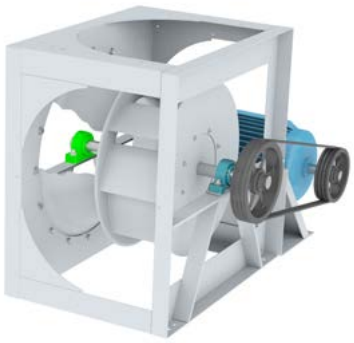
PLENUM FANS



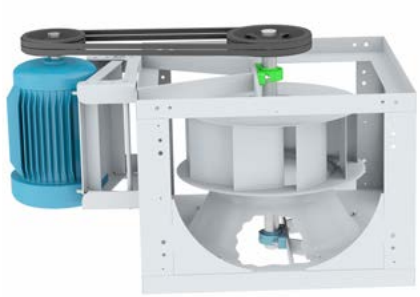
Arrangement 1
(Horizontal Mount)

Arrangement 3
(Horizontal Mount)

Arrangements 3HA / 3HS
(Horizontal Mount)



Arrangements 3SM
(Horizontal Mount)



(Vertical Up Mount)

(Vertical Down Mount)

Arrangement 3VA / 3VS

OVERVIEW

Two bearings support and locate a shaft axially and radially in relation to the housing, which is stationary. There is a "fixed" side and a "floating" side. The fixed side controls the shaft axially. The floating side has more freedom of movement (floating) to help compensate for thermal expansion or contraction of shaft.

Guidelines for use

300°F and below

Ball Type: Use 2 fixed
Roller Type: (1) fixed; (1) floating
Split Roller Type: (1) fixed; (1) floating

301°F and above

All Types: (1) fixed; (1) floating

FIXED BEARING

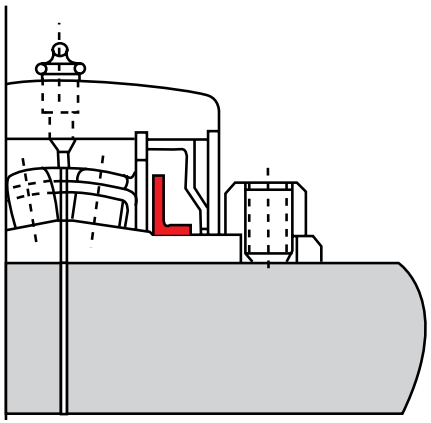
Also known as:
Non-Expansion Bearing
Thrust Bearing

FLOATING BEARING

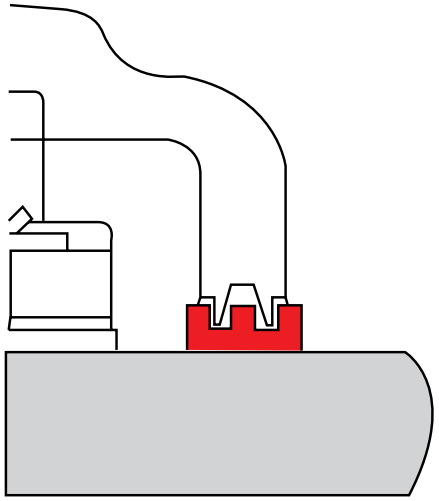
Also known as:
Expansion Bearing
Non-Locating Bearing

BEARINGS
BEARING SEALS

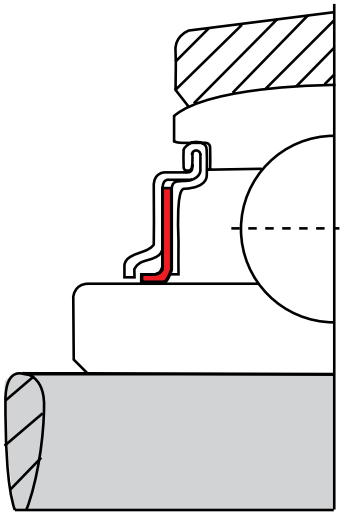
Seal Material Shaft



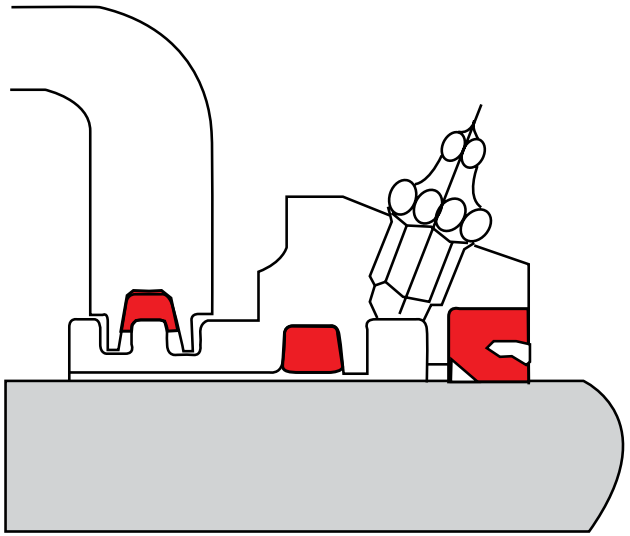
Labyrinth Seal



Labyrinth Seal



Lip Seal



Taconite Seal

GENERAL INFORMATION

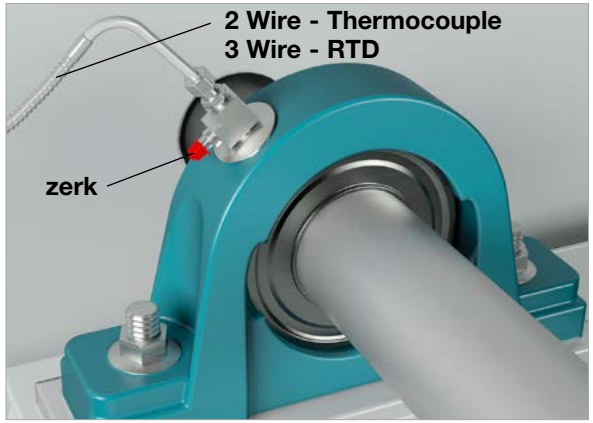
- Bearing seals prevent foreign material from entering the bearing
- Exact seal construction and material varies by bearing manufacturer
- Seal type dictates speed limits on operation (Max RPM)

COMMON BEARING SEALS

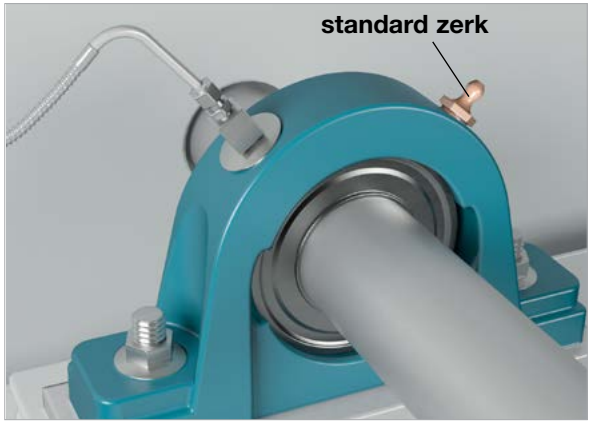
- **Labyrinth Seal (aka Non-Contact Seal)**
  - Used for higher speed applications
  - Used on Spherical Roller Bearings (Solid and Split Pillow Block)
- **Lip Seal (aka Contact Seal)**
  - Used for low to moderate shaft surface speeds
  - Used on Ball Bearings
- **Taconite Seal**
  - Designed for dirty or abrasive environments
  - Used on Split Pillow Block Spherical Roller Bearings
  - Standard Type Taconite Seal: speed limits are lower than standard labyrinth seals
  - Canadian Type Taconite Seals (aka Non-Contact) are available for higher speed limits
  - Taconite Seals can increase the width of the bearing
    > Requires longer shaft
    > May require repositioning of the bearing on the pedestal and/or a larger bearing support structure (i.e. bearing bar)

Refer to Fan Engineering Letter FE-1200.

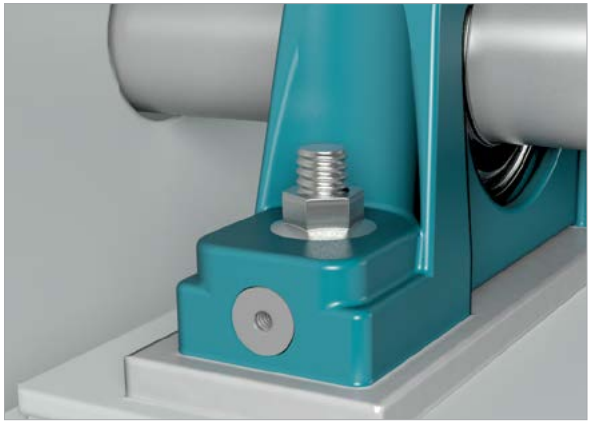
BEARINGS
ACCESSORIES/MODIFICATIONS



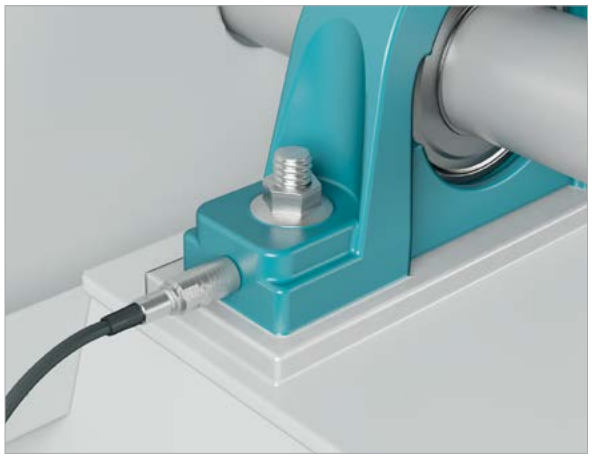
BEARING RTD / THERMOCOUPLE (TYPE K)
T-Fitting through existing zerk



BEARING RTD / THERMOCOUPLE (TYPE K)
Drilled and Tapped

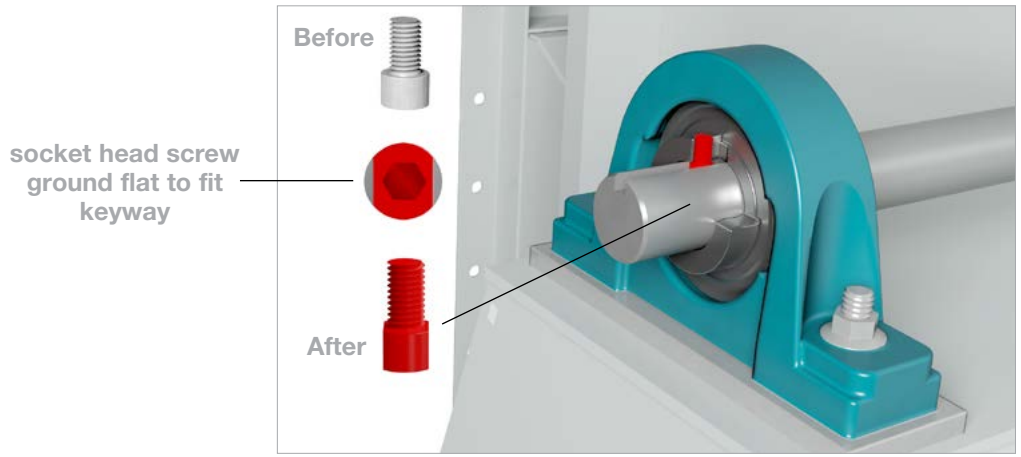


ACCELEROMETER HOLES
Drill and Tap: 1/4"- 28UNF with 1" spot face
Optional: Drill and Tap: 1/4"- 18NPT with 1" spot face

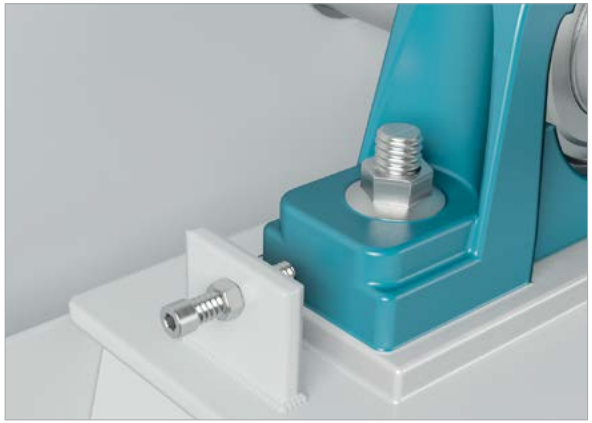


BEARING VIBRATION SENSOR
Standard 1/4" - 28 UNF with 1" spot face
(sensor cord supplied by others)

NOTE: See *Technical Descriptions* section for more detailed description.



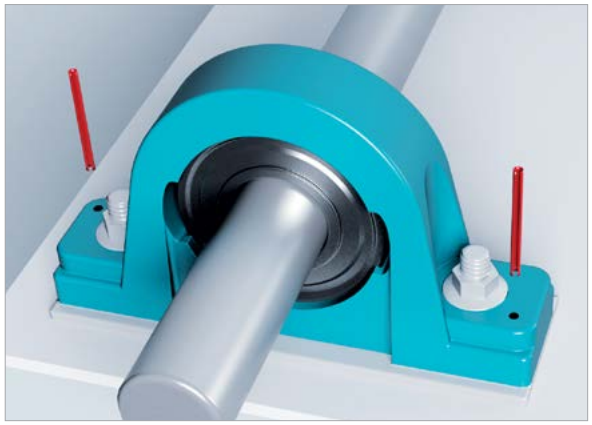
HIGH EXPANSION BEARING AND SHAFT MODIFICATION (for Air Kits Only)

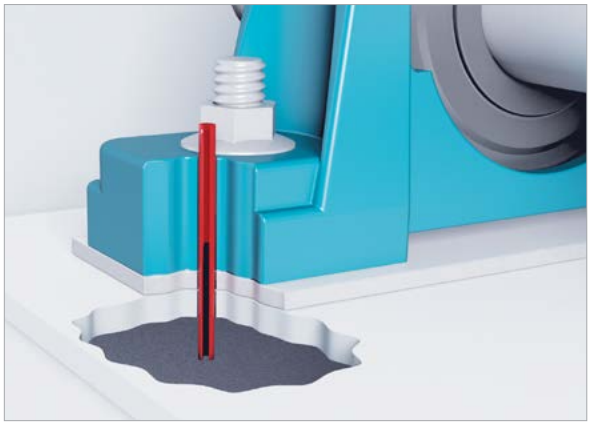


BEARING POSITIONERS

Also known as:
- Bearing Alignment Jacking Screws

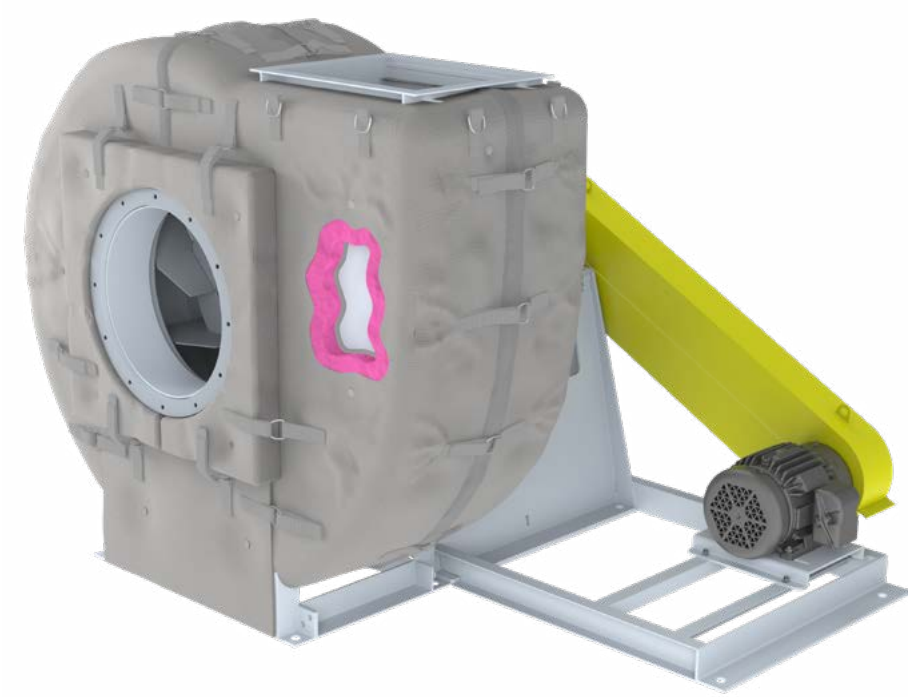
BEARING STOP BLOCKS
(Restrained Bearings)

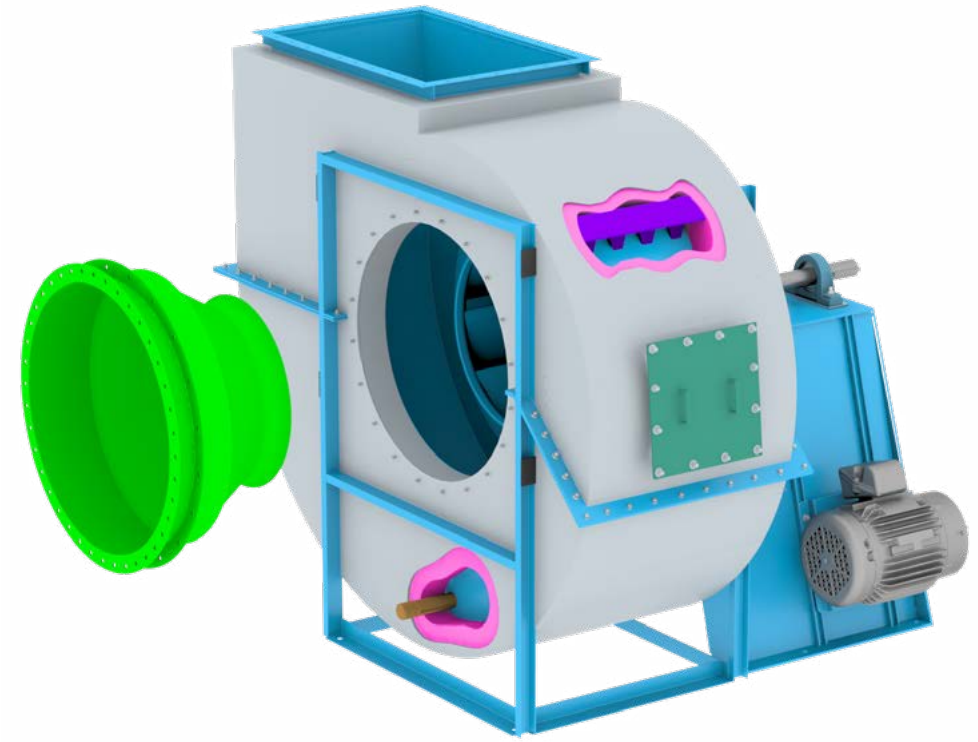




BEARING DOWEL PINS
(Restrained Bearings)

NOTE: See *Technical Descriptions* section for more detailed descriptions.





FAN CONSTRUCTION

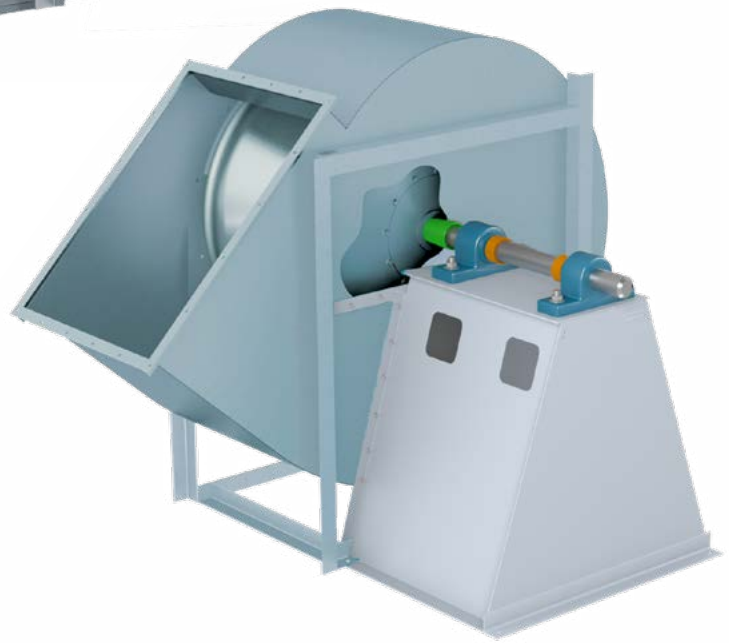
SPARK RESISTANT CONSTRUCTION

CENTRIFUGAL FANS

Typical Non-Ferrous Materials
- Aluminum
- Aluminum/Nickel/Bronze
- Monel
- Copper
- Brass
- Bronze

Bearing Dowel Pins
(first choice)

Bearing Stop Blocks



Type A

OVERVIEW

Type A provides the highest degree of spark resistance, requiring that all fan components in the airstream be constructed of a non-ferrous material and that they be assembled in a manner such as to reduce the possibility of contact between any stationary and rotating component.

NON-FERROUS AIRSTREAM CONSTRUCTION

- HOUSINGS / FRAMES
- IMPELLER (WELDED HUB)
- INLET FUNNEL
- SLEEVE (AS SHOWN)
- INTERIOR FASTENERS (HUB SET SCREWS TO BE STAINLESS STEEL, FLUSH WITH HUB)
- HUB CAP WITH ALUMINUM / NON-FERROUS BOLT

STEEL CONSTRUCTION

- PEDESTAL (BOLTED ON)
- SHAFT
- SHAFT LOCKING COLLARS

FAN MODIFICATIONS

- RESTRAINED BEARINGS
(BEARING DOWEL PINS OR BEARING STOP BLOCKS)

NOTE: Bearings not allowed in airstream.

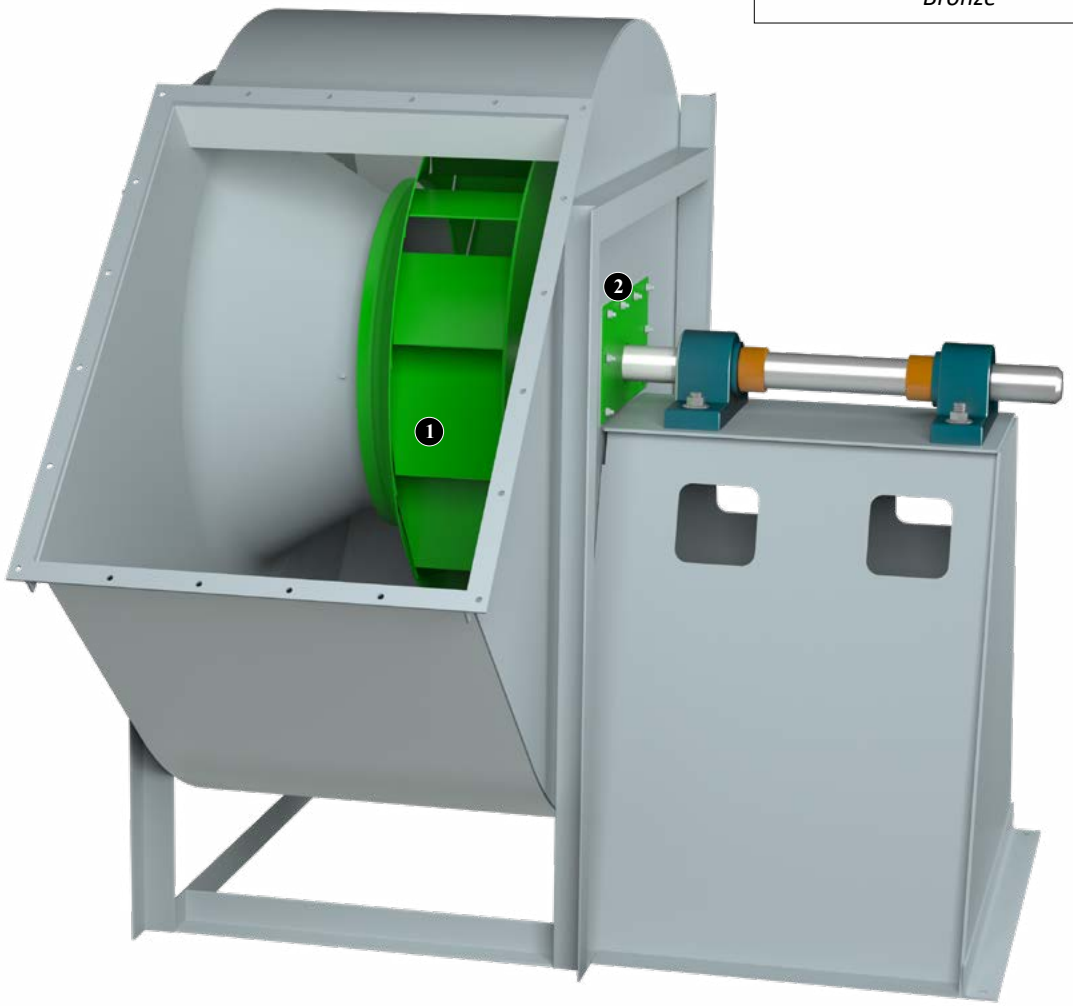
Construction varies by model.

SPARK RESISTANT CONSTRUCTION

CENTRIFUGAL FANS

Type B

Typical Non-Ferrous Materials
- Aluminum
- Aluminum/Nickel/Bronze
- Monel
- Copper
- Brass
- Bronze



OVERVIEW

Type B requires that the impeller be constructed of non-ferrous materials, and that the fan components in the airstream be assembled in a manner that reduces the possibility of contact between any stationary and rotating component. Typically, this is satisfied with the use of an aluminum impeller and an aluminum rub plate. If there is a mechanical failure of the fan, the aluminum impeller will contact a steel inlet cone.

NON-FERROUS CONSTRUCTION

❶ - IMPELLER (WELDED HUB)
❷ - RUB PLATE
Rub plate also known as:
SHAFT SEAL, ENCLOSURE PLATE, STRIKER PLATE, SPARK PLATE, ASH TRAY
NOTE: If fan has an outside protruding hub, a rub plate is not required.

STEEL CONSTRUCTION

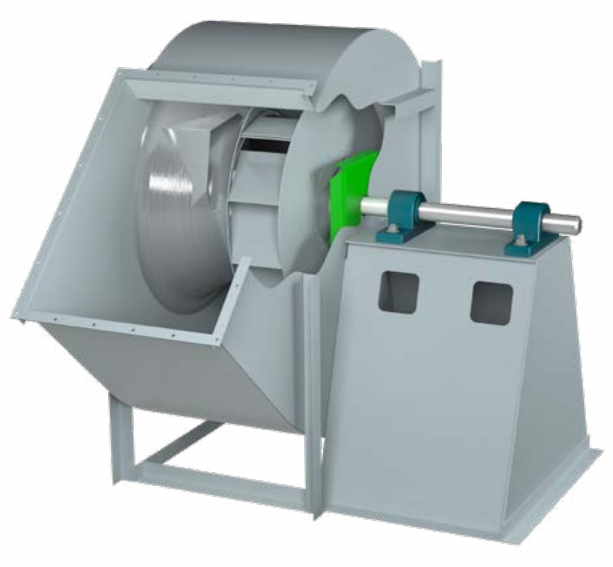
- HOUSINGS / FRAME
- FASTENERS
- PEDESTAL
- INLET FUNNEL
- SHAFT
- SHAFT LOCKING COLLARS

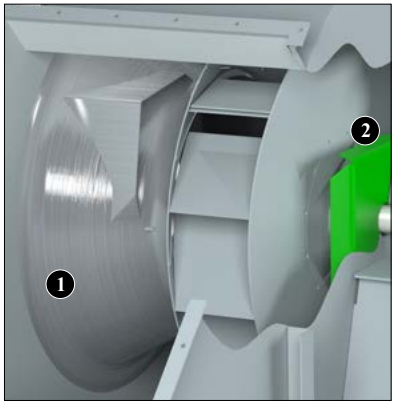
NOTE: Bearings not allowed in airstream.

Construction varies by model.

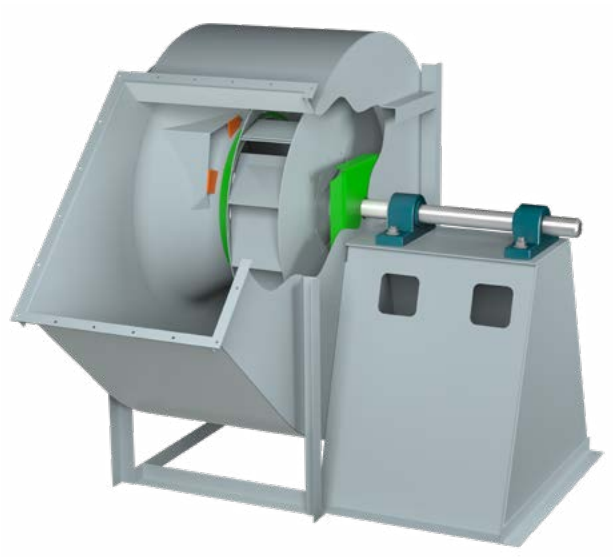
SPARK RESISTANT CONSTRUCTION

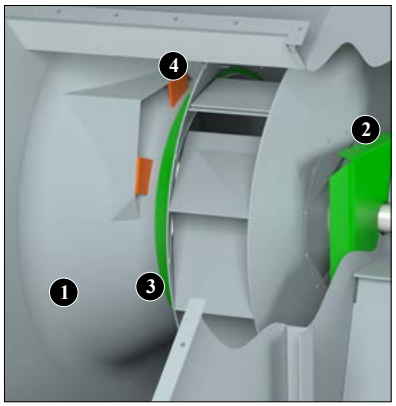
CENTRIFUGAL FANS





ALUMINUM FUNNEL
(Standard)





STEEL FUNNEL
(501°F and above)

Construction varies by model.

Type C

OVERVIEW

Type C offers a minimal level of spark resistance and only requires that possible contact between stationary and rotating components be reduced. Typically, this construction includes the use of an aluminum inlet cone and an aluminum rub plate. The aluminum inlet cone will be the first point of fan impeller contact if there is a mechanical failure. The aluminum rub plate placed at the opening of the housing where the shaft passes, protects against contact of the steel fan shaft and steel fan housing. For high temperature applications, a steel funnel is required with the use of a rubbing band and rubbing bars.

NON-FERROUS CONSTRUCTION

1 - INLET FUNNEL
2 - RUB PLATE
Rub plate also known as:
SHAFT SEAL, ENCLOSURE PLATE, STRIKER PLATE, SPARK PLATE, ASH TRAY
3 - RUBBING BAND (NAVAL BRASS OR MONEL)
4 - RUBBING BARS (MONEL)

STEEL CONSTRUCTION

- HOUSINGS / FRAME
- FASTENERS
- PEDESTAL
- IMPELLER
- SHAFT

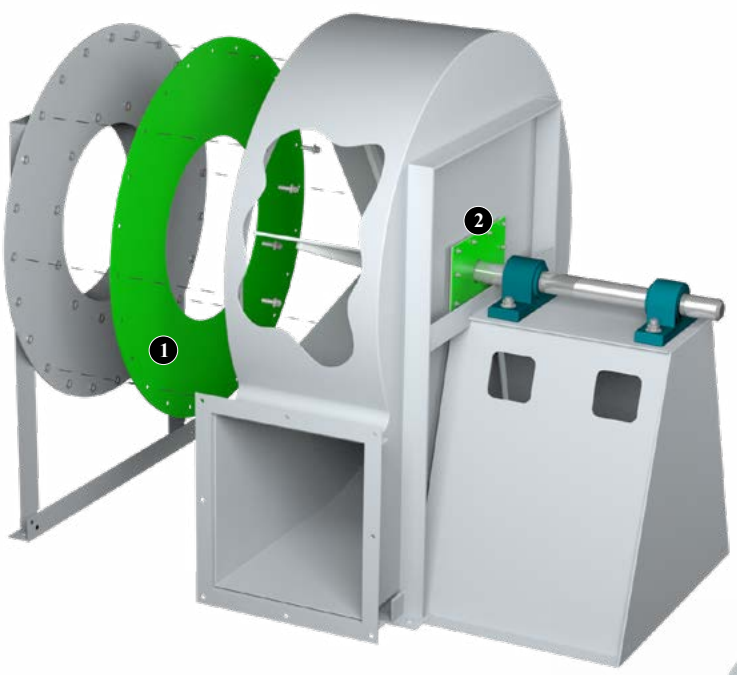
Typical Non-Ferrous Materials
- Aluminum
- Aluminum/Nickel/Bronze
- Monel
- Copper
- Brass
- Bronze

NOTE: Bearings not allowed in airstream.

SPARK RESISTANT CONSTRUCTION

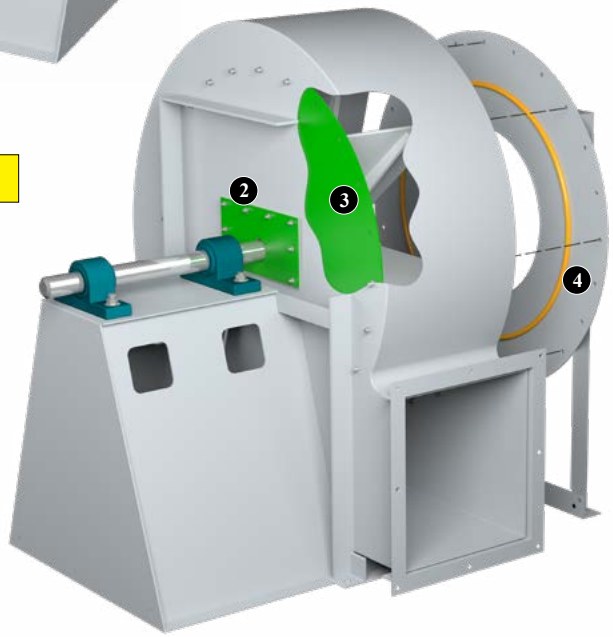
RADIAL BLADED FANS

Type C



Typical Non-Ferrous Materials
- Aluminum
- Aluminum/Nickel/Bronze
- Monel
- Copper
- Brass
- Bronze

Construction varies by model.



OVERVIEW

Type C offers a minimal level of spark resistance and only requires that possible contact between stationary and rotating components be reduced. Typically, this construction includes the use of an inlet rub ring and a rub plate. The inlet rub ring or rub plate will be the first point of fan impeller contact if there is a mechanical failure. The aluminum rub plate placed at the opening of the housing where the shaft passes, protects against contact of the steel fan shaft and steel fan housing.

NON-FERROUS CONSTRUCTION

1 - INLET PLATE
2 - RUB PLATE
Rub plate also known as:
SHAFT SEAL, ENCLOSURE PLATE, STRIKER PLATE, SPARK PLATE, ASH TRAY
3 - INNER DRIVE PLATE
4 - RUB RING (MONEL)

STEEL CONSTRUCTION

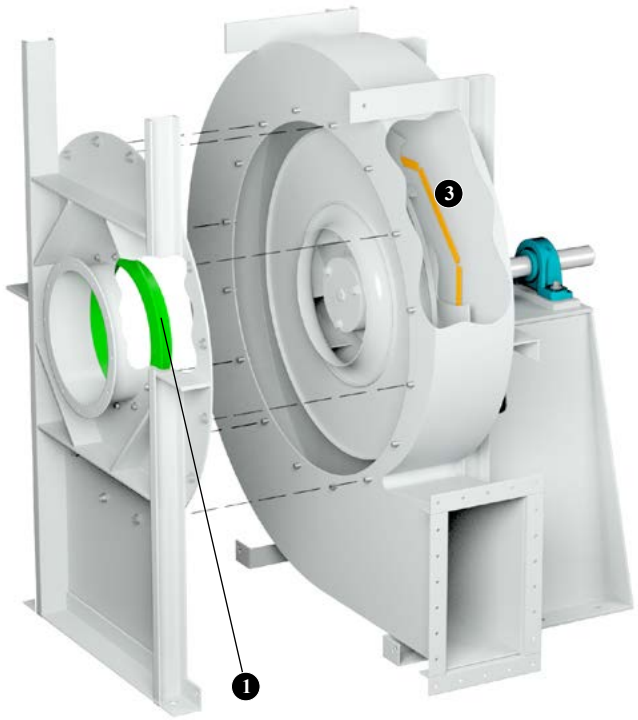
- HOUSINGS / FRAME
- IMPELLER
- FASTENERS
- PEDESTAL
- SHAFT

NOTES:
1. Bearings not allowed in airstream.
2. If fan has a non-ferrous impeller as standard, use Type B.

SPARK RESISTANT CONSTRUCTION

PRESSURE BLOWERS

Type C



Typical Non-Ferrous Materials
- Aluminum
- Aluminum/Nickel/Bronze
- Monel
- Copper
- Brass
- Bronze

OVERVIEW

Type C offers a minimal level of spark resistance and only requires that possible contact between stationary and rotating components be reduced. Typically, this construction includes the use of inlet rub rings. The aluminum rub ring will be the first point of fan impeller contact if there is a mechanical failure. The aluminum rub plate placed at the opening of the housing where the shaft passes, protects against contact of the steel fan shaft and steel fan housing. The monel rub strip or rub ring protects against a shift of the steel impeller towards the steel housing or drive plate.

NON-FERROUS CONSTRUCTION

1 - INLET RUB RING
2 - RUB PLATE
3 - RUB STRIP (MONEL)
4 - RUB RING (MONEL)

STEEL CONSTRUCTION

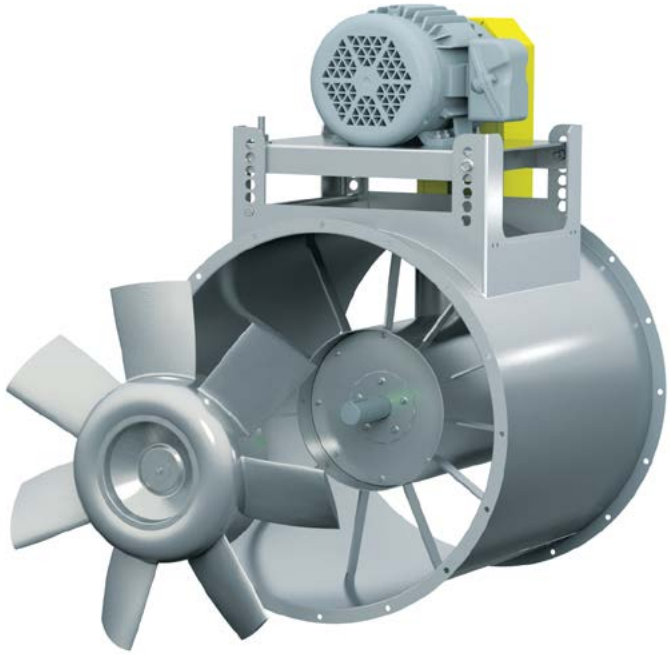
- HOUSINGS / FRAME
- IMPELLER
- FASTENERS
- PEDESTAL
- STEEL

NOTES:
1. Bearings not allowed in airstream.
2. If fan has a non-ferrous impeller as standard, use Type B.

Construction varies by model.

SPARK RESISTANT CONSTRUCTION

AXIAL FANS



Type A

NON-FERROUS CONSTRUCTION

- HOUSINGS
- IMPELLER
- FASTENERS
- SLEEVE

OTHER CONSTRUCTION

- STAINLESS STEEL SHAFT
- MILD STEEL MOTOR MOUNT PLATE, WEATHER COVER AND BELT GUARD

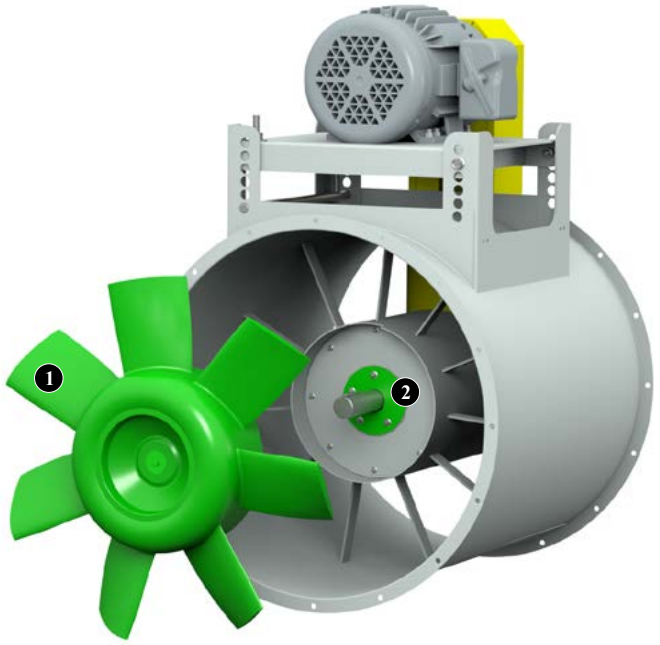
NOTE: Type A uses restrained bearings (Slotted Steel Spring Pins or Bearing Stop Blocks).

Typical Non-Ferrous Materials

- Aluminum
- Aluminum/Nickel/Bronze
- Monel
- Copper
- Brass
- Bronze

Construction varies by model.

NOTE: Bearings not allowed in airstream for Type A, B or C.



Type B & C

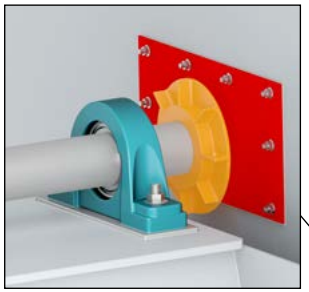
NON-FERROUS CONSTRUCTION

❶ - IMPELLER (TYPE B)
❷ - RUB PLATE (TYPE C)
(FOR NON-FERROUS IMPELLERS, USE TYPE B)

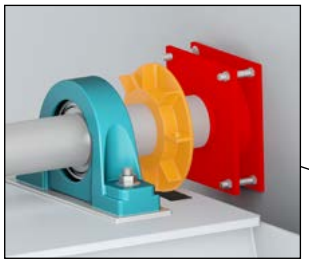
STEEL CONSTRUCTION

- HOUSINGS
- FASTENERS
- SHAFT

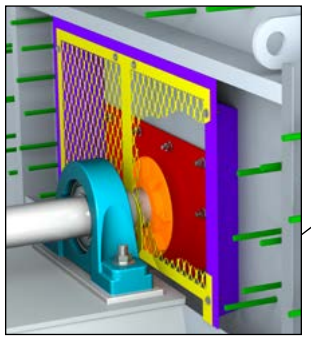
NOTE: Type B uses restrained bearings (Slotted Steel Spring Pins or Bearing Stop Blocks).



High Temp Style Pedestal with Standard Shaft Seal and Cooler



High Temp Style Pedestal With Shaft Cooler and Stuffing Box or Mechanical Shaft Seals



High Temp Style Pedestal with Cooler Box

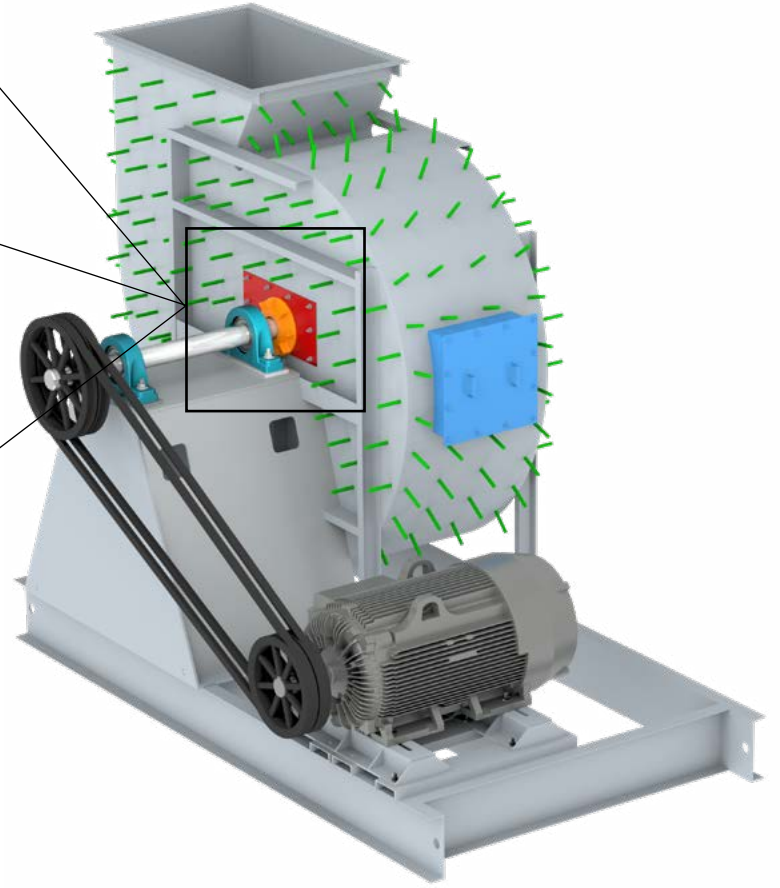
NOTE: Cooler Box provides uninsulated open area around the shaft cooler for dissipation of heat. Standard on fans with aluminum clad insulation and housing with insulation pins.

CENTRIFUGAL FANS (General Construction)

Arrangements 1, 8, 9, 9F, 10

Shaft Seal | **Shaft Cooler** | **Insulation Pins (Optional)**

Safety Screen | **Cooler Box** | **Raised Access Door (Optional)**



GENERAL INFORMATION

Industrial processes often require high heat fans that can withstand operating airstream temperatures ranging from 276°F to 1,000+°F.

High temperature fans are commonly used for:

- Re-circulating air in high temperature equipment such as kilns, dryers, industrial ovens and furnaces
- Exhausting gases and fumes from industrial processes
- Supplying air for heating and drying systems

Packages

- 301°F - 500°F
- 501°F - 600°F
- 601°F - 800°F
- 801°F - 1,000°F
- 1,001°F and over
  (requires Engineering review)

High Temp Materials

- Mild Steel and Corten
- Stainless Steel

Bearing Requirements

- Use High Temp Grease
- Use Fixed and Floating Bearings
  - Refer to *Bearings: Fixed & Floating* section

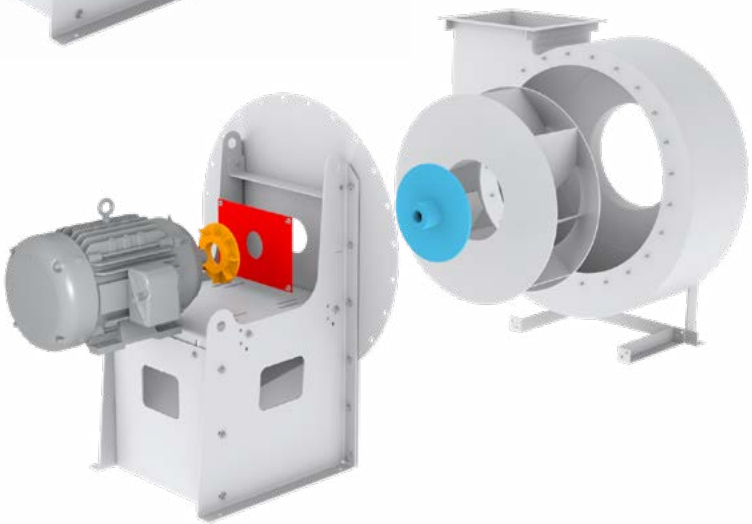
Refer to Fan Engineering Letter FE-3200.

CENTRIFUGAL FANS (General Construction)

Arrangement 4

Shaft Seal **Shaft Cooler** **Cooler Guard** **Hub**

Section View



GENERAL INFORMATION

Industrial processes often require high heat fans that can withstand operating airstream temperatures ranging from 181°F to 1,000+°F.

High temperature fans are commonly used for:

- Re-circulating air in high temperature equipment such as kilns, dryers, industrial ovens and furnaces
- Exhausting gases and fumes from industrial processes
- Supplying air for heating and drying systems

Packages

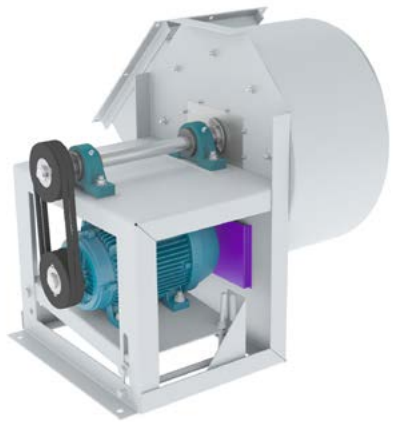
- 181°F - 300°F
- 301°F and over
  (requires Engineering review)

High Temp Materials

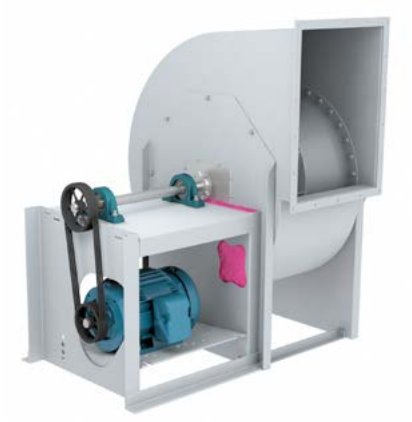
- Aluminum (rotating parts up to 250°F)
- Mild Steel and Corten
- Stainless Steel

CENTRIFUGAL FANS (Pedestal Types)

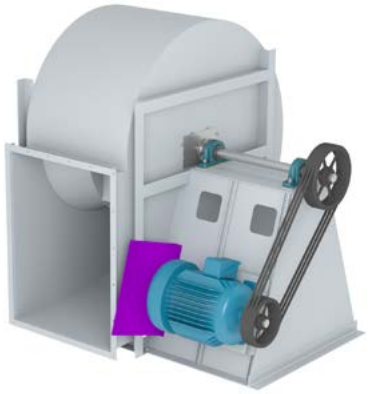
Motor Heat Shield Insulation Pedestal Spacer



Pedestal w/ Motor Heat Shield
Arrangement 10 (up to 600°F)

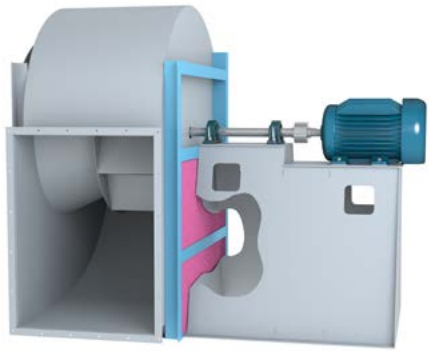


Pedestal w/ Insulated Panel
Arrangement 10 (up to 600°F)



Pedestal w/ Motor Heat Shield
Arrangement 9* (up to 600°F)

*multiple variations of Arr. 9



Separated Pedestal Design
Arrangements 1, 8 and 9F (601°F and above)

NOTES:
1. Provides up to a 3" gap between the housing and pedestal.
2. For Arr. 1 and 9F, the overall pedestal length shall be shorted by the short leg dimension of the angle (or width of the channel).

GENERAL INFORMATION

Industrial processes often require high heat fans that can withstand operating airstream temperatures ranging from 276°F to 1,000+°F.

High temperature fans are commonly used for:

- Re-circulating air in high temperature equipment such as kilns, dryers, industrial ovens and furnaces
- Exhausting gases and fumes from industrial processes
- Supplying air for heating and drying systems

Packages

- 301°F - 500°F
- 501°F - 600°F
- 601°F - 800°F
- 801°F - 1,000°F
- 1,001°F and over
  (requires Engineering review)

High Temp Materials

- Mild Steel and Corten
- Stainless Steel

Bearing Requirements

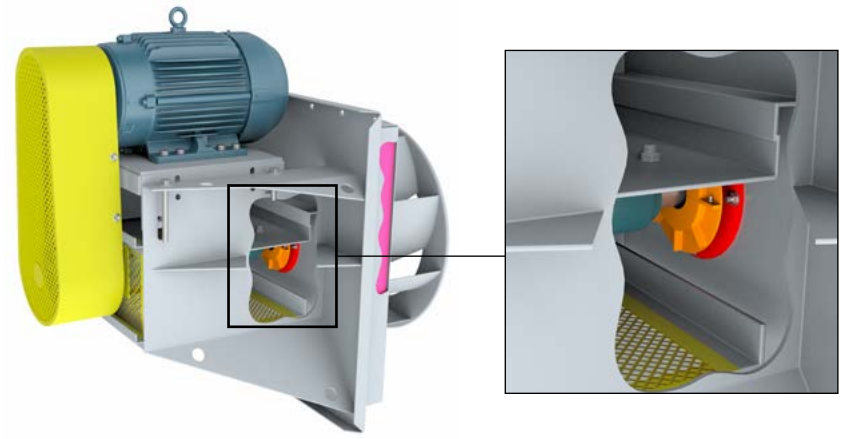
- Use High Temp Grease
- Use Fixed and Floating Bearings
  - Refer to *Bearings: Fixed & Floating* section

Refer to Fan Engineering Letter FE-3200.

ARR. 9 PLUG FANS (Centrifugal Fans)

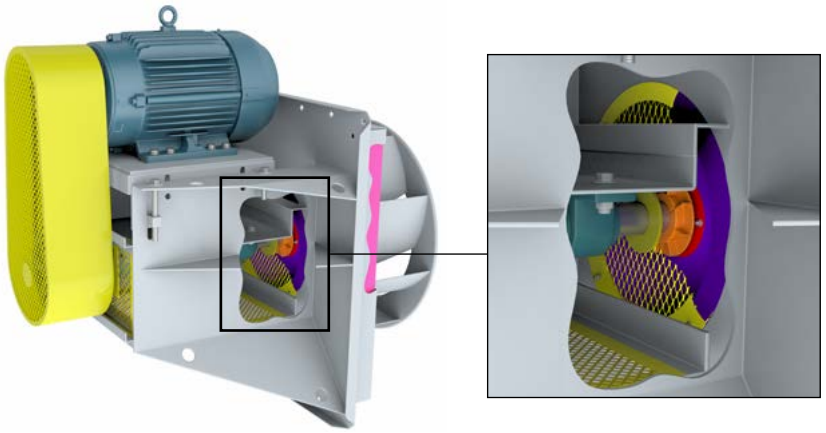
Shaft Seal | Shaft Cooler | Recess Cone (aka Drive Cone) | Insulation (inside plug) | Cooler Guard

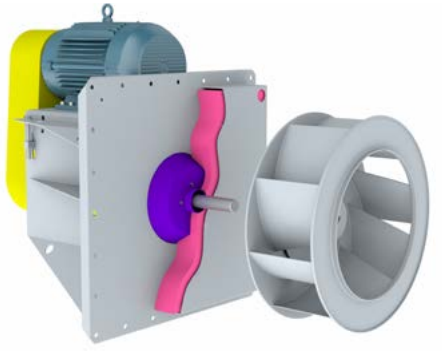
Design #1 - With Gap for Shaft Cooler



Insulated Plug
- Optional up to 500°F
- For fans with less than 4" plug or wall thickness

Design #2 - With Recess Cone for Shaft Cooler





Insulated Plug
- Required for 301°F and above
- For fans with 4" or more plug or wall thickness

GENERAL INFORMATION

Industrial processes often require high heat fans that can withstand operating airstream temperatures ranging from 276°F to 1,000+°F.

High temperature fans are commonly used for:
- Re-circulating air in high temperature equipment such as kilns, dryers, industrial ovens and furnaces
- Exhausting gases and fumes from industrial processes
- Supplying air for heating and drying systems

Packages
- 301°F - 500°F
- 501°F - 600°F
- 601°F - 800°F
- 801°F - 1,000°F
- 1,001°F and over (requires Engineering review)

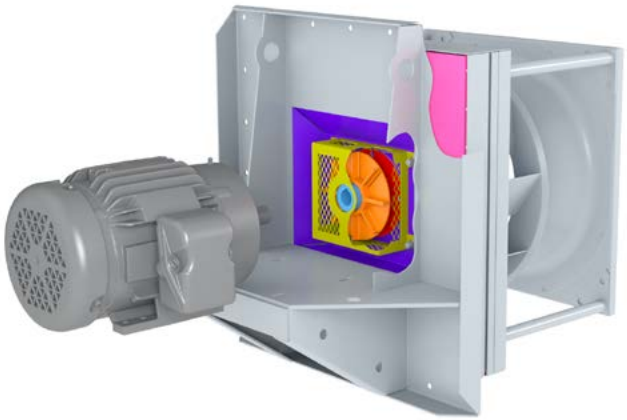
High Temp Materials
- Mild Steel and Corten
- Stainless Steel

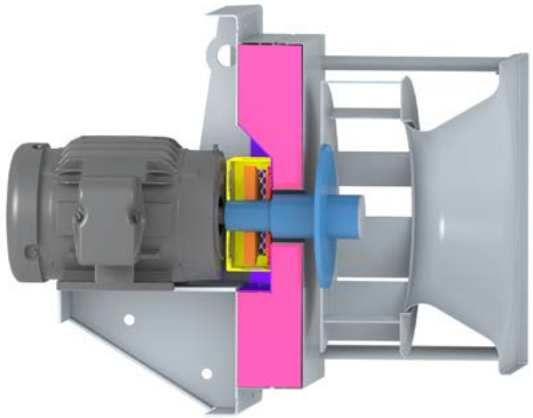
Bearing Requirements
- Use High Temp Grease
- Use Fixed and Floating Bearings
  - Refer to *Bearings: Fixed & Floating* section

Refer to Fan Engineering Letter FE-3200.

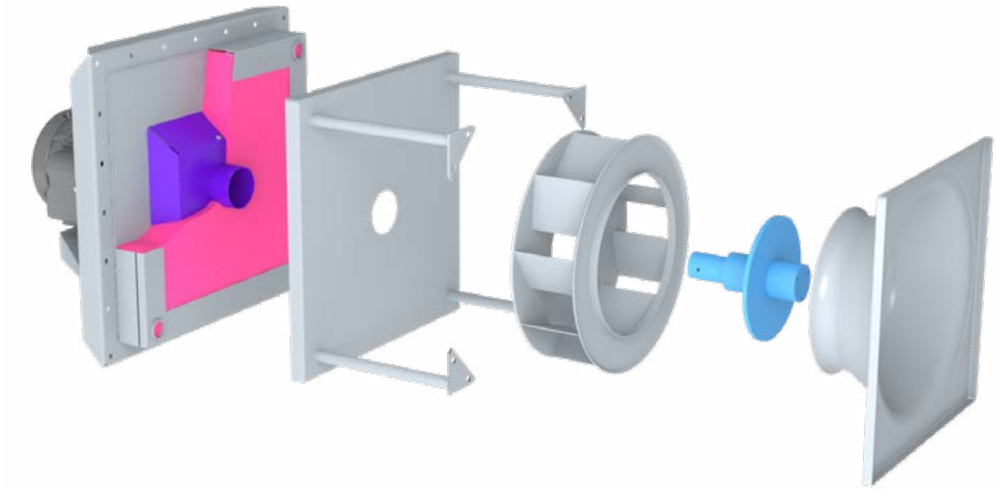
ARR. 4 PLUG FANS (Centrifugal Fans)

Shaft Seal | Shaft Cooler | Recess Cavity | Insulation | Cooler Guard | Hub





Section View



GENERAL INFORMATION

Industrial processes often require high heat fans that can withstand operating airstream temperatures ranging from 181°F to 1,000+°F.

High temperature fans are commonly used for:

- Re-circulating air in high temperature equipment such as kilns, dryers, industrial ovens and furnaces
- Exhausting gases and fumes from industrial processes
- Supplying air for heating and drying systems

Packages

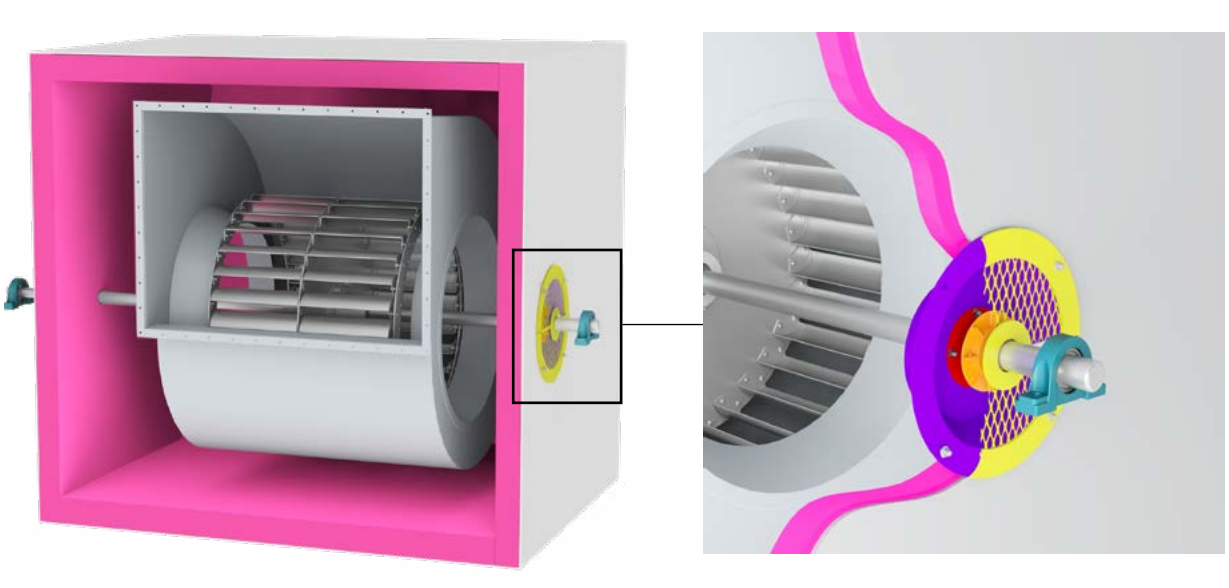
- 181°F - 300°F (select models)
- 301°F and over (requires Engineering review)

High Temp Materials

- Aluminum (rotating parts up to 250°F)
- Mild Steel and Corten
- Stainless Steel

AIR KITS
Arrangement 3

Shaft Seal **Shaft Cooler** **Recess Cone** (aka Drive Cone) **Insulation** **Cooler Guard**



Enclosure and insulation provided by others in the field.

GENERAL INFORMATION

Industrial processes often require high heat fans that can withstand operating airstream temperatures ranging from 301°F to 1,000+°F.

High temperature fans are commonly used for:

- Re-circulating air in high temperature equipment such as kilns, dryers, industrial ovens and furnaces
- Exhausting gases and fumes from industrial processes
- Supplying air for heating and drying systems

Packages

- 301°F - 500°F
- 501°F - 600°F
- 601°F - 800°F
- 801°F - 1,000°F
- 1,001°F and over
  (requires Engineering review)

High Temp Materials

- Aluminum (non-rotating parts)
- Mild Steel and Corten
- Stainless Steel

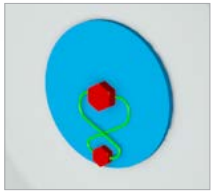
Bearing Requirements

- Use High Temp Grease
- Use Fixed and Floating Bearings
  - Refer to *Bearings: Fixed & Floating* section
- High heat modified bearings (optional)

AXIAL FANS

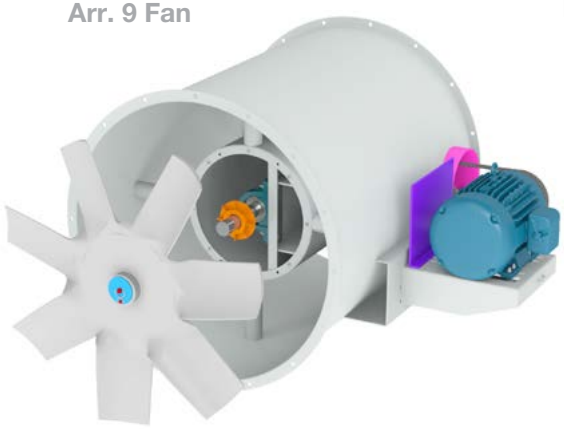
Arr. 4 Fan

Packages
- 106°F to 150°F
- 151°F to 195°F
  (Requires Eng Review)
- 196°F to 240°F
  (Requires Eng Review)

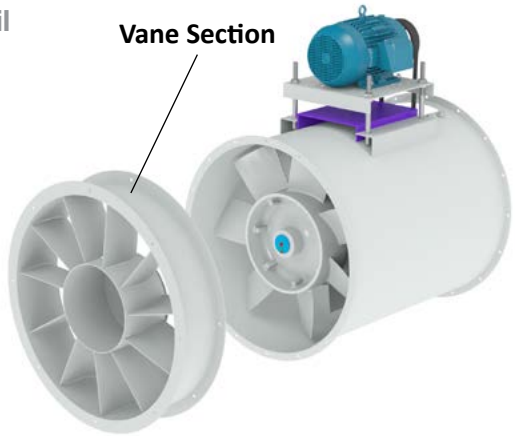


Retaining Washer Detail

Arr. 9 Fan



Packages
- 201°F to 250°F
- 201°F to 300°F



GENERAL INFORMATION

Industrial processes often require high heat fans that can withstand operating airstream temperatures ranging from 106°F to 600°F.

High Temp Materials
- Standard Aluminum (Impeller): Up to 275°F
- Mild Steel and Stainless Steel

Bearing Requirements
- Use High Temp Grease (over 275°F)
- Use Fixed and Floating Bearings
  - Refer to *Bearings: Fixed & Floating* section
- Metal lube lines
- Bearing housing (inner cylinder) open on impeller end (some models)
- Flange bearings require "scalloped" bearing plates

Other Requirements
- Impeller on outlet end of housing (outer shell)
  - *Some models require vane section*
- Fixed Impeller required over 250°F

NOTE: In Arr. 9 fans, cool air is pulled into the bearing housing through the belt tube.

Refer to Fan Engineering Letter FE-3200.

(Select Fan Models)

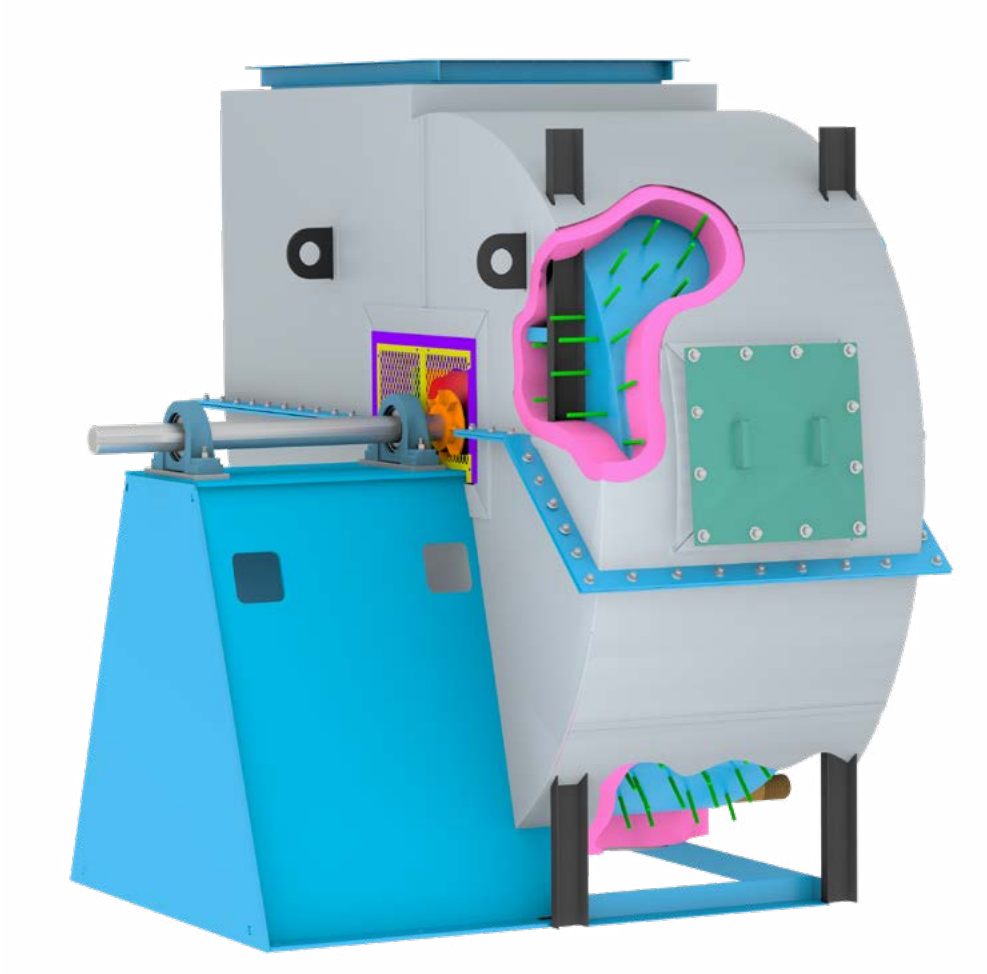
Retaining Washer | **Safety Wire** | **Hardware**

Shaft Cooler (Select Arr. 9 Fans)

Heat Shield (Arr. 9 only)

Belt Tube

CENTRIFUGAL FANS
Aluminum Clad Construction



Shaft Seal | Shaft Cooler | Cooler Box | Cooler Guard | Insulation | Insulation Pins

Access Door | Lifting Lugs/Extended Frame | Extended Drain | Aluminum Clad Housing

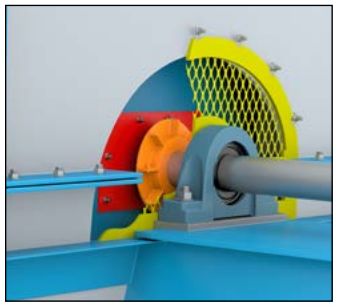
GENERAL INFORMATION

The purpose of aluminum clad construction is to insulate the fan surface from high temperature, condensation or sound.

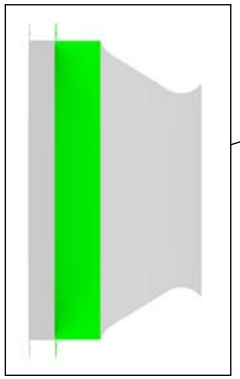
Overview

- Insulation thickness per customer request and TCF guidelines
- Outside vendor insulates the fan and builds a skin around the insulated housing
- Fans ship out from vendor or back to TCF
- Exterior cladding material is 0.040" (minimum) thick stucco-embossed aluminum
- Insulation type (provided by vendor): 3# density fiberglass or mineral wool unless otherwise specified
- Insulation pins on fan by vendor
- Raised access door (usually raised 2" above insulation)
- Housing drain usually extends from inlet end of housing for accessibility
- Inlet and outlet of fan extended if required
- Fan centerline height increased if required
- Housing split (if specified) to have split bars protruding 2" past insulation for access to mounting holes
- Cooler box on high temperature applications

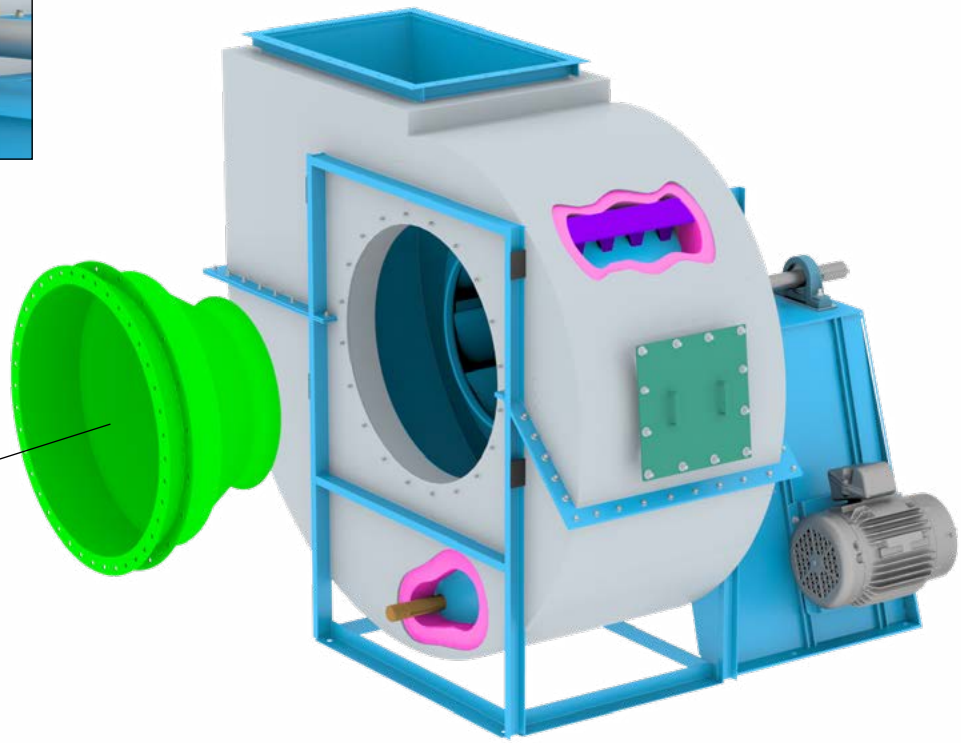
CENTRIFUGAL FANS
Steel/Double Wall Construction



Recessed Cavity for the Shaft Cooler/Shaft Seal



"Green" Section is Added To Extend the Inlet Funnel



GENERAL INFORMATION

The purpose of steel/double wall construction is to insulate the fan surface from high temperature, condensation or sound.

Overview

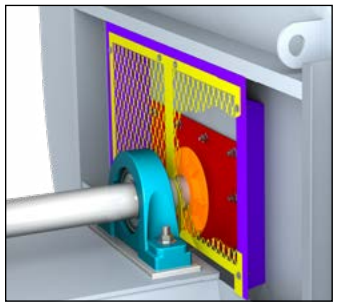
- Insulation thickness per customer request and TCF guidelines
- TCF builds a second structural outer housing (outer shell) around the inner housing
- Outer shell material is 14 gauge (minimum) thick mild steel or stainless steel (if requested)
- Insulation type: Fiberglass or mineral wool unless otherwise specified.
- Structural fabricated angle between inner and outer housings help to hold insulation in place
- Structural angle is "scalloped" on fans with 40" and larger impeller diameters (reduces heat transfer)
- Raised access door usually raised 2" above insulation
- Housing drain usually extends from inlet end of housing for accessibility
- Inlet and outlet of fan extended if required
- Fan centerline height increased if required
- Pedestal endplate next to outer shell
- Pedestal does not have a high temperature angle
- Shaft cooler housing imbedded into insulation cavity
- Housing split (if specified) to have split bars protruding 2" past insulation for access to mounting holes
- Inlet funnel modified to extend through insulation

Shaft Seal **Shaft Cooler** **Scalloped Angle** **Cooler Guard** **Insulation** **Extended Inlet Funnel**

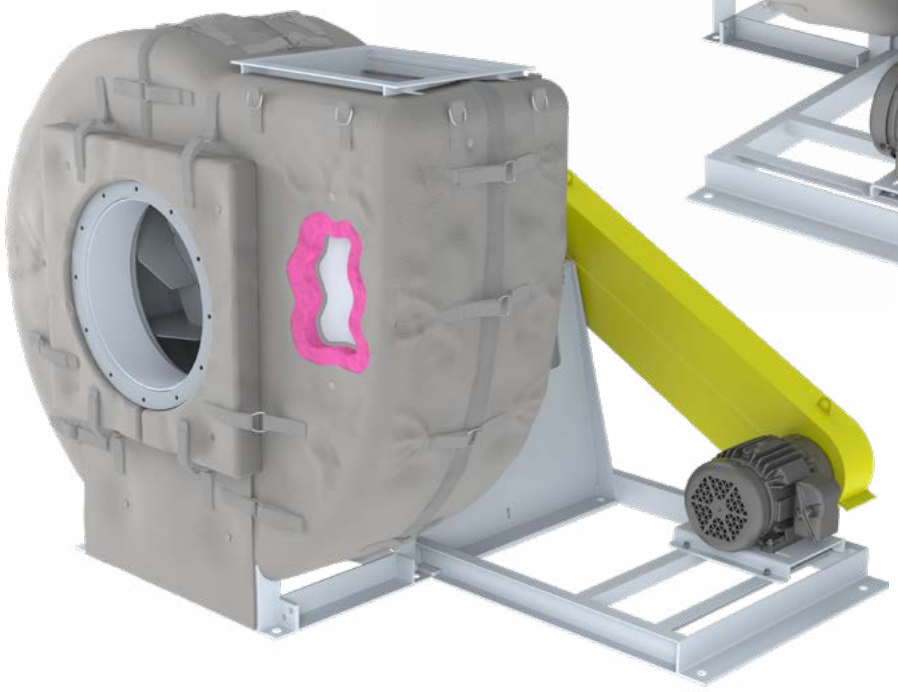
Access Door **Lifting Lugs/Extended Frame** **Extended Drain** **Steel Wall Housing (Outer Shell)**

CENTRIFUGAL FANS

Insulated Jackets



High Temp Applications use a Cooler Box. Insulated Jacket Wraps around Cooler Box.



GENERAL INFORMATION

The purpose of insulated jackets is to insulate fan surface from high temperature, condensation or sound. Jackets can also be used as a safety device to protect personnel from injury.

Overview

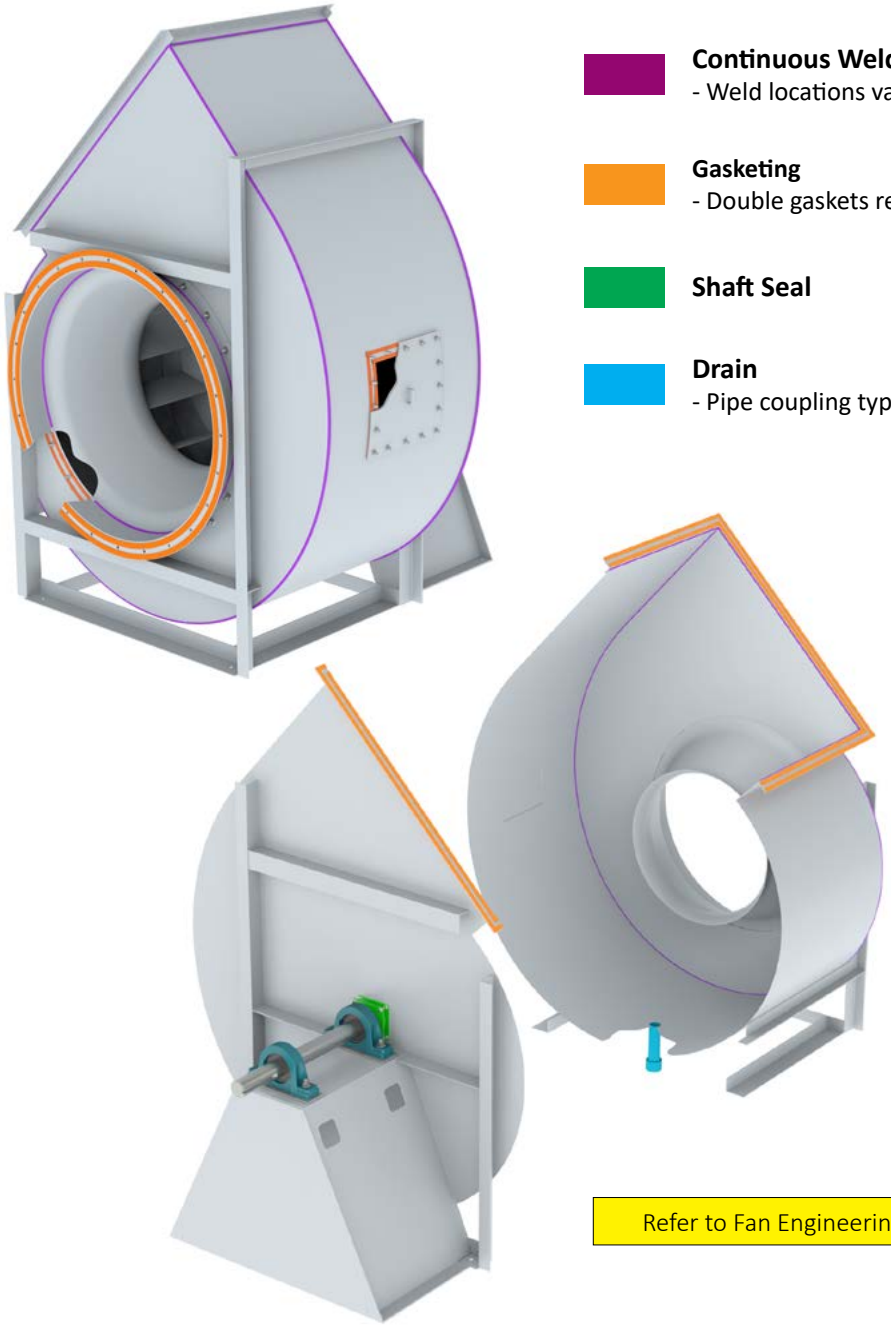
- 2" thick jacket around entire fan housing including housing surface inside the pedestal
- Insulation type (provided by vendor): Type “E” and low-density fiberglass, alone or in combination depending on application
- Jacket removed in pieces and labeled accordingly for shipment
- Jacket to be easily opened or removed to gain access to various fan accessories such as access doors, drains, housing splits, lifting lugs, shaft and bearing guards, pedestals, inlet boxes, frame angles and shaft seals.

(Cooler Box Parts)

- Shaft Seal
- Shaft Cooler
- Recess Cavity
- Cooler Guard

- Insulation

SPECIAL CONSTRUCTION
NOMINALLY LEAK-TIGHT



Continuous Weld
- Weld locations vary by model

Gasketing
- Double gaskets required

Shaft Seal

Drain
- Pipe coupling type with plug

Refer to Fan Engineering Letter FE-700.

GENERAL INFORMATION

A fan generally cannot be constructed to be totally leak-tight. Hence the term “Nominally Leak-Tight” is used. This type of construction is used to reduce leakage to within acceptable levels decided upon with the customer. *Fans are tested at the shop with a Soap Bubble Test to check for leaks, which are fixed if needed, and recorded on the inspection form.*

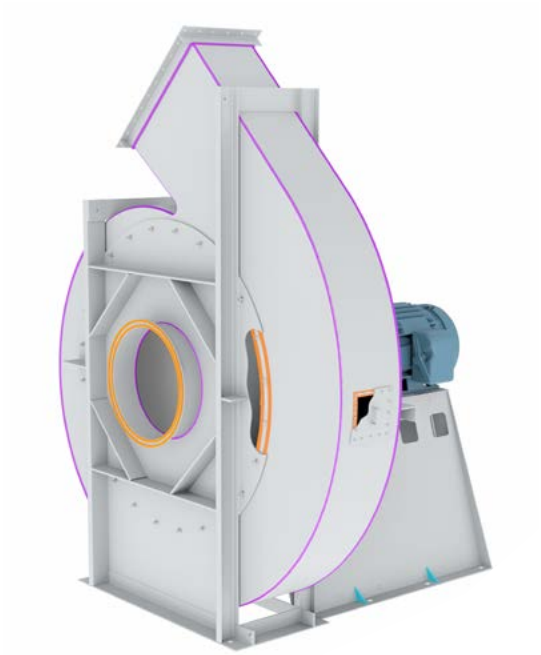
Fan leakage refers to air (or other gas mixture) either leaking into the fan housing or out of the fan housing. Leakage in or out depends on air pressure. When the air (or gas mixture) mixes with hazardous contaminants, excessive leakage can be dangerous. Excessive leakage can waste energy, be an environmental or safety hazard, damage fan bearings or create excessive noise.

Overview
- Arrangements 1, 8 and 9 only
- Solid drive side on housing (no drive plates)
- Not recommended for applications over 600°F
- Split housings not recommended
- Bolted connections must have close centered hole patterns (3" to 4" centers). Includes inlet and outlet flanges, access doors, cover plates, inlet funnels, split housings, etc.
- ANSI flange hole pattern is sufficient if it is standard for the fan

Gasketing
- Use on all connections: inlet/outlet flanges, funnel, inlet plate, access doors, split housing, etc.
- Split housings require centering plate to seal open areas by shaft seals and inlet funnel or plate

Shaft Seals (Fan Shaft - do not use shaft sleeve and cap)
- Lip type
- Stuffing Box (Graphoil) type
- Double Ring Mechanical type (Double Carbon Ring)

SPECIAL CONSTRUCTION
REGENERATIVE THERMAL OXIDIZER (RTO)



Continuous Weld
- Weld locations vary

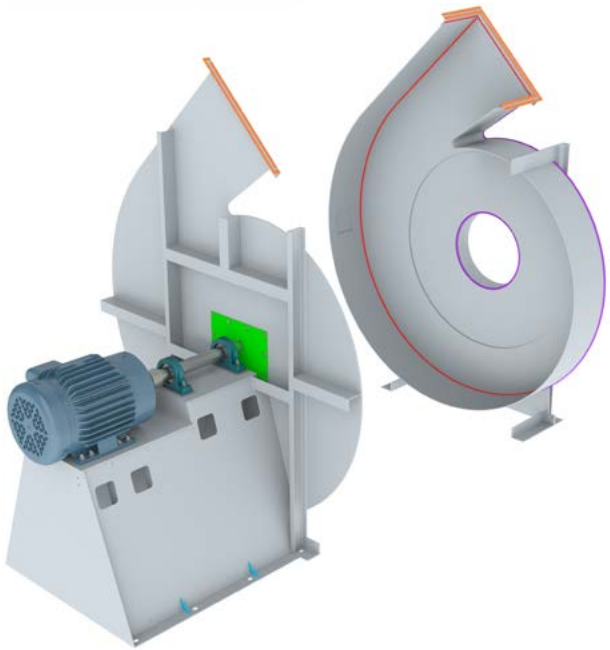
Seal Weld
- Weld locations vary

Gasketing
- Double gaskets required

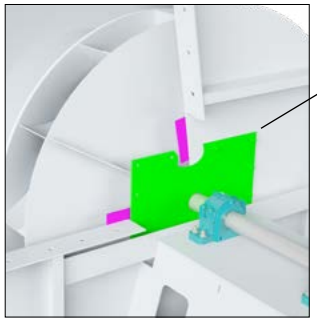
Shaft Seal

Pedestal Foot Gussets

Centering Plates



Vane Section



GENERAL INFORMATION

A regenerative thermal oxidizer (RTO) is an industrial process that destroys air pollutants emitted from process exhaust. These gas streams are usually produced by industrial process ventilation, i.e. paint booths (i.e. automotive), printing and paper mills. *Fans are tested at the shop with a Soap Bubble Test to check for leaks, which are fixed if needed, and recorded on the inspection form.*

Fan Construction
- Solid drive side on housing (no drive plates)
- Bolted connections must have close centered hole patterns (3" to 4" centers). Includes inlet and outlet flanges, access doors, cover plates, inlet funnels, split housings, etc.
- Not recommended for applications over 600°F
- Dampers (if required) must have stuffing boxes

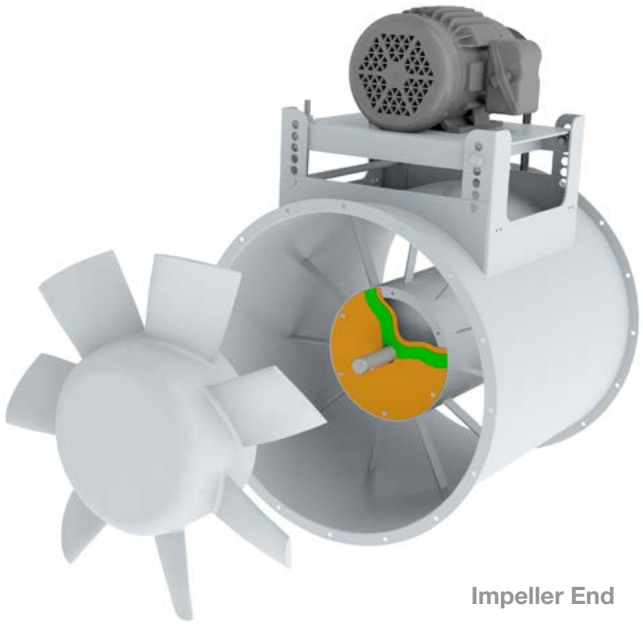
Gasketing
- Use silicone sponge and silicone caulk
  - *Automotive jobs require an alternative to silicone*
- Use on all connections: inlet/outlet flanges, funnel, inlet plate, access doors, split housing, etc.
- If constructed with a split housing, centering plates are required to seal open areas by shaft seals and inlet funnel or inlet plate

Shaft Seals
- Friction type
- Single Carbon Ring type
- Commercially available carbon ring or others seal

Special Requirements (sales to specify)
- Pedestal: Concrete requirements
- Fan Base: Construction based on how fan will be mounted in field
- Fan Operation (VFD, cycling, bake out conditions)

GENERAL INFORMATION

High moisture modification construction is used in applications where steam or condensation may collect in the fan housing.
Used on Arrangement 9 Axial Fans Only.



Impeller End

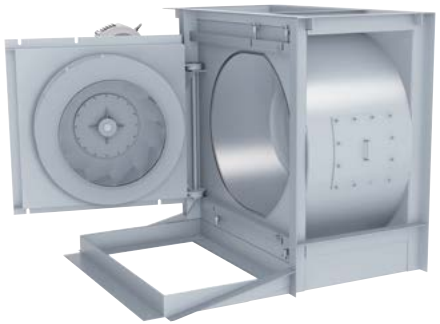
Drive End

Shaft Seal / Seal Material **Cover Plate** **Shaft Seal Cover Plates**

Note: High Moisture construction cannot be used in conjunction with High Temperature Construction.

SWINGOUT FANS

Swingout fans are designed for frequent cleaning and provide full access to the impeller and inner casing of the fan. The entire impeller/shaft/bearing assembly is mounted on a large swingout door. Swingout construction is available for centrifugal, inline centrifugal and axial fans.



Centrifugal Swingout Fans
Arrangements 4S, 9ST, 9SS

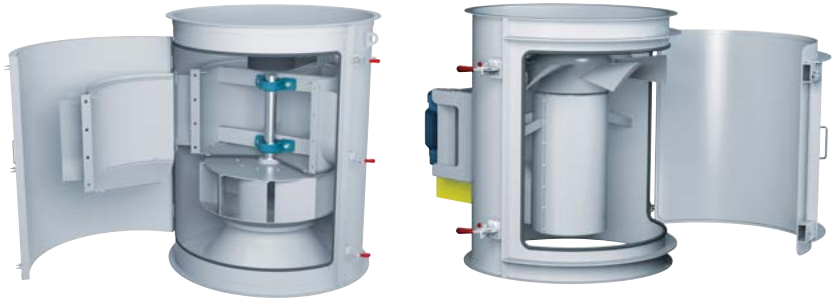
Axial Swingout Fans
Arrangements 4SO, 9SO

Inline Centrifugal Swingout Fans
Arrangements 4SO, 9SO

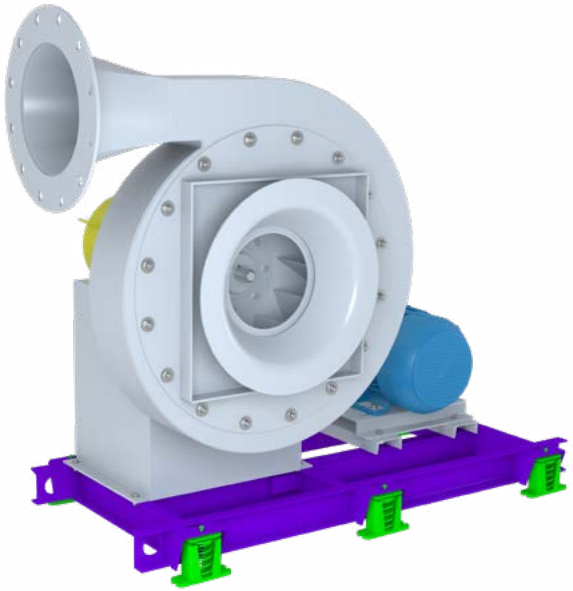
CLAMSHELL FANS

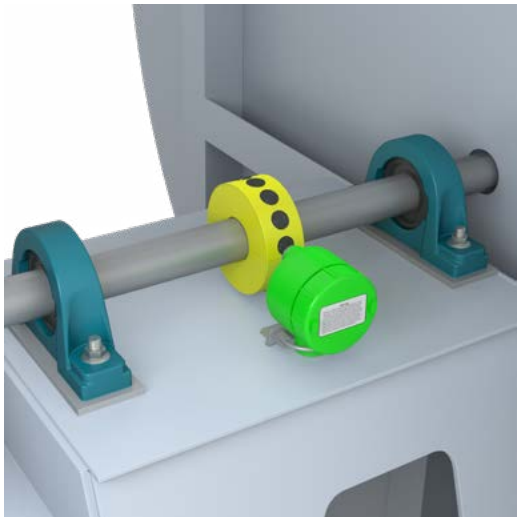
Clamshell fans are designed to provide complete access to the interior of the fan for maintenance or cleaning without removal of ductwork. Clamshell construction is available for inline centrifugal and axial fans and is typically used in vertical mount applications. For the double door configuration, one of the two access doors is wide enough for impeller removal.

Axial and Inline Centrifugal Double Door Clamshell Fans
Arrangements 4CS, 9CS



Axial and Inline Centrifugal Single Door Clamshell Fans
Arrangements 4CS, 9CS

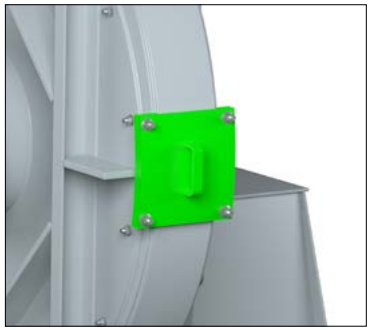




ACCESSORIES

COMMON ACCESSORIES

On Housing

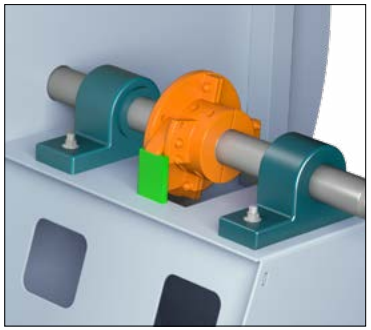


Over Edges of Housing

BOLTED ACCESS DOOR

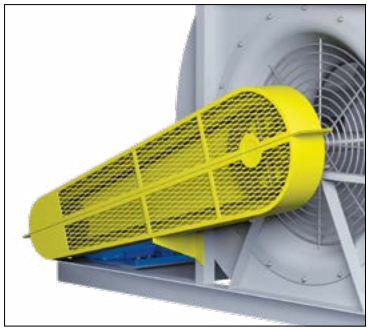
RAISED ACCESS DOOR

QUICK OPEN ACCESS DOOR

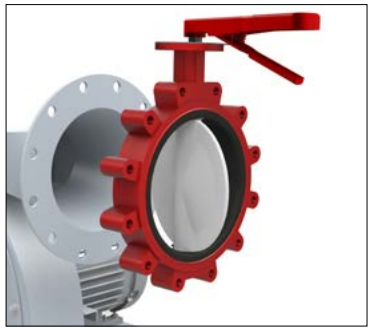


ANTI-ROTATION DEVICE

Also known as:
- Anti-Rotation Clutch
- Anti-Backspin Device

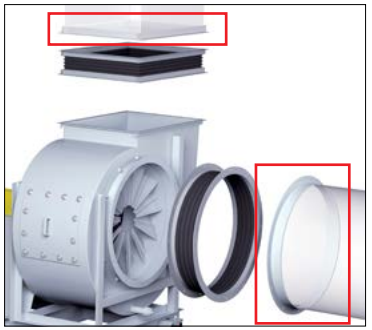


BELT GUARD



BLAST GATE
(Blast Gate and Flange Bolt Pattern - 125# ASA Pipe Flange)

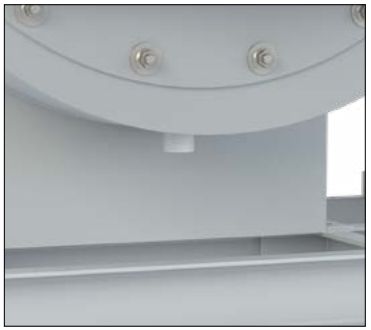
Also known as:
- Waffle Damper
- Wafer-Type Butterfly Valve
- Butterfly Damper



COMPANION FLANGES
(Inlet and Outlet)
(Round and Rectangular)

NOTE: Some *Common Accessories* are further explained throughout this reference manual.

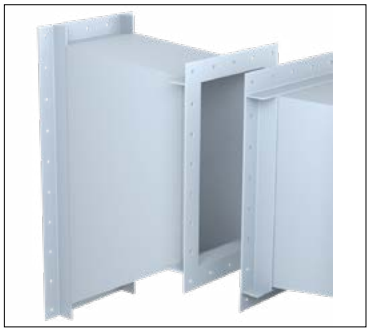
COMMON ACCESSORIES



Standard

With Plug

DRAIN



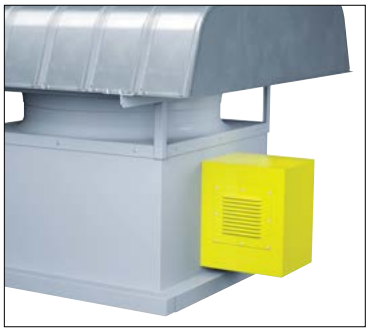
EVASÉ

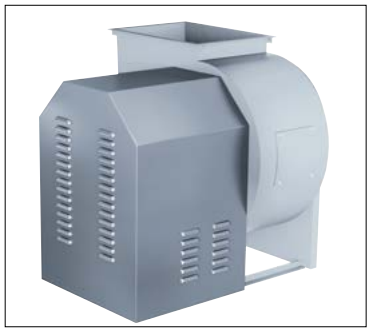
FINS ON IMPELLER BACK PLATE

Also known as:
- Thrust Fins
- Thrust Vanes/Anti-Thrust Vanes
- Back Plate Fins
- Back Pressure Fins
- Cooling Fins

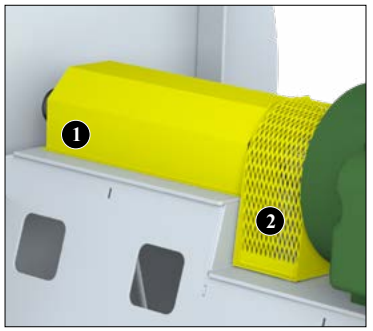
INLET/OUTLET FLEX CONNECTORS
(Round and Rectangular)

Also known as:
- Expansion Joint





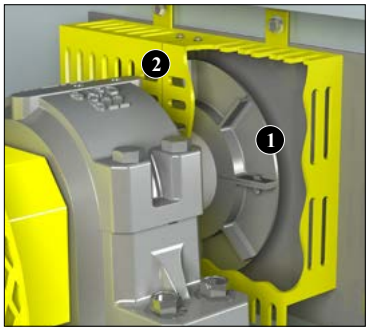
MOTOR COVER / WEATHER COVER



❶ SHAFT/BEARING GUARD
❷ COUPLING GUARD

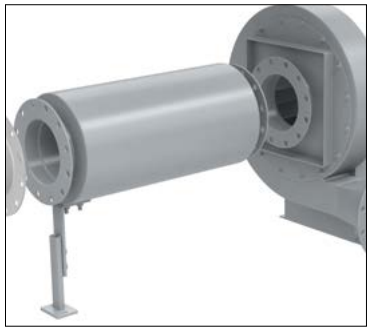
NOTE: Some *Common Accessories* are further explained throughout this reference manual.

COMMON ACCESSORIES



❶ SHAFT COOLER and ❷ COOLER GUARD

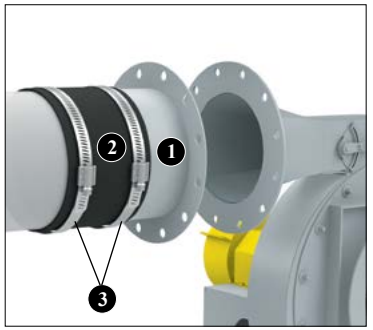
Shaft Cooler also known as:
- Heat Flinger
- Heat Slinger
- Cooling Impeller



SILENCER
(with support legs)

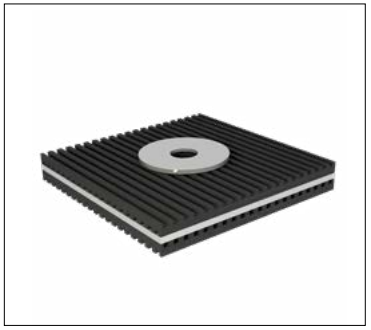
Silencers are available for both the inlet and outlet of fans

SLIDE GATE DAMPER
(Cast Aluminum Pressure Blowers)



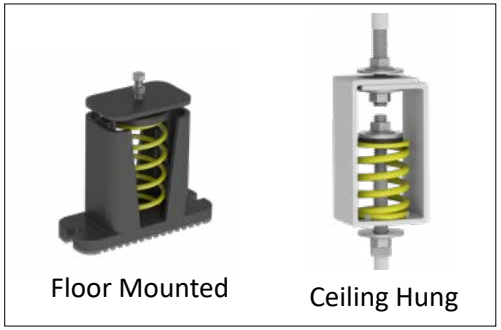
❶ TUBE ADAPTER and ❷ RUBBER SLEEVE ❸ w/ CLAMPS
Flange Bolt Patterns - 125# ASA Pipe Flange

Also known as:
- Flanged Adapter w/ Rubber Sleeve and Clamps
- Flange w/ Boot
- Mounting Flange w/ Boot
- Flex Connector



Pads

Rubber-in-Shear Type

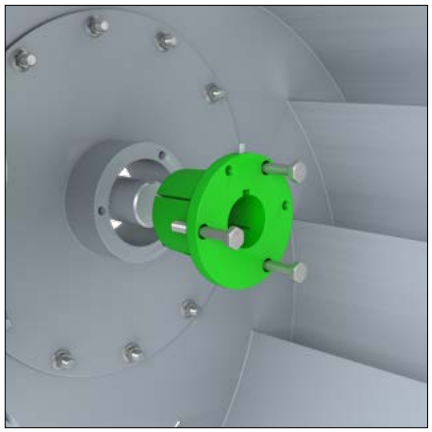


Spring Type

VIBRATION ISOLATION

WEEP HOLE

NOTE: Some *Common Accessories* are further explained throughout this reference manual.

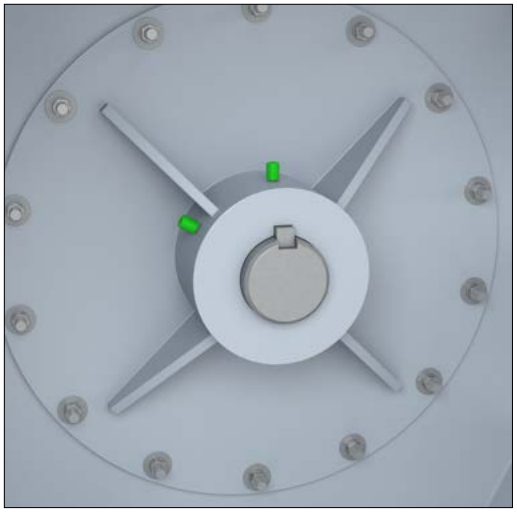


Bushing

Hub Cap

- **Anti-Rotation Device:** See image in *Common Accessories* section.
- **Bushing:** Used to connect the shaft to either an impeller or a drive sheave.
- **Drive Sheaves:** Sheave mounted to fan shaft and motor shaft. Can be with or without a bushing.
- **Hub Cap:** Helps to hold the shaft to a hub or isolates the shaft from the airstream (i.e. dissimilar materials).
- **Set Screw:** Provides means of connecting the rotating element to the shaft, which is available as standard or flattened type. The flattened type has an area on the shaft that is machined flat for easy removal of impeller from shaft.
- **Shaft Cooler:** Typically used in High Temperature applications. See image in *Common Accessories* section.

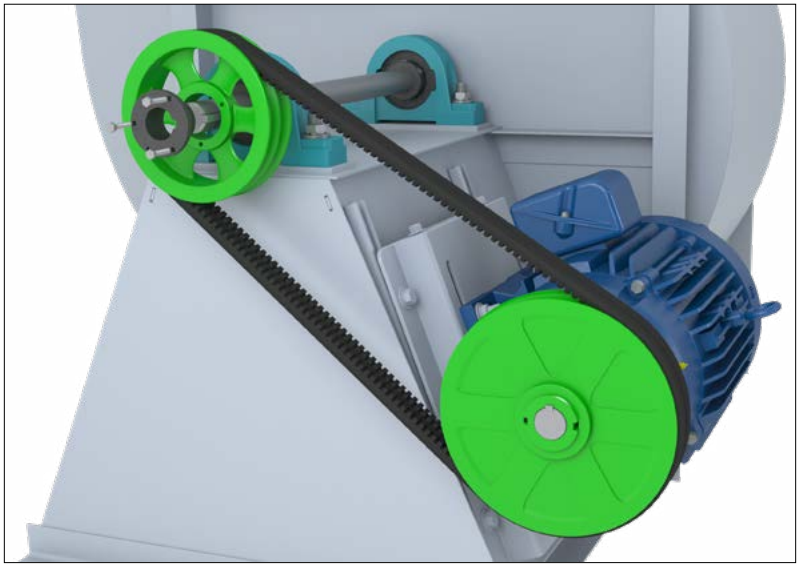
For more information, refer to *Bearings: Mounting & Orientation* section and *Special Construction: High Temperature* section.



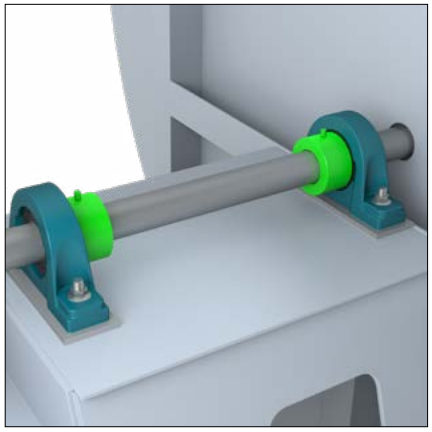
Standard

Flattened

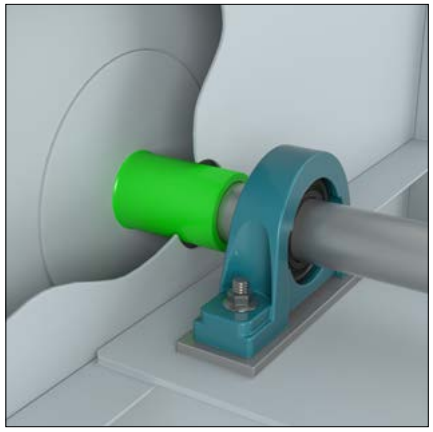
Set Screw



Drive Sheaves

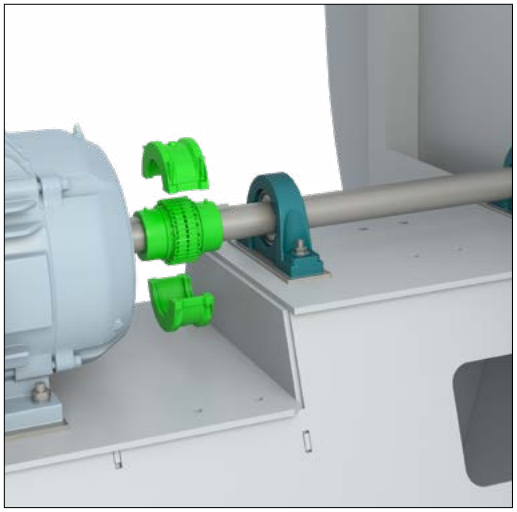


Shaft Collar

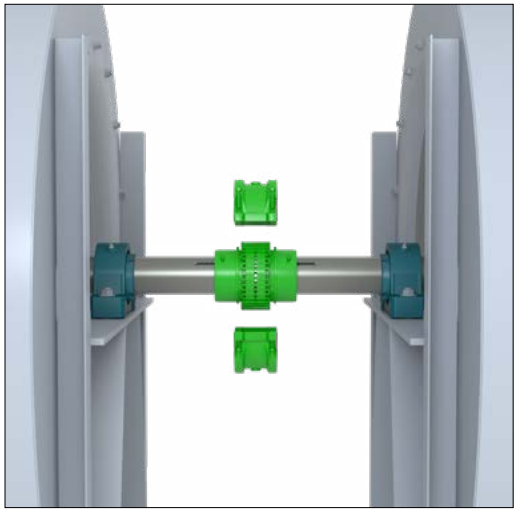


Shaft Sleeve

- **Coupling:** Used to connect the fan shaft to the motor shaft or fan shaft to fan shaft (i.e. twin fan assembly).
- **Shaft (Locking) Collar:** Helps hold the shaft in place to prevent it from hitting another object (i.e. bearings, impeller, etc.). Typical uses include Type A and Type B Spark Resistant Construction and Vertical Fan Construction.
- **Shaft Sleeve:** Shields the shaft from the fan airstream usually because of dissimilar materials. Typically used for Arrangements 1, 8, 9 and 10 fans. Arrangement 4 fans can use a protruding hub in lieu of a shaft sleeve. See *Hub Configurations* section for more detail.
- **Zero Speed Switch:** Detects slowing or stopping of the fan shaft. Other designs provided when requested by customer.

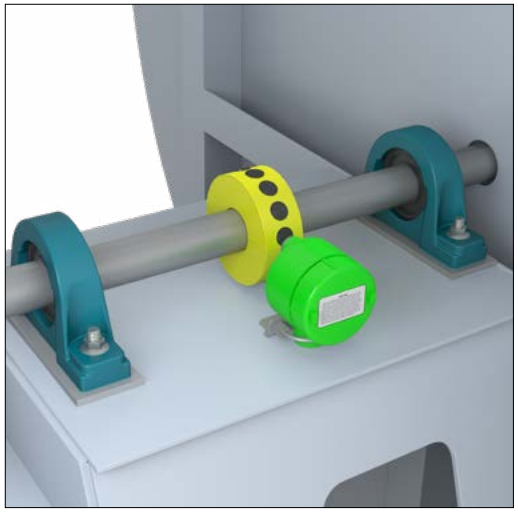


Fan Shaft to Motor Shaft



Fan Shaft to Fan Shaft

Coupling

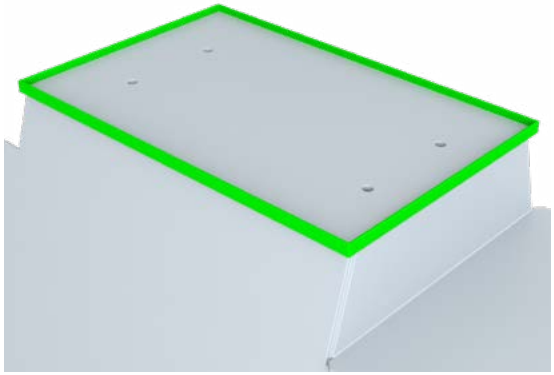


Zero Speed Switch

Also known as:
- Speed Sensor

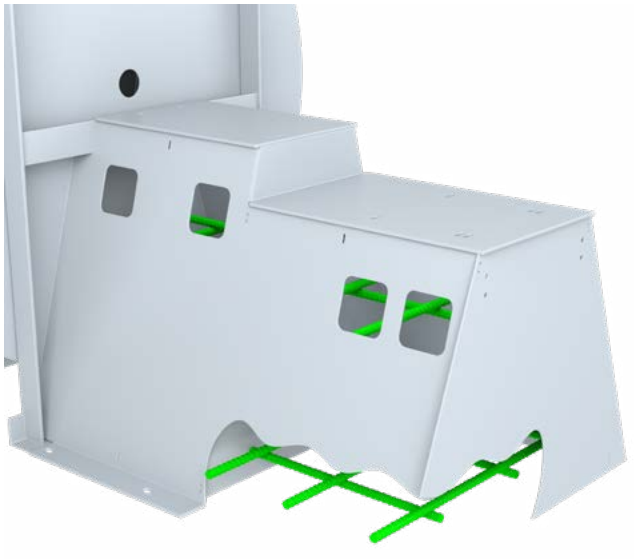
PEDESTALS
ACCESSORIES

Stop Blocks

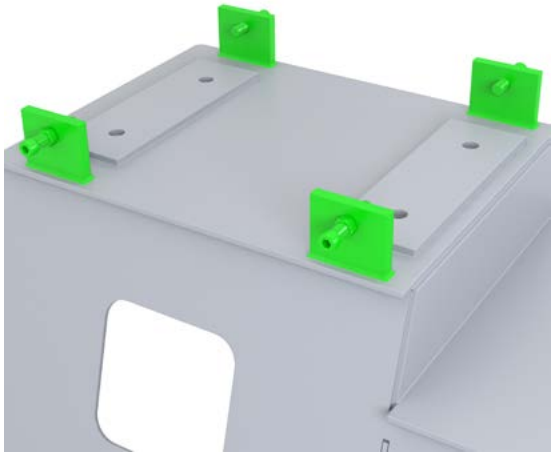


Grease Pan

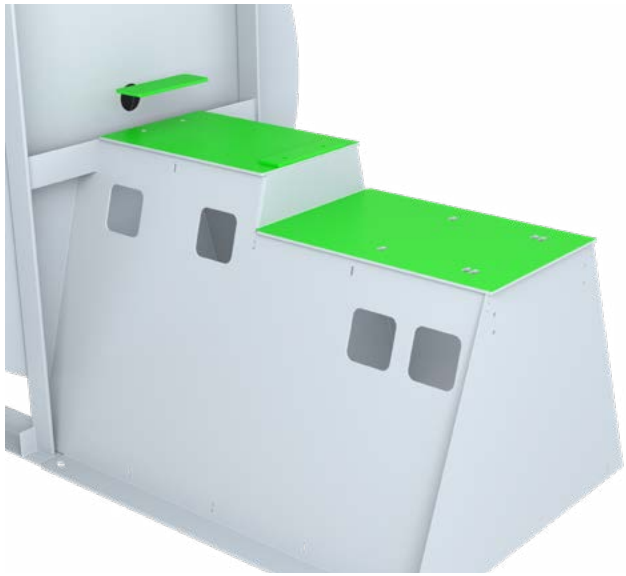
- **Positioners:** Used next to bearings or motors to aid in alignment during assembly and testing.
- **Machined Top:** Provides a very flat surface to aid in alignment of bearings and fan shaft or motor shaft. Entire top may be machined or may be pads (bearing and/or motors).
- **Grease Pan:** Provides enclosed area to collect excess grease emitted from bearings.
- **Rebar:** Metal rod welded in a pattern to the inside of the pedestal. Provides support for concrete that fills part of the internal pedestal cavity.
- **Stop Blocks:** Used next to bearings or motors.



Rebar for Concrete Fill

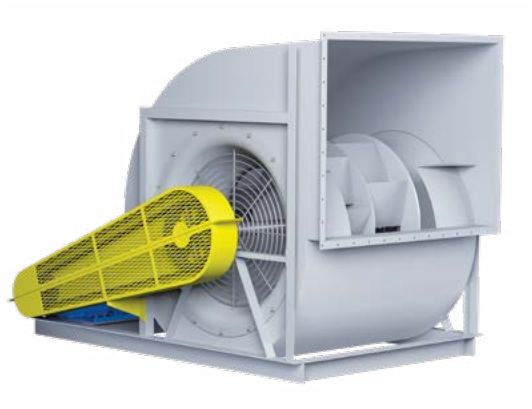


Positioners



Machined Top

BASE TYPES
CENTRIFUGAL FANS



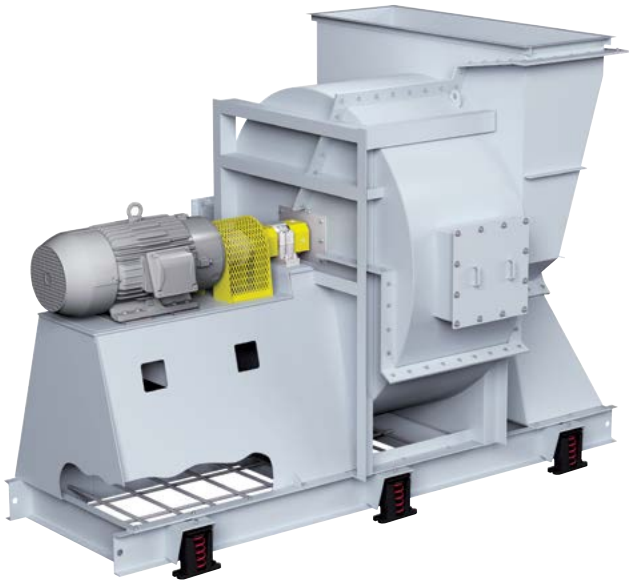
UNITARY BASE

Also known as:
- Channel Base

Unitary bases utilize structural channel to support the fan assembly and are designed for use without isolators.

ISOLATION BASE

Isolation bases provide a common support to fan, motor and drive including guards and utilize heavy-duty structural channel. Vibration isolation bases require spring or rubber-in-shear type isolators that are designed to limit forces transmitted to the support structure of an operating fan. Flexible connectors at the inlet and outlet are also required.



INERTIA BASE

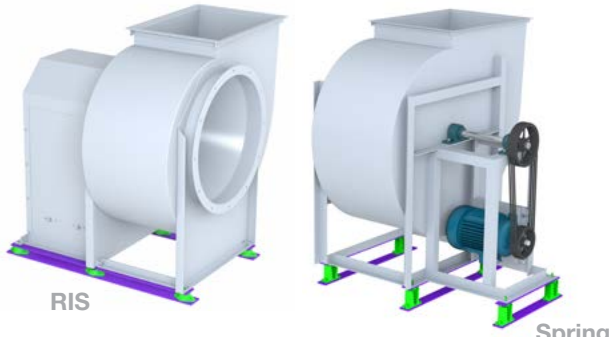
(isolation base with rebar - filled with concrete by customer)

Inertia bases provide a common support to fan, motor and drive including guards and utilize heavy-duty structural channel with spring isolators. Inertia bases incorporate reinforcing rods (rebar) and require customer-supplied concrete. Inertia bases are typically used on longer, direct drive fans to mitigate assembly deflection, maintaining proper alignment between the motor, coupling, shaft and bearings. Flexible connectors at the inlet and outlet are required. Shown with optional bottom pan to allow for easier filling of concrete in the field.

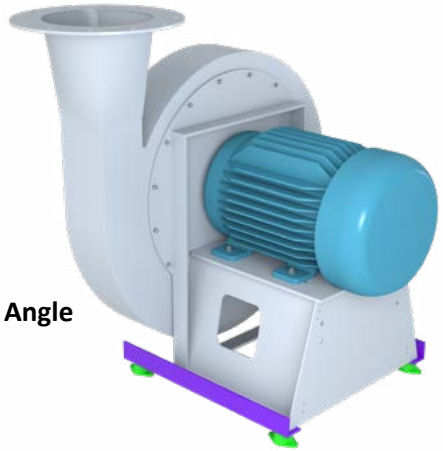
VIBRATION ISOLATION
OVERVIEW AND MOUNTING

Directly Under Fan

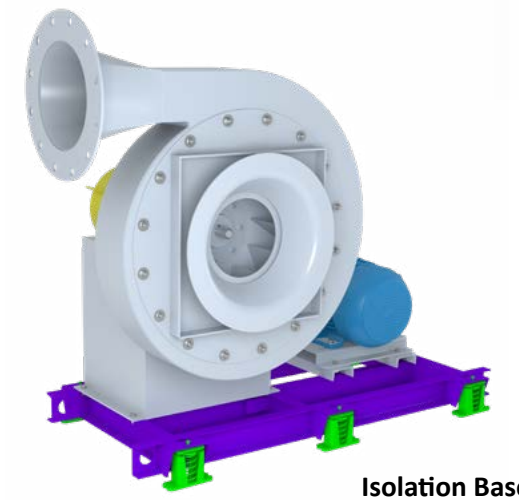
NOTE: Usually limited to fans with 36.5" diameter impellers or less. An exception is made for swingout housed centrifugal fans, any size impeller, with flat pads only.



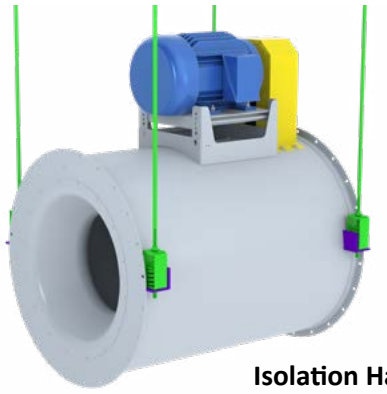
Isolation Rails



Mounting Angle



Isolation Base



Isolation Hangers

Vibration isolation is used to prevent or limit the amount of force transferred to the supporting structure by a fan in operation. These forces are either undesirable, as in an office setting where they may be distracting or possibly destructive to a process, as in electronic manufacturing where they may cause upset in a production process. In an extreme case vibration can be destructive enough to destroy the supporting structure.

All fans do not require vibration isolators, but do require adequate support of the mounting structure, so vibration is not a problem. When isolation is used, rigid duct connections are not allowed. Flex connectors are required. Some fans, such as commercial roof ventilators, are internally isolated and no other isolation is required.

TYPES OF VIBRATION ISOLATION MOUNTING

- **Directly Under a Fan:** Isolators mounted under foundation holes in fan structure. Can use springs, RIS pads or neoprene pads.
- **Isolation Rails:** Isolators mounted between two pieces of flat bar. Top flat bar attached to foundation holes of fan. Bottom flat bar attached to the ground or other mounting structure. Can use springs or RIS pads.
- **Mounting Angle:** Angle mounted between fan and isolators. Usually used when fan inlet does not have a structural support. Can use springs or RIS pads.
- **Isolation Base:** Fan, possibly motor and other components, mounted on a structural base with isolators under mounting brackets of the base. Can use springs, RIS pads or neoprene pads.
- **Isolation Hangers:** Fan suspended from a structure (i.e. ceiling, etc.) with isolators mounted between the overhead supporting structure and the fan. Can use spring or RIS hangers.

For additional information, refer to Fan Engineering Letter FE-200, FE-1900 and Base Types in *Accessories* section.

VIBRATION ISOLATION
ISOLATOR TYPES

Several types of mounts can be used in fan vibration isolation installations. The types shown in this publication describe what Twin City Fan typically uses unless otherwise specified. Vibration isolators normally compress to dampen the vibration during normal operation of a fan assembly. This is known as "deflection". Most isolators used by Twin City Fan usually have the following deflection rates:
Under 1" (25.4 mm), 1" (25.4 mm) or 2" (50.8 mm). Higher deflection is available (with additional cost) and can be provided based on Engineering review.

For additional information about isolator types, refer to Fan Engineering Letter FE-1900.

Floor Mounted

Ceiling Hung

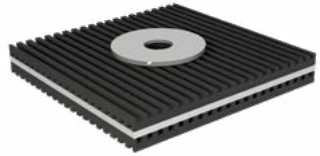
Ceiling Hung

Floor Mounted

RUBBER-IN-SHEAR (RIS) TYPE

Floor mounted RIS pads consist of two load plates of steel that are embedded in a rubber pad.
Typical deflection range: 0.2" (5 mm) to 0.5" (12.7 mm).

Ceiling hung RIS pads are mounted in a formed metal surround.
Typical deflection range: 0.2" (5 mm) to 0.5" (12.7 mm).



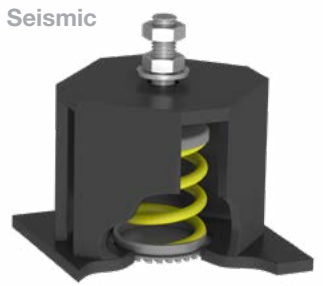
PADS

Molded ribbed neoprene pads are used in some instances for isolation. A metal plate is mounted between two ribbed neoprene pads and a neoprene washer goes between the pad and fan structure. They offer minimal vibration isolation and are low cost.
Typical deflection: about 0.0625" (1.58 mm).

SPRING TYPE

Open springs are the simplest of the spring mounts. They do not offer any restriction of motion caused by aerodynamic forces. Floor mounted types are typically not used by Twin City Fan. Ceiling hung types are mounted in a formed metal surround.
Typical deflection: 1" (25.4 mm)

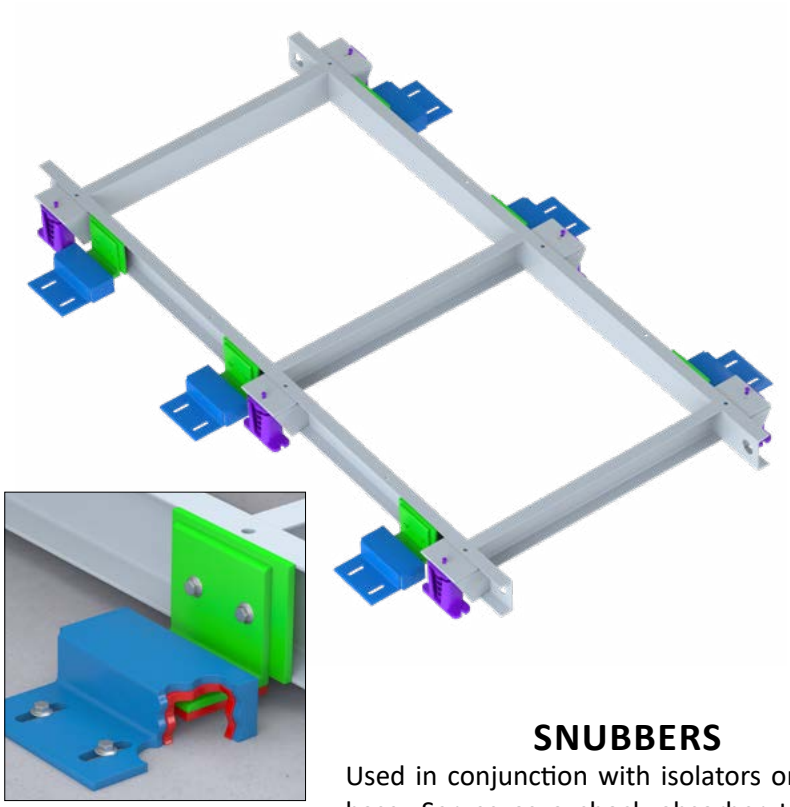
Housed springs work in the same way as open springs, but are contained in some type of enclosed housing. Isolator housings can hold one or more springs depending on application.
Typical deflection: 1" (25.4 mm) or 2" (50.8 mm).



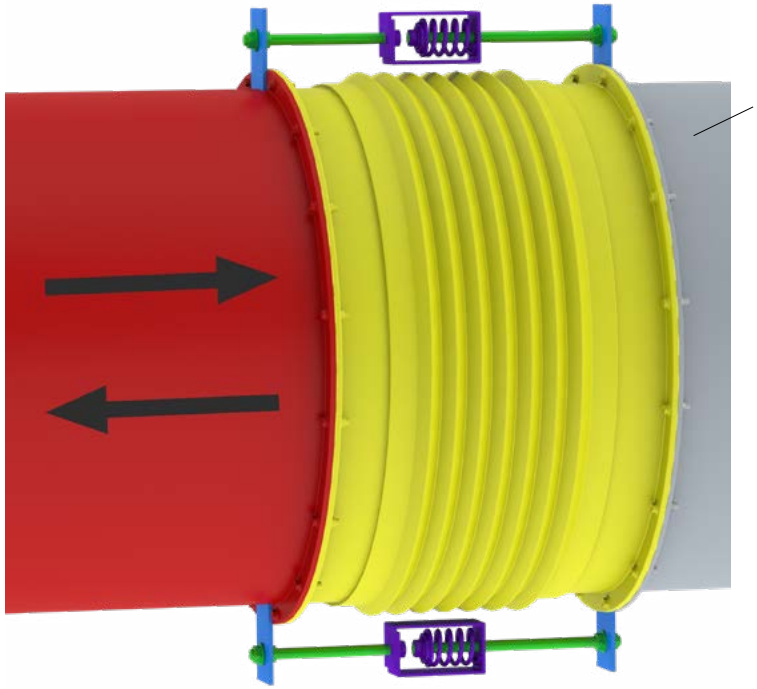
Restrained springs are the same in design as the open springs, but a housing or frame is included to restrain the vertical and/or horizontal motion of the spring.
Typical deflection: 1" (25.4 mm) or 2" (50.8 mm).

Seismic springs are similar to a restrained spring except housing nearly surrounds the entire spring to withstand loads generated during a seismic event (i.e. an earthquake).
Typical deflection: 1" (25.4 mm) or 2" (50.8 mm).

VIBRATION ISOLATION
ISOLATOR TYPES



Horizontal Airflow Only
Either Direction



SNUBBERS

Used in conjunction with isolators on a fan or base. Serves as a shock absorber to prevent excessive movement of the fan or base in any direction. Often used when fan must withstand seismic loading.

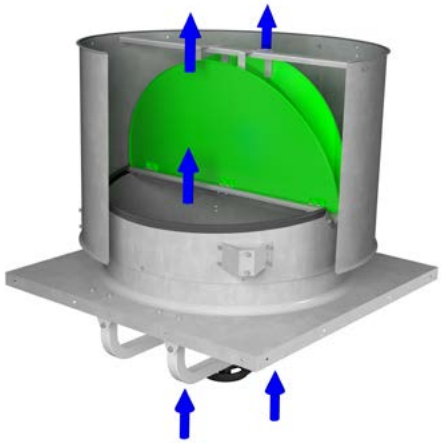
- **Snubber Bracket (attached to fan or base)**
- **Snubber Bracket (attached to floor)**
- **Isolators**
- **Elastomeric (Rubberized) Material**
  - prevents metal to metal contact

THRUST RESTRAINTS

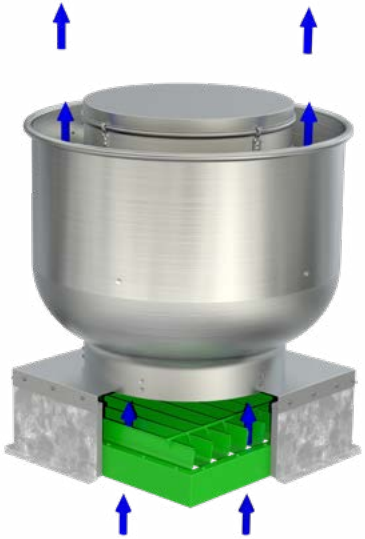
Used to prevent excessive motion of fans due to aerodynamic force. Standard ceiling hung type isolators (springs or spring/RIS pad combinations) are attached to both the fan discharge and the discharge duct using a threaded rod. They are adjusted to prevent horizontal motion. Two restraints per fan are mounted 180° apart.

- **Thrust Arrestor Brackets**
- **Threaded Rods and Hardware**
- **Isolators**
- **Flex Connector (supplied by TCF or others)**
- **Customer Duct**

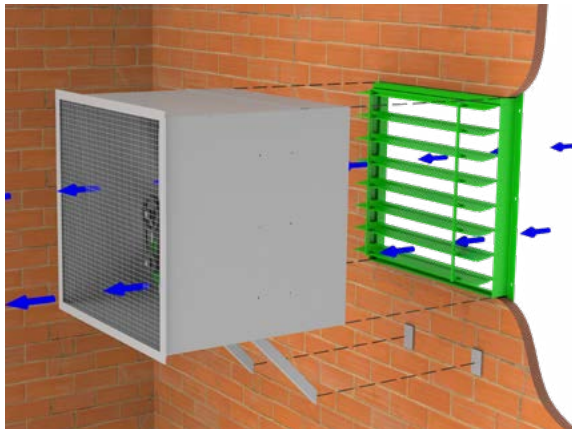
Refer to Fan Engineering Letter FE-1900 for more information.



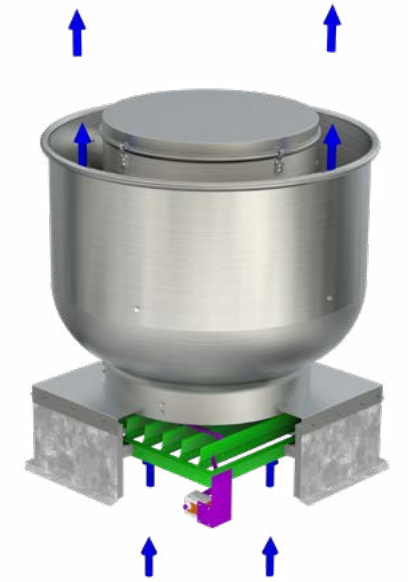
GRAVITY DAMPER
(Butterfly Type)

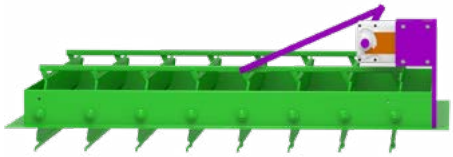


GRAVITY DAMPER
(Ceiling Type)

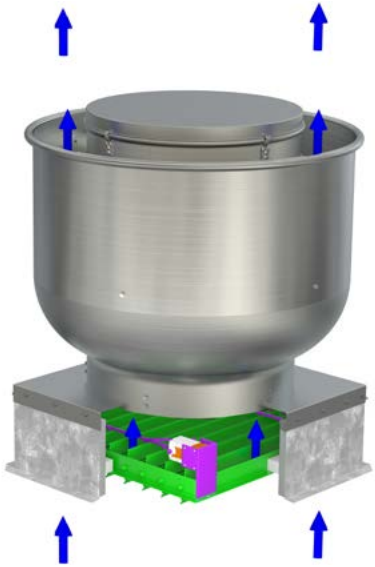


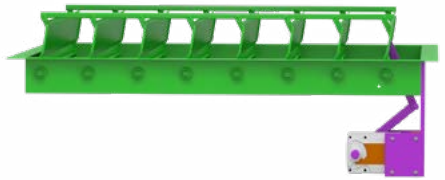
GRAVITY DAMPER
(Wall Type)





MOTORIZED DAMPER
(Actuator with Center Pivot)



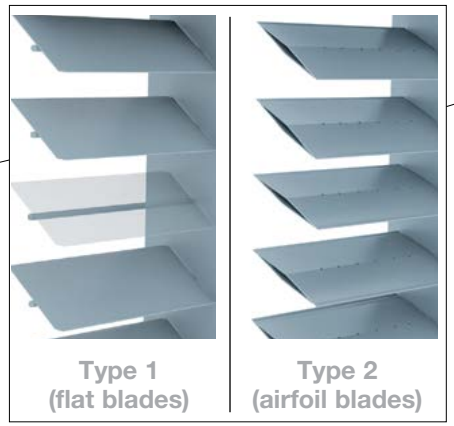


MOTORIZED DAMPER
(Actuator with End Pivot)

NOTE: See *Technical Descriptions* section for detailed descriptions of dampers.

DAMPERS
INDUSTRIAL GRADE

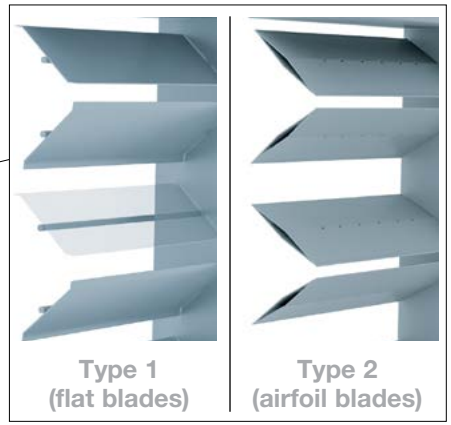
PARALLEL BLADE OUTLET DAMPER
(Type 1 and Type 2)



PARALLEL BLADE INLET BOX DAMPER
(Type 2 Only)

Also known as:
- Pre-spin Parallel Blade Inlet Box Damper

OPPOSED BLADE OUTLET DAMPER
(Type 1 and Type 2)

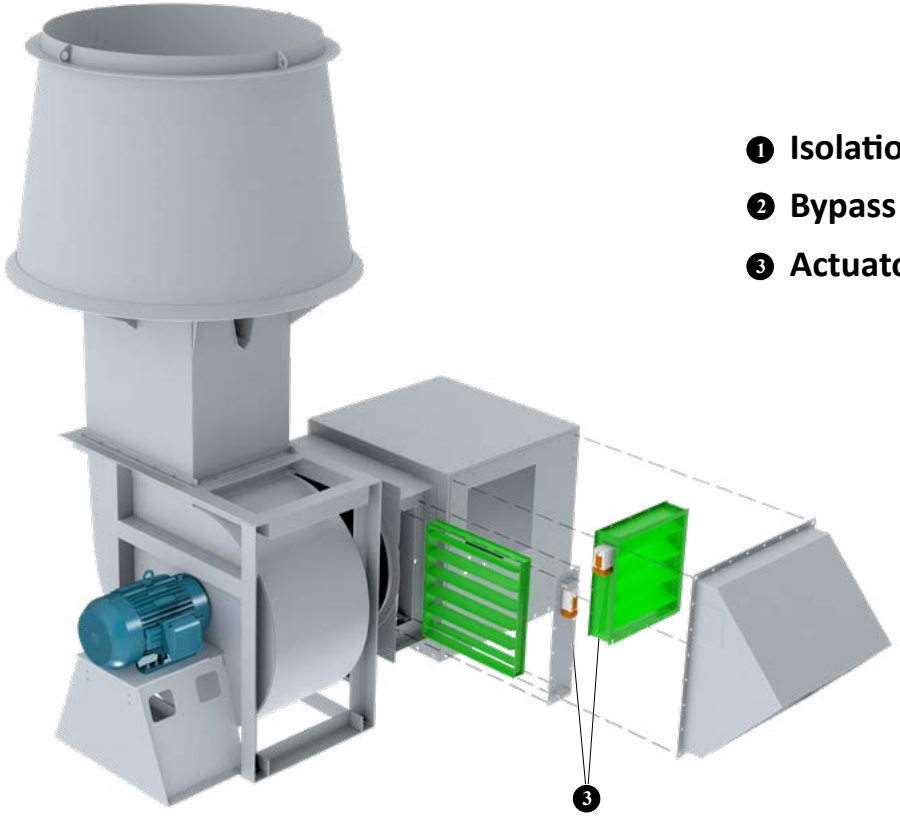


MANUAL OUTLET DAMPER

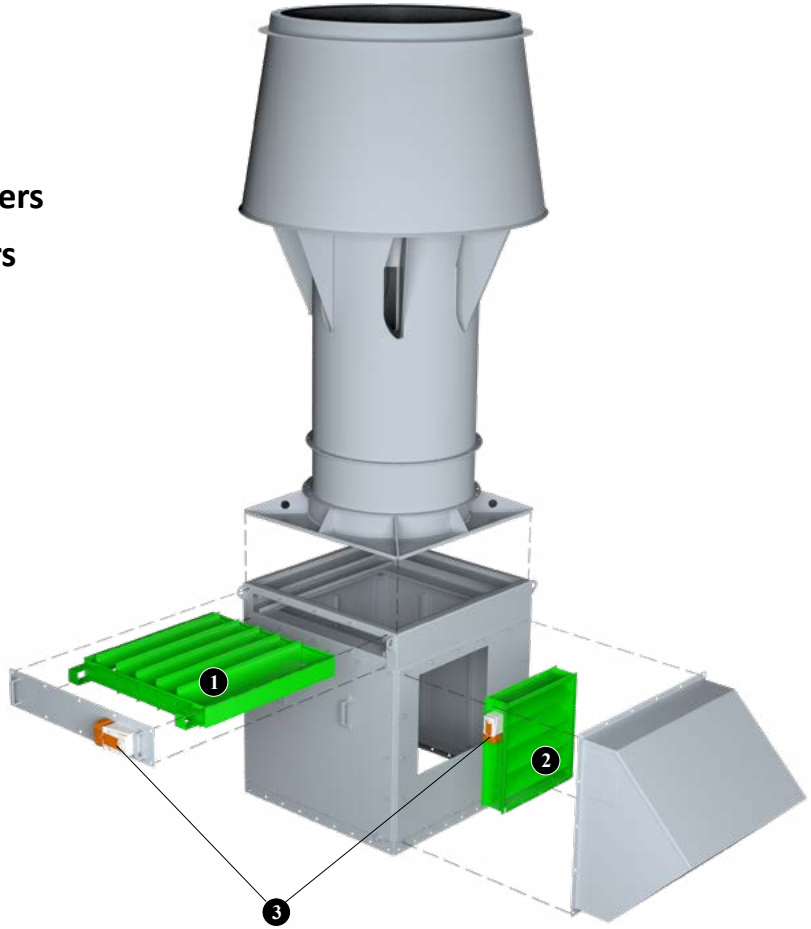
OUTLET DAMPER WITH ACTUATOR

NOTE: See *Technical Descriptions* section for detailed descriptions of dampers.

DAMPERS
LAB EXHAUST FANS



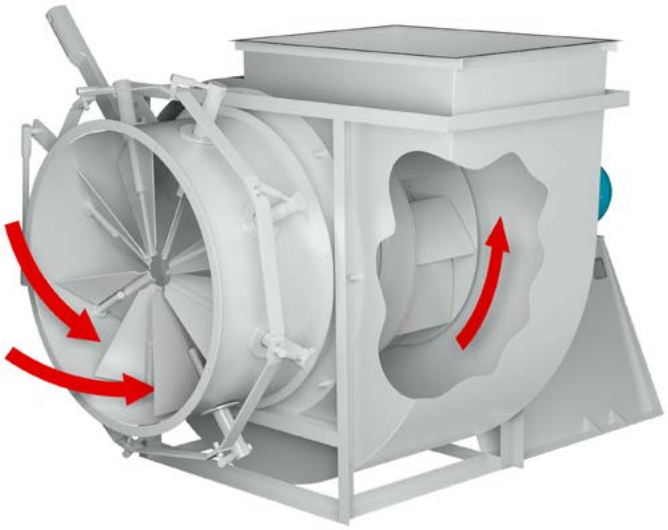
❶ Isolation Dampers
❷ Bypass Dampers
❸ Actuators



Models BCIFE, BAIFE

Models TVIFE, QIFE, QFE, TFE

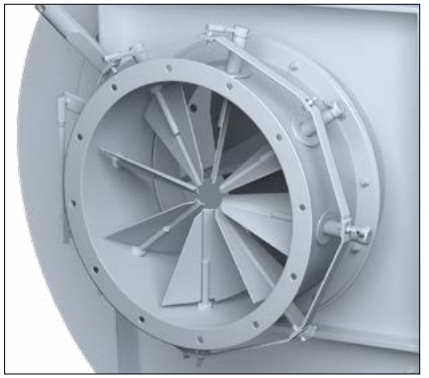
INLET VANES
INDUSTRIAL GRADE

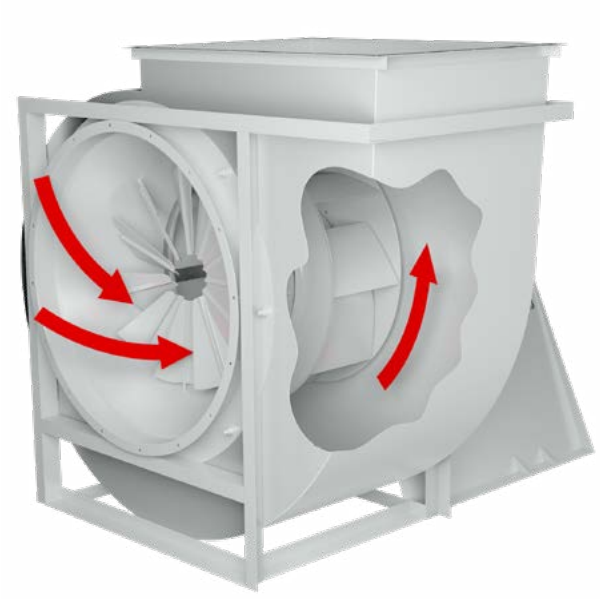


EXTERNAL INLET VANE

Also known as:
- Vortex Damper
- Inlet Damper
- Variable Inlet Vanes
- Inlet Guide Vanes
- Radial Inlet Damper

Application: Used for contaminated airstreams or for high temperature airstreams up to 600°F. Radial vanes at the fan inlet pre-spin the air entering the fan to control the flow. Vanes come standard with a manual handle, but can be provided with an actuator. External vanes have a housing and are bolted to the fan inlet.





NESTED INLET VANE

Also known as:
- Vortex Damper
- Inlet Damper
- Variable Inlet Vanes
- Inlet Guide Vanes
- Radial Inlet Damper

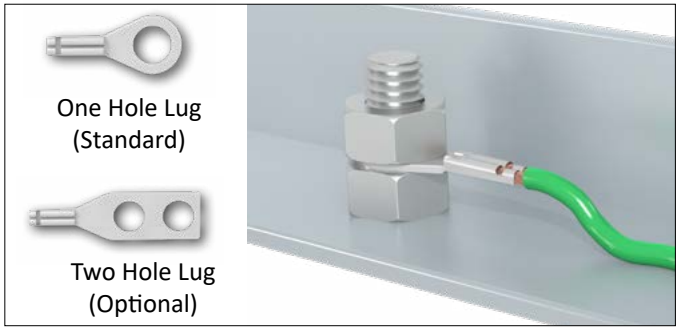
Application: Used for clean airstreams up to 600°F. Same function as the external inlet vane, but the vanes are nested within the inlet funnel. Replacing the vanes require the inlet funnel assembly to be replaced. Vanes come standard with a manual handle, but can be provided with an actuator.

GROUNDING DEVICES
ALL MATERIALS (EXCLUDING FIBERGLASS)

STANDARD 3/8" GROUNDING STUD
(Stainless Steel Stud Standard)

Also known as:
- Lug (commonly mistaken for grounding stud)

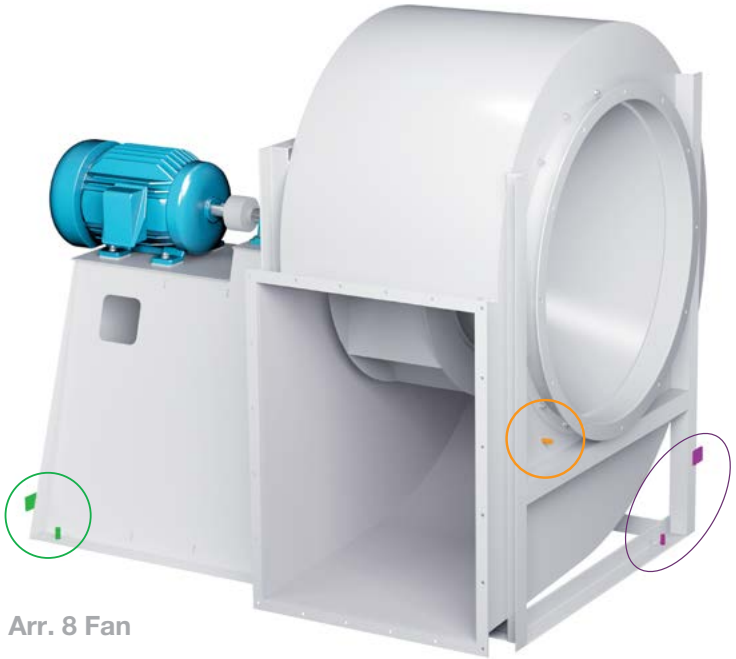
Lugs shown in photo on the right



STANDARD 3/8" GROUNDING STUD WITH LUG
(Stainless Steel Stud and Nuts Standard)
(Aluminum Lugs Standard)

STANDARD GROUNDING PAD WITH CLEARANCE HOLE
(Stainless Steel Standard)

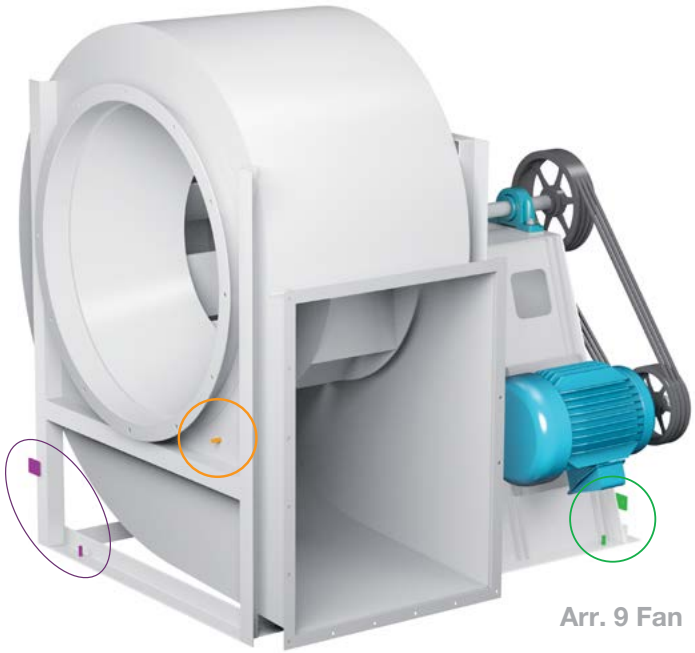
Options
- Threaded Hole
- With Stud
- Copper
- Two Hole



Arr. 8 Fan

Fan Grounding Stud
Standard Location (Drive Side)
Standard Location (Inlet Side)
Optional Location (Inlet Side)

Fan Grounding Pad
Standard Location (Drive Side)
Standard Location (Inlet Side)



Arr. 9 Fan

OVERVIEW

An inlet box is designed to minimize pressure drop and airflow losses. Inlet boxes are recommended for applications where uniform flow is difficult to obtain due to limited space or where the air must enter the fan at an angle. Inlet boxes can be either detached or integral (attached) to the fan.

STYLES

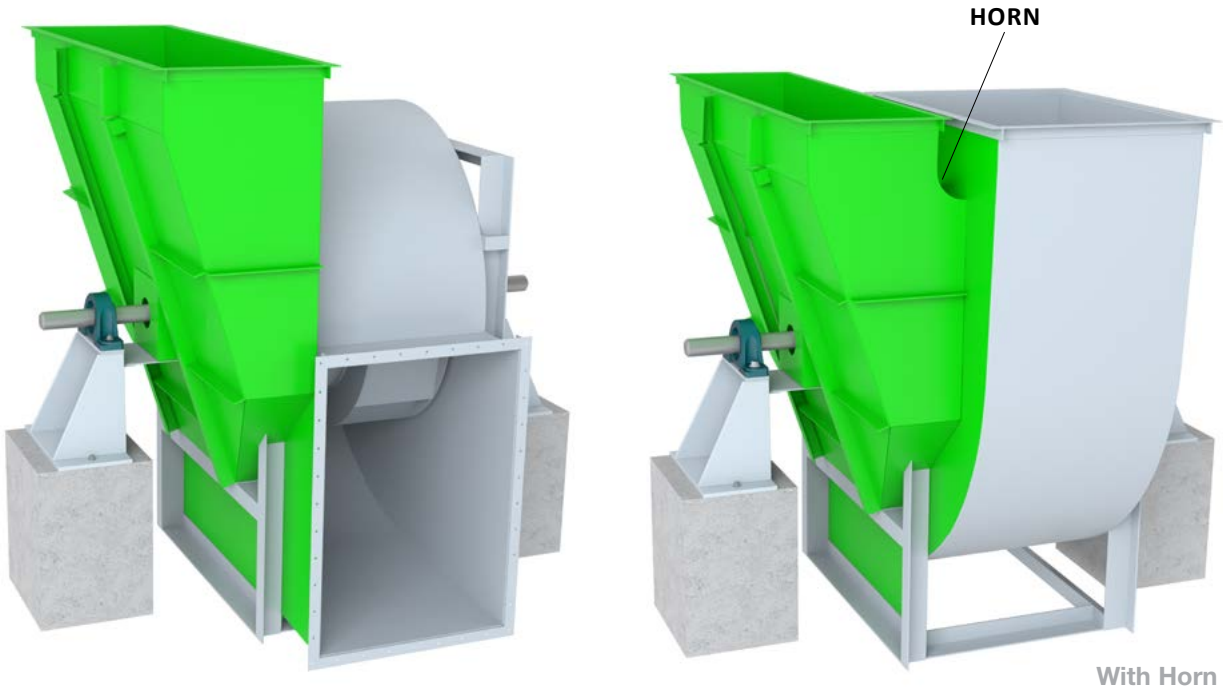
- Integral (Attached) Inlet Box, With Horn
- Integral (Attached) Inlet Box, Without Horn
- Detached (Bolt-On)
- Detached (Free Standing)

INTEGRAL INLET BOX

Also known as: Attached Inlet Box

Inlet box is integrated into the inlet side of the fan housing. The inlet box is supported by the fan.

- Integral to fan housing
- Common plate with fan inlet housing sideplate



Without Horn

With Horn

Note: Horns are used when inlet and discharge airflows would intersect. The horn allows ductwork to be connected without interference.

DETACHED INLET BOX (BOLT-ON)

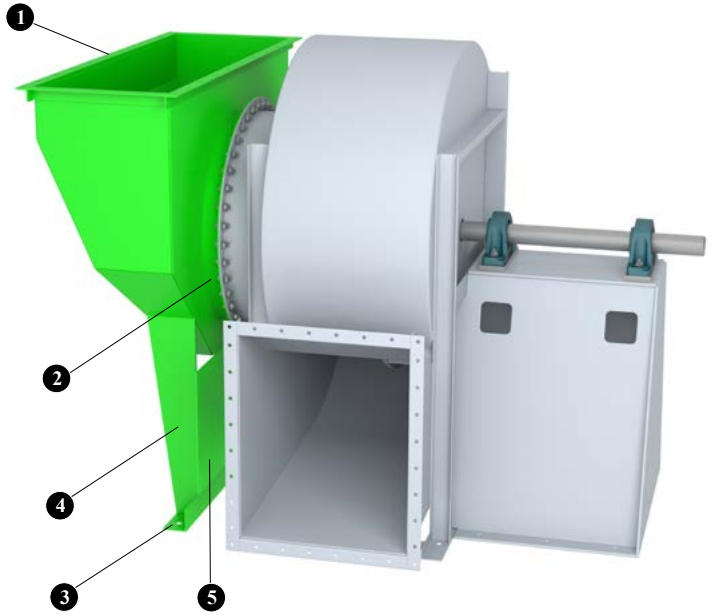
Inlet box is bolted directly to the inlet flange of the fan. Available with both straight and flared connection. This is TCF's preferred inlet box design.

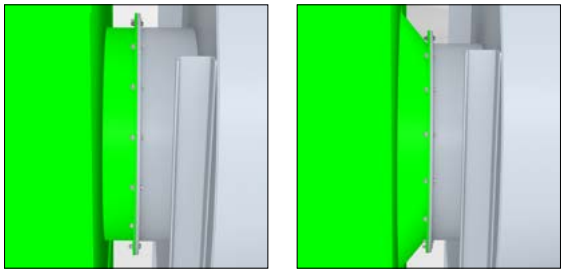
Consists of the following:

1. Inlet (Rectangular) Flange: Connects to customer ductwork
2. Outlet (Round) Flange: Connects to fan inlet flange

Mounting Structure:

3. Single Base Angle: Connects to mounting surface (bolt-on)
4. Gussets: Connects box to base angle
5. Reinforcement Plate: Ties gussets to base angle for full support structure





Straight Connection | Flared Connection

DETACHED INLET BOX (FREE STANDING)

Inlet box is mounted separate from the fan and is fully supported at the floor. Available with both bolted and slip (shown) connection. Consists of the following:

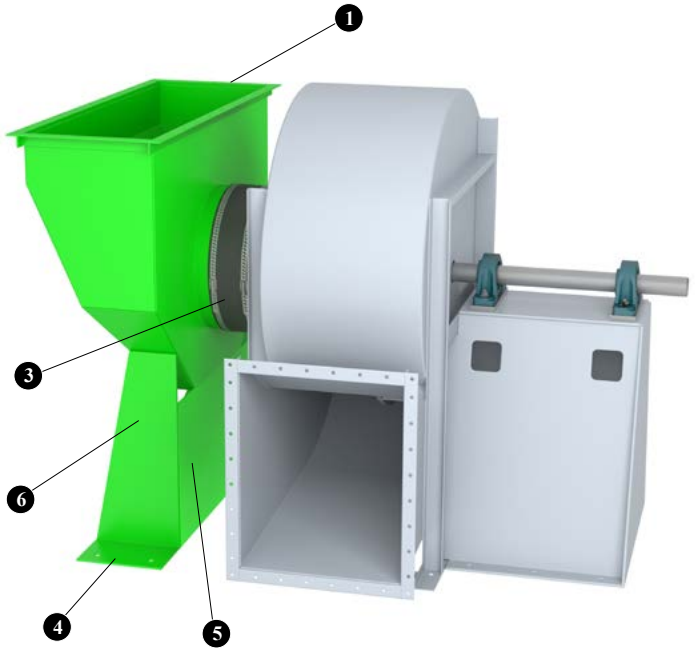
1. Inlet (Rectangular) Flange: Connects to customer ductwork

Connection to Fan Options:

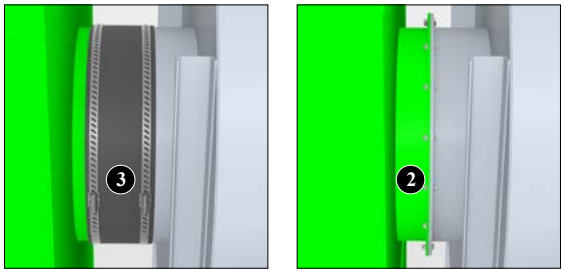
2. Outlet (Round) Flange (only available with bolted connection): Connects to fan inlet flange
3. Outlet Collar (only available with slip connection): Connects to fan inlet collar with a rubber sleeve and clamps

Mounting Structure:

4. Base Plate (Foot): Connects to mounting surface
5. Reinforcement Plate: Ties gussets to base plate for full support structure
6. Gussets: Connects box to base plate

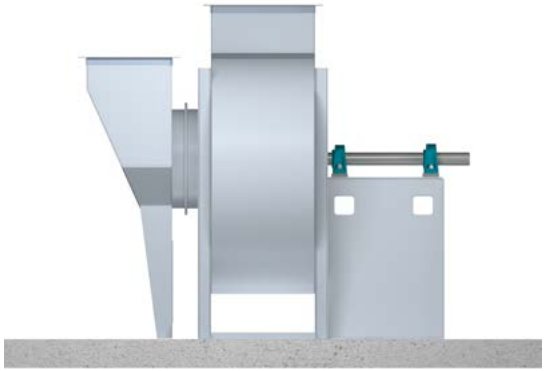


Must select one of these options:

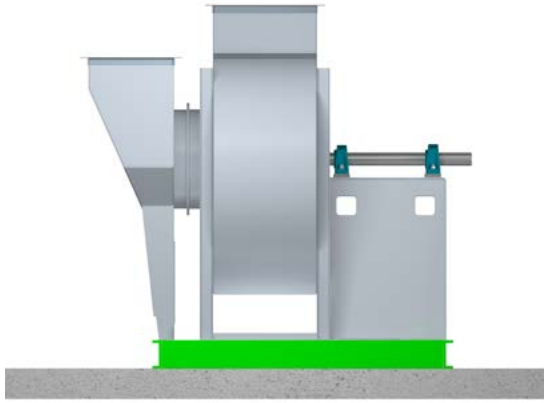


Slip Connection | Bolted Connection

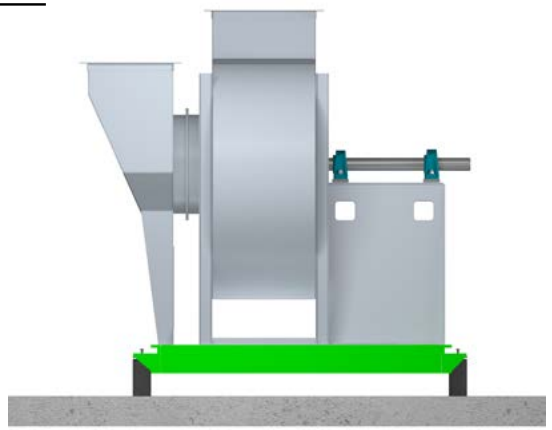
FAN AND INLET BOX (DETACHED) MOUNTED ON SAME PLANE



FAN AND INLET BOX MOUNTED
ON GRADE (LEGS TO GRADE)



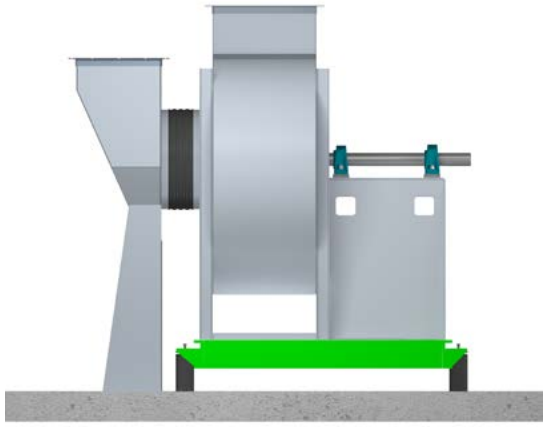
Unitary Base



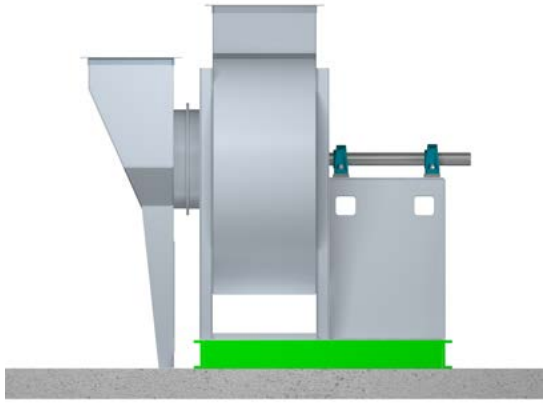
Isolation Base

FAN AND INLET BOX MOUNTED
ON BASE (LEGS TO BASE)

FAN AND INLET BOX (DETACHED) MOUNTED ON DIFFERENT PLANES



FAN MOUNTED ON ISOLATION BASE
AND INLET BOX MOUNTED ON
GRADE (LEGS TO GRADE)

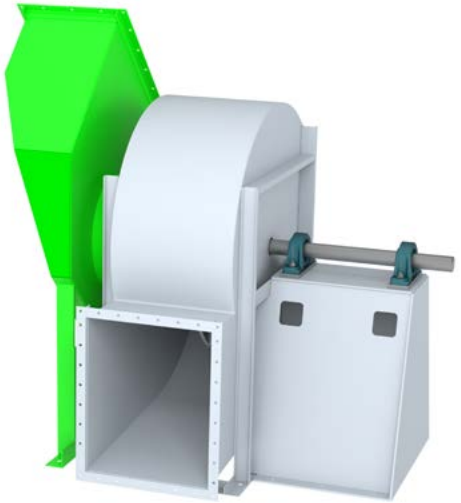


FAN MOUNTED ON UNITARY BASE
AND INLET BOX MOUNTED ON
GRADE (LEGS TO GRADE)

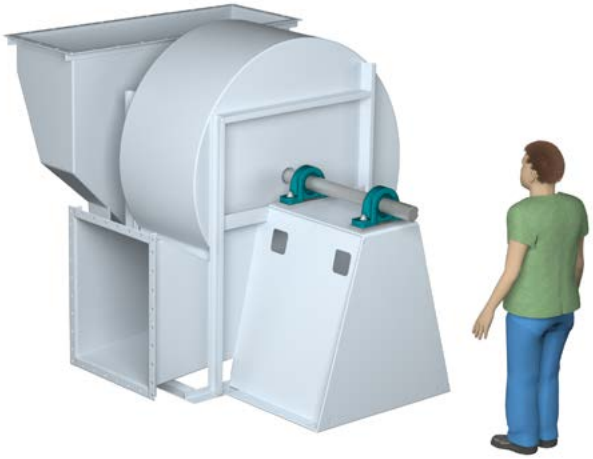
Note: Flex connector (slip connection) required between fan and inlet box.

EXAMPLES OF INLET BOX POSITIONS

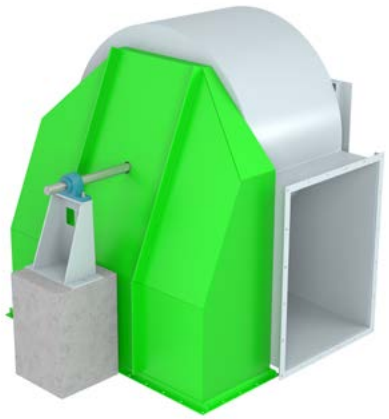
Inlet Box at 90° position



Inlet Box at 45° position



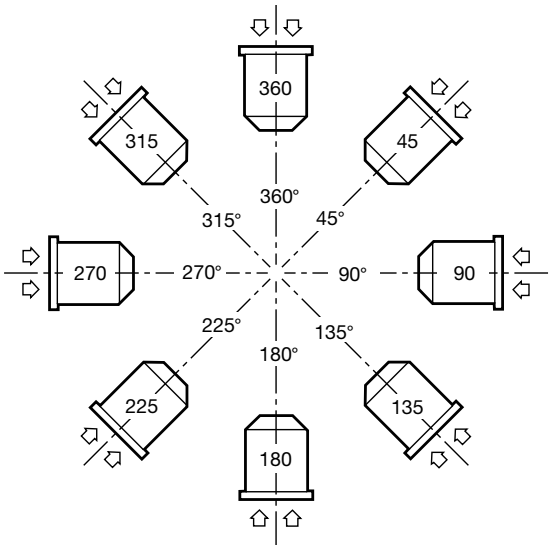
Inlet Box Positions Determined
FROM DRIVE SIDE



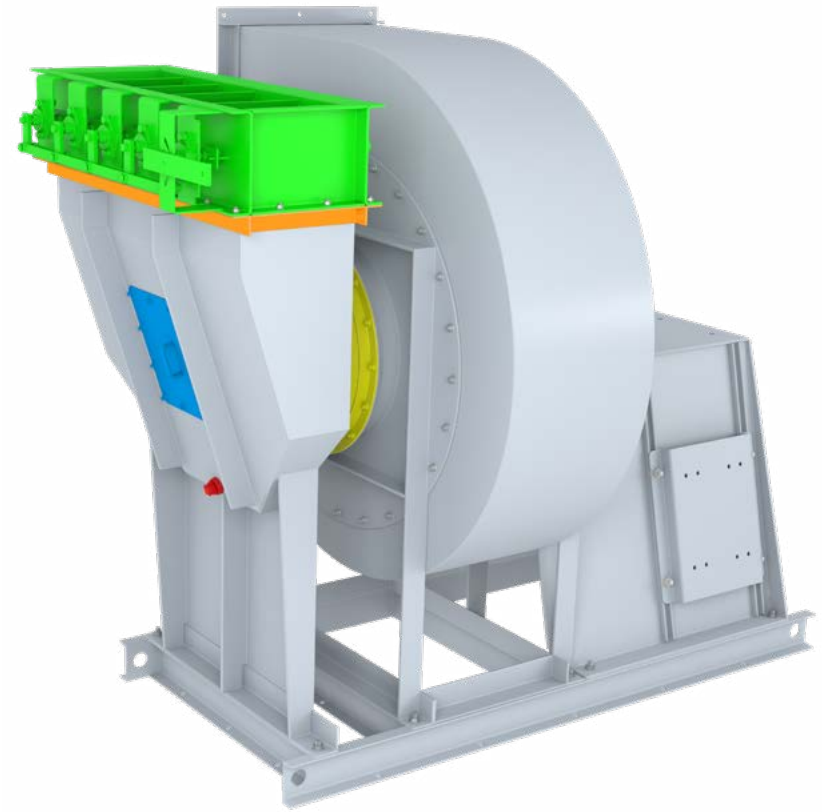
Inlet Box at 180° position

INLET BOX POSITION DESCRIPTIONS

45 — Angular Down Intake
90 — Horizontal Right Intake
135 — Angular Up Intake
180 — Bottom Up Intake
225 — Angular Up Intake
270 — Horizontal Left Intake
315 — Angular Down Intake
360 — Top Down Intake



INLET BOXES
FEATURES AND ACCESSORIES

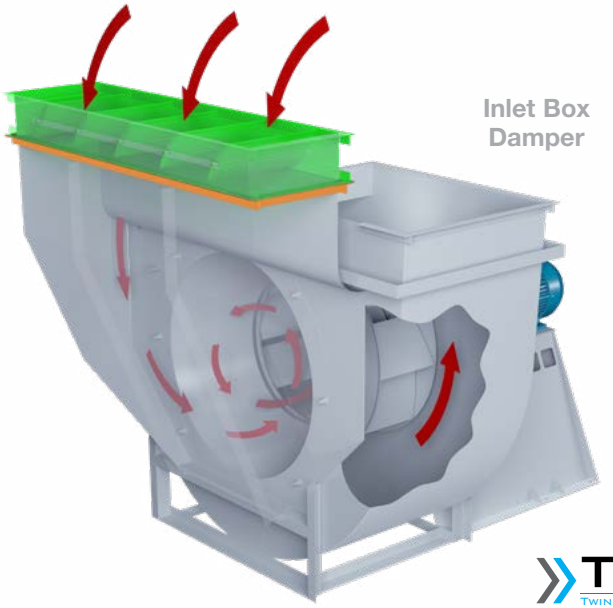


- **Inlet Box Damper**
- **Access Door**
- **FGR**
- **Flange/Collar**
- **Flange at Inlet**
- **Drain**

- **Access Door:** Standard accessory on most inlet boxes.
- **Drain Connection:** Standard accessory on most inlet boxes.
- **FGR (Flue Gas Recirculation or Recovery) Connection:** Special flange connection provided on the front of the inlet box. Allows air from the whole system to be re-circulated through the fan.
- **Flange at Inlet:** Connects the inlet box to the customer's ductwork.
- **Flange or Collar at Connection to Fan:** Connects the inlet box to the inlet of the fan.
- **Insulated Inlet Box:** Used for high temperature or sound applications. (See *Special Construction: Insulated Fans* section for more information.)
- **Inlet Box Damper:** Pre-spins the air in the direction of impeller rotation, resulting in a savings in horsepower at reduced loads. (See *Dampers* section for more information.)

FGR Connection

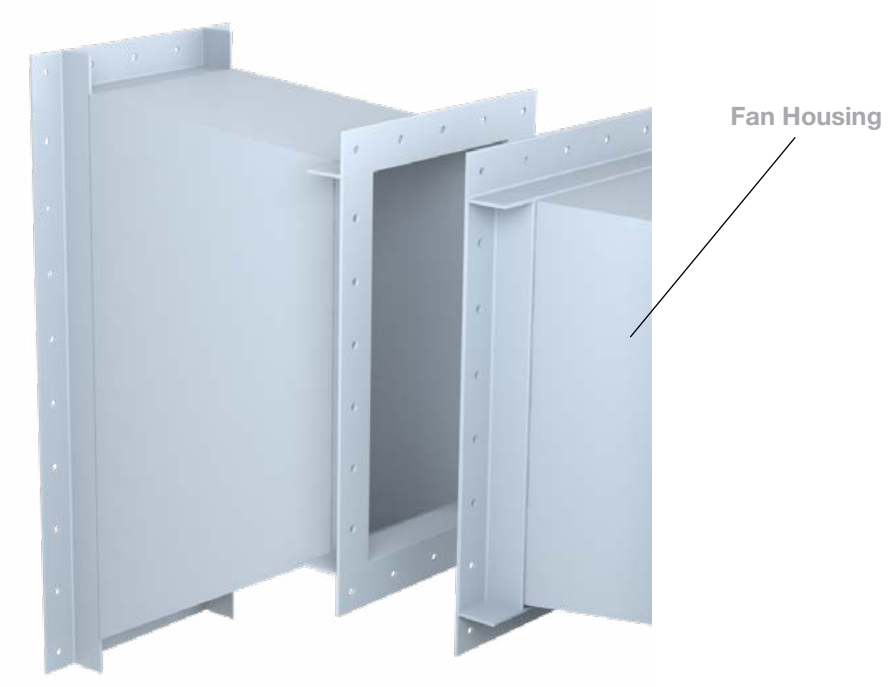
Insulated Inlet Box



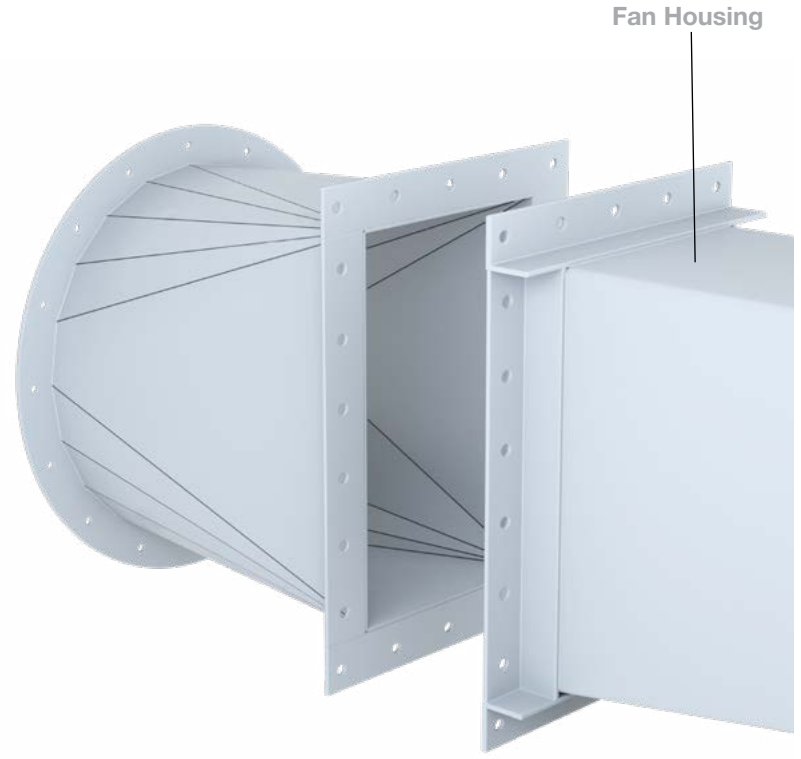
Inlet Box Damper

EVASÉS

An evasé is a section of ductwork attached (usually bolted) to the fan discharge. The outlet of the evasé is larger than at the inlet (fan discharge), which ultimately expands the outlet area of the fan. Its purpose is to reduce the outlet velocity of the fan and to increase the static pressure capability. For some fans, the published performance ratings include the influence of an evasé. The customer may use a well-designed transition piece in place of the evasé as long as the outlet area matches.

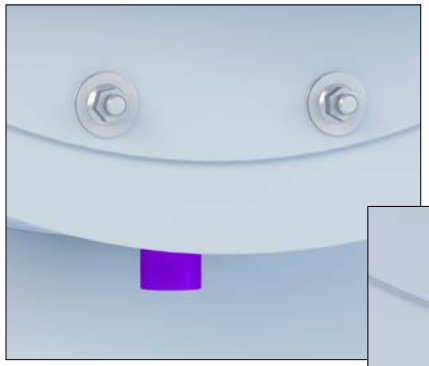


RECTANGULAR EVASÉ



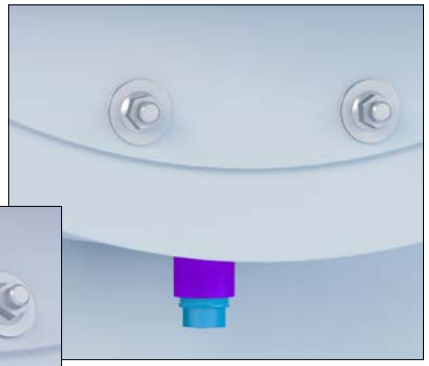
ROUND EVASÉ

DRAINS & WEEP HOLES



STANDARD DRAIN, HALF COUPLING

WEEP HOLE



STANDARD DRAIN, WITH PLUG

OVERVIEW

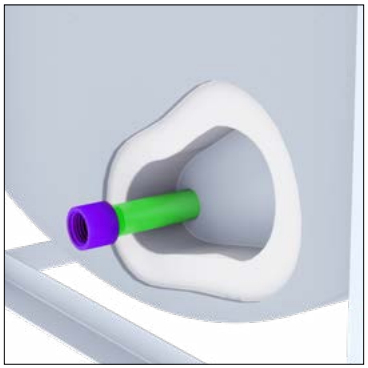
Fan housings typically need an opening at the lowest point for draining moisture build up. Most come standard with a weep hole. Weep holes are used by manufacturing to drain wash water out of the housing prior to painting. They also assist customers by allowing moisture to drain from the housing after fan installation. Drains are typically a half coupling pipe welded to the fan housing scroll. Drain diameter varies by fan model. Special diameter drains can be provided. A plug or valve may be added to close the hole if desired.

Inlet boxes may also get drains as a feature or an added accessory.

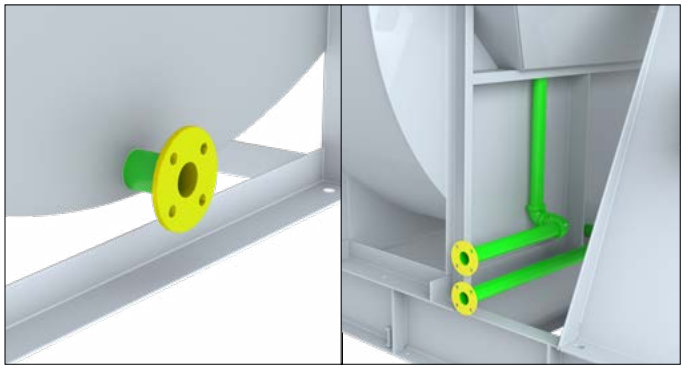
Specialty Drains

- Extended from inlet side
- Flanged
- Valve to open and close
- Fan and inlet box

SPECIALTY DRAINS



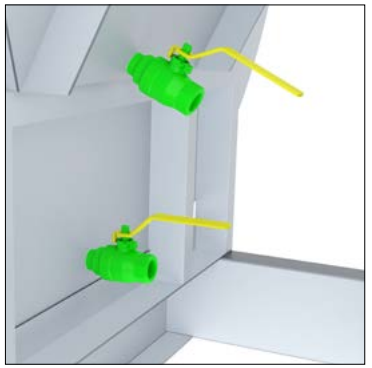
EXTENDED FROM INLET SIDE



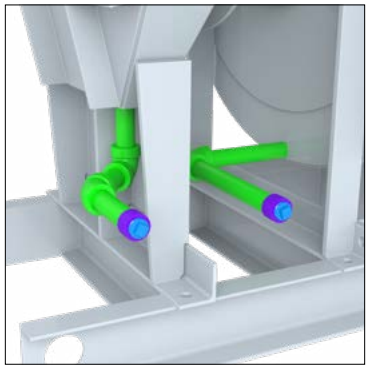
From Inlet Side

Past Fan Base to Common Point

FLANGED

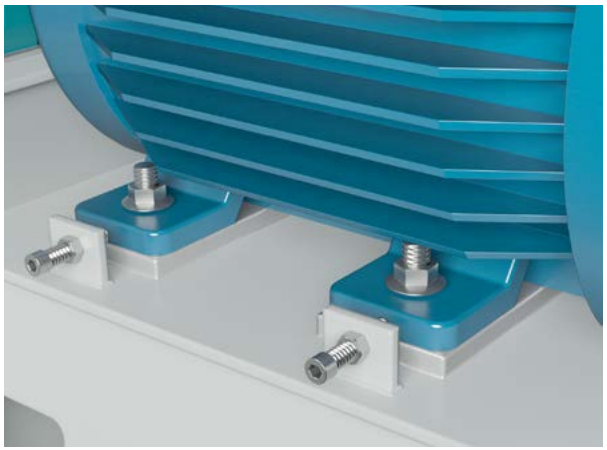


VALVE



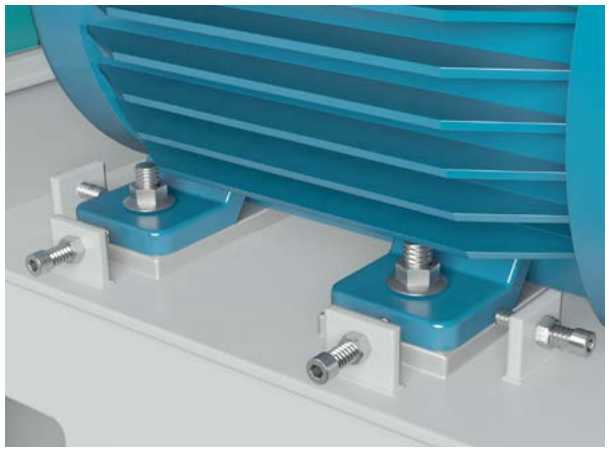
FAN AND INLET BOX (to Common Point, Shown with Plug)

MOTOR POSITIONERS



MOTOR POSITIONERS

Also known as:
- Motor Alignment Jacking Screws



BI-DIRECTIONAL MOTOR POSITIONERS

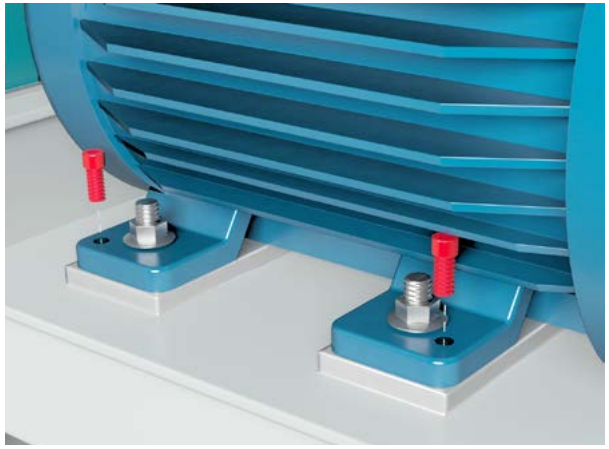
Also known as:
- Motor Alignment Jacking Screws

TRI-DIRECTIONAL MOTOR POSITIONERS

(Motor Feet Drilled and Tapped by Vendor)

Also known as:
- Motor Alignment Jacking Screws

Note: Vertical jack screws (red) are removed after the motor is shimmed.

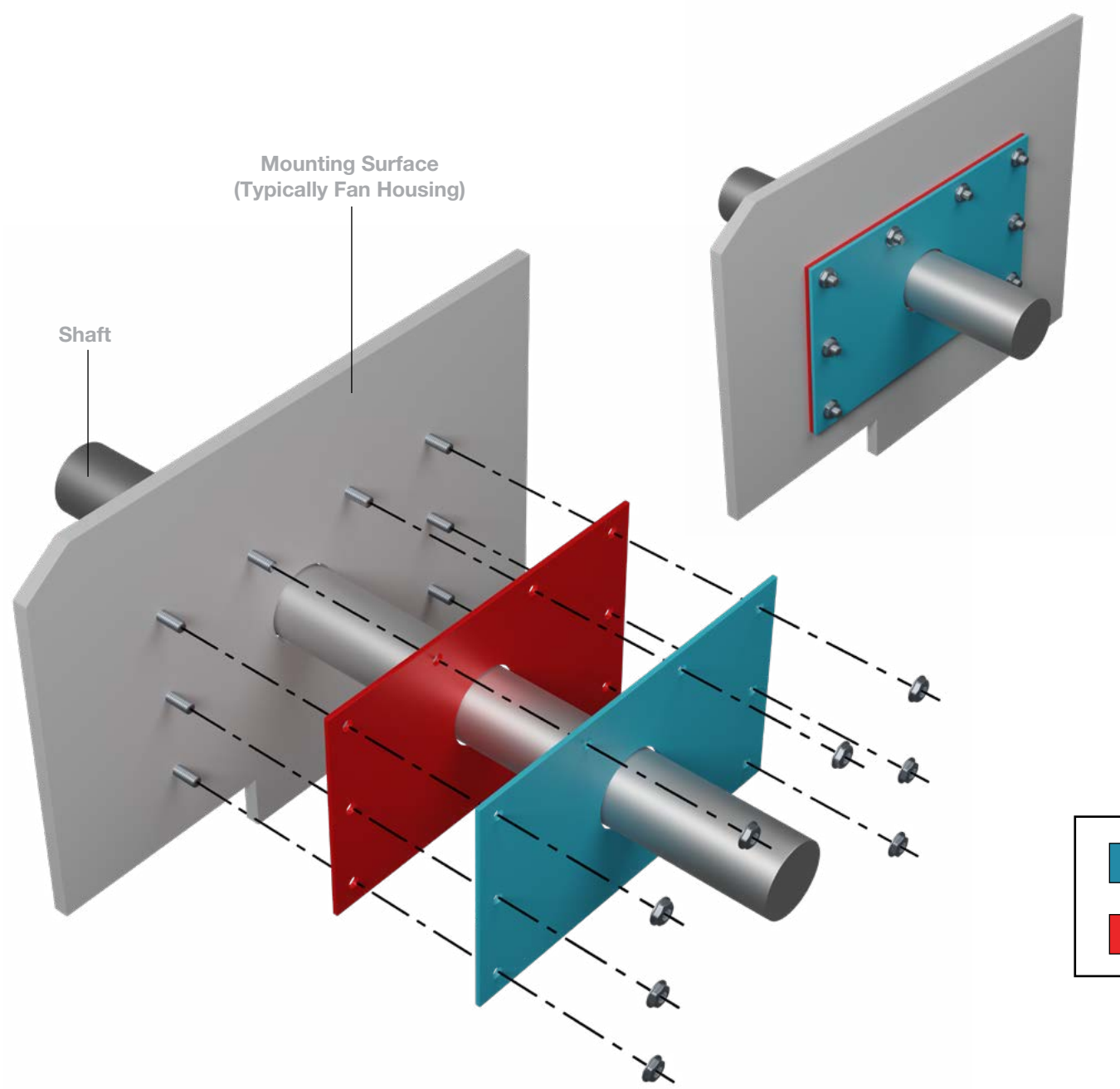


VERTICAL JACK SCREWS

(Motor Feet Drilled and Tapped by Vendor)

Note: Vertical jack screws (red) are removed after the motor is shimmed.

SHAFT SEALS



FRICTION SHAFT SEAL

Also known as:
- Shaft Seal (Standard Type)
- Tacky Cloth Seal

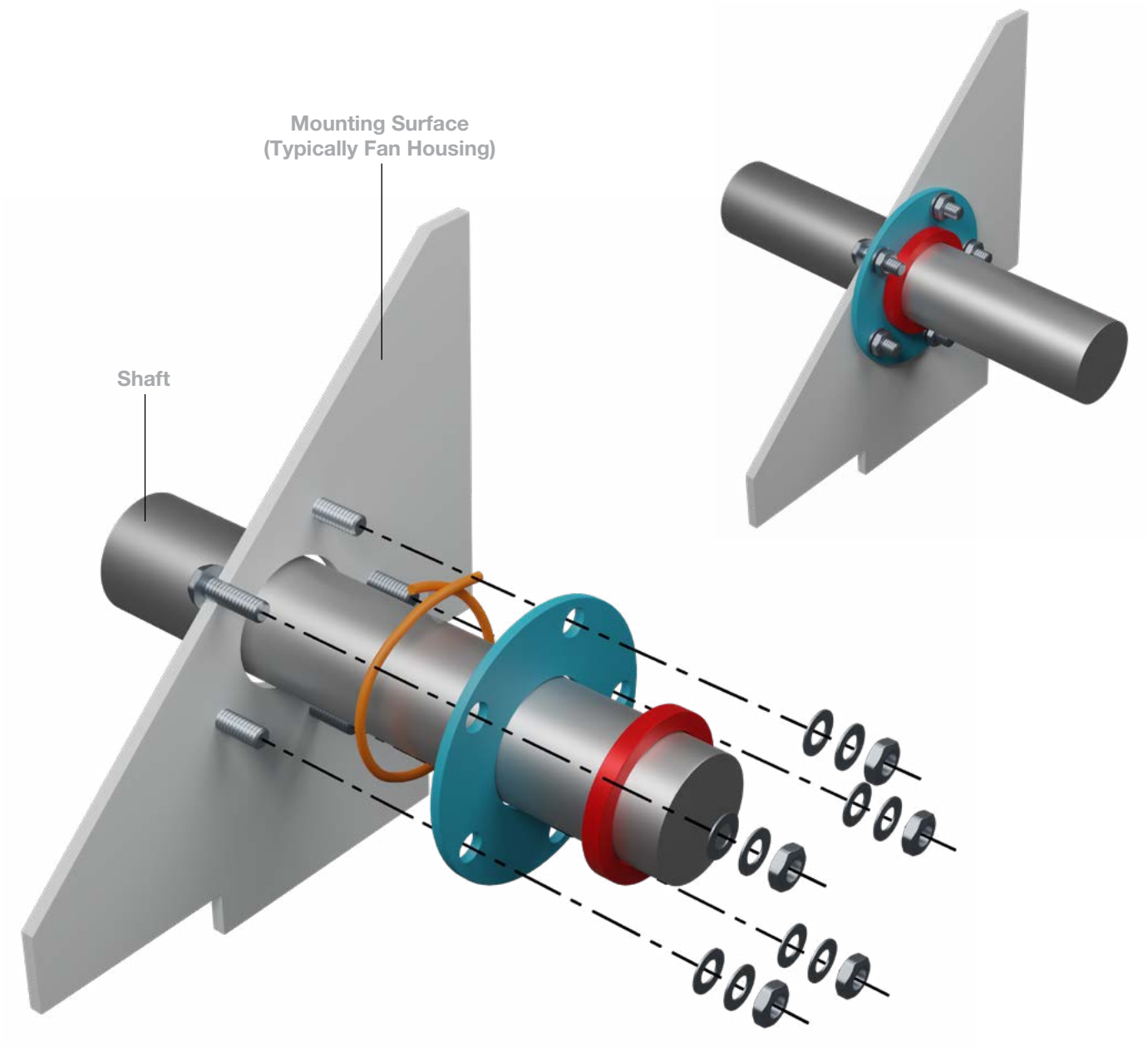
Typical Seal Materials
- Tacky Cloth
- Teflon
- Viton
- Nomex Mineral Wool
- Silicone Sheet
- Fiber Frax (Ceramic Felt)

Mounting Hardware
Mounting Studs, Nuts

Cover Plate (Typically Aluminum)

Seal Material (see above)

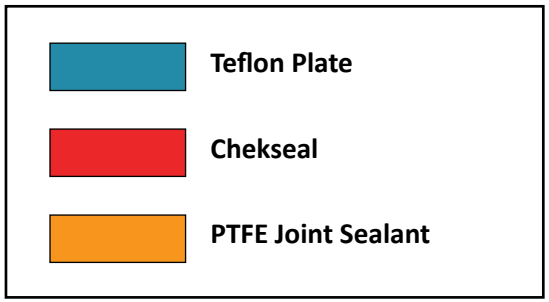
SHAFT SEALS



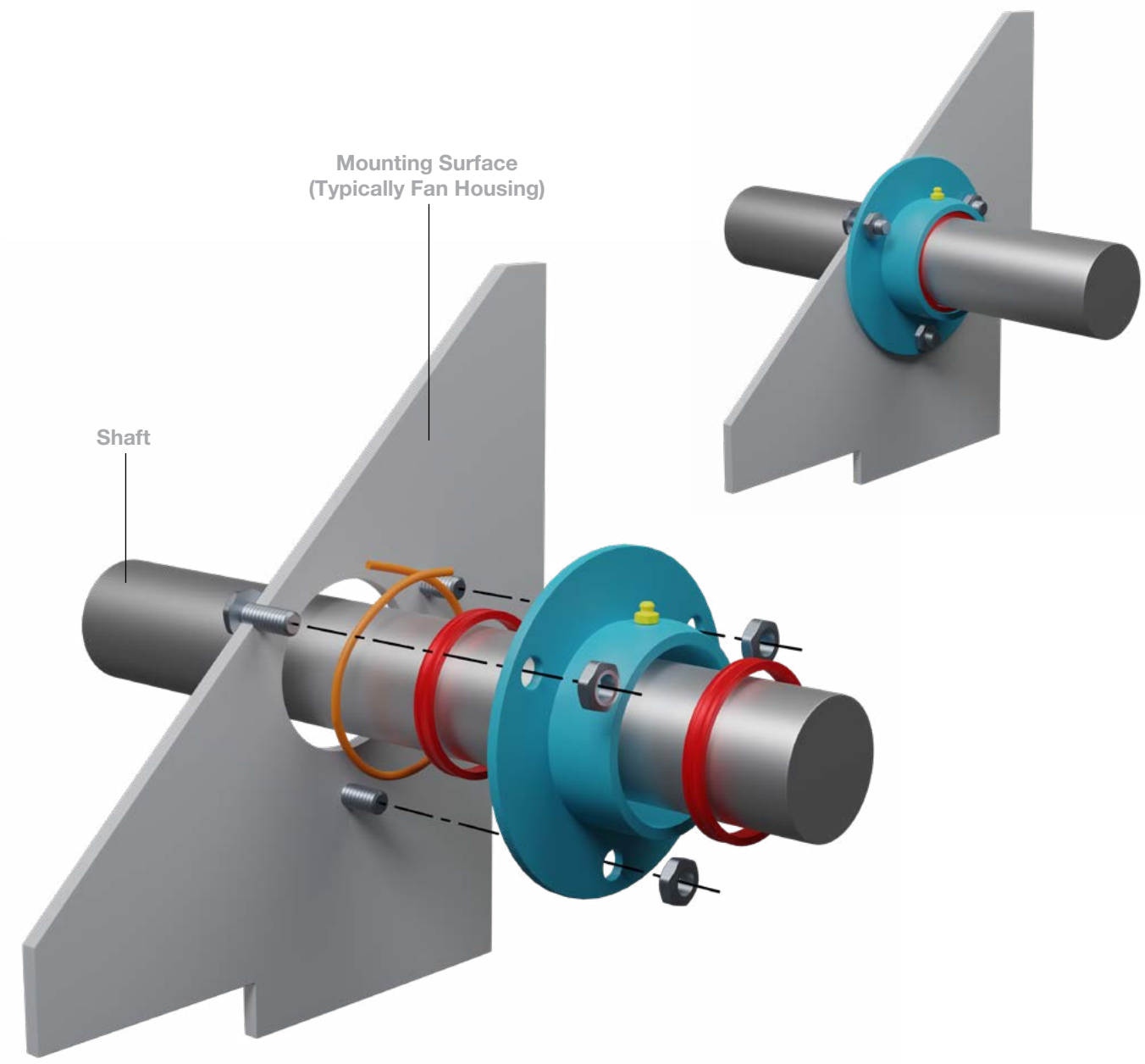
V-RING TYPE SHAFT SEAL

Also known as:
- Axial Shaft Seal
- Teflon Shaft Seal/Teflon Style

Mounting Hardware
Mounting Studs (bolts welded inside housing), Washers, Nuts



SHAFT SEALS



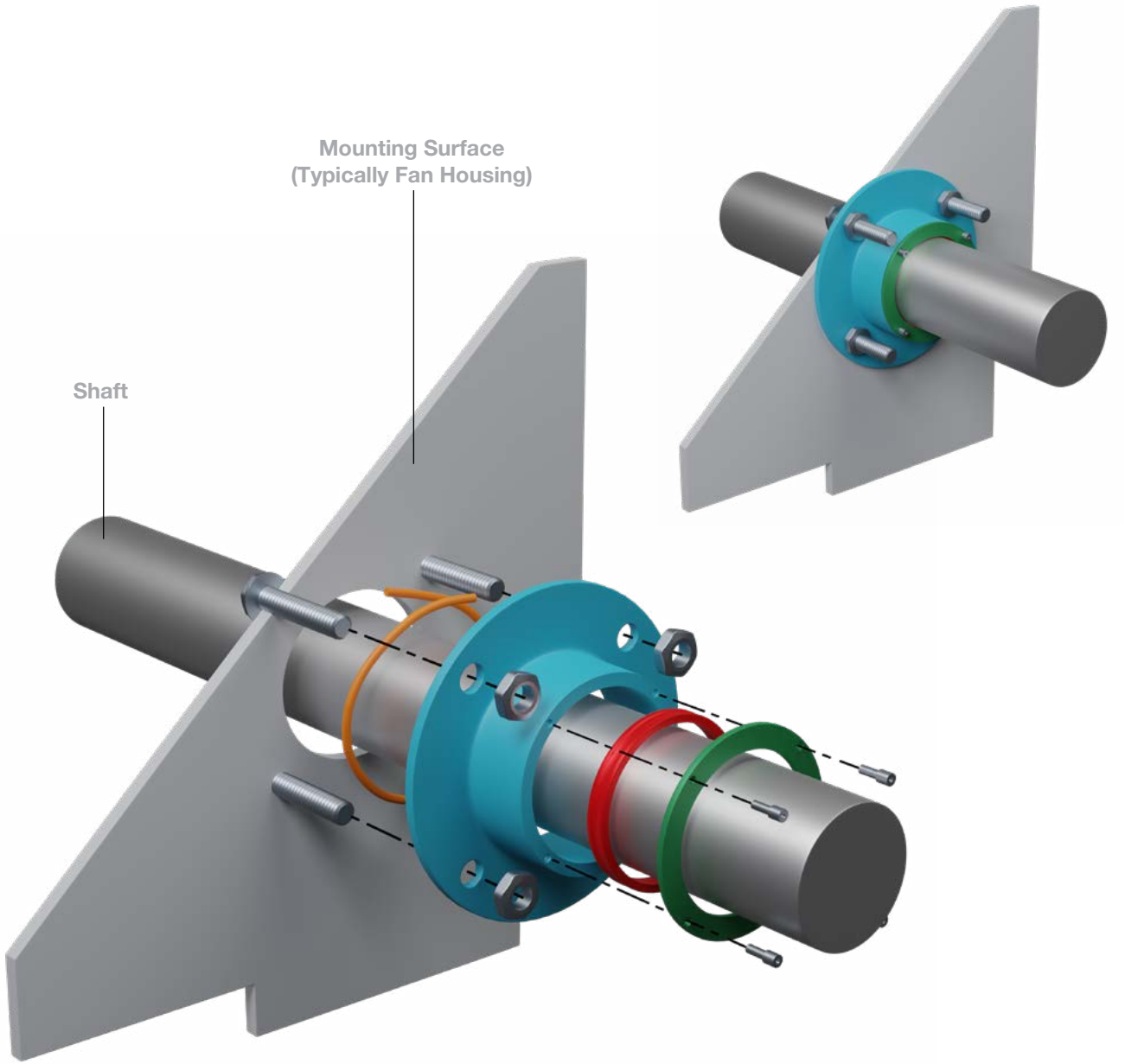
LIP TYPE SHAFT SEAL

Also known as:
- Grease Seal/Grease Purge
- Viton Seal
- Shaft Seal: Buna Rubber (lip type), Standard
- Shaft Seal: Viton (lip type), Special
- Double Lip Seal

Mounting Hardware
Mounting Studs (bolts welded inside housing), Nuts

	Seal Housing
	Grease Fitting
	Lip Type Shaft Seal (Buna-N Standard)
	PTFE Joint Sealant

SHAFT SEALS



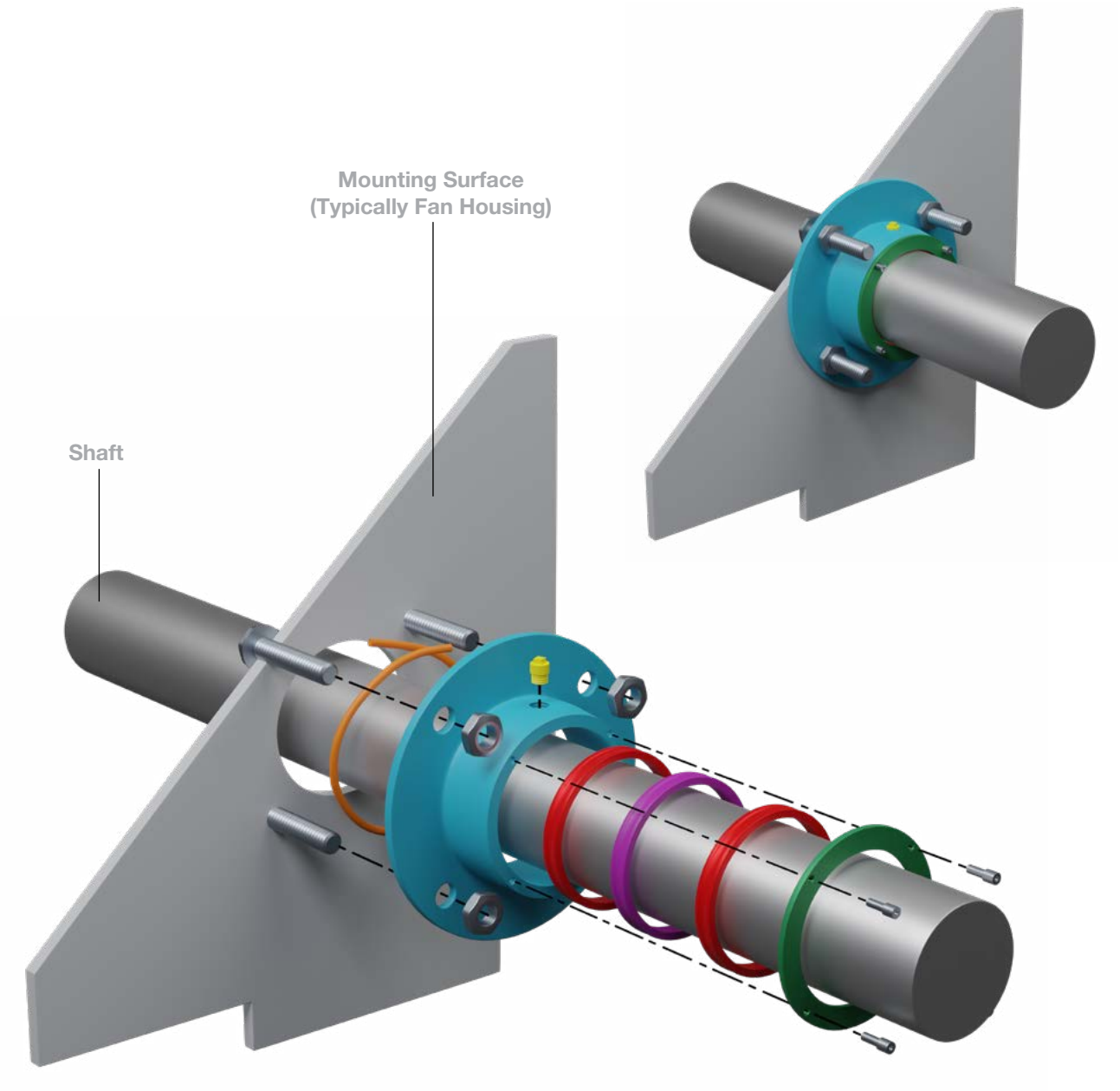
SINGLE RING MECHANICAL SHAFT SEAL
(Vendor Supplied)

Also known as:
- Single Carbon Ring
- Floating Circumferential Carbon Ring Seal
- Labyrinth Shaft Seal
- John Crane
- Flow Serve
- Eagle Burgmann

Mounting Hardware
Mounting Studs (bolts welded inside housing), Nuts, Cap Screws

	Seal Housing
	Split Carbon Ring
	Cover Plate
	PTFE Joint Sealant

SHAFT SEALS



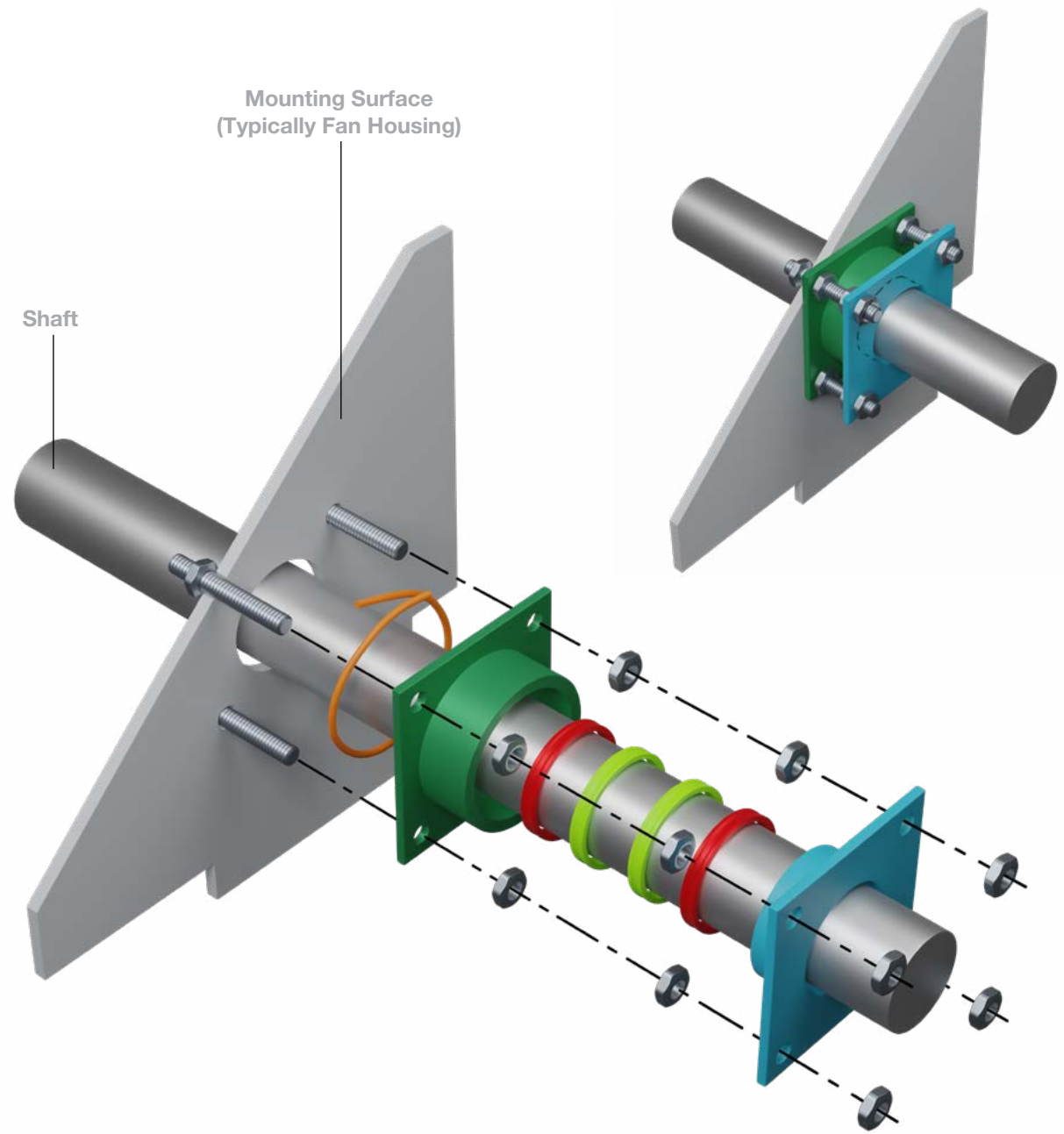
DOUBLE RING MECHANICAL SHAFT SEAL
(Vendor Supplied)

Also known as:
- Double Carbon Ring
- Floating Circumferential Carbon Ring Seal
- Labyrinth Shaft Seal
- John Crane
- Flow Serve
- Eagle Burgmann

Mounting Hardware
Mounting Studs (bolts welded inside housing), Nuts, Cap Screws

- **Seal Housing**
- **Purge**
- **Split Carbon Rings**
- **Lantern Ring** (located at purge hole)
- **Cover Plate**
- **PTFE Joint Sealant**

SHAFT SEALS



STUFFING BOX TYPE SHAFT SEAL

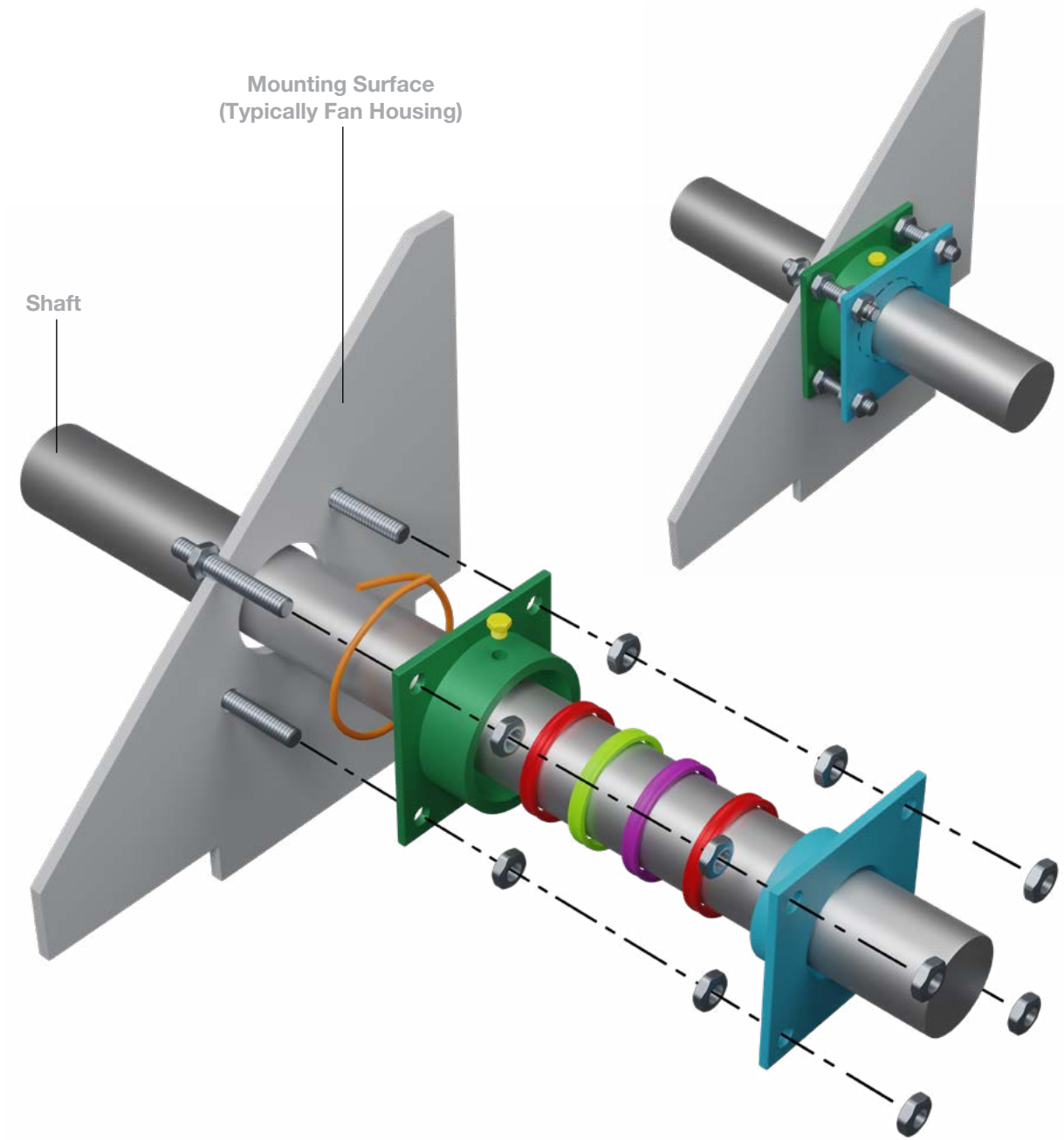
Also known as:
- Graphoil Seal
- Packing Gland Seal
- Shaft Seal: Graphoil Stuffing Box
- Shaft Seal: Stuffing Box Type

Same as illustration except two inner rings are hard seals

Mounting Hardware
Threaded Mounting Rod with Nut Welded to Inside Housing, Nuts

- **Outside Plate w/ Retaining Ring**
- **Outer Rings - Carbon Yarn Packing**
- **Inner Rings - Graphoil Split Rings**
- **Inside Plate w/ Seal Housing**
- **PTFE Joint Sealant**

SHAFT SEALS



STUFFING BOX TYPE SHAFT SEAL WITH GAS PURGE

Also known as:
- Graphoil Seal with Purge
- Packing Gland Seal with Purge
- Shaft Seal: Graphoil Stuffing Box With Purge
- Shaft Seal: Stuffing Box Type With Purge

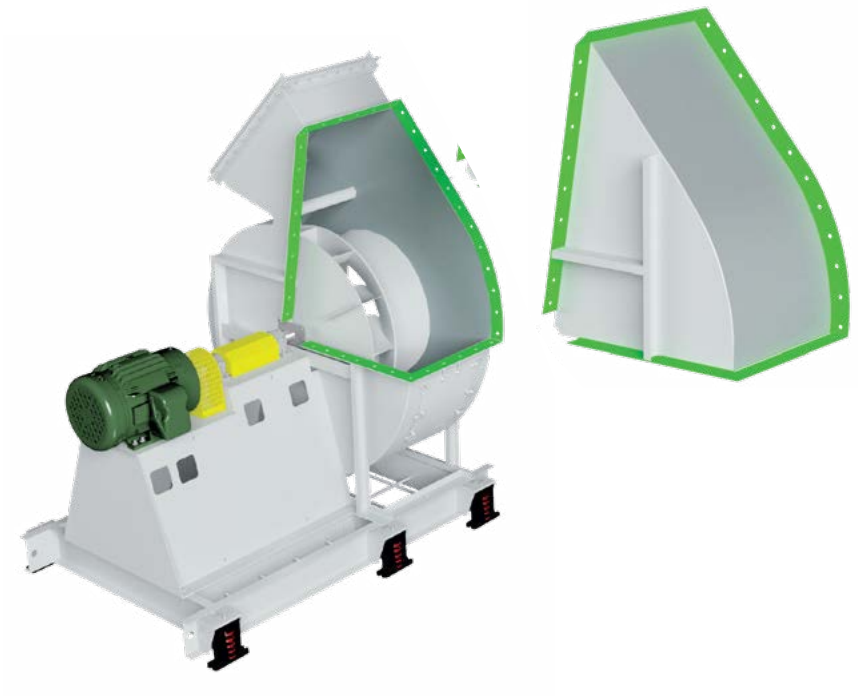
Mounting Hardware
Threaded Mounting Rod with Nut Welded to Inside Housing, Nuts

- **Outside Plate w/ Retaining Ring**
- **Outer Rings - Carbon Yarn Packing**
- **Lantern Ring - Teflon**
  (located at purge hole)
- **Graphoil Split Ring**
- **Inside Plate w/ Seal Housing**
- **1/8" NPT Pipe Plug for Purge Hole**
  Replaced in field with customer-supplied purge line
- **PTFE Joint Sealant**

PIE SPLIT HOUSINGS

(Typical for impeller removal)

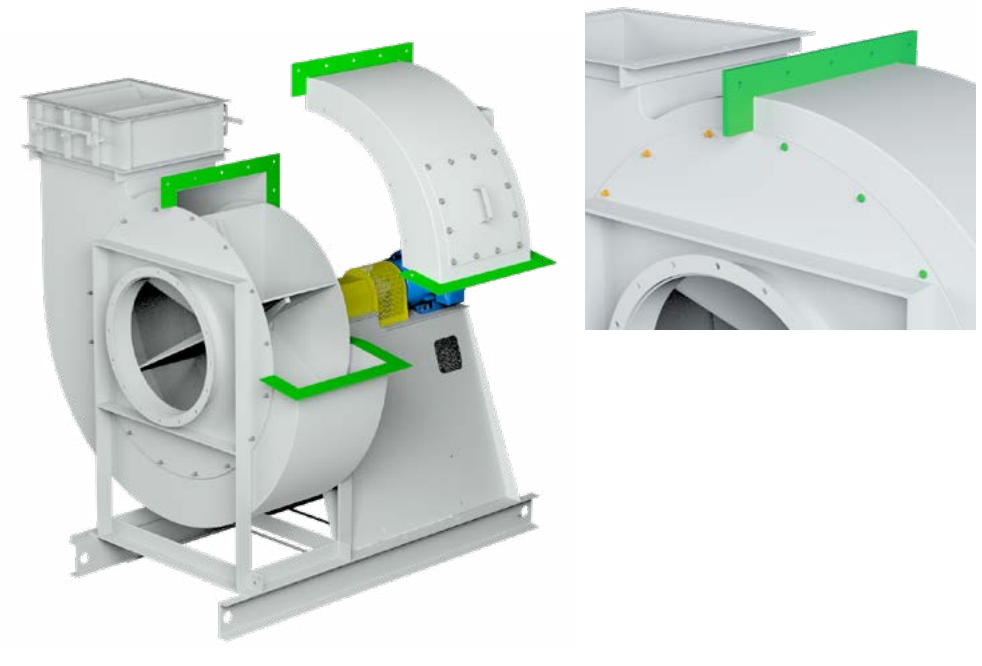
Housings are split at angles 90 degrees or greater to facilitate impeller removal without disturbing inlet or outlet.



"Mohawk" (newer style)

Mohawk (newer style) - Splits between scroll and inlet housing side. Inlet side of housing does not have a split.

Not used on double width fans or fans with attached inlet boxes

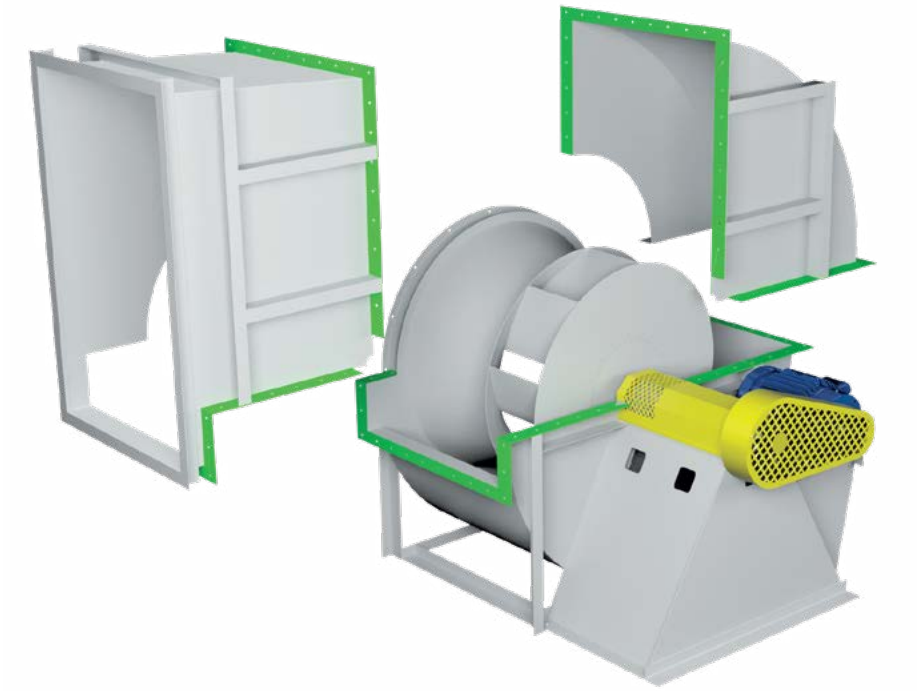


Standard (older style)

Splits all the way down to the funnel or inlet plate.

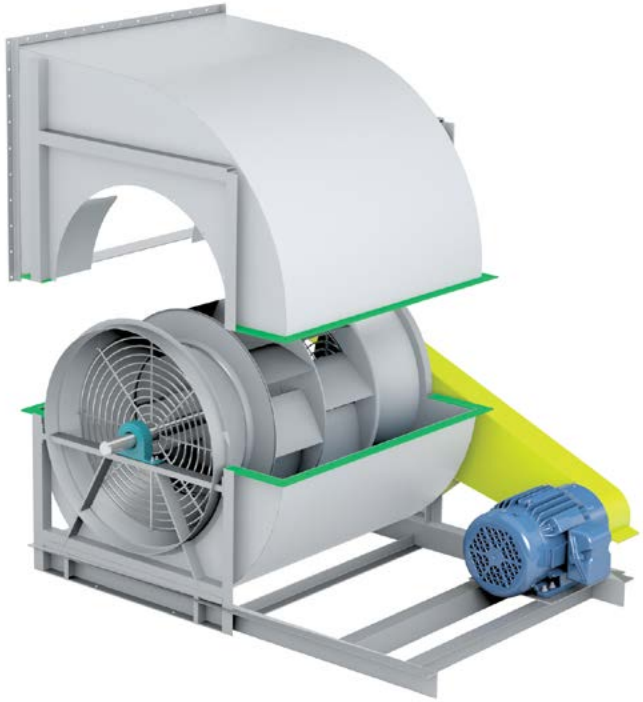
Weld Nuts are welded on the inside of the split and bolt from outside the housing.

Studs are welded to the outside of the housing.



3-WAY SPLIT HOUSING

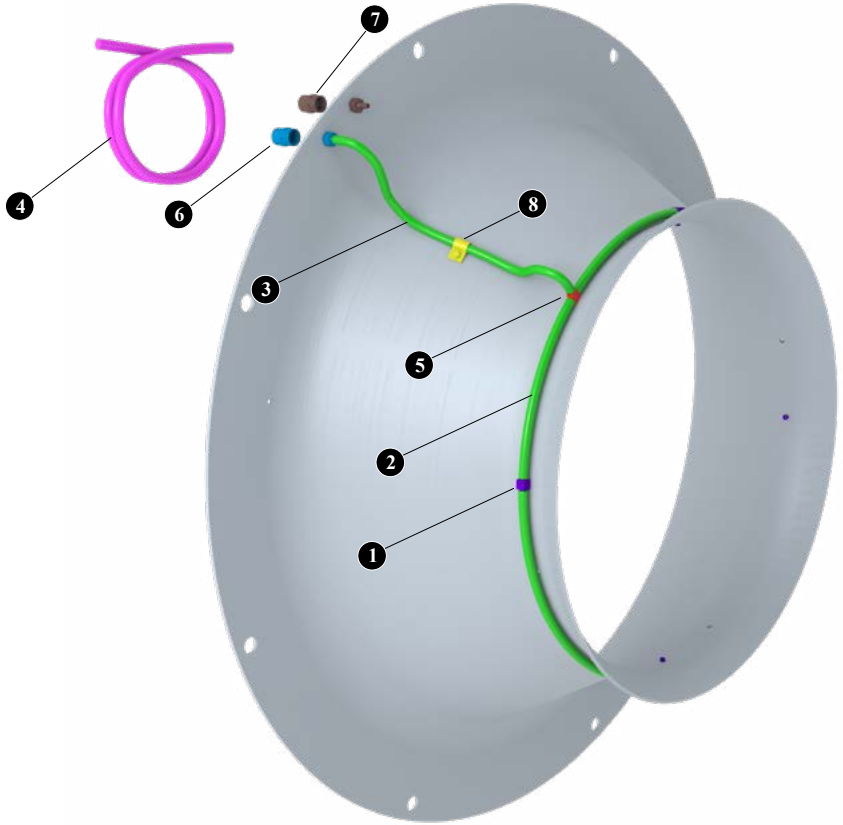
The housing is split into three sections up to 180 degrees. This split is normally required either for shipping or to enable fan to enter a specific sized opening.



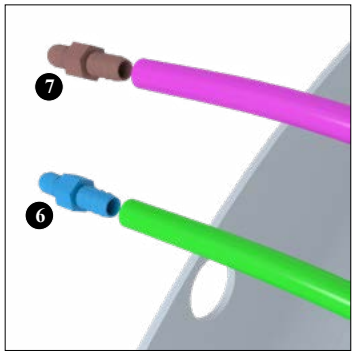
HORIZONTAL SPLIT HOUSING

Standard split along the horizontal centerline. Size 807 and above may be split by the shop for shipping purposes.

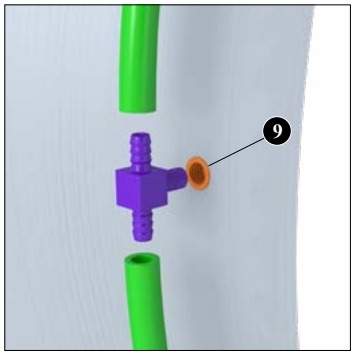
PIEZOMETER RINGS
OVERVIEW



❺ Union "T" Fitting
(One required)



❻ ❼ Fitting Tap
(Two required: one low pressure and one high pressure)



❶ Fitting Tap
(Four required)

OVERVIEW

A piezometer ring is part of an airflow measuring system, based on the principle of a flow nozzle. The inlet funnel of the fan is used as the flow nozzle. Available on plenum fans and housed centrifugal fans (SWSI and DWDI).

The system consists of tubing mounted at the throat of the inlet funnel and a fitting mounted on the face of the inlet funnel. A differential pressure transducer and digital display can also be provided. The pressure drop is measured from the tap located on the face of the inlet funnel to the piezometer ring in the throat. The inlet tap is connected to the high pressure side of the transducer and the piezometer ring is connected to the low-pressure side.

INLET FUNNEL COMPONENTS

Throat of Funnel

❶ **Couplings w/ "T" Fittings**

❷ **Tubing Around the Throat**
- **Nylon: Temps up to 180°F**
- **Copper: Temps over 180°F**

❸ **Tubing to Low Pressure Tap**

❹ **Tubing to High Pressure Tap**
(shipped loose on funnel applications)

❺ **Union Tee for Tubing to Low Pressure Tap**

❻ **Low Pressure Tap Fitting**

❼ **High Pressure Tap Fitting**

❽ **Hanger Clip**

❾ **Rivnut**

Face of Funnel on Inlet Side of fan

Connection for high pressure tap when mounted on inlet funnel. See other mounting scenarios on the following pages.

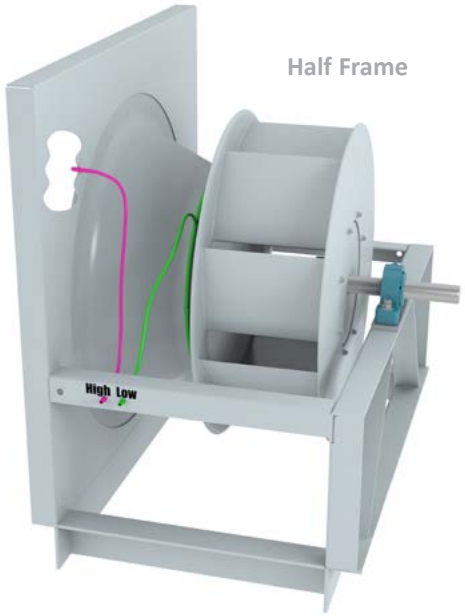
PIEZOMETER RINGS
MOUNTING

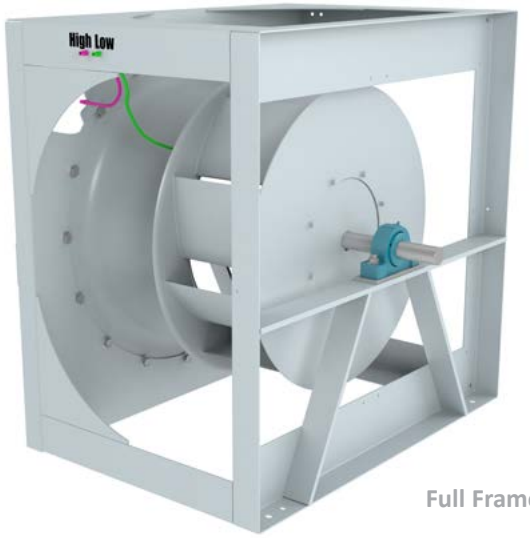
PLENUM FANS

Low Pressure Tubing

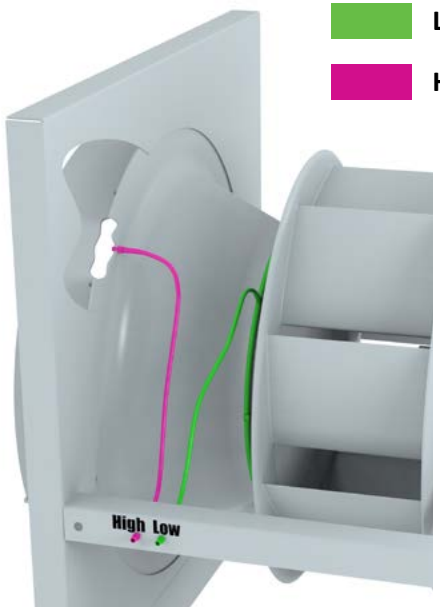
High Pressure Tubing

Half Frame





Full Frame



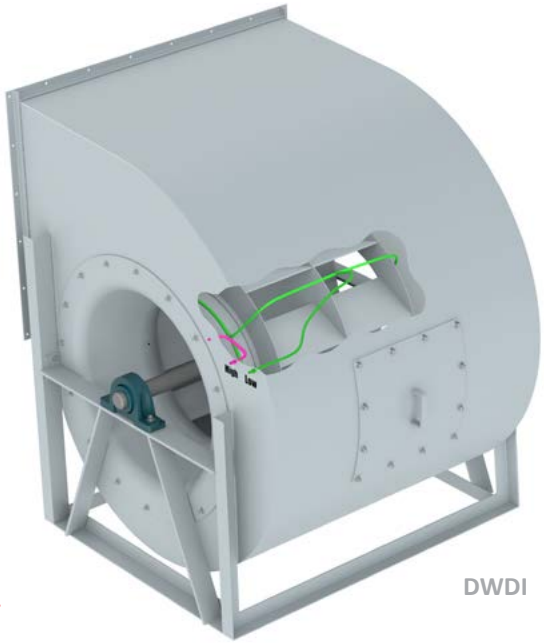
With Collar

CENTRIFUGAL FANS

Without Collar

SWSI

Note: Access door required by pressure taps.



DWDI

With Collar

PIEZOMETER RINGS
MOUNTING AND MONITORING

INLINE CENTRIFUGAL AND MIXED FLOW FANS

Low Pressure Tubing

High Pressure Tubing

Refer to TCF&B IM-105 for more detailed information regarding all fan types.

Differential Pressure Monitoring Devices

Pressure Transmitter w/o Display

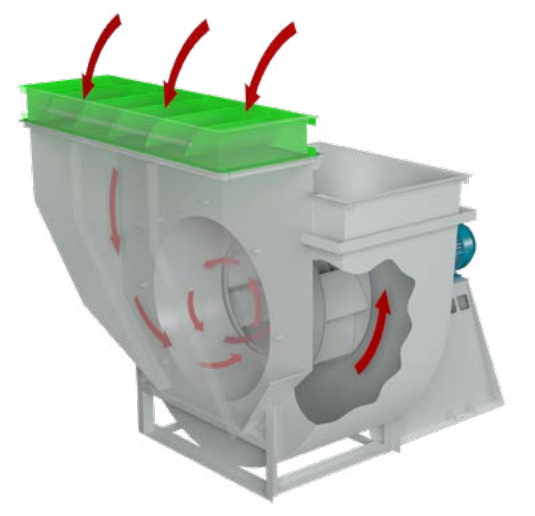
- Optional components customer can purchase from TCF:
  - Pressure transmitter without display
  - Pressure transmitter/transducer with display
- Can be mounted on fan or remotely by others.
- Transmitters need to be sized based on application and fan performance.

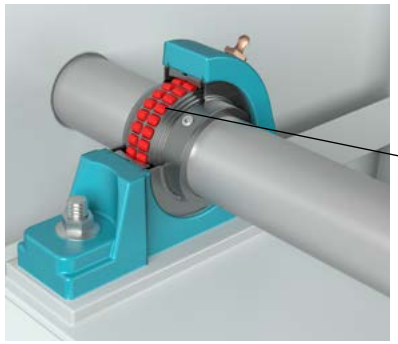
Pressure Transmitter/Transducer with Display

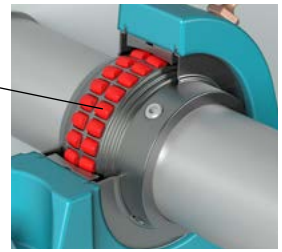
Regular

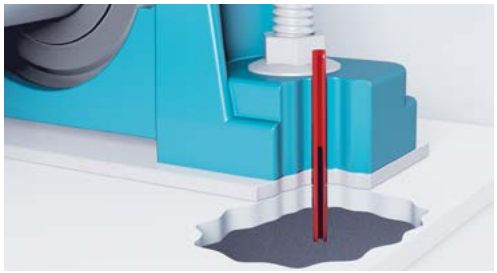
With NEMA 4 Enclosure

TCF TWIN CITY FAN

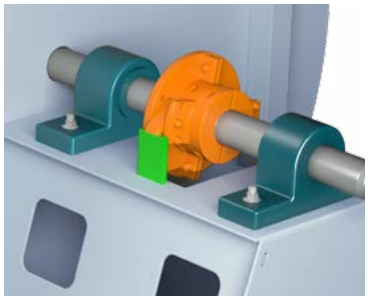








Technical Descriptions



Anti-Backspin Devices
Prevent the rotor from freewheeling in reverse when not in operation. They are typically mounted between the bearings on overhung impeller designs and on a shaft extension on the non-drive end of center hung impeller designs.

Arrangement 1 SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 1 is usually belt driven. The impeller is overhung on the shaft, i.e., mounted at the end of the shaft. The two fan bearings are mounted on the bearing pedestal, out of the airstream, which makes them ideal for high temperature or contaminated air applications. Belt driven configurations offer performance flexibility. The motor can be mounted in any of the four AMCA standard motor positions: W, X, Y or Z.

<u>Motor Position restrictions based on Discharge</u>
BHD discharge (motor interferes with outlet opening of housing)
- CW rotation: Motor position “Z” NOT ALLOWED
- CCW rotation: Motor position “W” NOT ALLOWED

TAD discharge (motor interferes with outlet opening of housing)
- CW rotation: Motor position “W” NOT ALLOWED
- CCW rotation: Motor position “Z” NOT ALLOWED

THD discharge (Height restriction: motor may not fit below the discharge)
- CW rotation: Motor position “W”
- CCW rotation: Motor position “Z”

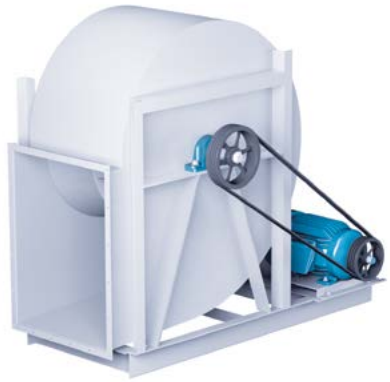
* On Arrangement 1 fan the motor will fit if pedestal is lengthened to accommodate motor.

Arrangement 3 SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 3 is usually belt driven and is configured with the impeller center hung on the shaft, i.e., mounted between the bearings making it structurally sound and compact. The Arrangement 3 has one bearing located in the airstream. The motor can be mounted in any of the four AMCA standard motor positions: W, X, Y or Z.

Motor Position restrictions based on Discharge
BHD discharge (motor interferes with outlet opening of housing)
- CW rotation: Motor position “Z” NOT ALLOWED
- CCW rotation: Motor position “W” NOT ALLOWED

TAD discharge (motor interferes with outlet opening of housing)
- CW rotation: Motor position “W” NOT ALLOWED
- CCW rotation: Motor position “Z” NOT ALLOWED

THD discharge (Height restriction: motor may not fit below the discharge)
- CW rotation: Motor position “W”
- CCW rotation: Motor position “Z”



Arrangement 3F SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 3F is an Arrangement 3 with extended angle frame to mount the motor and horizontal slide base as an assembly. Arrangement 3F is typically not suitable for mounting vibration isolators directly under the fan.

Motor Position restrictions based on Discharge
BHD discharge (motor interferes with outlet opening of housing)
- CW rotation: Motor position “Z” NOT ALLOWED
- CCW rotation: Motor position “W” NOT ALLOWED

TAD discharge (motor interferes with outlet opening of housing)
- CW rotation: Motor position “W” NOT ALLOWED
- CCW rotation: Motor position “Z” NOT ALLOWED

THD discharge (Height restriction: motor may not fit below the discharge)
- CW rotation: Motor position “W”
- CCW rotation: Motor position “Z”

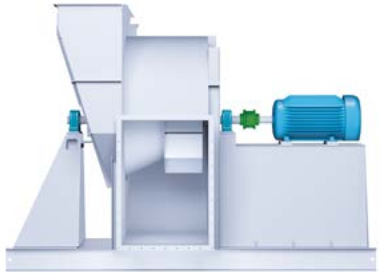
Arrangement 3SI SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 3SI is usually direct drive. Like the Arrangement 3, the impeller is mounted between the bearings. The Arrangement 3SI utilizes an attached inlet box to locate the bearing outside of the airstream on independent bearing pedestals that allows for elevated operating temperatures and relatively clean air. The Arrangement 3SI includes a pie split housing for easy impeller removal. The motor is located by the customer off the fan assembly and direct-coupled to the shaft opposite of the inlet box side.

Arrangement 4 SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 4 is a direct drive fan. The impeller is mounted directly to the motor shaft with the motor mounted to a pedestal. Arrangement 4 offers low maintenance since there are no fan bearings, fan shaft or drive parts to maintain. Arrangement 4 fans are typically limited up to size 365.

Arrangement 4S (Swingout Construction) SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 4S is a modified Arrangement 4 fan intended for easy access to the impeller and housing interior. The motor and impeller assembly is mounted to reinforced framework to support the opened housing.

Arrangement 4VI (Vertical) SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 4VI is a modified Arrangement 4 fan designed to mount directly on the inlet of the fan. The Arrangement 4VI and features reinforced inlets and removable motor side to allow the rotating assemblies to be removed without removing the housing from the mounting structure. Arrangement 4VI fans utilize a vertical airflow into the fan (vertical motor shaft).

Arrangement 4HI (Horizontal) SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 4HI is a modified Arrangement 4 fan designed to mount directly on the inlet of the fan. The Arrangement 4HI fans features reinforced inlets and removable motor side to allow the rotating assemblies to be removed without removing the housing from the mounting structure. Arrangement 4HI fans employ horizontal airflow into the fan (horizontal motor shaft).



Arrangement 7SI SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 7SI is direct drive. Like the Arrangement 3SI, the impeller is mounted between the bearings. The Arrangement 7SI includes an integrated inlet box to locate the bearing outside of the airstream. The pedestal is designed to accommodate the motor, flexible coupling and one bearing. A pie split housing is provided for easy impeller removal. The fan assembly is then mounted on a unitary base as standard. An inertia base is an available option.

Arrangement 8 SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 8 is a modified version of Arrangement 1 used for direct drive. The Arrangement 1 bearing pedestal is extended to accommodate the motor. A flexible coupling connects the fan and motor shaft.

Arrangement 9 SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 9 is available as belt driven only. A motor slide base is mounted on the side of the bearing pedestal. This arrangement permits the unit to ship as a complete assembly with the motor and drive mounted. Typically, the motor is mounted on the left side of the pedestal for CW rotation fans and on the right side for CCW rotation fans.

Arrangement 9F SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 9F is available when an Arrangement 9 requires a motor that is too large to mount on the bearing pedestal. The fan frame is extended to accommodate the motor, for horizontal mounting, similar to an Arrangement 1 fan. Arrangement 9F is not suitable for mounting vibration isolators directly under the fan. *If isolators are required, use an Arrangement 1 fan with a separate isolation base.*

Arrangement 9H SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 9H is available for motor mounting on the side of the bearing pedestal when horizontal motor adjustment is preferred. The pedestal is extended on one side to accommodate the motor for horizontal mounting. Typically, the motor is mounted on the left side of the pedestal for CW rotation fans and on the right side for CCW rotation fans.

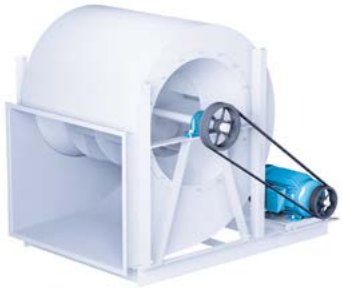
Arrangement 9ST (Swingout) SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 9ST is a modified Arrangement 9 fan intended for easy access to the impeller and housing interior. The motor and impeller assembly is mounted to reinforced framework to support the opened housing. Arrangement 9ST mounts the motor above the bearing pedestal. Motor mounted with a NEMA type slide base only.

Arrangement 9SS (Swingout) SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 9SS is a modified Arrangement 9 fan intended for easy access to the impeller and housing interior. The motor and impeller assembly is mounted to reinforced framework to support the opened housing. The Arrangement 9SS mounts the motor on the side of the bearing pedestal. Motor location is restricted based on the fan's rotation. CW rotation and (L) motor position or CCW rotation and (R) motor position. Motor mounted with an automotive pivot base only.

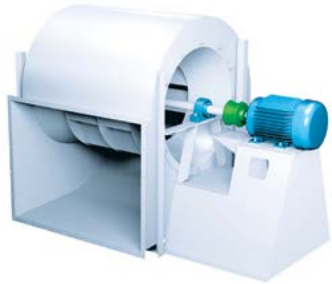
Arrangement 10 SWSI – Single Width, Single Inlet (Centrifugal)
Arrangement 10 is available as belt driven only. For Class I and II fans, sizes 122 through 365, Arrangement 10 units are commonly referred to as Ventilating Sets. (Refer to TCF Catalog 600 for more details.) Arrangement 10 units have adjustable motor bases mounted inside the bearing pedestal. This arrangement offers a more compact design than the Arrangement 9 and is suitable for roof or outdoor installations when supplied with the optional weather cover.

Arrangement 3 DWDI – Double Width, Double Inlet (Centrifugal)
DWDI fans are generally supplied in Arrangement 3 for V-belt drive. The impeller is mounted between the bearings and supported by the fan housing. Since both bearings are located in the airstream, standard DWDI fans should be used for clean air applications with air temperatures limited to 130°F. The motor can be mounted in any of the four standard motor positions: W, X, Y or Z.

Arrangement 3DI DWDI – Double Width, Double Inlet (Centrifugal)
Arrangement 3DI is direct drive. Like the Arrangement 3, the impeller is mounted between the bearings. The Arrangement 3DI utilizes integrated inlet boxes to locate the bearings outside of the airstream on independent bearing pedestals that allows for elevated operating temperatures and relatively clean air. The Arrangement 3SI includes a pie split housing for easy impeller removal. The motor is located by the customer off the fan assembly and direct-coupled to the shaft.



Arrangement 3F DWDI – Double Width, Double Inlet (Centrifugal)
Arrangement 3F offers an integral extended base to accommodate the motor. The base has brackets to accept vibration isolators. Arrangement 3F is available to Size 660 and with motor positions W and Z as standard. Consult factory for motor positions X and Y.



Arrangement 7 DWDI – Double Width, Double Inlet (Centrifugal)
Arrangement 7 is direct drive. Like the Arrangement 3, the impeller is mounted between the bearings, but the Arrangement 7 incorporates a pedestal designed to accommodate the motor, flexible coupling and one bearing. An inertia base is an available option.

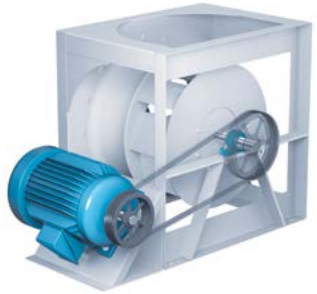
Arrangement 7DI DWDI – Double Width, Double Inlet (Centrifugal)
Arrangement 7DI is direct drive. Like the Arrangement 3DI, the impeller is mounted between the bearings, but the Arrangement 7DI incorporates a pedestal designed to accommodate the motor, flexible coupling and one bearing. The Arrangement 7DI utilizes integrated inlet boxes to locate the bearings outside of the airstream allowing for elevated operating temperatures and relatively clean air. A pie split housing is provided for easy impeller removal. The Arrangement 7DI fan assembly is then mounted on a unitary base as standard. An inertia base is an available option.

Arrangement 1 (Plenum)
Arrangement 1 features an overhung impeller design suitable for V-belt drive and requires mounting of motor independent of the fan.

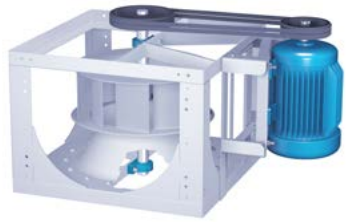
Arrangement 3 – Horizontal (Plenum)
This is the most common plenum fan arrangement is frequently used in OEM and site-built air handlers. Arrangement 3 is suitable for V-belt drive and requires mounting of the motor independently of the fan.

Arrangement 3HA – Horizontal with Top Mounted Motor with Adjustable Motor Base (Plenum)
Arrangement 3HA provides a means for mounting the motor on top of the unit. This design is often desirable when floor space is limited. Arrangement 3HA provides an adjustable motor base motor mounting option. The heavy-duty adjustable motor base is available for all fan sizes.

Arrangement 3HS – Horizontal with Top Mounted Motor with Slide Base (Plenum)
Arrangement 3HS provides a means for mounting the motor on top of the unit. This design is often desirable when floor space is limited. Arrangement 3HS provides a slide base type motor mounting option. Due to limited belt center range, NEMA “slide base” option is available on sizes 182 and larger only.



Arrangement 3SM – Horizontal With Side Mounted Motor With Slide Base (Plenum)
Arrangement 3SM is designed to provide an economical and space-saving means to supply plenum fans with motors mounted to the side of the fan frame. A motor slide base allows for quick and easy belt adjustments.



Arrangement 3VA – Vertical with Side Mounted Motor (Plenum)
Arrangement 3VA provides an adjustable motor base motor mounting option. The heavy-duty adjustable motor base is available for all fan sizes.

Arrangement 3VS – Vertical with Side Mounted Motor (Plenum)
Arrangement 3VS provides a slide base type motor mounting option. Due to limited belt center range, NEMA “slide base” option is available on sizes 182 and larger only.

Arrangement 4 – Horizontal (Plenum)
Direct drive Arrangement 4 mounts the fan impeller directly onto the motor shaft. This arrangement provides a compact fan/motor unit, which eliminates belt residue and requires less maintenance than other arrangements. For these reasons, Arrangement 4 plenum fans are widely used in cleanroom, pharmaceutical and other critical applications. Fans can be selected with varying impeller widths to provide desired performance at direct drive motor speeds. Performance changes in the field are usually achieved by means of variable inlet vanes or VFD.

Arrangement 4V – Vertical (Plenum)
Vertical Arrangement 4 is available for mounting with either vertical up airflow (inlet under the motor) or vertical down airflow (inlet above the motor).

Arrangement 1P (Plug)
A belt driven arrangement where the fan is mounted to grade and the motor is mounted separate from the fan. Typically used on larger fans and/or larger HP motors where the customer’s wall may not be sufficient by itself. Mounting to the foundation also makes it better for meeting lower vibration requirements. Mounting panel is optional on Arrangement 1P.

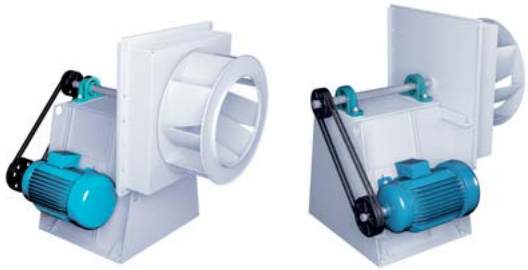
Arrangement 4 (Plug)
Direct drive arrangement where the impeller is mounted to the motor shaft. The design is more compact and requires less maintenance due to not having fan shaft, bearings or belts. High airstream temperatures may limit the use of this arrangement.

Arrangement 4P (Plug)
Same as the Arrangement 4 fan except the fan is mounted to grade. Typically used where the customer's wall may not be sufficient by itself. Mounting to the foundation also makes it better for meeting lower vibration requirements. Mounting panel is optional on Arrangement 4P.

Arrangement 8 (Plug)
Arrangement 8 is a direct drive arrangement where the motor shaft is coupled to the fan shaft. The entire assembly is mounted to the customer's wall. This is the least common plug fan arrangement due to the length of the assembly.

Arrangement 8P (Plug)
Same as the Arrangement 8 fan except the fan is mounted to grade. Typically used on larger fans and/or larger HP motors where the customer's wall may not be sufficient by itself. Mounting to the foundation also makes it better for meeting lower vibration requirements. Mounting panel is optional on Arrangement 8P.

Arrangement 9 (Plug)
Arrangement 9 is the most common plug fan arrangement. It is fully supported by the customer's wall. Plug fans are housed in the customer's enclosure in applications where the system plenum acts as the fan housing. Unlike the plenum fan, motor, shaft and bearings are outside of the process airstream.



Arrangement 9P (Plug)
Same as the Arrangement 9 fan except the fan is mounted to grade. Typically used on larger fans and/or larger HP motors where the customer's wall may not be sufficient by itself. Mounting to the foundation also makes it better for meeting lower vibration requirements. Mounting panel is optional on Arrangement 9P.

Arrangement 4 (Axial & Inline Centrifugal)
The direct drive Arrangement 4 is the logical choice when space is at a premium or a simple, dependable fan with minimum maintenance is required. The fan impeller is mounted directly on the fan motor shaft in this arrangement for a smaller overall size. Where exact performance of the system is required, the user can adjust the blade angle to fine-tune the system and obtain the necessary flow.

Arrangement 4CS – Clamshell (Axial & Inline Centrifugal)
The direct drive Arrangement 4CS is the logical choice when space is at a premium or a simple, dependable fan with minimum maintenance is required. The fan impeller is mounted directly on the fan motor shaft in this arrangement for a compact envelope. A spacious clamshell door gives maintenance personnel access to the rotor assembly for ease of inspection, cleaning or repair.

Arrangement 4SO – Swingout (Axial & Inline Centrifugal)
The direct drive Arrangement 4SO is the logical choice when space is at a premium or a simple, dependable fan with minimum maintenance is required. The fan impeller is mounted directly on the fan motor shaft in this arrangement for a compact envelope. The rotor assembly is built onto a swingout door that allows maintenance personnel to easily inspect, clean or repair out of the airstream.

Arrangement 9 (Axial & Inline Centrifugal)
The belt driven Arrangement 9 is the perfect choice for applications that require the motor to be out of the airstream. Driven by either a fixed or adjustable V-belt drive system, the exact point of rating can be easily achieved. Any future change in rating can be accomplished through a simple sheave change or blade angle adjustment.

Arrangement 9CS – Clamshell (Axial & Inline Centrifugal)
The belt driven Arrangement 9CS is the perfect choice for applications that require the motor to be out of the airstream. Driven by either a fixed or adjustable V-belt drive system, the exact point of rating can be easily achieved. A spacious clamshell door gives maintenance personnel access to the rotor assembly for ease of inspection, cleaning or repair.

Arrangement 9SO – Swingout (Axial & Inline Centrifugal)
The belt driven Arrangement 9SO is the perfect choice for applications that require the motor to be out of the airstream. Driven by either a fixed or adjustable V-belt drive system, the exact point of rating can be easily achieved. The rotor assembly is built onto a swingout door that allows maintenance personnel to easily inspect, clean or repair out of the airstream.

Arrangement 1 (Lab Exhaust)
Arrangement 1 is belt driven. The impeller is overhung on the shaft, i.e., mounted at the end of the shaft. The two fan bearings are mounted on the bearing pedestal, out of the airstream, which makes them ideal for high temperature or contaminated air applications. Belt driven configurations offer performance flexibility. The motor can be mounted in any of the four AMCA standard motor positions: W, X, Y or Z.

Arrangement 4 (Lab Exhaust)
Arrangement 4 is a direct drive fan. The impeller is mounted directly to the motor shaft with the motor mounted to a pedestal (BAIFE and BCIFE) or motor drive plate (TVIFE). Arrangement 4 offers low maintenance since there are no fan bearings, fan shaft or drive parts to maintain.

Arrangement 8 (Lab Exhaust)
Arrangement 8 is a modified version of Arrangement 1 used for direct drive. The Arrangement 1 bearing pedestal is extended to accommodate the motor. A flexible coupling connects the fan and motor shaft.

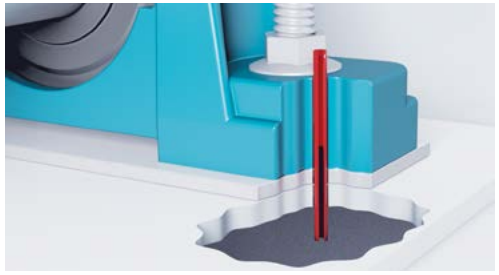
Arrangement 9 (Lab Exhaust)
Arrangement 9 is available as belt driven only. The impeller is overhung on the shaft, i.e., mounted at the end of the shaft. A motor slide base is mounted on the side of the bearing pedestal for BAIFE and BCIFE fans. An adjustable motor base is mounted on the exterior of the housing for inline lab exhaust fans (excluding TVIFE). This arrangement permits the unit to ship as a complete assembly with the motor and drive mounted. Typically, the motor is mounted on the left side of the pedestal for CW rotation fans and on the right side for CCW rotation fans.

Arrangement 10 (Lab Exhaust)
Arrangement 10 is available as a belt driven, scroll-type centrifugal only. The impeller is overhung on the shaft, i.e., mounted at the end of the shaft. Arrangement 10 units have adjustable motor bases (sizes 365 and smaller) or NEMA slide bases (sizes 402 and larger) mounted inside the bearing pedestal. This arrangement offers a more compact design than the Arrangement 9 and is suitable for roof or outdoor installations when supplied with the optional weather cover.

Base: Inertia Base (Concrete Filled)
Provides a common support to fan, motor and drive including guards and utilize heavy-duty structural channel with spring isolators. Inertia bases incorporate reinforcing rods (rebar) and require customer-supplied concrete. Inertia bases are typically used on longer, direct drive fans to mitigate assembly deflection, maintaining proper alignment between the motor, coupling, shaft and bearings. Flexible connectors at inlet and outlet are required. Shown with optional bottom pan to allow for easier filling of concrete in the field.

Base: Isolation Base
Provides a common support to fan, motor and drive including guards and utilize heavy-duty structural channel. Vibration isolation bases require spring or rubber-in-shear type isolators that are designed to limit forces transmitted to the support structure of an operating fan. Flexible connectors at inlet and outlet are also required.

Base: Unitary Base
Utilizes structural channel to support the fan assembly and are designed for use without isolators.



Bearing Dowel Pins
Bearing dowel pins hold the position of the bearing to confirm proper alignment. A rod is fixed to the pedestal for mounting through a hole on the bearings.

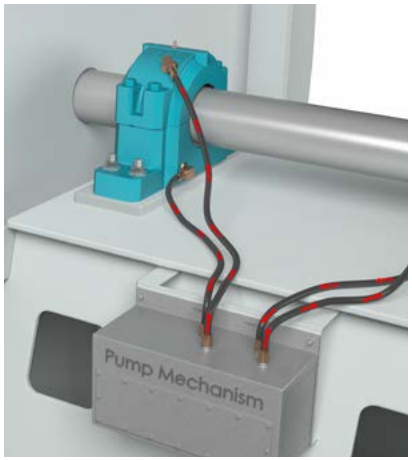
Bearing Positioner
A bearing positioner is a threaded bolt mounted to a bracket on each side of the fan bearings. Used for fine adjustments of the fan's bearing location.

Bearing Stop Blocks
A welded bracket or key stock next to each side of the bearing welded to the pedestal. Used to confirm bearing location.

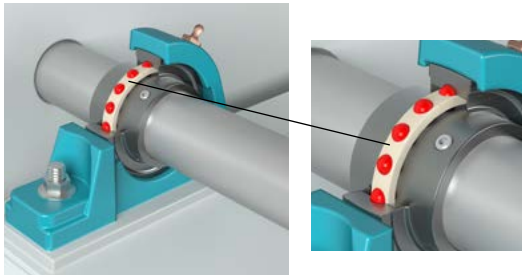
Bearing Vibration Sensor
Sensors are used for monitoring vibration levels at the fan bearings. The bearing housing is drilled and tapped. Sensors are typically shipped loose for field mounting as damage could occur in transit. Other mounting methods could include a bracket mounted through the bearing bolt or epoxy mounting to the housing.

Bearings: Flange Bearing (Damper-Related)
Bearings that are mounted within a flanged housing are used when the bearing mounting surface is perpendicular to a shaft axis and are used for the following TCF products:
- Dampers with bearing bridges
- Directly mounted to a damper without bearing bridges
- Control linkage rod support for inlet vanes

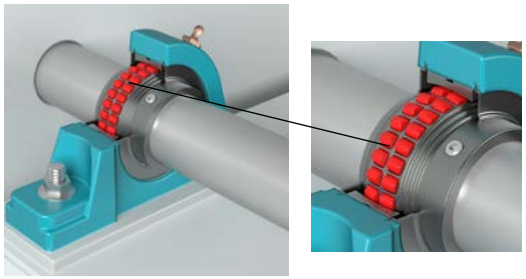
Bearings: Flange Bearing (Fan Shaft-Related)
Bearings that are mounted within a flanged housing are used when the bearing mounting surface is perpendicular to a shaft axis and are used for the following TCF products:
- Flange bearings available with ball type elements or spherical roller type elements
- Used mostly in some axial fans and special fan applications



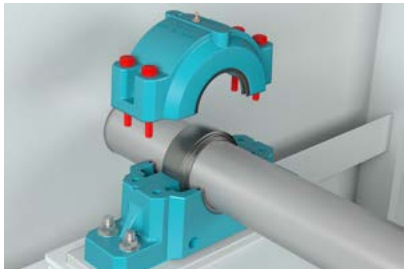
Bearings: Oil Mist Lubrication System
In oil+air lubrication, a quantity of oil metered volumetrically by a pump or distributor is pulled apart by a continuous airflow in a tube and carried along the tube wall in the direction of compressed-airflow. The quantity of oil is fed into the airflow in pulses at a mixing point (mixing valve). A nearly continuous flow of oil is produced that leaves the outlet nozzle as fine drops and is fed to the rolling bearing without contact. This means that the bearing housing is under a slight overpressure, which keeps dirt away from the sensitive bearings. The carrier air leaves the bearing nearly free of oil.
- One pump unit for both bearings
- Inlet line on top of each bearing delivers an oil mist
- Outlet line on bottom recirculates liquid oil back to the pump unit



Bearings: Solid Pillow Block Bearing (Ball Type Rolling Element)
Pillow Block Bearings are designed to provide shaft support where the mounting surface is parallel to the shaft axis. The bolt holes are usually slotted for adjustment during mounting. Ball Type Pillow Block Bearings have a ball as the rolling element. They are used to provide smooth, low friction motion in rotary applications.



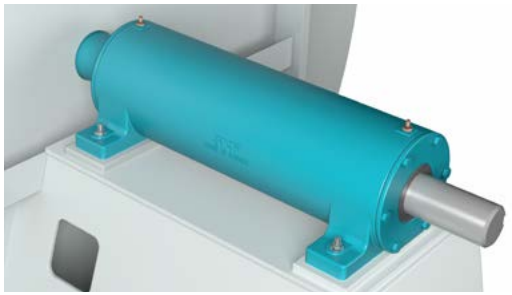
Bearings: Solid Pillow Block Bearing (Spherical Roller Element)
Pillow Block Bearings are designed to provide shaft support where the mounting surface is parallel to the shaft axis. The bolt holes are usually slotted for adjustment during mounting. The rolling element in these pillow block bearings has a crowned or spherical shape. Spherical Roller Pillow Block Bearings are superior when dealing with high loads and loads that require tolerance to shock; however, they have limited speed capabilities.



Bearings: Split Pillow Block Bearing (Ball Type Element or Spherical Roller Element)
Also known as bearings with split pillow block housings, the pillow block housing is split for easy bearing replacement and inspection.

Bearings: Static Oil Lubrication System (Trico Oiler)
Static oiler lubrication systems are designed to maintain a predetermined oil level in a sump. If the oil level drops below a certain point, the depleted oil automatically self levels based on the lubricators volume. This adds the right amount of lubricant, increasing efficiencies in the equipment.
- Separate Trico oiler unit for each bearing
- Inlet line on bottom
- Requires either a pressure relief line routed back to oiler or a breather tube/vent on top of the bearing

Bearings: Totally Split Roller Bearing
Totally split roller bearings are completely split to the shaft. All internal bearing parts split into two halves, allowing for easy removal of internal bearing parts without totally removing the shaft.

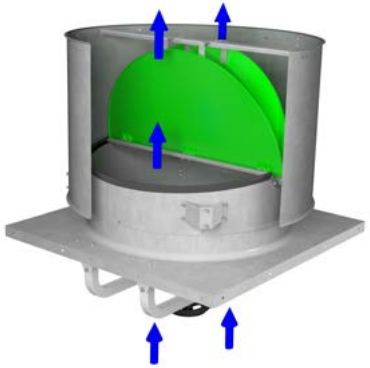


Bearings: Two Bearing Housing
- Pillow block bearings built inside a common housing
- Special shaft required per application
- Preserves precise alignment of bearings
- Also known as monoblock bearings

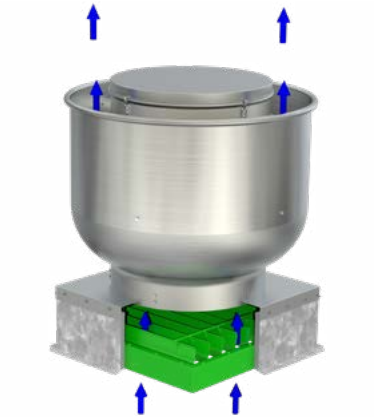
Blast Gate
A wafer-type butterfly valve for mounting to outlet flange allows controlling flow to full shutoff. Available for automatic control. Maximum temperature 250°F. The blast gate and flange bolt pattern match 125# ASA pipe flange.

Clamshell Fans: Axial Fans (Single and Double Door)
Clamshell fans are available designed to provide complete access to the interior of the fan for maintenance or cleaning without removal of ductwork. Clamshell construction is available for inline centrifugal and axial fans and is typically used in vertical mount applications. For the double door configuration, one of the two access doors is wide enough for impeller removal.

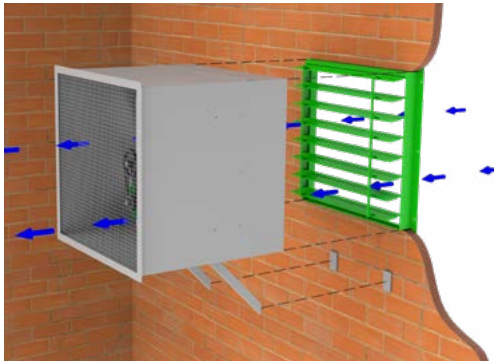
Companion Flanges (Round and Rectangular)
Companion flanges are connected to the connecting ductwork in the field and ensure a matching connection to the fan. They are shipped loose for field mounting.



Damper: Gravity Damper (Butterfly Type)
Butterfly Type Gravity Dampers, integral to roof mounted upblast fans, prevent a backdraft of outside air and provide weather protection when the fan is not in operation.

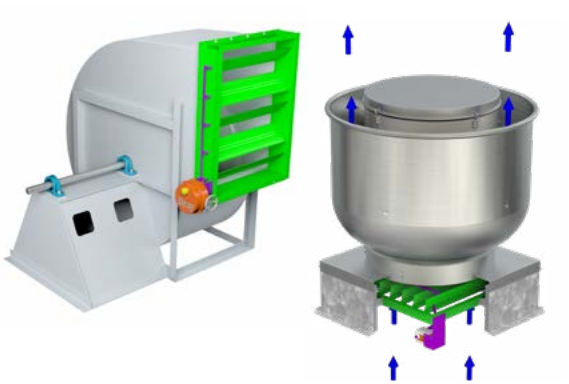


Damper: Gravity Damper (Ceiling Type)
Ceiling Type Gravity Dampers are designed to open automatically when the fan is energized and to close by gravity when power is turned off. These parallel blade, end-pivoted dampers provide a mechanism that prevents the air from back flowing through the system while also serving to exclude outside elements such as rain and snow.

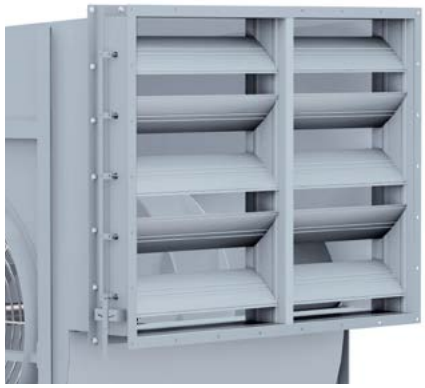


Damper: Gravity Damper (Wall Type)
Wall Type Gravity Dampers are designed to open automatically when the fan is energized and to close by gravity when power is turned off. These parallel blade, end-pivoted dampers provide a mechanism that prevents the air from back flowing through the system while also serving to exclude outside elements such as rain and snow.

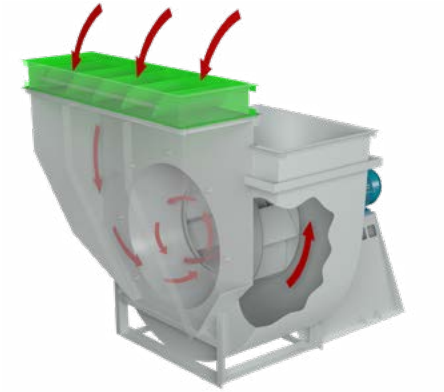
Damper: Manually Operated Dampers
Outlet dampers are available in both “parallel” or “opposed” blade configurations and are manually controlled. Manual dampers are typically used to balance a system.



Damper: Motorized Dampers
Motorized dampers are usually furnished with an actuator that powers the blades open rather than relying on the velocity pressure of the airflow. This is of particular importance in low flow conditions that might otherwise only partially open the automatic damper blades creating blade flutter and potentially more noise.

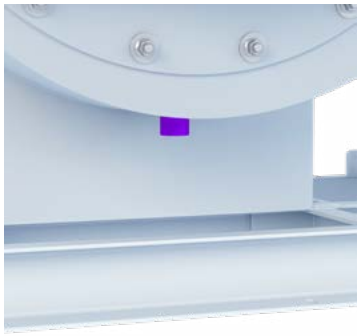


Damper: Opposed Blade Outlet Damper
Outlet dampers add resistance to the fan by shifting the operating point to the left of the rating point. The horsepower savings depends on the relative position on the fan curve and is usually much less than other methods. Outlet dampers are typically the least expensive option and should be considered when infrequent operation at lesser capacity is desired or when handling hot, humid or particulate-laden air. Opposed blade dampers cost about 10% more and are recommended for systems where volume is modulated over the entire range. Opposed blades reduce air volume in a closer relationship to the control arm movement. Available to 750°F construction.



Damper: Parallel Blade Inlet Box Damper
When partially closed, the inlet box damper pre-spins the air in the direction of impeller rotation, resulting in a savings in horsepower at reduced loads.

Damper: Parallel Blade Outlet Damper
Outlet dampers add resistance to the fan by shifting the operating point to the left of the rating point. The horsepower savings depends on the relative position on the fan curve and is usually much less than other methods. Outlet dampers are typically the least expensive option and should be considered when infrequent operation at lesser capacity is desired or when handling hot, humid or particulate laden air. Parallel blade dampers are recommended for systems where air volume is modulated between full-open to about 75% of open. Available to 750°F construction.



Drain
Drains are typically a half coupling pipe welded to the fan housing scroll. Drain diameter varies by fan model. Special diameter drains can be provided. A plug or valve may be added to close the hole if desired.

Evasé
An evasé is a section of ductwork attached (usually bolted) to the fan discharge. The outlet of the evasé is larger than at the inlet (fan discharge), which ultimately expands the outlet area of the fan. Its purpose is to reduce the outlet velocity of the fan and to increase the static pressure capability.

Fins on Impeller Back Plate
Fins on impeller back plate reduce the thrust load on the bearings. Fins can create a negative pressure behind the impeller to draw air into the fan through the shaft hole in the housing. Helps reduce the possibility of leakage of the airstream to atmosphere.

Grounding Devices: Standard Grounding Pad with Clearance Hole (Stainless Steel Standard)
Used for electrically grounding the fan. Includes a threaded hole for attaching the customer-supplied, field-installed ground cable.

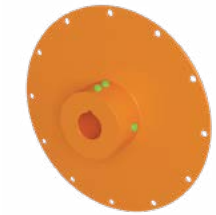
Grounding Devices: Grounding Stud, 3/8" (Stainless Steel Stud Standard)
Used for electrically grounding the fan. Includes a stud welded to the pedestal foot for attaching the customer-supplied, field-installed ground cable.

Grounding Devices: Grounding Stud with Lug, 3/8" (Stainless Steel Stud and Nuts Standard), (Aluminum Lugs Standard)

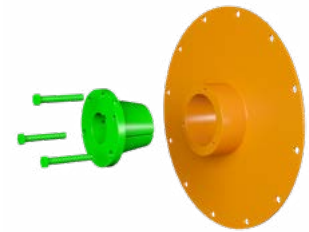
Centrifugal Housing

Tubular Housing

Housings
Housings provide a means of directing air or particulate through a system. The air or particulate enters through the inlet of the housing and exits through the outlet. All fans do not require a housing (i.e. plenum fans, plug fans, panel and ring fans). Housings are the main structure to support other key components such as inlet, outlet, framing and structural supports. Components may be mounted internally and/or externally.



Hub: Straight Bore
The bore of the hub is straight through. Shafts are keyed and mounted to the hub.

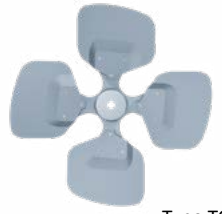


Hub: Taper Lock
The hub bore is tapered with respect to the fan shaft. The hub is locked to the shaft using a tapered bushing.

AXIAL FLOW IMPELLERS

Type L

Type BSA

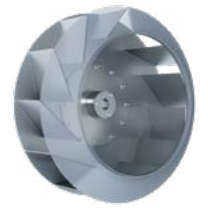


Type TCPE

Type Z

CENTRIFUGAL FLOW IMPELLERS

Forward Curved



Backward Inclined

Radial Bladed

Mixed Flow

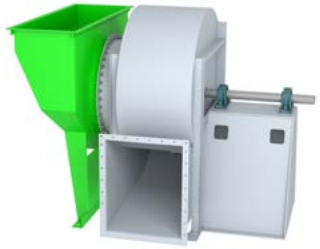
Impellers

There are two general classifications of impellers:

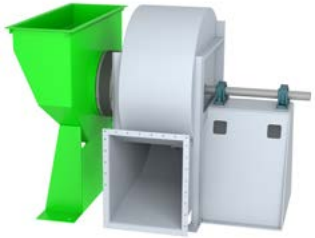
- *Axial flow type* - Axial flow impellers come with many variations of blade profile and number of blades, where emphasis is on moving large volumes of air against relatively low pressures as economically (low first cost) as possible.
- *Centrifugal/Radial flow type* - Centrifugal/Radial flow impellers are classified into three basic types according to blade configuration:
  - Forward curved
  - Backward inclined
  - Radial or straight-bladed

Each type has its own application range and limits. Modifications of these basic types include Radial Tip and Mixed Flow.

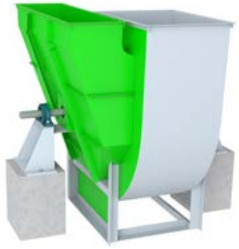
In the broadest sense, what sets Axial Flow and Centrifugal Flow impellers apart is how the air passes through the impeller. The Axial Flow type propels the air in an axial direction with a swirling tangential motion created by the rotating impeller blades. In a centrifugal or radial fan, the air enters the impeller axially and is accelerated by the blades and discharged radially.



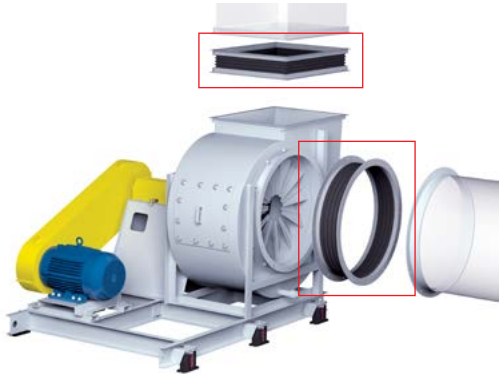
Inlet Box: Detached (Bolt-On) Inlet Box
Inlet boxes are used when the installation does not allow for a straight run of duct into the fan. The inlet box is designed to minimize the system effect of a 90 degree turn into the fan. The bolt-on design is bolted directly to the inlet flange of the fan.



Inlet Box: Detached (Free-Standing) Inlet Box
This is the same concept as the detached inlet box except it can be mounted separate from the fan and is fully supported at the floor.

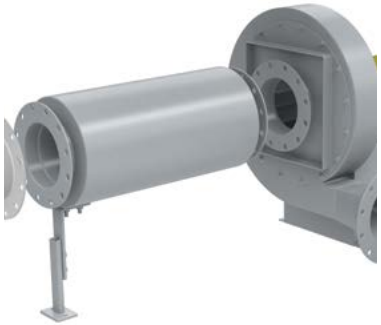


Inlet Box: Integral (Attached) Inlet Box
Inlet boxes are used when the installation does not allow for a straight run of duct into the fan. The inlet box is designed to minimize the system effect of a 90 degree turn into the fan. Attached inlet boxes are integrated into the inlet side of the fan housing. The Inlet box is supported by the fan.



Inlet/Outlet Flex Connectors (Round and Rectangular)
Flex connectors reduce vibration transmission to/from connecting ductwork and allow for some misalignment in the installation. Flex connectors are required on all isolated fans and can be provided by TCF or the customer. Flex connectors are shipped loose for field mounting.

Inlet Funnel
Aerodynamically shaped piece that funnels air into the fan inlet. Provides high efficiency and smooth airflow through the fan. Flanged on one end to mount onto the fan housing.
- Also known as inlet cone, funnel or inlet bell



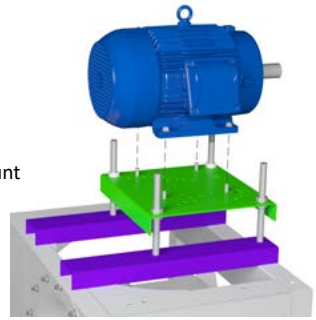
Inlet Silencer (with Support Leg)
Constructed of welded steel with acoustical absorption material to reduce noise emanating from fan inlet. Flanged connection is suggested for mounting to the inlet of the fan. The opposite end of the silencer can be furnished with an inlet venturi, inlet flange or inlet pipe assembly. Unless otherwise specified, the silencer will be furnished with flanges (punched) at both ends.

Inlet Vanes: External
Radial vanes at the fan inlet pre-spin the air entering the fan to control the flow. Vanes come standard with a manual handle operator, but can be provided with an actuator. External vanes have a housing and are bolted to the fan inlet.

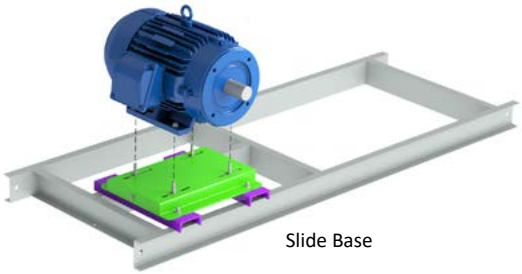
Inlet Vanes: Nested
Same function as the external inlet vane, but the vanes are nested within the inlet funnel. Replacing the vanes require the inlet funnel assembly to be replaced.

Motor: Electronically Commutated
An electronically commutated motor utilizes on-board electronics to control motor speed. The electronics are made up of two main parts:
- a rectifier, which converts the AC supply to DC
- a controller, which directs the right amount and right direction of current at the right time, through each of the windings

Motor: Induction
An induction motor is an AC electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding. An induction motor can therefore be made without electrical connections to the rotor.



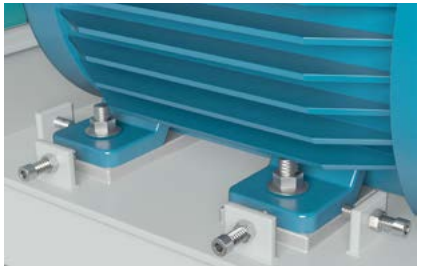
Post Mount



Slide Base

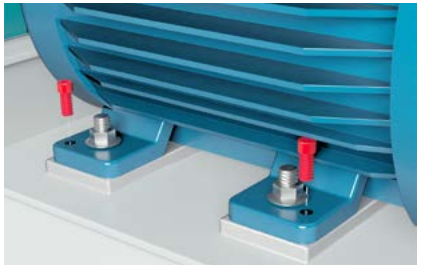
Motor Bases
Used on belt driven fans to provide a means of mounting a motor to a fan or on the fan base. The motor base is used for positioning the motor and adjusting belt tension during installation and maintenance. Several styles are used based on fan design and/or industry requirements: slide base or slide rails, post mount, bolt-on and various pivot styles.

Motor Positioners
Used for horizontal adjustment of the motor position in one direction.

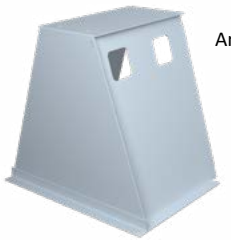


Motor Positioners: Bi-Directional
Used for horizontal adjustment of the motor position in both directions of the horizontal plane.

Motor Positioners: Tri-Directional
Motor feet are drilled and tapped. Vertical jack screws (red) are removed after the motor is shimmed.



Motor Positioners: Vertical Jack Screws
Motor feet are drilled and tapped. Vertical jack screws (red) are removed after the motor is shimmed.



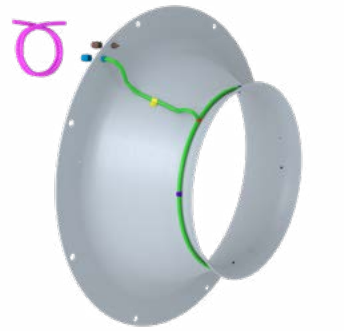
Angled

Straight

Formed
Sheet Metal

Pedestals

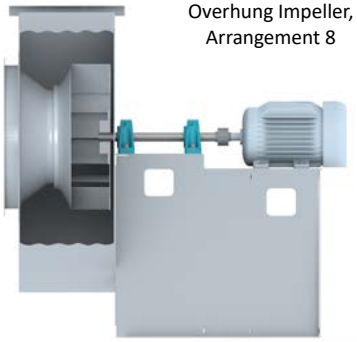
Pedestals provide a means of support for components such as motors, bearings and shafts. These components then provide a way to mount the impeller. The pedestal also provides structural stability to the fan assembly to aid in proper balancing and vibration requirements. The basic parts of a pedestal typically consist of a top, sides, feet, front and sometimes back. Typical construction consists of angled, straight or formed sheet metal.

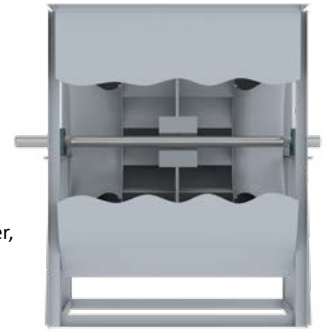


Piezometer Ring

A piezometer ring is part of an airflow measuring system, based on the principle of a flow nozzle. The inlet funnel of the fan is used as the flow nozzle. Available on plenum fans and housed centrifugal fans (SWSI and DWDI).

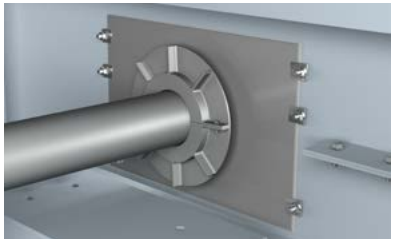
Overhung Impeller,
Arrangement 8





Center Hung Impeller,
Arrangement 3

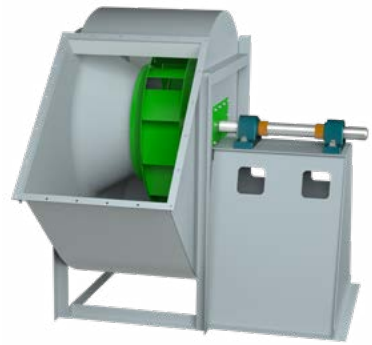
Shaft
A shaft is the core piece of the rotor assembly (impeller and shaft) of a fan. The shaft is supported by two bearings in one of two basic mounting arrangements: overhung impeller or center hung impeller. Shafts come in varying diameters to align with the structural, vibration and balance requirements of the fan assembly. Shaft materials vary based on the environment in which the fan assembly is operated.



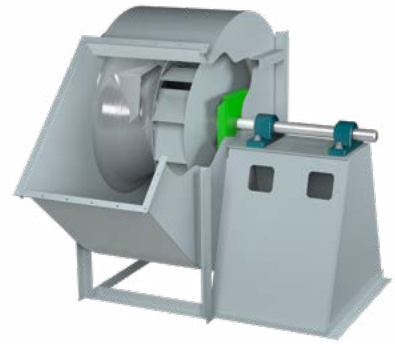
Shaft Cooler
Cast aluminum shaft coolers dissipate the heat transferred to the shaft from the airstream protecting the fan bearings. Recommended for applications over 300°F. Bore size is needed if ordered as just a stand-alone part.

Slide Gate Damper (Cast Aluminum Pressure Blowers)
Dampers feature cast aluminum frame with galvanized steel gate. Available on inlet or outlet. Slide gate type dampers provide manual adjustment of airflow and flexibility to meet any application.

Spark Resistant Construction: Type A
Type A provides the highest degree of spark resistance, requiring that all fan components in the airstream be constructed of a non-ferrous material and that they be assembled in a manner such as to reduce the possibility of contact between any stationary and rotating component.

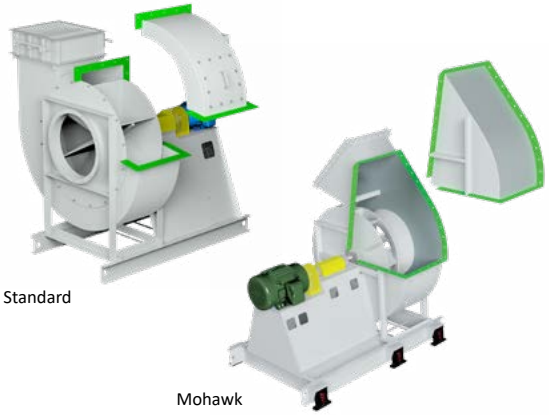


Spark Resistant Construction: Type B
Type B requires that the impeller be constructed of non-ferrous materials, and that the fan components in the airstream be assembled in a manner that reduces the possibility of contact between any stationary and rotating component. Typically, this is satisfied with the use of an aluminum impeller and an aluminum rub plate. If there is a mechanical failure of the fan, the aluminum impeller will contact a steel inlet cone.



Spark Resistant Construction: Type C
Type C offers a minimal level of spark resistance and only requires that possible contact between stationary and rotating components be reduced. Typically, this construction includes the use of an aluminum inlet cone and an aluminum rub plate. The aluminum inlet cone will be the first point of fan impeller contact if there is a mechanical failure. The aluminum rub plate placed at the opening of the housing where the shaft passes, protects against contact of the steel fan shaft and steel fan housing. For high temperature applications, a steel funnel is required with the use of a rubbing band and rubbing bars.

Split Housing: Horizontal
Standard split along the horizontal centerline. Size 807 and above may be split by the shop for shipping purposes.

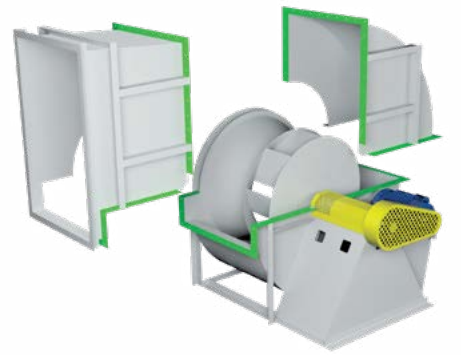


Standard

Mohawk

Split Housing: Pie
The housing is split at angles 90 degrees or greater to facilitate impeller removal without disturbing inlet or outlet. Typical for impeller removal.

- **Mohawk (newer style)** - Splits between scroll and inlet housing side. Inlet side of housing does not have a split. *Not used on double width fans or fans with attached inlet boxes.*
- **Standard (older style)** - Splits all the way down to the funnel or inlet plate.

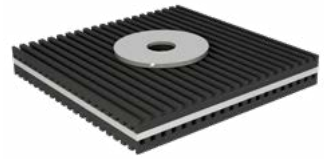


Split Housing: 3-Way
The housing is split into three sections up to 180 degrees. This split is normally required either for shipping or to enable the fan to enter a specific sized opening.

- Additional drafting and engineering time is required for 3-way splits.

Swingout Fans: Centrifugal and Axial Fans
Swingout fans are designed for frequent cleaning and provide full access to the impeller and inner casing of the fan. The entire impeller, shaft and bearing assembly is mounted on a large swingout door. Swingout construction is available for centrifugal, inline centrifugal and axial fans.

Tube Adapter and Rubber Sleeve with Clamps
This consists of a 4" long metal collar and flange that bolts to the blower discharge. A 6" long, 2-ply molded rubber slip-type connector with two hose clamps connects the adapter to the pipe line and helps to isolate vibration and noise transmission to the rest of the system. The connector is rated for pressures up to 5 psi and 180°F. Flange bolt patterns match 125# ASA pipe flange.

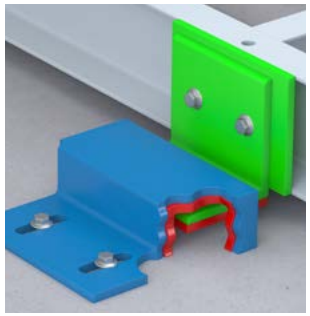


Vibration Isolation: Pads
Molded ribbed neoprene pads are used in some instances for isolation. A metal plate is mounted between two ribbed neoprene pads and a neoprene washer goes between the pad and fan structure. They offer minimal vibration isolation and are low cost.

Floor Mounted

Ceiling Hung

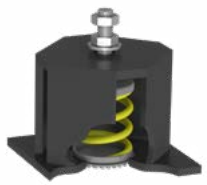
Vibration Isolation: Rubber-in-Shear (RIS)
Floor mounted RIS pads consist of two load plates of steel that are embedded in a rubber pad. *Ceiling hung* RIS pads are mounted in a formed metal surround.



Vibration Isolation: Snubbers
Used in conjunction with isolators on a fan or base. Serves as a shock absorber to prevent excessive movement of the fan or base in any direction. Often used when fan must withstand seismic loading.

Open

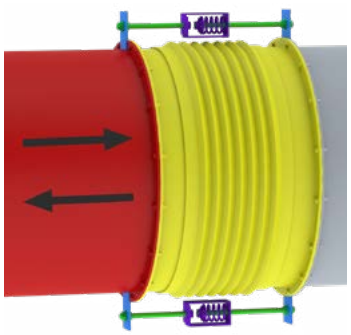
Restrained



Seismic

Housed

Vibration Isolation: Spring
Open springs are the simplest of the spring mounts. They do not offer any restriction of motion caused by aerodynamic forces. Floor mounted types are typically not used by Twin City Fan. Ceiling hung types are mounted in a formed metal surround. *Housed springs* work in the same way as open springs, but are contained in some type of enclosed housing. Isolator housings can hold one or more springs depending on application. *Restrained springs* are the same in design as the open springs, but a housing or frame is included to restrain the vertical and/or horizontal motion of the spring. *Seismic springs* are similar to a restrained spring except housing nearly surrounds the entire spring to withstand loads generated during a seismic event (i.e. an earthquake).



Vibration Isolation: Thrust Restraints
Used to prevent excessive motion of fans due to aerodynamic force. Standard ceiling hung type isolators (springs or spring/RIS pad combinations) are attached to both the fan discharge and the discharge duct using a threaded rod. They are adjusted to prevent horizontal motion. Two restraints per fan are mounted 180° apart.

Weep Hole
Used by manufacturing to drain wash water out of the housing prior to painting. They also assist customers by allowing moisture to drain from the housing after fan installation.