

INSTALLATION MANUAL



Hudson Auto-Variable® Hubs and Tuf-Lite® Fan Blades

Hudson Auto-Variable® (AV) hubs feature Timken tapered roller bearings and synthetic lubricants. All components are suitable for high and low temperature operation and are interchangeable (except hub bodies) in 4, 5, or 6 blade configurations. Hudson AV hubs are durable and designed for low maintenance and energy saving operation.

Hudson Tuf-Lite® fan blades are made from fiberglass reinforced epoxy resin having a very high strength-to-weight ratio and corrosion resistance.

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
- Retainer Ring Tool (Hudson Provided)
- 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
- Dial Indicator

INSTALLATION PROCEDURES

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

ASSEMBLY WITH BUSHING

Slide bushing and key onto straight fan shaft. Depending on shaft size, an R-2 bushing or a Q-2 bushing will be supplied. Tighten set screw in R-2 bushing flange to lock it on shaft. Q-2 bushings have no set screw. Set coupling squarely on bushing and install the three (3) 3/8" cap screws (See Figure 1). Use torque wrench with 9/16" socket, tighten bolts evenly to recommended standard of 29 ft-lb (dry).



Figure 1

ASSEMBLY WITH TAPERED SHAFT

Align keyways and install coupling evenly on tapered shaft. Install key in keyways, then install retainer plate. Install 3/4" cap screw and lock washer through coupling into fan shaft. Tighten with 1-1/4" socket torque wrench to 125 ft-lb (lubricated), 130 ft-lb (dry) torque (See Figure 2).



Figure 2

INSTALLATION OF BOTH TAPERED AND STRAIGHT SHAFTS

Clean mating surfaces of hub and coupling or flanged shaft, if used, and apply a light coating of anti-seize and lubricating compound.

Rigidly attach dial indicator and measure the run-out of top face of coupling (See Figure 3). Rotate coupling and check for alignment. ***Adjust coupling until run-out is less than 0.003".***

MINIMUM VIBRATION
***THE FOLLOWING FOUR STEPS ARE
EXTREMELY CRITICAL***

Rigidly attach dial indicator to the air line support or other stationary object. Measure run-out of the rotary joint (See Figure 5). Rotate hub 360° to locate point of minimum reading on the dial; set indicator to read zero at this point.



Figure 3



Figure 5

Install hub onto coupling and fasten in place with the four (4) 3/4" cap screws and lock washers used on the hub-shipping pallet (See Figure 4). Make sure coupling is pulled down evenly. Tighten cap screws to recommended standard of 125 ft-lb (lubricated) or 130 ft-lb torque.

Rotate coupling 360° while watching indicator at rotary joint for misalignment reading. Total indicated run-out should be 0.005". If run-out is over 0.005", mark low point on face of coupling. Install shims under hub at low point (See Figure 6). **THIS STEP IS EXTREMELY CRITICAL FOR MINIMUM VIBRATION.**

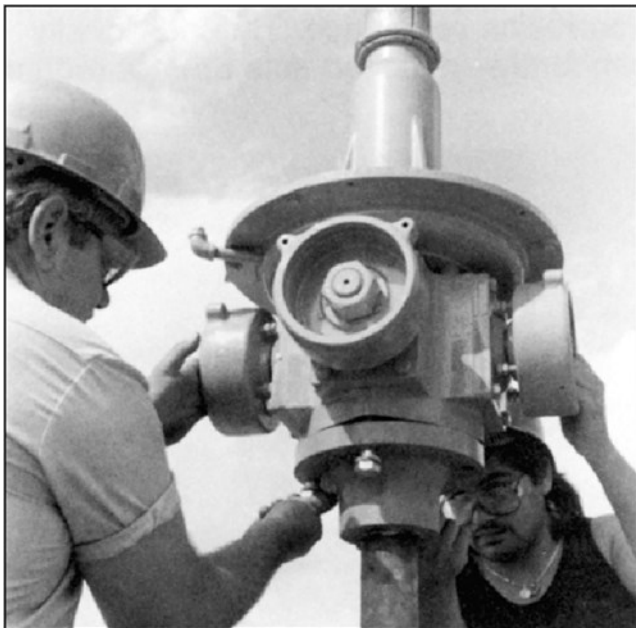


Figure 4

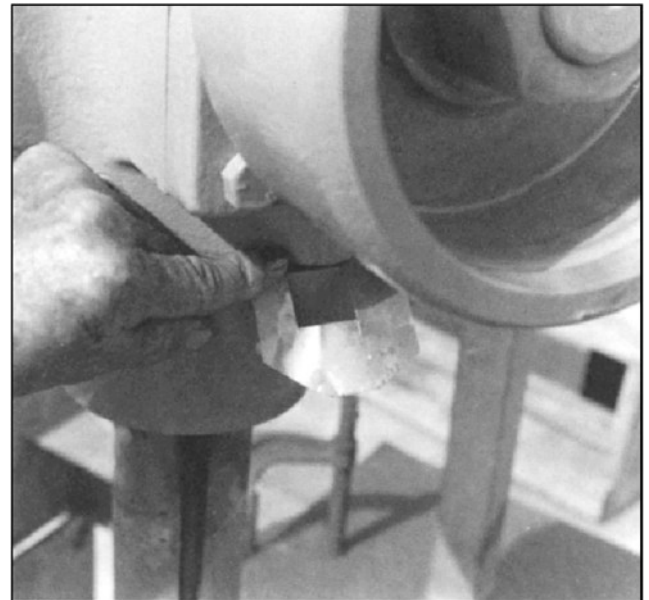


Figure 6

LOOSEN SCREWS AND REMOVE RINGS

Unscrew jam nuts back to near the heads of 3/8" blade socket cap screws. Remove lock screws in top and bottom retainer rings. Mark retainer ring and blade socket at the center to indicate lock screw position. Use retainer ring tool to remove individual blade retainer ring halves. Insert end of tool into hole in end of retainer ring half and pry ring out of blade socket (See Figure 7). If tool is not available, a 1/4" hook bent on the end of a piece of 1/8" diameter wire will work.



Figure 7

INSTALLATION OF TUF-LITE II® BLADES INTO TUF-LITE® HUBS

To mount Tuf-Lite II® blades into original Tuf-Lite® blade sockets, use H-blade adapter. Install both halves of adapter over blade. Make sure flange of blade is against inside shoulder of adapter. Tighten 3/8" cap screws to recommended standard of 23 ft-lb (lubricated) or 30 ft-lb (dry) torque (See Figure 8).

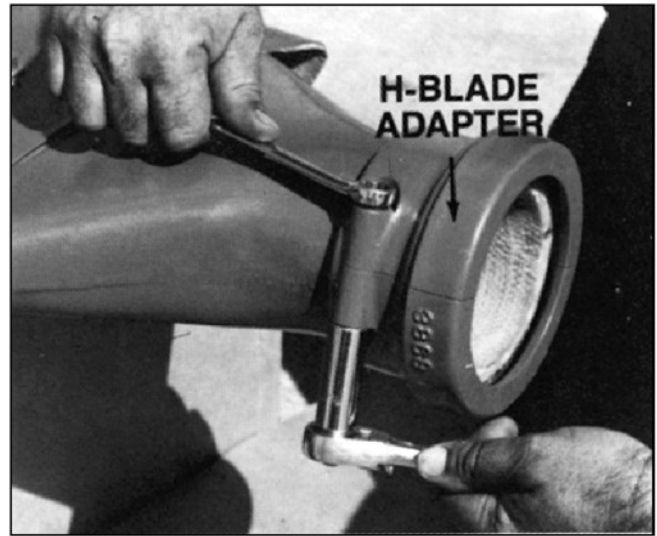


Figure 8

INSTALL BLADES IN HUB SOCKETS

Place blade in hub socket. If you are using H-blade adapter with Tuf-Lite II® blades, make sure that split in adapter is horizontal. Position blade's thick leading edge to left and thin trailing edge to right as you stand at end of blade. Insert blade shank into socket far enough to allow blade retainer ring halves to be "snapped" into place.

Insert one end of retainer ring into groove and rotate ring into groove with end of screwdriver (See Figure 9). Make sure rings are seated properly in groove and that mark drawn on ring lines up with mark on socket. Gaps between upper and lower retainer ring halves should be equal.



Figure 9

Install lock screw into each retainer ring half. Hold ring in place with screwdriver while tightening screws (See Figure 10). Hand tightens the blade socket cap screws. **DO NOT TIGHTEN JAM NUTS.**

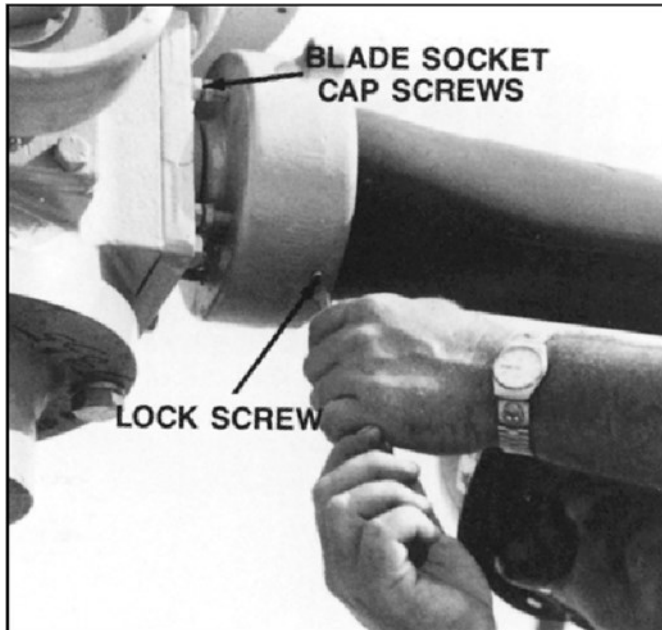


Figure 10

INSTALL SEVERE DUTY RETAINING RING (OPTIONAL EQUIPMENT)

If included, place severe duty retainer (SDR as shown in Figure 10A; for old recessed-ear hubs, both the old 65289 SDR and the D3246 retrofit spacer are required) into the blade socket cavity by either pushing it directly into position on top of socket or by pushing it into the blade socket at 90° to one side and then rotating it into position on top (12:00) side. Refer to the following Figures 10A, 10B or 10C.



Figure 10A

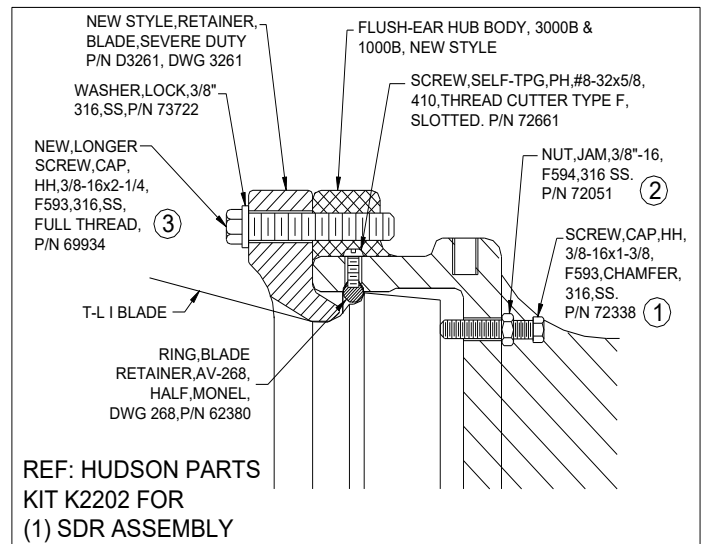


Figure 10B (new style hub & SDR)

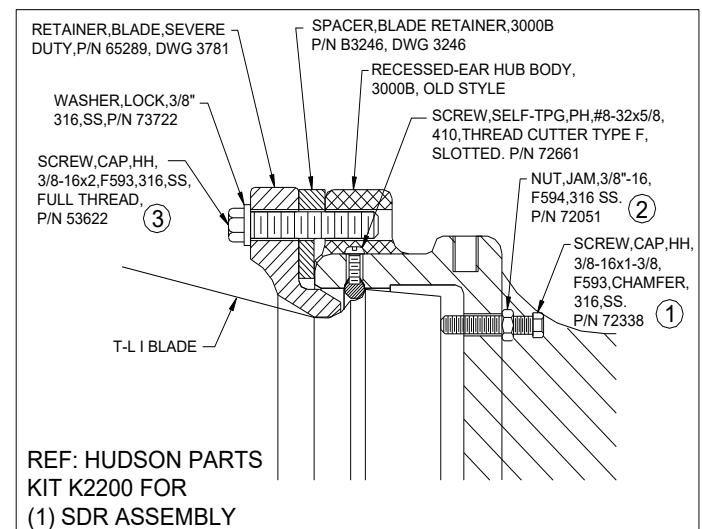


Figure 10C (old style hub & retro-fit SDR)

It may be necessary to partially loosen the four (4) blade socket cap screws (labels 1 & 2 in Figure 10B and/or jostle the blade slightly to initially place the SDR part into its assigned position as shown in Figure 10B or 10C.

Now insert the two (2) 3/8" cap screws (labeled 3 in Figure 10B or 10C) and lock washers into the SDR and finger tighten only.

Note A: The four (4) blade socket cap screws and the two (2) SDR cap screws are maintained finger-tight until the blade(s) is (are) adjusted for both blade pitch and blade track. After a gradual trial & error series of adjustments, occurring in subsequent portions of this manual, these same cap screws shall at completion achieve final tightness to specified torque values.

SET PITCH AND TRACK

Use Hudson EXACT-A-PITCH® digital protractor (See Figure 11) 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 a mid-point between high and low pitch readings, and set pitch at that point.



Figure 11

Rotate blade in socket 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.* For reverse acting hubs (fails to minimum air flow on loss of instrument air pressure), pitch angle should be set with 15 psi instrument signal and 55 psi supply air pressure applied (See "INSTALLING AIR LINES").

After desired pitch angle is set, raise and lower end of fan blade and find midpoint of blade travel. Position blade at the midpoint and pull blade outward so it sits against retainer rings. *Check to see that blade retainer rings are properly seated in both hub and blade grooves.* It may be necessary to back cap screws off about one turn and re-tighten them in order to force ring to fit properly in groove.

Tighten the four (4) blade socket cap screws by alternating the sequence of tightening (as if tightening lug nuts on a car wheel). The torque applied to any one (1) cap screw shall be no more than 5 ft-lb, greater than the torque on any of the other three (3) cap screws during the tightening process. All cap screws are to be tightened to recommended standard of 15 ft-lb (lubricated) or 20 ft-lb (dry). Make sure shoulder on blade neck fits tightly into and against retainer ring. **DO NOT OVERTIGHTEN CAP SCREWS.** After cap screws are tight, tighten jam nuts against socket to recommended standard of 15 ft-lb (lubricated) or 20 ft-lb (dry) (See Figure 12).

Note B: If a severe duty retainer (SDR, Figure 10A) is used, it may be necessary to loosen the SDR fasteners as necessary for proper retainer ring seating at the outset. See cap screws labeled as (3) in Figure 10B or 10C.

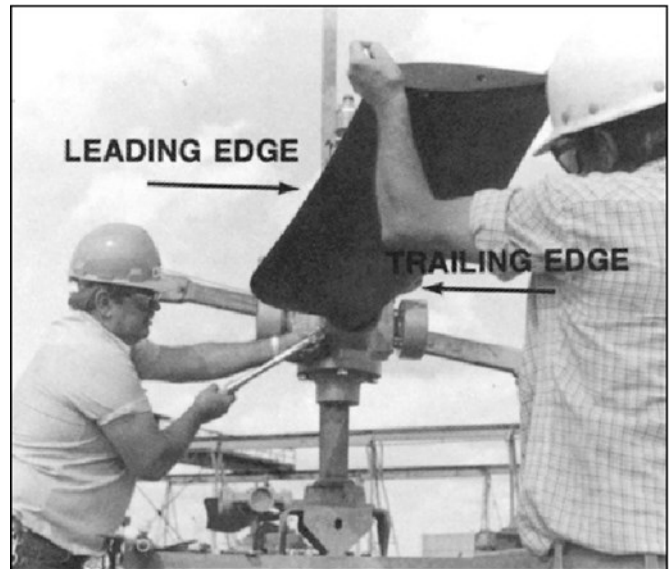


Figure 12

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 procedures above. After tightening bolts, mark top end of each blade in same place marked. If marks differ by 1" or more, adjust blade.

Note C: It is more important to positively seat the retainer ring pair into the blade shank ring groove than to achieve perfectly consistent tracking between all blades. If there is a conflict in achieving both blade seating and blade tracking, ignore the tracking specification.

CHECK TRACK

After fan is installed in fan ring, outline top end of each blade onto fan ring with a marker (See Figure 13). The difference between levels of highest and lowest outlines should be within $\pm 1"$. To raise blade track, loosen blade socket cap screws on top half of socket and tighten cap screws on bottom half. To lower blade track, loosen bottom screws and tighten top ones. Tighten 3/8" cap screws to recommended standard of 15 ft-lb (lubricated) or 20 ft-lb (dry) torque. Re-tighten jam nuts after adjustment.



Figure 13

Note D: It is more important to positively seat the retainer ring pair into the blade shank ring groove than to achieve perfectly consistent tracking between all blades. If there is a conflict in achieving both blade seating and blade tracking, ignore the tracking specification.

COMPLETE SEVERE DUTY RETAINER (SDR) INSTALLATION (OPTIONAL EQUIPMENT)

If the SDR is installed, the blade socket jam nuts & blade socket cap screws (labeled 1 and 2 in Figure 10B, 10C) must now be finally tightened to the recommended standard of 15 ft-lbs (lubricated) or 20 ft-lbs (dry) and the SDR cap screws (labeled 3 in Figure 10B, 10C) must now be finally tightened to 20 ft-lbs (lubricated) or 25 ft-lbs (dry).

FINAL INSTALLATION CHECK (IMPORTANT)

Double check and make final adjustments as necessary by essentially going through the provisions of those paragraphs entitled “Install Blades in Hub Sockets” on page 4 through “Complete Severe Duty Retainer Installation” on page 7 inclusively.

In so doing, one shall check the following setup criteria for all blade positions:

0. Blade seated in hub socket.
1. Retainer rings fully seated in blade neck grooves and hub socket grooves.
2. If applicable, SDR's properly mounted into hub sockets and onto blade necks.
3. Blade pitch set within ± 0.2 degrees of design value.
4. Tracking, if possible (see note above), set within $\pm .375$ " (3/4" max spread).
5. All (4 per blade pos) blade retainer cap screws torqued to spec, 15 ft-lbs (lubricated) or 20 ft-lbs (dry).
6. All (4 per blade pos) blade retainer cap screws jam nuts torqued to spec, 15 ft-lbs (lubricated) or 20 ft-lbs (dry).
7. If applicable, SDR cap screws torqued to spec, 20 ft-lbs, (lubricated) or 25 ft-lbs (dry).

INSTALL SEAL DISC

Making sure hole in seal disc is over oil filler assembly, fasten seal disc to top of hub with six (6) 3/8" cap screws (See Figure 14). Put flat washer against seal disc and lock washer between flat washer and cap screw. Tighten to recommended standard of 15 ft-lb (lubricated) or 20 ft-lb (dry). Make sure seal disc is not inverted and not touching blades.



Figure14

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 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 (ft)	Minimum	Maximum
6' through 9'	1/2"	1/4"
>9' through 11'	5/8"	1/4"
>11' through 14'	3/4"	1/4"

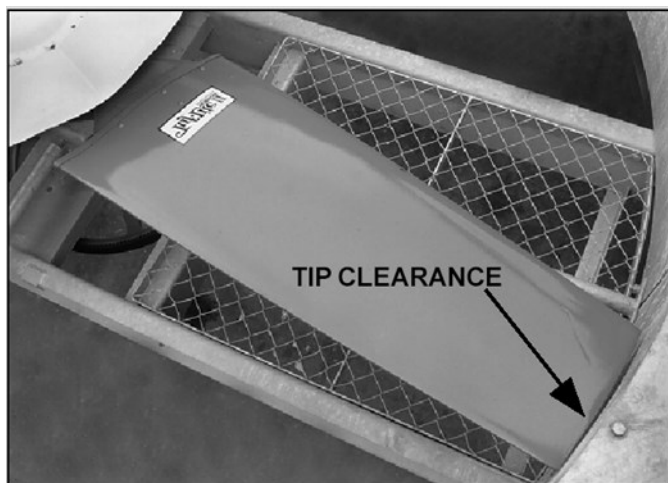


Figure 15

Adjust fan ring for proper clearance at all points around its circumference. To increase clearance, add spacers at fan ring joints. Use a chisel to maintain correct distance until bolts on ring are re-tightened (See Figure 16).



Figure 16

If a small adjustment is needed, tighten or loosen nut on fan strut in area of incorrect clearance (See Figure 17). Make sure to re-tighten inside jam nut.



Figure 17

INSTALLING AIR LINES

Remove protective shipping cover and install air line(s).

All 1000 series hubs are shipped completely pre-adjusted for specified spring pre-load and pitch travel.

ROTARY JOINT

Hook up instrument line to connection on rotary joint (See Figure 18).



Figure 18

Rotary joint assembly which is used to deliver controlled pressure to hub has mechanical seal with ball bearings to assure alignment. It is very important that the air line is installed with some slack.

IMPORTANT: Do not pull air line to rotary air joint tight when installing hub. Instrument air pressure should be 3-15 psi.

VALVE POSITIONER

Connect instrument line to connection marked INSTRU. Connect supply line to connection marked SUPPLY (See Figure 19). Instrument line hookup is all that is necessary before operating. Instrument air pressure should be 3-15 psi. Valve positioners are adjusted for 3 psi instrument starting point. Supply air pressure should be set to level according to table below.



Figure 19

BIAS RELAY

Connect both supply and instrument lines. Check instructions included with bias relay. If problems are encountered, contact Hudson fan engineer. Instrument air pressure should be 3-15 psi. Bias relays are adjusted for 3 psi instrument starting point. Supply air pressure should be set to level according to table below.

OPERATING INSTRUCTIONS

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

Check motor power consumption to make 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 available horsepower; therefore, motors will not be overloaded at lowest winter temperatures if preset pitch remains unaltered.

HUB MAINTENANCE

Hub is designed for oil lubrication and is filled with Summit Syngear 7150 or Shell Omala RL 150 synthetic oil for minimum oxidation and very low evaporation over wide temperature ranges. For minimum maintenance, Hudson strongly recommends using only syn-thetic oil. Under normal conditions oil level should be checked on a yearly basis.

The rotary joint requires yearly re-lubricating. Fill bearings with Dow Corning 44 synthetic grease through zerk fitting. Saturate felt oiler in seal with Summit Syngear 7150 or Shell Omala RL 150 synthetic oil.

If valve positioner is supplied, remove rotary joint and lubricate range spring sub-assembly with Dow Corning 44 or some other syn-thetic grease yearly.

If further Auto-Variable hub clarification is needed see "Auto-Variable Maintenance Manual"

SUPPLY PRESSURE FOR VALVE POSITIONER OR BIAS RELAY

Hub Type	Fan Diameter (ft)	Blade Type	Hub Spring	Supply Pressure (psi)	
				To Vary Pitch	To Check Blade Pitch Travel at Rest
Standard Acting Hub	8	B, C, D or H	Yellow	35	45
	9-14	B, C, D or H	White	45	55
	16-20	B or H	Brown/Black	75	85
	All Sizes	W, HW	Brown/Black	75	85
Reverse Acting Hub	All Sizes	All	White	45	55

PARTS LIST

Tuf-Lite® Fans - Auto-Variable® Hubs

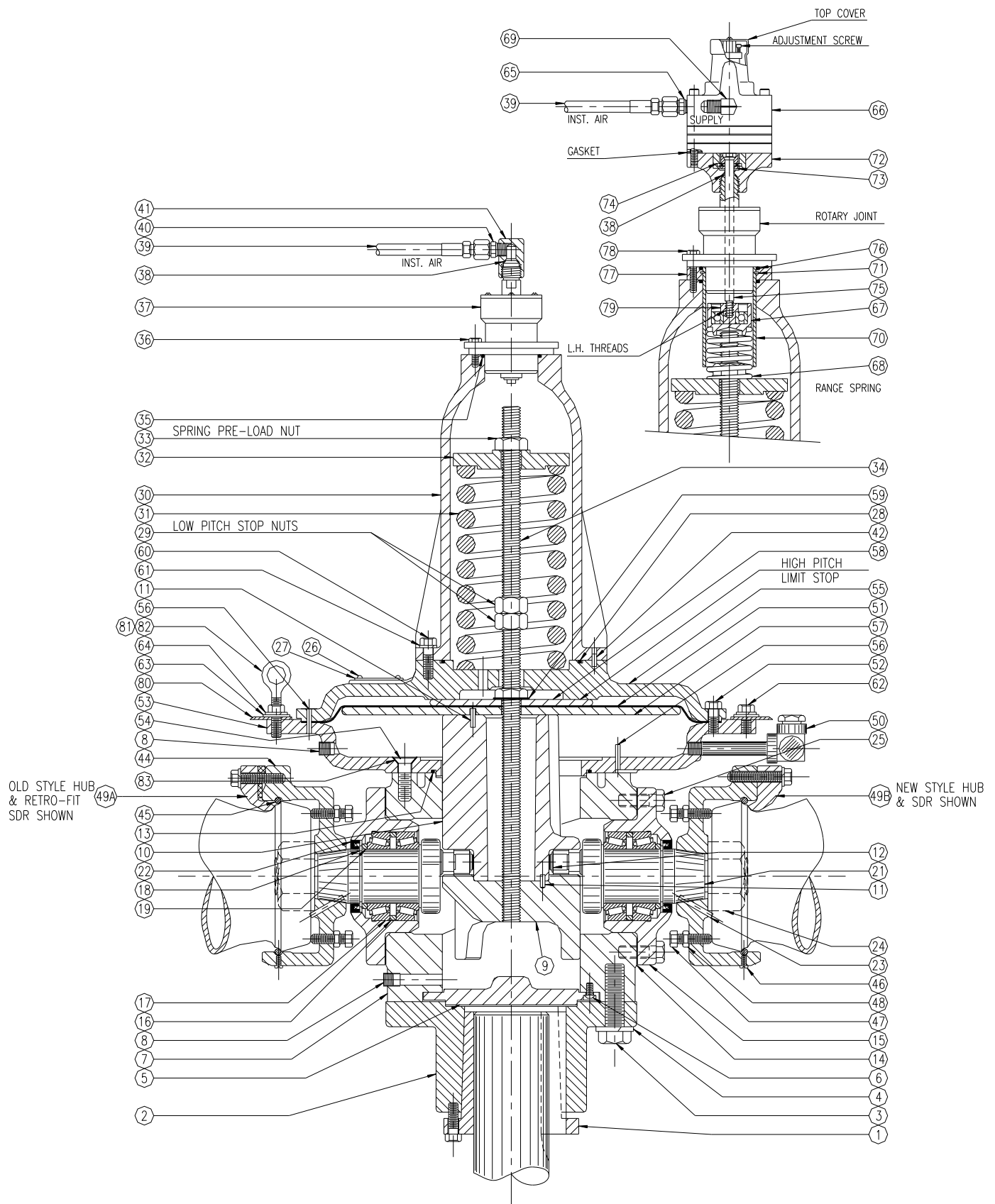
1000B Series

ITEM NO.	P/N	DESCRIPTION	QTY. BLDS PER HUB		
			4	5	6
1	Specify Bore	Q2 Bushing (up to 2 5/8 bore) R2 Bushing (2 11/16 to 3/5 bore)	1	1	1
2	65450 65455	Coupling for Q2 Bushing Coupling for R2 Bushing (Specify Bushing)	1	1	1
3	72424	Cap Screw, 3/4 NC x 2 1/2	4	4	4
4	73738	3/4" Lock Washer	4	4	4
5	65425	Seal Plate	1	1	1
6	70505	Bolt, Stove, Rnd H, 1/4 x 1/2 L.	4	4	4
7	65128 65129 65130	Hub Body, 4 Blades Hub Body, 5 Blades Hub Body, 6 Blades	1	1	1
8	71405	1/4 NPT Pipe Plug	2	2	2
9	65272	Lower Piston	1	1	1
10	65270	Upper Piston	1	1	1
11	74423	Roll Pin 3/16 x 1/2	3	3	3
12	K2030 62210 65175 73331	Actuator Bearing Assembly Consisting of: 1 – Actuator Stud 1 – Actuator Bearing 1 – Retainer Ring	4	5	6
13	73114	Oil Seal Silicone O-Ring #2-258	1	1	1
14	62703	Bearing Housing Gasket	4	5	6
15	65200	Bearing Housing	4	5	6
16	65216	Bearing Spacer	4	5	6
17	70180 70181	Roller Bearing Cup Roller Bearing Cone	8	10	12
18	73332	Retainer Ring	4	5	6
19	65217	Support Washer	4	5	6
20	62369	Bearing Shim (as required)	4	5	6
21	65240	Blade Shaft	4	5	6
22	73475	Bearing Housing Oil Seal	4	5	6
23	74432	Roll Pin 3/16 x 1 1/2	4	5	6
24	72126	Blade Shaft Nut	4	5	6
25	72376	Cap Screw, Self Locking	16	20	24
26	72610	Drive Screw	4	4	4
27	62750	Name Plate	1	1	1
28	73250	Silicone O-Ring #2-253	1	1	1
29	72110	Low Pitch Stop Nut	2	2	2
30	65150	Spring Housing	1	1	1
31	63115 63116 63117 63101	Spring (To Suit Fan Dia.) W - White HH Inner – Black HH outer – Brown H - Yellow	1	1	1
32	63126	Spring Washer	1	1	1
33	72110	Spring Preload Nut	1	1	1
34	K2080	Spring Rod Assembly	1	1	1
35	73213	Silicone O-Ring #2-227	1	1	1
36	72312	Cap Screw 1/4 NC x 1	6	6	6
37	64100	2702D Rotary Joint Assembly	1	1	1
38	64530	Copper Flare Gasket	1	1	1
39	62215	Air Hose	1	1	1
40	64535	Male Connector	1	1	1
41	65300	Rotary Joint Adapter	1	1	1
42	74423	Roll Pin 3/16 x 1/2	1	1	1
43					
44	65020	Blade Socket	4	5	6
45	62380	Blade Retainer Half	8	10	12
46	72661	Retainer Ring Lock Screw	8	10	12
47	72338	Cap Screw 3/8 NC	16	20	24
48	72051	Jam Nut 3/8 NC	16	20	24

ITEM NO.	P/N	DESCRIPTION	QTY. BLDS PER HUB		
			4	5	6
49A	K2200	Old Style Severe Duty Blade Retainer Assembly (Opt.) Consisting of: 1 – Severe Duty Blade Retainer 2 – Cap Screws 3/8-16x2 2 – Lock Washers 3/8 1 – Blade Retainer Spacer	4	5	6
OR	65289 53622 73222 B3246				
49B	K2202	New Style Severe Duty Blade Retainer Assembly (Opt.) Consisting of: 1 – Severe Duty Blade Retainer 2 – Cap Screws 3/8-16x2 1/4 2 – Lock Washers 3/8			
	D3261 69934 73222				
	62379	Retainer Ring Removal Tool (Not Shown)	1	1	1
50	71066 71064 71065	Oil Filler Assembly 1 – 3/8 NPT Nipple 1 – 3/8 NPT Elbow 1 – 3/8 NPT Plug	1	1	1
51	62599	Silicone Diaphragm	1	1	1
52	72332	Cap Screw, Self Locking	20	20	20
53	65320	Lower Diaphragm Cover	1	1	1
54	72522	F, H. Cap Screw, Self Locking	6	6	6
55	65300	Upper Diaphragm Cover	1	1	1
56	74430	Roll Pin 3/16 x 1	1	1	1
57	65290	Bottom Diaphragm Plate	1	1	1
58	65276	Top Diaphragm Plate	1	1	1
59	73495	Air Seal Washer 3/4	1	1	1
60	72342	Cap Screw 3/8 NC x 1 1/4 SS	4	4	4
61	73722	Lock Washer, 3/8	4	4	4
62	72330	Cap Screw 3/8 NC x 5/8, SS	6	6	6
63	73623	Flat Washer 3/8, SS	6	6	6
64	73722	Lock Washer 3/8, SS	6	6	6
		OPTIONAL EXTRA VALVE POSITIONER ASSEMBLY INCLUDES:			
39	62215	Air Hose	1	1	1
65	64535	Male Connector	1	1	1
66	64510	Model 73N12F Positioner (Low Temp/High Temp Diaphragms and O-rings)	1	1	1
67	M2040	Range Spring Holder Sub Assembly	1	1	1
68	64251 64252 64253 64255	Range Spring (as required) 15 Deg. Travel B-W-B 20 Deg. Travel P-W-P 25 Deg. Travel Y-W-Y 30 Deg. Travel R-W-R	1	1	1
69	64540	Male Elbow, 5/16 Tube	1	1	1
70	65515	Range Spring Guide	1	1	1
71	73307	Retainer Ring	1	1	1
	54406	Supply Pressure Regulator 0-100 psi, 1/4 NPT (Not Shown)	1	1	1
72	65525	Base Plate	1	1	1
73	64580	Torque Sleeve	1	1	1
74	64565	Spring Pin (1/8 x 1 1/8)	1	1	1
75	65500	Feedback Rod (5 7/8)	1	1	1
76	73213	Silicone O-Ring Seal #2-227 (Furnished when Rotary Joint Spacer is required)	1	1	1
77	65535	Rotary Joint Spacer 4 Blades: Required when Yellow Hub Spring is used. (1104W, 1204W) 6 Blades: Required when Yellow Hub Spring is used. (1106W, 1206W)	1	1	1
78	72315	Cap Screw, 1/4 NC x 1 1/4 (When Rotary Joint Spacer is required)	6	6	6
79	64525	Bearing Seat	1	1	1
80	81102 81107 81112	Seal Disc 30" Dia. for 6' – 10' AV Fans 38" Dia. for 11' – 12' AV Fans 42" Dia. for 13' – 14' AV Fans	1	1	1
81	70325	Eye Bolt, 3/8-16 x 1 1/4, A489	3	3	3
82	72050	Nut, Hex, 3/8-16, SS	3	3	3
83	64529	Gasket, 5/8 Tube Size	6	6	6

Note:

1. Items 81 & 82 for shop handling only, remove after paint.



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