

INSTALLATION MANUAL



Adjustable Pitch Fan Assembly 5' thru 15' Diameter

Hudson Tuf-Lite III® fan blades

Hudson Tuf-Lite III® (White) fan blades are of single piece fiberglass reinforced plastic (FRP) construction optimized for performance, reliability, noise, and cost effectiveness. Tuf-Lite III® fan blades are constructed of light weight, corrosion resistant, fiberglass reinforced vinyl-ester resin, with materials, thickness, and processes determined from finite element analysis modeling. Tuf-Edge® leading edge erosion and UV protection is a standard with this blade.

The individually balanced blades can be replaced independently - matched sets are not required.

This is a new manual showing the latest Hudson fan line. This fan line includes 5 ft - 15 ft diameter and blade counts from 4 - 15 inclusive. For the original Series 3000 fans in the 6 ft - 14 ft diameter range having 4 - 9 blades, the hubs are identical to the original 3000H family, which means that the K blades can be used to replace the H blades in those fans - if all blades are changed at one time. For those new fans outside this core family, different hub and seal disc sizes are utilized, as shown in the Parts List on Page 7 of 9. This same list shows the original fans highlighted.

RECOMMENDED TOOLS

- Long T-Handle Allen Wrench Set (3/16" to 3/8")
- Medium Size Flat Head Screw Driver
- Brass Ball Peen Hammer
- Flat Bastard File
- 240 Grit Sand Paper
- Anti-Seize Lubricant
- WD-40
- 12" Crescent Wrench
- Shop Towels
- Exact-A-Pitch® Digital Protractor (P/N 62375)
- 25 ft. Measuring Tape
- Pencil or Marker
- Open/Box End Wrench Set (1/2" – 1-1/2")
- Socket Set for 1/2" Drive (1/2" – 1-1/2")
- Torque Wrench(s) Rated for 0-200 ft-lb

INSTALLATION PROCEDURES

ASSEMBLY WITH BUSHING

Clean all mating surfaces between hub, bushing and shaft. All grease and lubricant should be removed, leaving the mating surfaces dry.

If there is no shoulder on shaft to prevent bushing from sliding down shaft, slide spacer/sleeve (not provided) on shaft before bushing. Slide bushing and key onto shaft until flush with end of shaft. The shaft size determines the bushing type (Q2 or R2). Lock bushing on shaft by tightening the set screw in flange with an Allen Wrench. (Note: Q2 bushings have no set screws.) Line up key and set hub on bushing. Engage the three (3) cap screws in flange of bushing into hub spool, using a torque wrench with a socket, and tighten evenly. Use the following table to determine the proper tools and torque values. Cap screw(s) for retainer plate are not required for bushing application.

| Bushing Size | Allen Wrench Size | Cap Screw Size | Socket Size | Torque (ft-lb) Dry |
|--------------|-------------------|----------------|-------------|--------------------|
| Q2 | - | 3/8" | 9/16" | 29 |
| R2 | 3/16" | 3/8" | 9/16" | 29 |

ASSEMBLY WITH STRAIGHT SHAFT (NO BUSHING)

Clean all mating surfaces between the hub and the shaft. If there is no shoulder on shaft to prevent hub from sliding down shaft, slide spacer/sleeve (not provided) on shaft before hub. Install key in shaft. Line up key and keyway and set hub on shaft. Tighten set screw(s) in hub.

ASSEMBLY WITH TAPERED SHAFT (NO BUSHING REQUIRED)

Clean all mating surfaces between the hub and shaft. Align keyways and install hub. Install retainer plate and cap screw(s) with lock washer(s). Shaft size determines what size cap screw is necessary. Using a torque wrench with a socket, evenly tighten cap screw to recommended standard per table below.

| Cap Screw Size | Socket Size | Torque Value (ft-lb) | |
|----------------|-------------|----------------------|-----|
| | | Lubricated | Dry |
| 5/8" NC | 15/16" | 80 | 90 |
| 3/4" NC | 1-1/8" | 100 | 110 |
| 1" NC | 1-1/2" | 150 | 160 |

NOTE: Retaining arrangement varies with gear shaft design.

SEAL DISC HARDWARE INSTALLATION

*Seal disc mounting hardware must be installed BEFORE installing blades and blade clamps, due to limited working space.

For 6' to 10' Dia. Fan Assemblies:

Install seal disc spacer as shown in Figure 1 and 2. Install 3/8" bolts on the top hub plate with the threaded portion pointing upwards. Place spacer on bolt, then flat washer, lock washer, and then tighten 3/8" NC nut to recommended standard of 15 ft-lb (lubricated) or 20 ft-lb (dry).

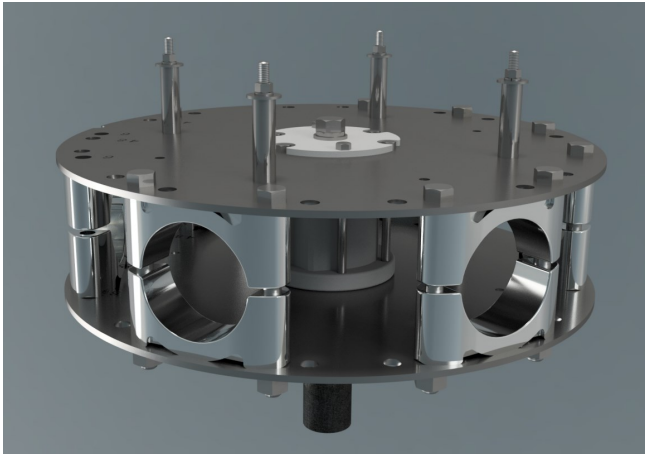


Figure 1

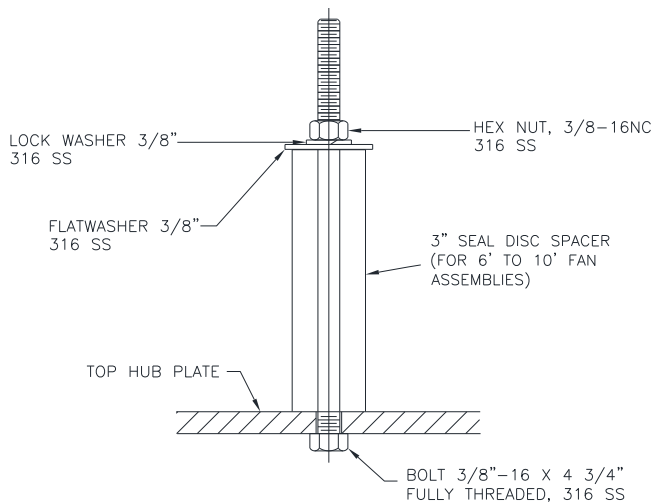


Figure 2

BLADE INSTALLATION

To prevent installation problems, work on one blade at a time. Remove blade clamp bolts, nuts, lock washers, and blade clamp halves from hub. Discard the plastic shipping spacers between the upper and lower blade clamp halves. Assemble blade clamp halves over groove in blade neck, and install into hub (See Figure 3). The thick leading edge will be to your left and thin trailing edge will be to your right as you stand at end of blade.



Figure 3

Install clamp bolts through hub plates and blade clamp, putting bolt heads on top, lock washers and nuts on bottom (See Figure 4). Tighten lightly.

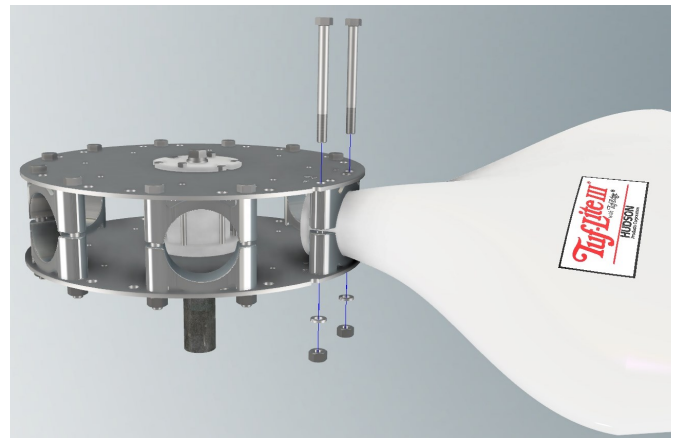


Figure 4

SET PITCH AND TRACK

Use Hudson's EXACT-A-PITCH® digital protractor (See Figure 5) or a bubble protractor to set blade pitch. Mount protractor on a flat bar as a base and place it approximately 1" from tip of blade. Note pitch on protractor. Rotate fan 360°, noting high and low pitch readings. Locate place where pitch reading is at mid-point between high and low readings, and set pitch at that point.

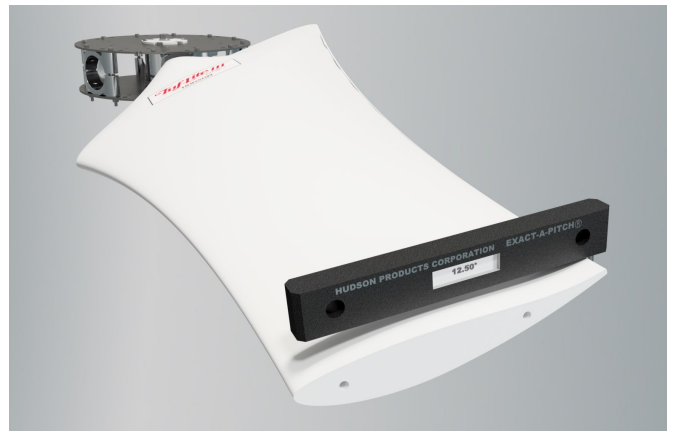


Figure 5

Rotate blade in clamp until digital protractor shows specified pitch angle to within $\pm 0.2^\circ$. *Fan pitch angle is shown on fan specification sheet for design duty.* After desired pitch angle is set, raise and lower end of fan blade and find midpoint of blade travel. Hold blade at the mid-point. Pull blade outward so that the blade neck flange rests against the back of the blade clamps. Push blade to the right to remove all slack.

Use torque wrench to tighten clamp bolts to 65 ft-lb (lubricated) or 80 ft-lb (dry). Re-check pitch setting. Blade must be set within $\pm 0.2^\circ$ of desired pitch angle. Tighten clamp bolts evenly. **DO NOT OVER-TORQUE CLAMP BOLTS.**

When bolts are tightened, hold a pencil against top end of blade and mark the level onto a fixed object, such as a pole or the fan ring.

Install remaining blades at same place as first blade, following the instructions above. After tightening bolts, mark top end of each blade in the same place first blade was marked. If marks differ by more than $1/2"$, adjust blade.

CHECK TRACK

After fan is installed in fan stack cylinder ring, outline the top side of each blade onto fan stack cylinder ring with a marker (See Figure 6). The difference between levels of highest and lowest outlines should not be more than $1/2"$. Correct blade track by loosening clamp bolts and adjusting blade to match track of other blades. Re-tighten bolts and re-check track and pitch angle setting. Re-tighten blade clamp bolts to recommended standard of 65 ft-lb (lubricated) or 80 ft-lb (dry) torque.

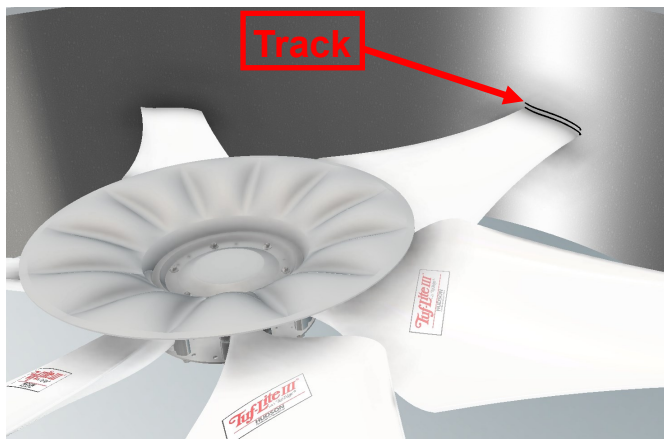


Figure 6

CHECK SWEEP

Measure the distance from trailing edge at blade tip of one blade to trailing edge at blade tip of the adjacent blade (See Figure 7). This distance should be within $1/2"$ of each other for all successive blades. Correct blade sweep by loosening clamp bolts and adjusting blade to match sweep of other blades. Re-tighten bolts and re-check sweep and pitch angle setting. Re-tighten blade clamp bolts to recommended standard of 65 ft-lb (lubricated) or 80 ft-lb (dry) torque.

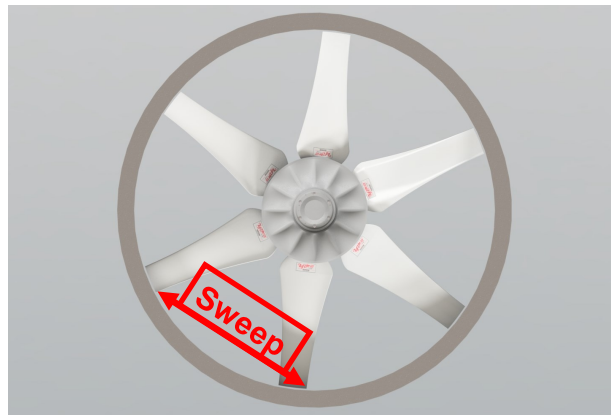


Figure 7

SEAL DISC INSTALLATION

Install 4, 5 or 6 seal disc bolts supplied to mount seal disc to hub, per bolt pattern on seal disc as shown in Figure 8.

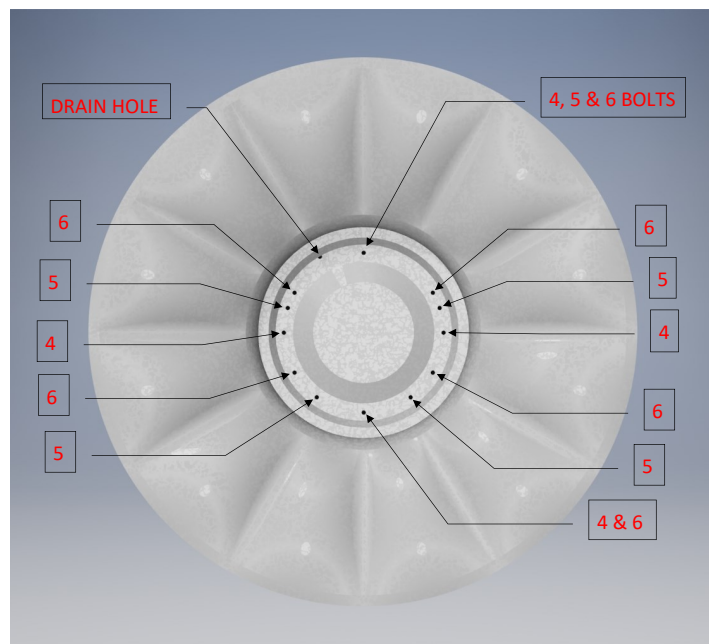


Figure 8

For 4 to 9 Blades

Fasten seal disc to top of hub with four (4) $3/8"$ cap screws, as shown in Figures 9. See Figure 10 for 5' fans, Figure 11 for 6' to 10' fans, and Figure 12 for 11' to 12' fans. Tighten to recommended standard of 15 ft-lb (lubricated) or 20 ft-lb (dry).

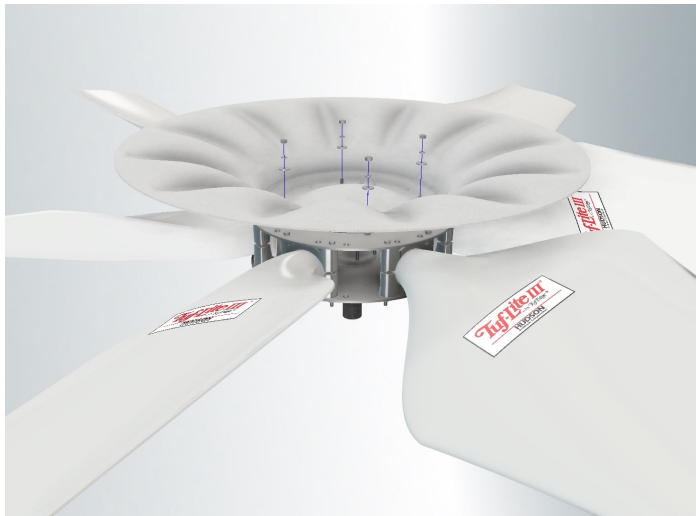


Figure 9

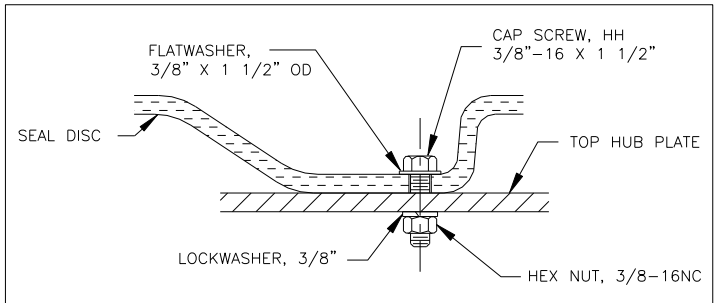


Figure 12: For 11' to 15" Dia. Fan Assemblies

For 10 to 15 Blades:

Install 3/8" NC bolts at six (6) places on top hub plate (See Figure 13 & 14). Threaded portion of bolts must be pointing up to mount seal disc. Install lock washer, nut, and flat washer on each bolt. Tighten 3/8" NC nuts to 15 ft-lb (lubricated) and 20 ft-lb (dry).

Locate the six (6) mounting holes in seal disc and install over the six (6) bolts pointing up on upper hub plate. If difficulty is encountered, loosen bolts on seal flanges until seal disc can be mounted, then re-tighten to 15 ft-lb (lubricated) or 20 ft-lb (dry).

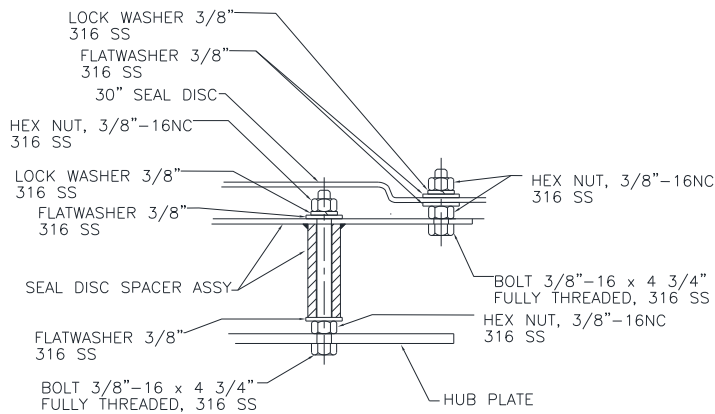


Figure 10: For 5' Dia. Fan Assemblies

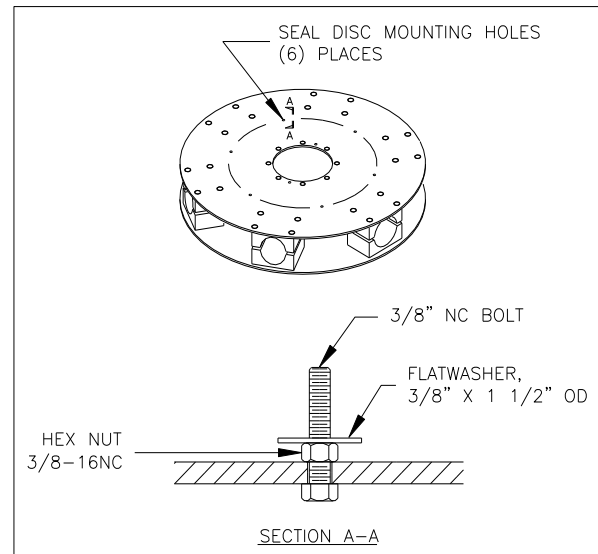


Figure 13

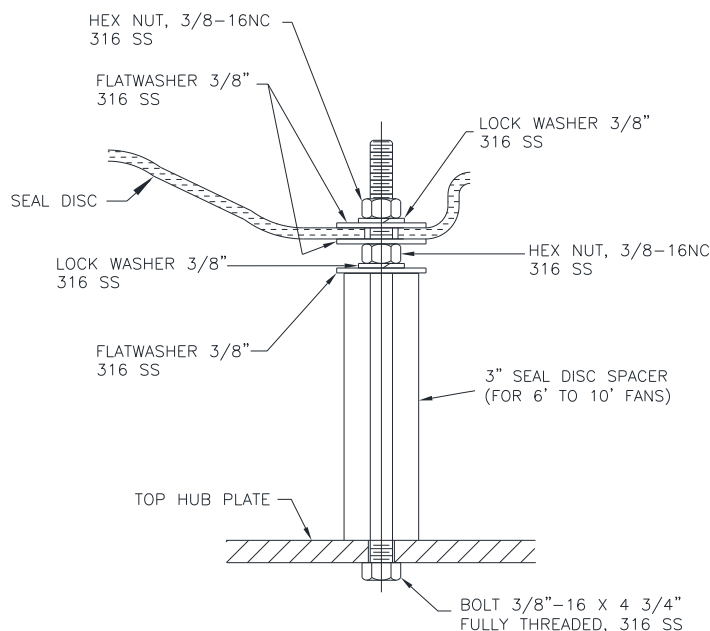


Figure 11: For 6' to 10' Dia. Fan Assemblies

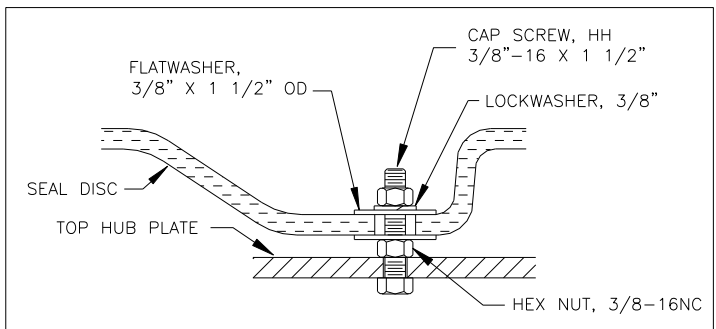


Figure 14

NOTE: The purpose of the seal disc is to prevent hot air from recirculating back down through the hub, increasing efficiency.

CHECKING TIP CLEARANCE

Rotate fan in position inside fan ring or fan stack to check tip clearance (See Figure 15). The recommended tip clearance is shown in the table below. Check for spots where fan blade clearance is not within the recommended tolerance.

| Fan Diameter | Minimum | Maximum |
|------------------|---------|---------|
| 5' through 9' | 1/4" | 1/2" |
| >9' through 11' | 1/4" | 5/8" |
| >11' through 14' | 1/4" | 3/4" |

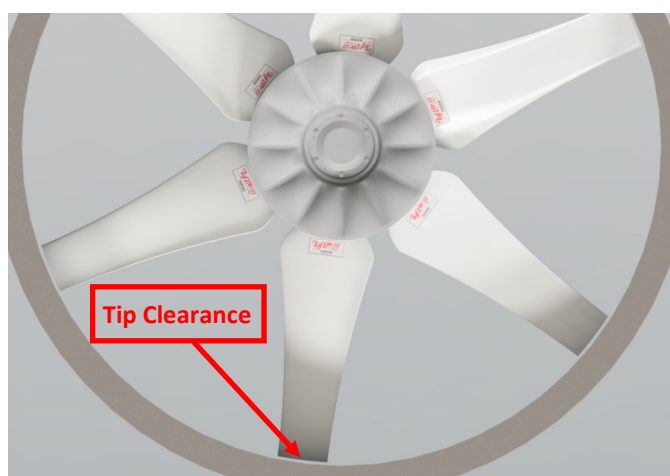


Figure 15

If necessary, adjust fan ring or fan stack by shimming to obtain proper clearance. For heat exchangers, spacers may be added at the fan ring joints to increase clearance (See Figure 16). Use a chisel to maintain the correct gap until the bolts on the ring are re-tightened.

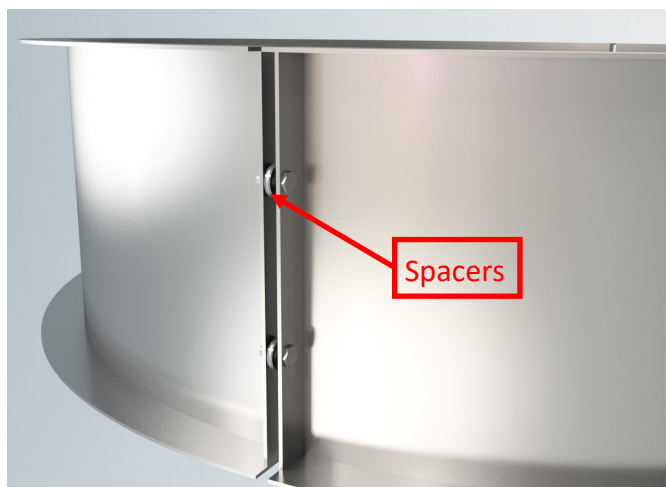


Figure 16

If a small adjustment is needed, tighten or loosen nut on fan strut in section requiring adjustment (See Figure 17).



Figure 17

OPERATING INSTRUCTIONS

Start fan and check rotation. Viewed from top (discharge), fan blades should rotate clockwise.

Hudson recommends to re-verify the blade clamp torque after the initial 10-15 minutes of cold operation (i.e., the fan doesn't need to be exposed to the working temperature of the process). This will ensure that the blades are settled within the clamps after the centrifugal forces have acted.

Check motor power consumption to be sure fan is pulling desired load. **CAUTION:** If positive pitch is set in summer to use all available motor amps (nameplate rating), motor could be overloaded in winter. Design pitch angles usually do not use all of the available motor horsepower. This ensures that the motors will not be overloaded at low winter temperatures.

For the fans that have remained idle (such as a shut-down or turn-around), it is highly recommended to re-verify the torque on the blade clamps before putting it back into operation.

For heat exchanger applications, we recommend using Hudson bearings part number: 50081 (top bearing) and 50082 (bottom bearing).



Figure 18

Parts List
HUDSON PRODUCTS CORPORATION
Adjustable Pitch Fan Assembly 5' Thru 15' Diameter
Series 3000K HUB

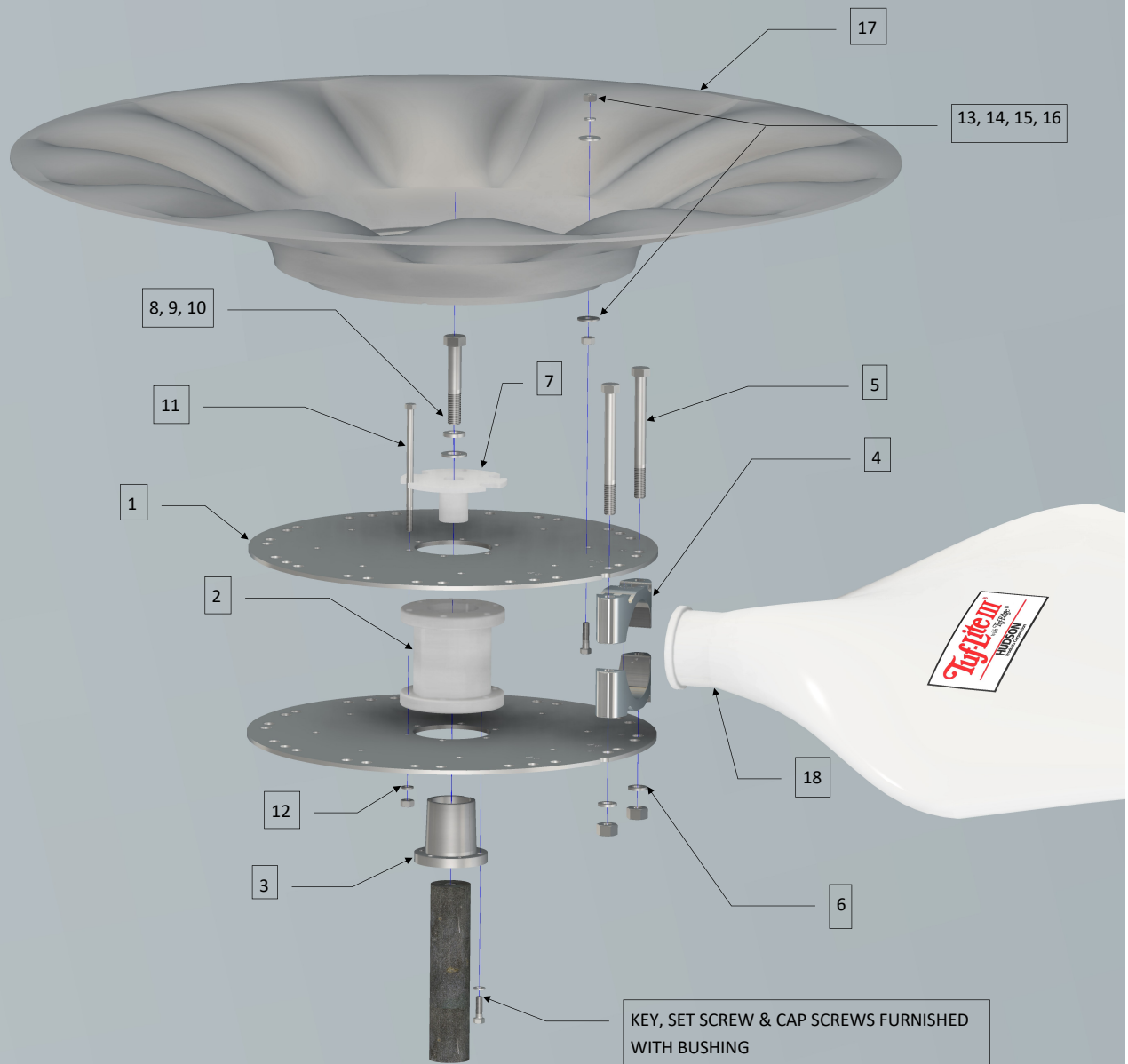
| ITEM | DESCRIPTION | TYPE | PART NO. | NO. OF BLADES | | | | | | | | | | | |
|------|--|------|--------------------------------|-----------------------|------------------|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | | | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | 1" Diameter Thru 2.62" Diameter Shaft | Q-2 | 5K Hub Assy. No. Part No. | 3104HM7 H3410 | 3105HM7 H3510 | 3106HM7 H3610 | | | | | | | | | |
| | | | 6K-10K Hub Assy. No. Part No. | 3104H H3410 | 3105H H3510 | 3106H H3610 | 3107H H3710 | 3108H H3810 | 3109H H3910 | | | | | | |
| | | | 11K-14K Hub Assy. No. Part No. | 3104H H3410 | 3105H H3510 | 3106H H3610 | 3107H H3710 | 3108H H3810 | 3109H H3910 | 3110H 79210 | 3111H 79212 | 3112H 79214 | 3113H 79216 | 3114H 79218 | 3115H 79220 |
| | | | 15K Hub Assy. No. Part No. | 3104HS 79222 | 3105HS 79224 | 3106HS 79226 | 3107HS 79228 | 3108HS 79230 | 3109HS 79232 | 3110HS 79234 | 3111HS 79236 | 3112HS 79238 | 3113HS 79240 | 3114HS 79242 | 3115HS 79244 |
| | 2.68" Diameter Thru 3.62" Diameter Shaft | R-2 | 5K Hub Assy. No. Part No. | 3204HM7 H3410 | 3205HM7 H3510 | 3206HM7 H3610 | | | | | | | | | |
| | | | 6K-10K Hub Assy. No. Part No. | 3204H H3420 | 3205H H3520 | 3206H H3620 | 3207H H3720 | 3208H H3820 | 3209H H3920 | | | | | | |
| | | | 11K-14K Hub Assy. No. Part No. | 3204H H3420 | 3205H H3520 | 3206H H3620 | 3207H H3720 | 3208H H3820 | 3209H H3920 | 3210H 79211 | 3211H 79213 | 3212H 79215 | 3213H 79217 | 3214H 79219 | 3215H 79221 |
| | | | 15K Hub Assy. No. Part No. | 3204HS 79223 | 3205HS 79225 | 3206HS 79227 | 3207HS 79229 | 3208HS 79231 | 3209HS 79233 | 3210HS 79235 | 3211HS 79237 | 3212HS 79239 | 3213HS 79241 | 3214HS 79243 | 3215HS 79245 |
| 1 | Hub Plate (2 Per Hub) | Q-2 | 5K Part No. | C3394 | C3395 | C3396 | | | | | | | | | |
| | | R-2 | | C3294 | C3295 | C3296 | | | | | | | | | |
| | | Q-2 | 6K-10K Part No. | C3216 | 61705 | C3216 | 61707 | C3216 | C3399 | | | | | | |
| | | R-2 | | C3216 | 61705 | C3216 | 61707 | C3216 | C3399 | C3410 | C3411 | C3412 | C3413 | C3414 | C3415 |
| | | Q-2 | 11K-14K Part No. | C3578 | C3580 | C3582 | C3584 | C3578 | C3579 | | | | | | |
| | | R-2 | | C3578 | C3580 | C3582 | C3584 | C3578 | C3579 | C3580 | C3581 | C3582 | C3583 | C3584 | C3585 |
| | | Q-2 | 15K Part No. | C3578 | C3580 | C3582 | C3584 | C3578 | C3579 | C3580 | C3581 | C3582 | C3583 | C3584 | C3585 |
| | | R-2 | | C3568 | C3570 | C3572 | C3574 | C3568 | C3569 | C3570 | C3571 | C3572 | C3573 | C3574 | C3575 |
| ITEM | DESCRIPTION | TYPE | PART NO | QUANTITY PER ASSEMBLY | | | | | | | | | | | |
| 2 | Hub Spool | Q-2 | 65101 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | R-2 | 65102 | | | | | | | | | | | | |
| 3 | Bushing | Q-2 | Specify Bore | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | R-2 | | | | | | | | | | | | | |
| 4 | Blade Clamp Half, Un-painted Aluminum (Standard) Option 1, Epoxy coated Aluminum Option 2, Epoxy coated Ductile Iron Option 3, Machined stainless steel | | 65003 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| | | | 65003S | | | | | | | | | | | | |
| | | | 65016 | | | | | | | | | | | | |
| | | | C3006 | | | | | | | | | | | | |
| 5 | Blade Clamp Bolt 5/8"-11 x 7" with Nut (Mech. Galv.) | | 70701 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| 6 | 5/8" Lock washer (Mech. Galv.) | | 73730 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| 7 | Stop Plate Sub-Assembly | Q-2 | 65007 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | R-2 | 65008 | | | | | | | | | | | | |
| 8 | Stop Plate Bolt 3/4"-10 x 4 1/2" (Zinc Plated) | | 72427 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 9 | 3/4" Lock washer (Mech. Galv.) | | 73738 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 10 | 3/4" Flat Washer (Mech. Galv.) | | 73640 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 11 | Hub Spool Bolt 3/8"-16 x 7" with Nut (Mech. Galv.) | | 70700 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 12 | 3/8" Lock washer (Mech. Galv.) | | 73723 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 13 | Seal Disc Bolt 3/8"-16 X 1 1/2" (316 SS) | | 60274 | 4 | 4 | 4 | 4 | 4 | 4 | 6 | 6 | 6 | 6 | 6 | 6 |
| 14 | 3/8" Flat Washer (316 SS) | | 73623 | 4 | 4 | 4 | 4 | 4 | 4 | 12 | 12 | 12 | 12 | 12 | 12 |
| 15 | 3/8" Lock washer (316 SS) | | 73722 | 4 | 4 | 4 | 4 | 4 | 4 | 6 | 6 | 6 | 6 | 6 | 6 |
| 16 | 3/8" Hex Nut (316 SS) | | 72050 | 4 | 4 | 4 | 4 | 4 | 4 | 12 | 12 | 12 | 12 | 12 | 12 |
| 17 | 30" Dia. Seal Disc with Spacer Assy Mounting (5K) | | 81100 | 1 | 1 | 1 | | | | | | | | | |
| | 38" Dia. Seal Disc w/ 3" Spacer (6K-10K with 4-9 blades) | | 81105 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | |
| | 50" Dia. Seal Disc (11K-14K with 4-9 blades) | | D3439 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | |
| | 53" Dia. Seal Disc (11K-14K with 10-12 blades) | | 81114 | | | | | | | 1 | 1 | 1 | | | |
| | 64" Dia. Seal Disc (11K-14K with 13-15 blades and 15K with 4-15 blades) | | 81115 | | | | | | | | | | 1 | 1 | 1 |
| 18 | Tuf-Lite III® Fan Blade (White) | | Varies | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |

Highlighting shows original 3000H fans having the 23" hub encompassing 6 - 14 ft dia and 4-9 blades where the new K blades can replace the H blades. K blades and H blades are interchangeable for this original hub group (if all blades changed at one time).

HUDSON PRODUCTS CORPORATION

Adjustable Pitch Fan Assembly 5' Thru 15' Diameter

Series 3000K HUB



STANDARD MATERIALS & FINISHES

Blades: Fiberglass reinforced vinyl ester
Hub Spool: Ductile Iron, Zinc Rich Coating
Plates: Steel, Galvanized
Bushing: Malleable Iron
Seal Disc: Fiberglass Reinforced Polyester

Blade Clamps:
 Un-painted Aluminum (Standard)
 Epoxy Coated Aluminum (Option 1)
 Epoxy Coated Ductile Iron (Option 2)
 Machined Stainless Steel (Option 3)
Fasteners:
 Steel, Mech. Galvanized & 316 SS Opt.
 Complete Fan with 316 SS (Option 1)
 Complete Fan with K500 Monel (Option 2)

WHEN ORDERING, SPECIFY FAN DIAMETER, TYPE & NUMBER OF BLADES & SHAFT DIAMETER

EXAMPLE:

APT

14K

6

2 7/8" BORE

Fan Model
Adjustable Pitch

Fan Diameter & Blade Type
(Specify "K" for Tuf-Lite III® Blades)

Number
of Blades

Shaft Diameter

HUDSON

Products Corporation

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<http://www.hudsonproducts.com>

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