HUDSON
Products Corporation

Tuf-Lite III® Fans
4000KW Series Hub

INSTALLATION MANUAL

Adjustable Pitch Fan Assembly
11’ through 20’ Diameter

Hudson Tuf-Lite III® fan blades

Hudson Tuf-Lite III® 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 lightweight, 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.

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 or use a thrust retainer (optional equipment) on top of hub. Slide bushing and key onto shaft until flush with end of shaft. The shaft size determines the bushing type (Q2, R2, or S2). 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.

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
S2	3/16"	1/2"	3/4"	70

ASSEMBLY WITH TAPERED SHAFT (NO BUSHING REQUIRED)

Clean all mating surfaces between the hub and shaft. Coat all mating surfaces with an anti-seize or lubricating compound.
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"	120	130
1" NC	1-1/2"	150	160

NOTE: Retaining arrangement varies with gear shaft design.

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 or use a thrust retainer (optional equipment) on top of hub. Install key in shaft. Line up key and keyway and set hub on shaft. Tighten set screw(s) in hub.

THRUST RETAINER (optional equipment)

Install proper load bolt (not provided) into top of fan shaft and tighten (See Figure A). Install thrust retainer channel on top hub plate using existing hub spool cap screws. Torque cap screws to 60-65 ft-lb. Install thrust retainer eyebolt and jam nut. Hand tighten eyebolt. Tighten jam nut securely against top of thrust retainer channel.

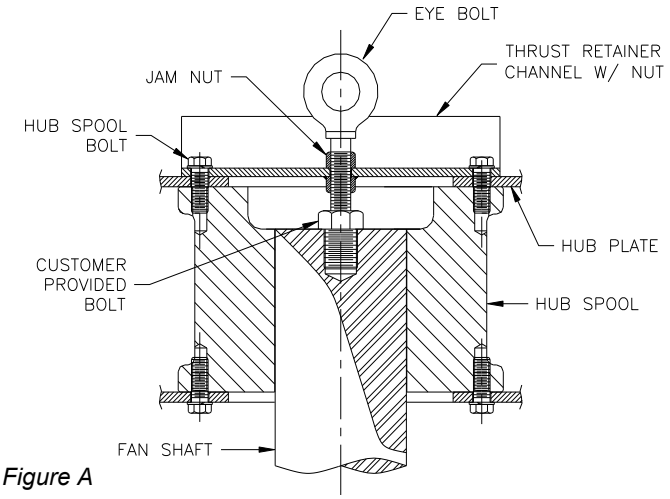


Figure A

SEAL DISC HARDWARE INSTALLATION

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

For 3 to 9 Blades:

Install seal disc spacer as shown in Figures 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, and then tighten 3/8” NC nut to recommended standard of 15 ft-lb (lubricated) or 20 ft-lb (dry).

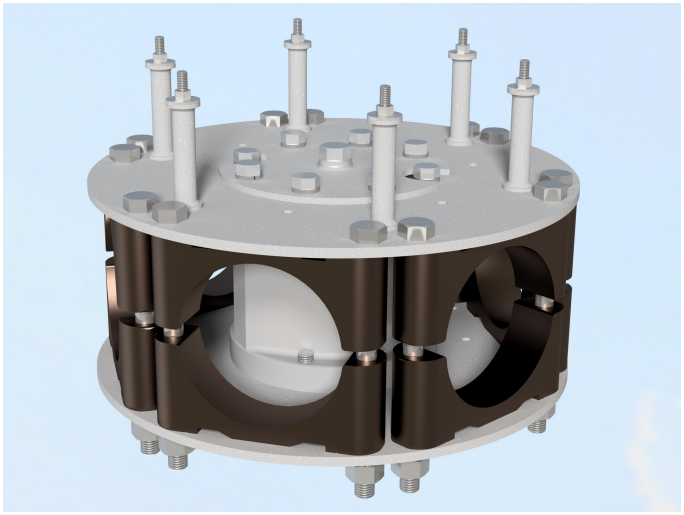


Figure 1

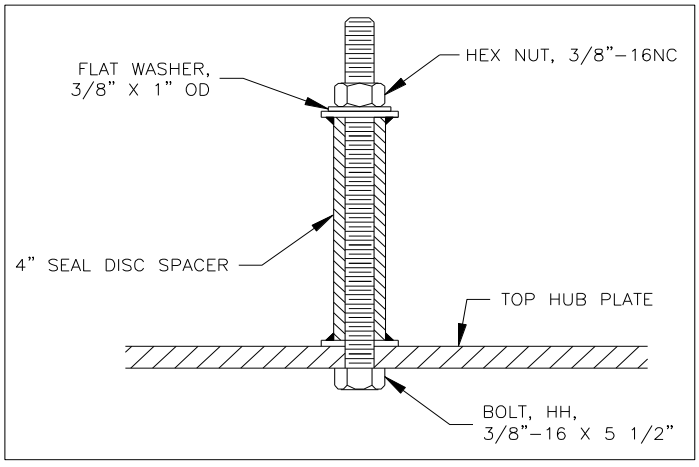


Figure 2

For 10 to 12 Blades:

Install 3/8" NC bolts at six (6) places on top hub plate as shown in Figure 3. Threaded portion of bolts must be pointing up to mount seal disc. Install nut on each bolt. Tighten 3/8" NC nuts to 15 ft-lb (lubricated) and 20 ft-lb (dry).

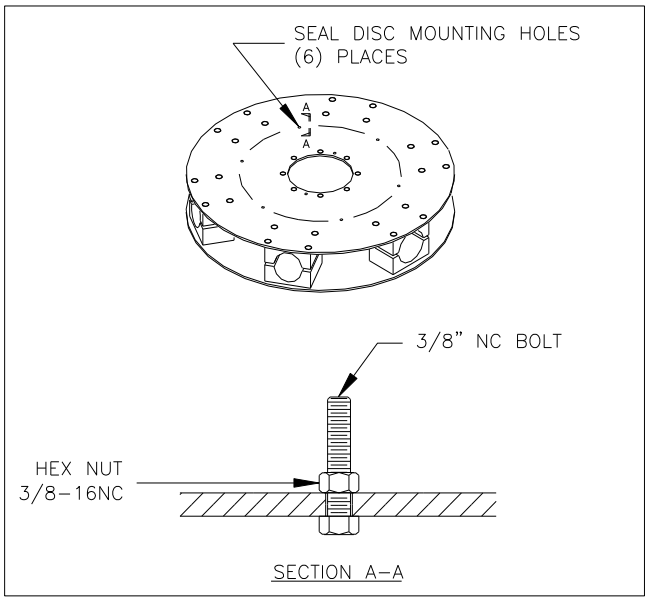


Figure 3

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 4). 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 4

Install clamp bolts through hub plates and blade clamp, putting bolt heads on top, lock washers and nuts on bottom. Tighten lightly (See Figure 5).

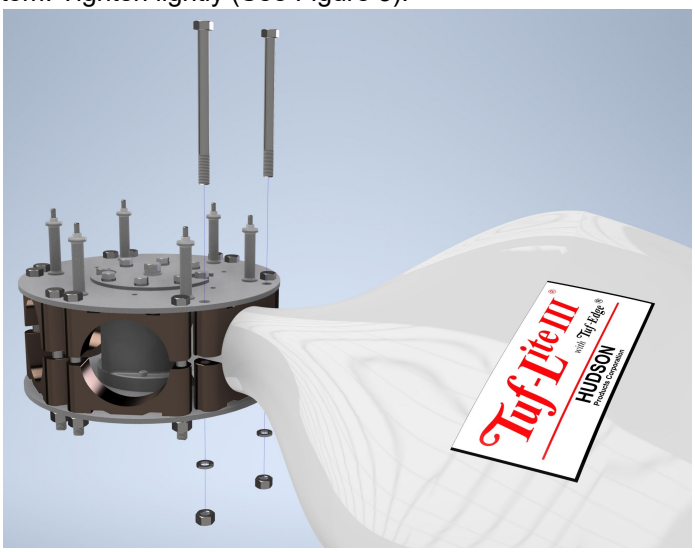


Figure 5

SET PITCH AND TRACK

Use Hudson's EXACT-A-PITCH® digital protractor (See Figure 6) 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 6

Rotate blade in clamp until digital protractor shows specified pitch angle to within +/-0.2°. *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 mid-point 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 120 ft-lb (lubricated) or 130 ft-lb (dry). Re-check pitch setting. Blade must be set within +/-0.2° 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 same place first blade was marked. If marks differ by more than 3/4", adjust blade.

CHECK TRACK

After fan is installed in fan stack cylinder ring, outline top side of each blade onto fan stack cylinder ring with a marker (See Figure 7). The difference between levels of highest and lowest outlines should be within ± 1" for fan diameters of 11ft - 15ft and within ± 1.5" for fan diameters of 16ft - 20ft. 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 120 ft-lb (lubricated) or 130 ft-lb (dry) torque.

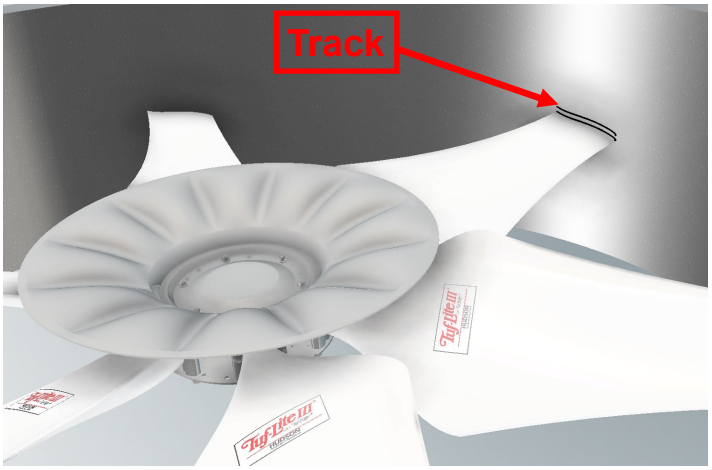


Figure 7

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 7a). This distance should be within 3/4" 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 120 ft-lb (lubricated) or 130 ft-lb (dry) torque.

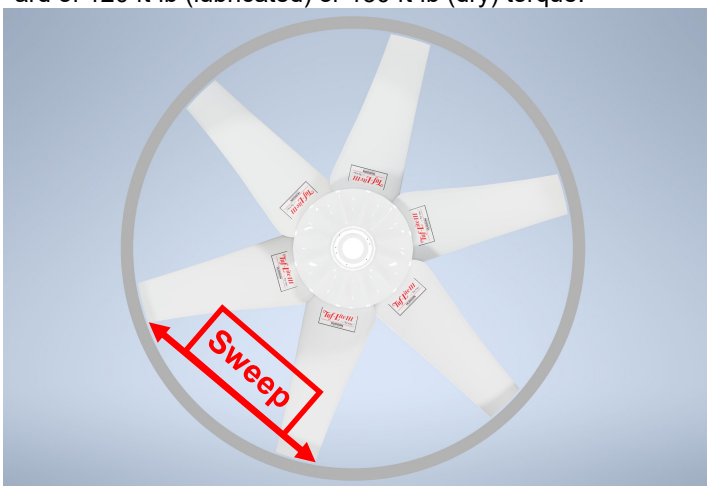


Figure 7a

SEAL DISC INSTALLATION

For all blade counts:

After installing blades, seal disc should be installed on the previously installed seal disc hardware as shown in Figure 8 for 3 to 9 bladed hubs, or Figure 9 for 10 to 12 bladed hubs. Install flat washer, then place seal disc on top. Install another flat washer, lock washer, and nut on top. Tighten 3/8" NC nut to recommended standard of 15 ft-lb (lubricated) or 20 ft-lb (dry). If difficulty is encountered, loosen bolts on seal flanges until seal disc can be mounted, then re-tighten.

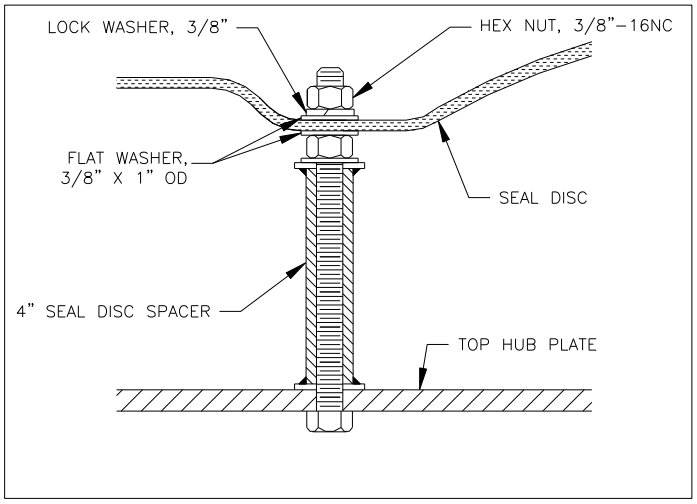


Figure 8 (3 to 9 bladed hub)

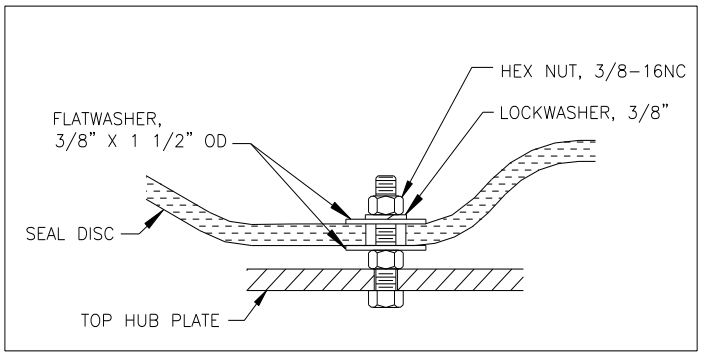


Figure 9 (10 to 12 bladed hub)

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 10). The recommended tip clearance is between 3/8" and 3/4". Check for spots where fan blade clearance is not within the recommended tolerance.

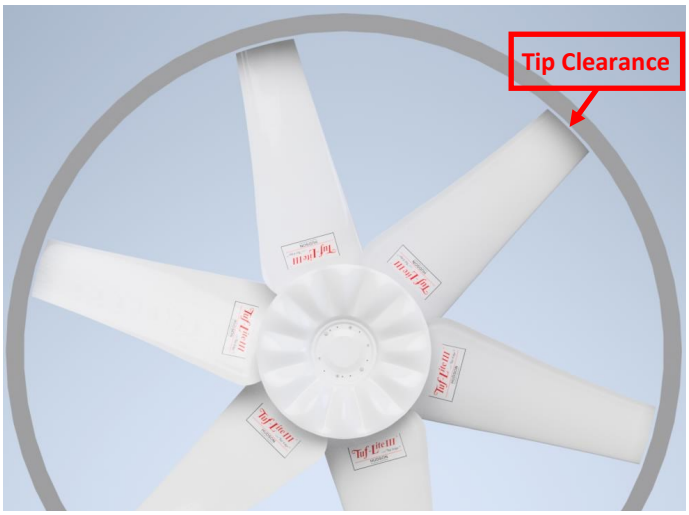


Figure 10

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 11). Use a chisel to maintain the correct gap until the bolts on the ring are re-tightened.

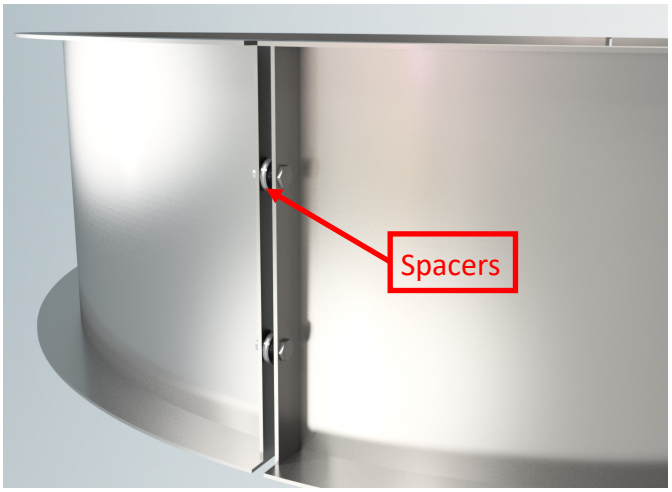


Figure 11

If a small adjustment is needed, tighten or loosen nut on fan strut in section requiring adjustment (See Figure 12).

Figure 12

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 shutdown or turn-around), it is highly recommended to re-verify the torque on the blade clamps before putting it back into operation.

OPERATIONAL LIMITS

Temperature: -100F to 220F Continuous,
250F Intermittent
Wind speed: 75 mph, shutdown fan if forecast is higher

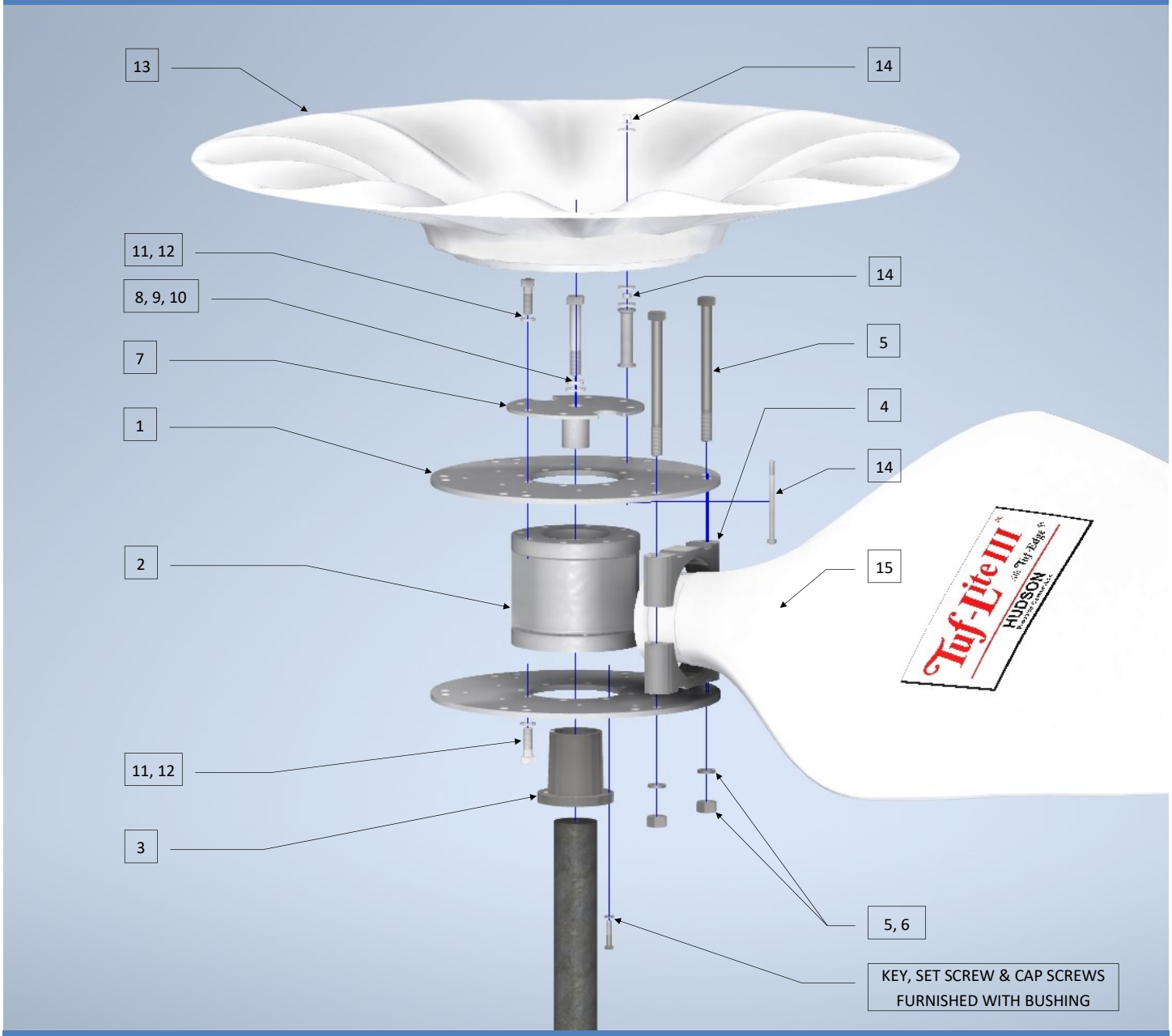
PART LIST
HUDSON PRODUCTS CORPORATION
Adjustable Pitch Fan Assembly 11' Thru 20' Diameter
4000KW Series hub

				NO. OF BLADES								
ITEM	DESCRIPTION	TYPE	PART NO.	4	5	6	7	8	9	10	11	12
	1" Diameter Thru 2.62" Diameter Shaft	Q-2	Hub Assy. No. Part No.	4104KW 77443	4105KW 77444	4106KW 77445	4107KW 77446	4108KW 77447	4109KW 77448	4110KW 77449	4111KW 77450	4112KW 77451
	2.68" Diameter Thru 3.62" Diameter Shaft	R-2	Hub Assy. No. Part No.	4204KW 77453	4205KW 77454	4206KW 77455	4207KW 77456	4208KW 77457	4209KW 77458	4210KW 77459	4211KW 77460	4212KW 77461
	3.68" Diameter Thru 4.19" Diameter Shaft	S-2	Hub Assy. No. Part No.	4304KW 77463	4305KW 77464	4306KW 77465	4307KW 77466	4308KW 77467	4309KW 77468	4310KW 77469	4311KW 77470	4312KW 77471
1	Hub Plate (2 Per Hub)	Q-2 / R-2 / S-2	Part No.	D5124	D4125	D4126	D4127	D4128	D4129	D4130	D4131	D4132

ITEM	DESCRIPTION	TYPE	PART NO.	QUANTITY PER ASSEMBLY								
2	Hub Spool	Q-2	65045	1	1	1	1	1	1	1	1	1
		R-2	65050									
		S-2	65055									
3	Bushing	Q-2	Specify Bore	1	1	1	1	1	1	1	1	1
		R-2										
		S-2										
4	Blade Clamp Half, Epoxy coated Aluminum (Standard) Option 1: Un-painted Aluminum Option 2: Epoxy coated Ductile Iron		C4742A 4742A 65010	8	10	12	14	16	18	20	22	24
5	Blade Clamp Bolt With Nut 3/4"-10 x 10" (Mech. Galv.)		79299	8	10	12	14	16	18	20	22	24
6	3/4" Lock washer (Mech. Galv.)		73738	8	10	12	14	16	18	20	22	24
7	Stop Plate Sub-Assembly	Q-2 / R-2 / S-2	B4113	1	1	1	1	1	1	1	1	1
8	Stop Plate Bolt 3/4"-10 x 5" (Zinc Plated)		51709	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
10	3/4" Flat Washer (Mech. Galv.)		73640	1	1	1	1	1	1	1	1	1
11	Hub Spool Bolt 5/8"-11 x 1 1/2" (316 SS)		72402	16	16	16	16	16	16	16	16	16
12	5/8" Lock washer (316 SS)		73731	16	16	16	16	16	16	16	16	16
13	53" Dia. Seal Disc (3-6 blades) 64" Dia. Seal Disc (7-9 blades) 76" Dia. Seal Disc Kit* (10-12 Blades)		81114 81115 D5177	1	1	1	1	1	1	1	1	1
14	Seal Disc Spacer 4" height		B4328	4	5	6	6	6	6	0	0	0
	Spacer Bolt, HH, 3/8"-16 x 5 1/2 (316 SS)		78659	4	5	6	6	6	6	0	0	0
	3/8" Hex Nut (316 SS)		72050	8	10	12	12	12	12	0	0	0
	3/8" Flat Washer (316 SS)		73623	12	15	18	18	18	18	0	0	0
	3/8" Lock washer (316 SS)		73722	4	5	6	6	6	6	0	0	0
	Seal Disc Bolt 3/8"-16 X 1 1/2" (316 SS)		60274	0	0	0	0	0	0	6	6	6
	3/8" Flat Washer (316 SS)		73623	0	0	0	0	0	0	12	12	12
	3/8" Lock washer (316 SS)		73722	0	0	0	0	0	0	6	6	6
	3/8" Hex Nut (316 SS)		72050	0	0	0	0	0	0	12	12	12
15	Tuf-Lite III® Fan Blade (White)		(Varies)	4	5	6	7	8	9	10	11	12

*Includes all 316 SS hardware (items 9 thru 12) to assemble and mount

HUDSON PRODUCTS CORPORATION
Adjustable Pitch Fan Assembly 11' Thru 20' Diameter
Series 4000KW HUB



STANDARD MATERIALS & FINISHES

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

Blade Clamps:
Epoxy Coated Aluminum (Standard)
Un-painted Aluminum (Option 1)
Epoxy Coated Ductile Iron (Option 2)
Fasteners:
Steel, Mech. Galvanized & 316 SS Opt.
Complete Fan W/31 6 SS (Option 1)
Complete Fan W/K500 Monel (Option 2)

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

EXAMPLE: APT —— 14KW —— 6 2 7/8" BORE

APT	14KW	6	2 7/8" BORE
Fan Model Adjustable Pitch	Fan Diameter & Blade Type (Specify "KW" for Tuf-Lite III® Blades)	Number of Blades	Shaft Diameter

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