

### INSTALLATION MANUAL



### Adjustable Pitch Fan Assembly 11' thru 15' Diameter

#### *Hudson Tuf-Lite III<sup>®</sup> fan blades*

Hudson Tuf-Lite III<sup>®</sup> Hi Temp (Red) fan blades are of single piece fiberglass reinforced plastic (FRP) construction optimized for performance, reliability, noise, and cost effectiveness. Tuf-Lite III<sup>®</sup> 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<sup>®</sup> 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. 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.

## 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 1). 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 1

Install clamp bolts through hub plates and blade clamp, putting bolt heads and belleville spring washers on bottom, lock washers and nuts on top (See Figure 2). Tighten lightly.

NOTE: Two belleville spring washers should be cupped upward and stacked in the same direction as shown on Figure 2A.



Figure 2

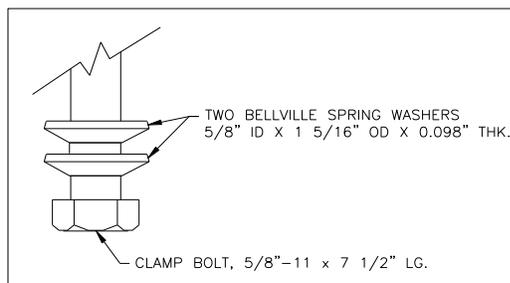


Figure 2A

## SET PITCH AND TRACK

Use Hudson's EXACT-A-PITCH<sup>®</sup> digital protractor (See Figure 3) 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 midpoint between high and low readings, and set pitch at that point.



Figure 3

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 midpoint. 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 4). 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 4

## 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 4a). 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.

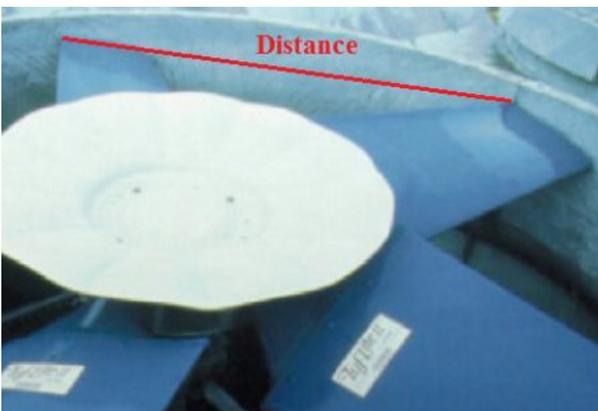


Figure 4a

## SEAL DISC INSTALLATION

For 4 to 9 Blades

Fasten seal disc to top of hub with four (4) 3/8" cap screws, as shown in figures 5 and 6. Tighten to recommended standard of 15 ft-lb (lubricated) or 20 ft-lb (dry).



Figure 5

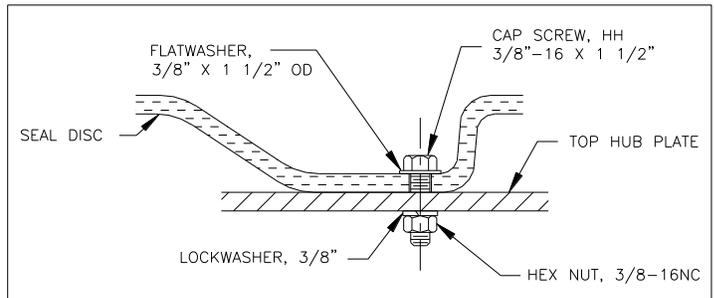


Figure 6

For 10 to 15 Blades:

Install 3/8" NC bolts at six (6) places on top hub plate (See Figure 6a & 6b). 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).

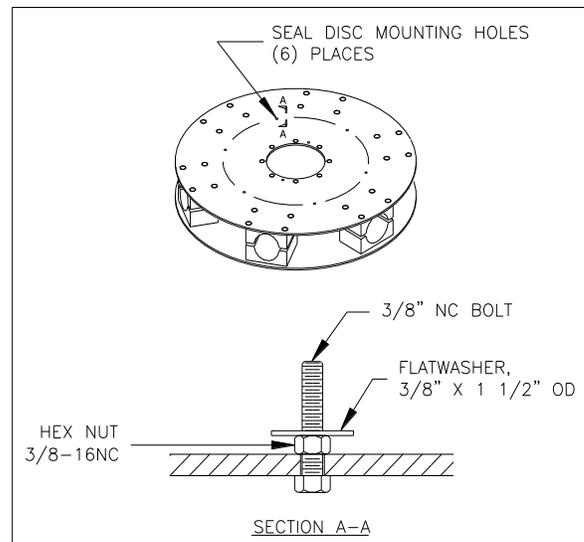


Figure 6a

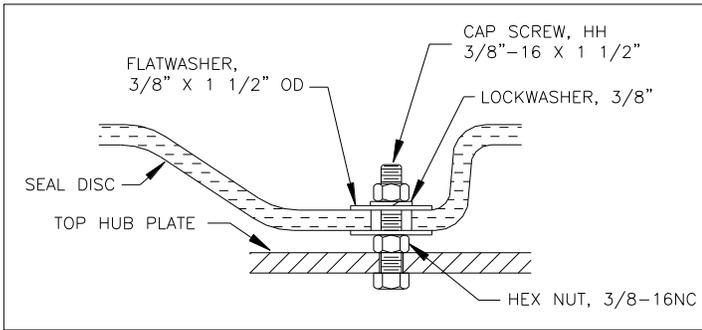


Figure 6b

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 7). 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
11'	1/4"	5/8"
12' through 15'	1/4"	3/4"

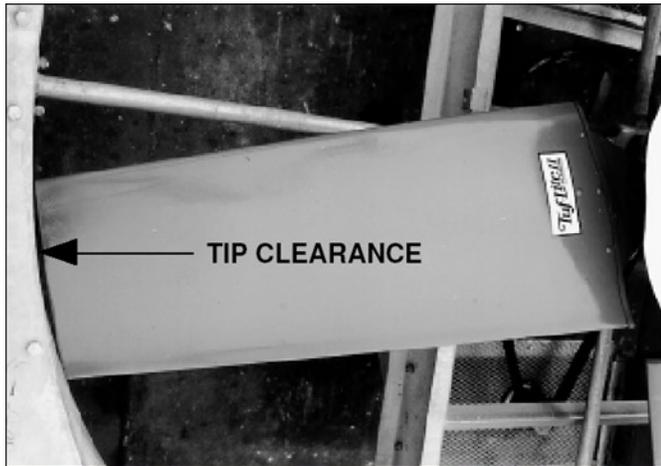


Figure 7

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



Figure 8

If a small adjustment is needed, tighten or loosen nut on fan strut in section requiring adjustment (See Figure 9).



Figure 9

### OPERATING INSTRUCTIONS

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

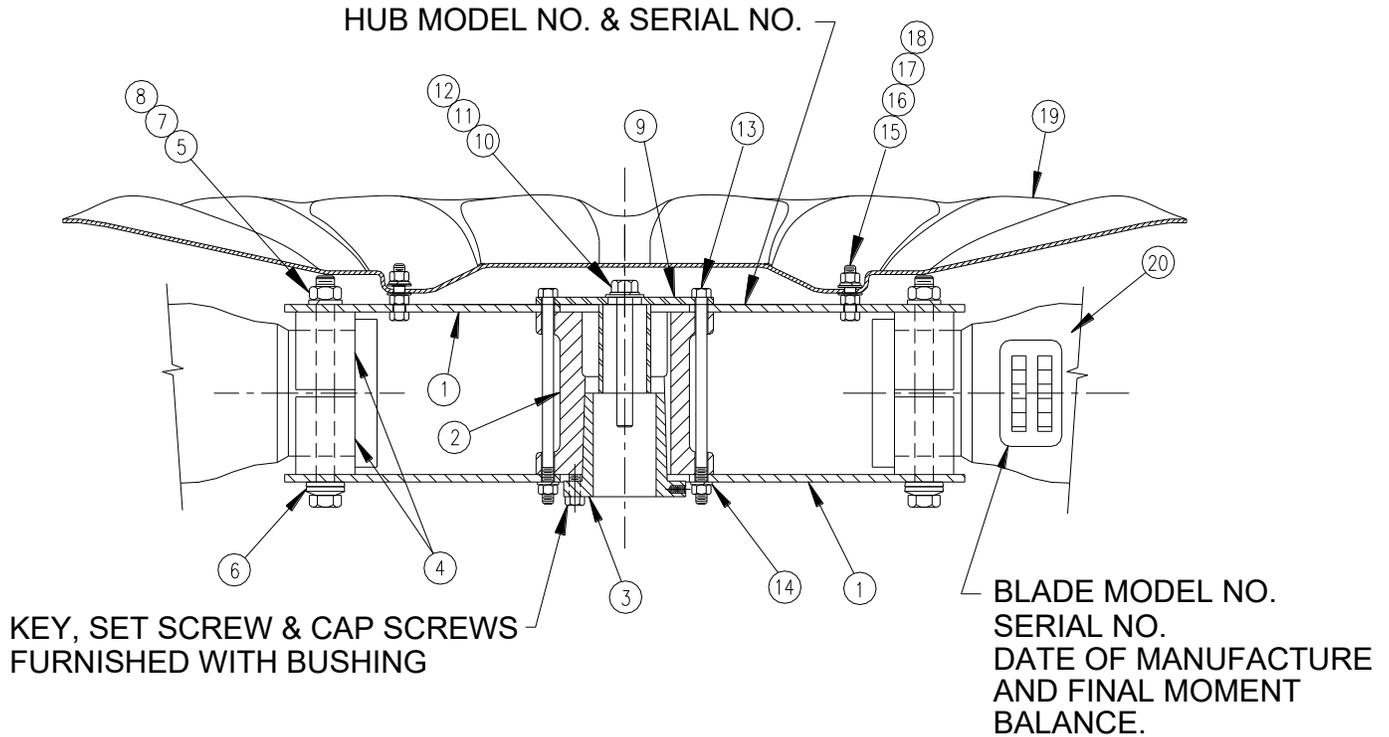
Check motor power consumption to be sure fan is pulling desired load. **CAUTION:** If positive pitch is set in summer to use all available motor amps (nameplate rating), motor could be overloaded in winter. Design pitch angles usually do not use all of the available motor horsepower. This ensures that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

**Parts List**  
**HUDSON PRODUCTS CORPORATION**  
**Adjustable Pitch Fan Assembly 11' Thru 15' Diameter**  
**Series 3000KHT HUB**

			NO. OF BLADES													
ITEM	DESCRIPTION	TYPE	PART NO.	4	5	6	7	8	9	10	11	12	13	14	15	
	1" Diameter Thru 2.62" Diameter Shaft	Q-2	11K-14K Hub Assy. No. Part No.	3104H H3410HT	3105H H3510HT	3106H H3610HT	3107H H3710HT	3108H H3810HT	3109H H3910HT	3110H 79210HT	3111H 79212HT	3112H 79214HT	3113H 79216HT	3114H 79218HT	3115H 79220HT	
			15K Hub Assy. No. Part No.	3104HS 79222HT	3105HS 79224HT	3106HS 79226HT	3107HS 79228HT	3108HS7 79230HT	3109HS 79232HT	3110HS 79234HT	3111HS 79236HT	3112HS 79238HT	3113HS 79240HT	3114HS 79242HT	3115HS 79244HT	
	2.68" Diameter Thru 3.62" Diameter Shaft	R-2	11K-14K Hub Assy. No. Part No.	3204H H3420HT	3205H H3520HT	3206H H3620HT	3207H H3720HT	3208H H3820HT	3209H H3920HT	3210H 79211HT	3211H 79213HT	3212H 79215HT	3213H 79217HT	3214H 79219HT	3215H 79221HT	
			15K Hub Assy. No. Part No.	3204HS 79223HT	3205HS 79225HT	3206HS 79227HT	3207HS 79229HT	3208HS 79231HT	3209HS 79233HT	3210HS 79235HT	3211HS 79237HT	3212HS 79239HT	3213HS 79241HT	3214HS 79243HT	3215HS 79245HT	
1	Hub Plate (2 Per Hub)	Q-2	11K-14K Part No.	C3216	61705	C3216	61707	C3216	C3399	C3410	C3411	C3412	C3413	C3414	C3415	
		R-2		C3215	61715	C3215	61717	C3215	C3299	C3400	C3401	C3402	C3403	C3404	C3405	
		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		
		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 1/2" (Mech. Galv.)		79326	8	10	12	14	16	18	20	22	24	26	28	30	
6	Belleville Spring Washer, 5/8"ID x 1 5/16"OD x 0.098"THK,301SS		78104	16	20	24	28	32	36	40	44	48	52	56	60	
7	5/8" Hex Nut (Mech. Galv.)		72086	8	10	12	14	16	18	20	22	24	26	28	30	
8	5/8" Lock washer (Mech. Galv.)		73730	8	10	12	14	16	18	20	22	24	26	28	30	
9	Stop Plate Sub-Assembly	Q-2	65007	1	1	1	1	1	1	1	1	1	1	1	1	
		R-2	65008													
10	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	
11	3/4" Lock washer (Mech. Galv.)		73738	1	1	1	1	1	1	1	1	1	1	1	1	
12	3/4" Flat Washer (Mech. Galv.)		73640	1	1	1	1	1	1	1	1	1	1	1	1	
13	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	
14	3/8" Lock washer (Mech. Galv.)		73723	6	6	6	6	6	6	6	6	6	6	6	6	
15	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	
16	3/8" Flat Washer (316 SS)		73623	4	4	4	4	4	4	12	12	12	12	12	12	
17	3/8" Lock washer (316 SS)		73722	4	4	4	4	4	4	6	6	6	6	6	6	
18	3/8" Hex Nut (316 SS)		72050	4	4	4	4	4	4	12	12	12	12	12	12	
19	50" Dia. Hi Temp Seal Disc (11K-14K with 4-9 blades)		D3439 HT	1	1	1	1	1	1							
	53" Dia. Hi Temp Seal Disc (11K-14K with 10-12 Blades)		81114HT							1	1	1				
	64" Dia. Hi Temp Seal Disc (11K-14K with 13-15 Blades and 15K with 4-15 Blades)		81115HT										1	1	1	
20	Tuf-Lite III <sup>®</sup> Hi Temp Fan Blade (Red)		Varies	4	5	6	7	8	9	10	11	12	13	14	15	

**HUDSON PRODUCTS CORPORATION**  
**Adjustable Pitch Fan Assembly 11' Thru 15' Diameter**  
**Series 3000KHT HUB**



**STANDARD MATERIALS & FINISHES**

**Blades:** Fiberglass reinforced epoxy  
**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:



# **HUDSON**

## **Products Corporation**

9660 Grunwald Rd.

Beasley, Texas 77417-8600

Phone: 281-396-8100

Fax: 281-396-8388

1-800-634-9160 (24 Hours)

[EMAIL: HUDSONPRODUCTS@HUDSONPRODUCTS.COM](mailto:HUDSONPRODUCTS@HUDSONPRODUCTS.COM)

<http://WWW.HUDSONPRODUCTS.COM>

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