
MAINTENANCE MANUAL

OPERATING PRINCIPLES

Standard Auto-Variable® Hub

A standard AV hub fails to maximum airflow in event of supply or signal air failure. For most fans a 3-15 psi instrument air signal is used along with supply air to actuate the hub and rotate fan blade pitch. An increase of signal pressure decreases pitch, with a 3 psi signal resulting in maximum pitch and a 15 psi signal resulting in minimum pitch.

A spring inside the hub, which is used to overcome the aerodynamic forces that try to feather the blades, holds the blades at maximum pitch. As instrument air pressure is applied, this spring force is overcome and blade pitch decreases. Thus, the spring is a “fail safe” device, which forces the blade into maximum pitch if instrument or supply air pressure fails.

Reverse Acting Auto-Variable® Hub

A reverse acting AV hub fails to minimum airflow in event of supply or signal air failure. A 3-15 psi instrument air signal is used along with supply air to actuate the hub and rotate fan blade pitch. An increase of signal pressure increases pitch, with a 3 psi signal resulting in minimum pitch and a 15 psi signal resulting in maximum pitch. A spring inside the hub holds the blades at minimum pitch, with the instrument and supply air acting to overcome the aerodynamic forces which try to feather the blades. The maximum pitch angle occurs when the low pitch limit stops against the diaphragm plate. The minimum pitch angle occurs with the diaphragm plate against the high pitch limit stop. If field modification is required, consult Hudson Fan Engineer.

METHODS OF CONTROL

The three basic means of operating the AV fan are:

1. **Rotary Joint:** Using 3-15 psi instrument air alone to control fan pitch is possible only on smaller fans. For larger fans, 30-45 psi variable input air will be required.
2. **Bias Relay** with or without amplification (requires supply air): A bias relay with an adjustable constant pressure added to instrument signal, allows operation of any size fan at nominal extra cost and minimum maintenance. A 30 psi minimum supply air line is required. Instrument “span” again will vary with the size fan but a 3 psi starting point can always be achieved regardless of spring pre-load. Consult Hudson Fan Engineer for this application.
3. **Valve Positioner** (requires supply air): A valve positioner allows faster and more accurate response on any size fan. Span will be 11-12 psi. A 30 psi minimum supply pressure is required. A valve positioner is required for split-range, maximum reverse flow applications or applications requiring $\pm 1\%$ temperature control. More maintenance is required than for scheme 1 or 2 above. (See section on Valve Positioners in this manual.)

AUTO-VARIABLE® HUB ASSEMBLY

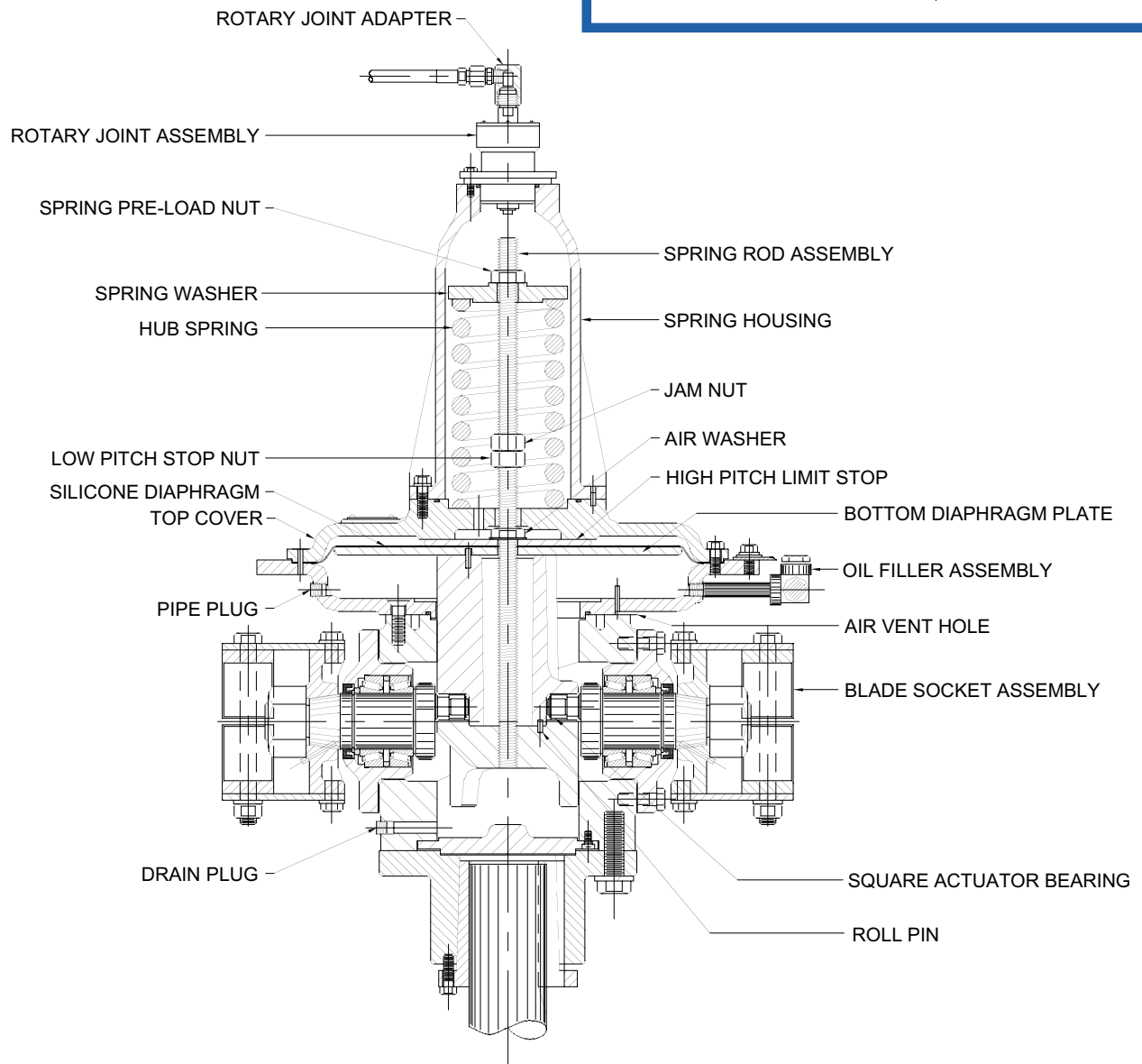
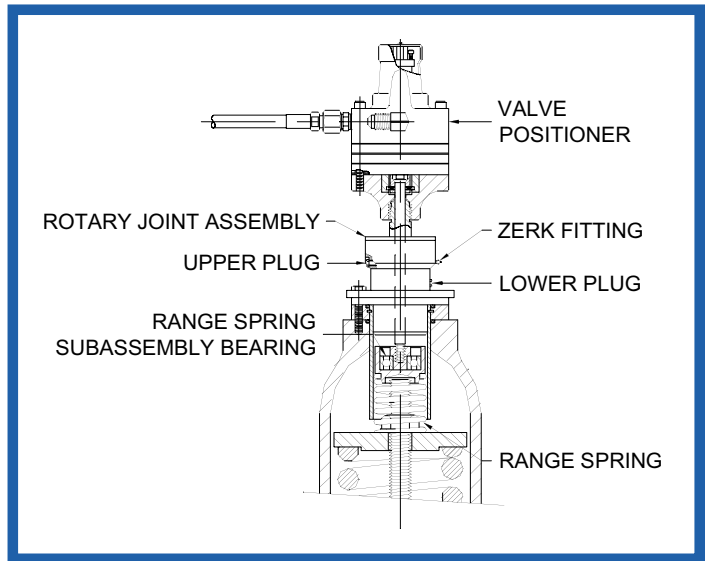


Figure 1

SELECTING FAN PITCH ANGLE

Maximum Pitch (round leading edge down) is usually determined from heat exchanger specifications. It is typically set at or above the design pitch in order to utilize all available motor amperage. Note however, that if maximum pitch is set in summertime to use all available motor amps (nameplate rating) motor could be overloaded in wintertime.

Minimum Pitch (round leading edge up) is normally set to attain minimum or “zero” airflow. This will be about -13° for induced draft units or -8° for forced draft units. Zero pitch is not zero flow. If full reverse flow is desired, the minimum pitch setting will be maximum pitch minus 45°, usually - 35° to -39°.

See repair and maintenance section of this manual for method of adjusting hub pitch stops.

RECOMMENDED MAINTENANCE SCHEDULE

The following maintenance should be performed annually for moderate temperature applications and every six months for high temperature applications.

1. Check hub assembly oil level
2. Grease rotary joint bearing
3. Lubricate rotary joint seal
4. Lubricate range spring sub assembly bearing (if valve positioner used)

Recommended Grease: Dow Corning 44 silicone grease or Amoco Supermil M-125

Recommended Oil: 21st Century Approvis 55 synthetic oil. (Available through Hudson Products Corporation)

<u>Oil Specifications</u>	<u>Alternate Oils Chart</u>
Synthetic Oil 5-10 weight SUS @ 210 °F = 63 @ 100 °F = 279 Viscosity Index = 188	Amoco Syntholube SL 32 Compressor Oil Conoco SYNCON Oil – ISO grade 68 AeroShell Turbine Oil 555 Mobil 1 Synthetic Motor Oil Texaco Royal Blue

Hub Lubrication

This hub is designed for oil lubrication and is filled with approximately 5 quarts of synthetic ester type oil for a minimum oxidation and very low evaporation over wide temperature ranges.

To Check Oil Level: Apply 15 psi instrument air pressure to move piston to lowest position. Remove pipe plug on lower diaphragm cover. Oil should be visible at bottom of plug.

To Drain Oil: Pull filler plug and drain plug. Apply 15 psi instrument air pressure to move piston to lowest position. After oil is drained, reinstall plugs.

To Fill Hub: Remove pipe plug on lower diaphragm cover and filler plug. Do not pull drain plug. Apply air pressure required to move piston to lowest position. Pour oil into filler hole until oil runs out of pipe plug. Reinstall plugs.

Valve Positioner Lubrication

1. Remove rotary joint and add grease to range spring subassembly bearing.
2. On older 1000W and 2000 series hubs, add grease under fiber retainer in range spring holder.
3. Replace rotary joint and tighten _” capscrews to 4-5 ft-lb torque.

To lubricate bearing,

1. Remove upper plug.
2. Fill with Dow Corning 44 silicone grease through zerk fitting.
3. Replace plug.

To lubricate seal,

1. Remove lower plug.
2. Saturate felt oiler with Approvis 55 synthetic oil.
3. Replace plug.

REPAIR AND MODIFICATION

To Check AV Hub Travel:

1. Set instrument air pressure to 3 psi. Measure pitch of blade.
2. Set instrument air pressure to 15 psi. Measure pitch of blade. The difference in pitch is the hub travel.

To Adjust AV Hub Travel:

1. Unhook supply and instrument air lines
2. Remove four (4) 3/8" capcrews and spring housing.
3. Remove range spring (with valve positioner).
4. Loosen spring pre-load nut and remove nut, spring washer and hub spring.
5. Turn hub socket until low pitch stop nuts are at highest setting.
6. Loosen low pitch stop nuts and raise a few inches.
7. Set protractor on hub socket with angle showing 0°.
8. Rotate socket to total required degrees of travel.
Total degrees of travel = maximum pitch angle – minimum pitch angle.
9. Lower low pitch stop nut until it just reaches stop plate. Tighten jam nut. Do not adjust high pitch limit stops.
10. Install hub spring, spring washer and spring pre-load nut.
11. Hold blades at maximum pitch (leading edge down) and tighten spring nut until it just touches spring washer, then tighten additional turns shown in pre-load specification (See Tables 1&2).
12. Replace range spring (valve positioner only) and spring housing. Tighten 3/8" cap screws to 20-25 ft/lbs torque.
13. Operate fan with no air pressure on diaphragm (maximum pitch) and check motor load. If it has dropped below the desired full load reading appreciably, it would indicate that more compression is required on the hub spring.
14. If motor load is OK, install supply and instrument air line(s).

TABLE 1: UNIVERSAL 1000 SERIES HUB SPRING PRE-LOAD SPECIFICATIONS

STANDARD ACTING HUBS						
FAN DIA (FT)	BLADE TYPE	HUB SPRING	PRE-LOAD TURNS	VALVE POSITIONER	SUPPLY PRESSURE (required to vary pitch)	SUPPLY PRESSURE (required to check blade pitch travel at rest)
5-7	B,C	Yellow	8	No	-	-
7	H	Yellow	8	No	-	-
8	B,C,D	Yellow	10	Yes	35 psi	45 psi
8	H	Yellow	10	Yes	35 psi	45 psi
9-14	B,C, D	White	10	Yes	45 psi	55 psi
9-14	H	White	10	Yes	45 psi	55 psi
All Sizes	W, HW	Brown/Black	12	Yes	75 psi	85 psi
16-20	B,H	Brown/Black	12	Yes	75 psi	85 psi
REVERSE ACTION (FAIL TO MIMIMUM AIR FLOW) HUBS						
All sizes	All	White	10	Yes	45 psi	55 psi

TABLE 2: 2000 SERIES HUB SPRING PRE-LOAD SPECIFICATIONS**(The 2000 series hub is now obsolete)**

STANDARD ACTING HUBS						
FAN DIA (FT)	TYPE BLADES	HUB SPRING	PRE-LOAD TURNS	VALVE POSTITIONER	SUPPLY PRESSURE required to vary pitch	SUPPLY PRESSURE required to check blade pitch travel at rest
All sizes	All	White	10	Yes	45 psi	55 psi
All sizes	All	Yellow	10	Yes	35 psi	45 psi
REVERSE ACTION (FAIL TO MIMIMUM AIR FLOW) HUBS						
All sizes	All	Yellow	10	Yes	45 psi	55 psi

To Change the Hub Spring

1. Unhook supply and instrument air line(s).
2. Remove four (4) 3/8" cap screws and spring housing.
3. Remove range spring (with valve positioner).
4. Loosen spring pre-load nut and remove nut, spring washer and main spring.
5. Replace with new spring.
6. Install spring washer and spring pre-load nut.
7. Hold blades at maximum pitch (leading edge down) and tighten spring nut until it just touches spring washer, then tighten additional turns shown in pre-load specification (See Tables 1 & 2).
8. Replace range spring (valve positioner only) and spring housing. Tighten 3/8" cap screws to 20-25 ft/lbs torque.
9. Operate fan with no air pressure on diaphragm (high pitch) and check motor load. If it has dropped below the desired full load reading appreciably, see troubleshooting chart.

1. If motor load is OK, install supply and instrument air lines (with valve positioner) on instrument line (with rotary joint).

To Set Hub Spring Pre-load

1. Unhook supply and instrument air line(s).
2. Remove four (4) 3/8” capscrews and spring housing.
2. Remove range spring (with valve positioner).
4. Loosen spring pre-load nut.
5. Hold blades at maximum pitch (leading edge down) and tighten spring pre-load nut until it just touches spring washer, then tighten additional turns shown in pre-load specification (See Tables 1 & 2).
6. Replace range spring (valve positioner only) and spring housing. Tighten 3/8” capscrews to 20-25 ft/lbs torque.
7. Operate fan with no air pressure on diaphragm (high pitch) and check motor load. If it has dropped below the desired full load reading appreciably, see troubleshooting chart.
8. If motor load is OK, install supply and instrument airlines (with valve positioner) or instrument line (with rotary joint).

To change from standard to reverse acting:

1. Apply 15 psi instrument pressure to hub. Measure minimum pitch angle.
2. Drain oil from hub (see Hub Lubrication section in this manual).
3. Disconnect air pressure.
4. Remove fan blades.
5. Remove four (4) bolts securing each bearing housing.
6. Remove the bearing housing/blade socket assembly. Note that the square actuator bearing was originally installed with its offset to the right of the shaft centerline. Reverse it to the left of the shaft centerline and reinsert it into the groove of the piston.
7. Repeat for all blade shaft bearing assemblies. Tighten blade socket bolts to 65 ft/lb. torque.
8. Reinstall blades to minimum pitch angle measured in step 1. If in doubt subtract range spring travel from original design pitch angle (See Table 3).
9. Refill hub with oil. See Hub Lubrication section in this manual.
10. Reinstall air line(s).
11. Check hub travel. Blades should be at minimum pitch angle (round leading edge up) at zero air pressure and rotate counterclockwise with the increase of instrument air pressure. At 15 psi they should be at maximum pitch angle (round leading edge down). If operation OK, modification is complete.

TABLE 3: RANGE SPRING COLOR CODES

2000 Series Hubs	1000W Series Hubs	Range Spring Travel
White-None-White	Black-White-Black	15°
Black-White-Black	Purple-White-Purple	20°
Purple-White-Purple	Yellow-White-Yellow	25°
Yellow-White-Yellow	Red-White-Red	30°
White-Green-White	Orange-White-Orange	45°

To Remove AV Hub from Tapered Shaft:

1. Remove four (4) _” capscrews and remove hub from coupling.
2. Remove _” lockscrew to prevent damage to threads.
3. Remove coupling with wheel puller.

To Check Diaphragm for Leaks:

1. Locate vent hole on bottom side of diaphragm housing.
2. Apply 15 psi signal pressure on hub to rotate hub to minimum pitch and hold air pressure on hub.
3. Cover hole with soap solution or a leak detector. If air continuously leaks through vent, diaphragm has a leak.

To Remove and Replace the Silicone Diaphragm

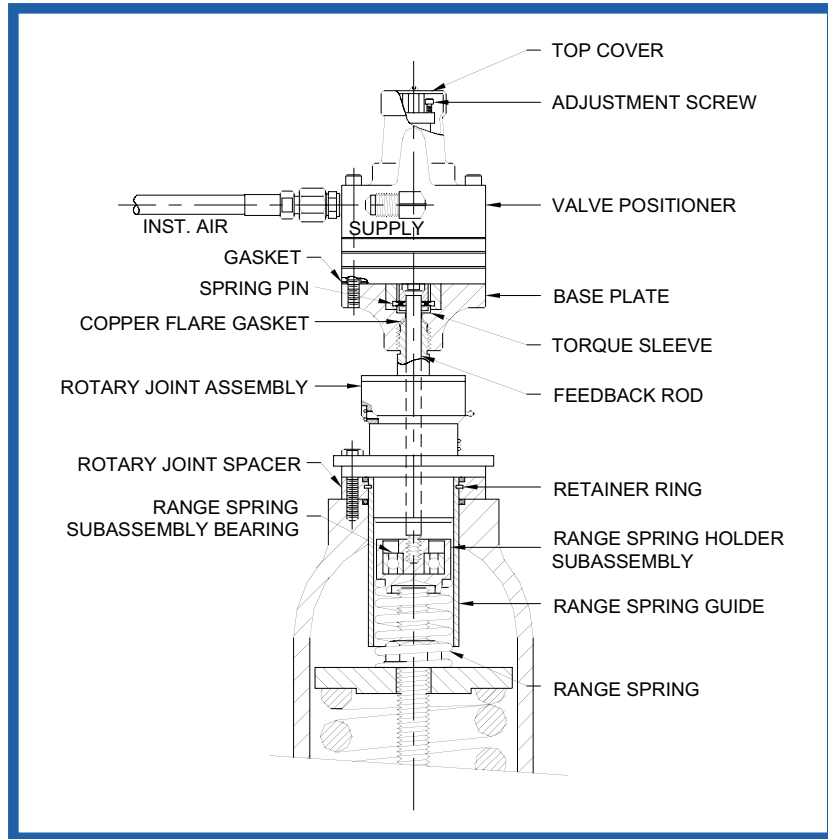
1. Remove four (4) 3/8" capscrews on spring housing and remove spring housing.
2. Take turns off hub spring pre-load nut. Count number of turns and record.
3. Remove spring.
4. With hub at maximum pitch (blade leading edge down), measure from bottom jam nut to top of cover (spring rod all the way up). Note measurement to reset hub at same travel. Remove jam nuts.
5. Remove twenty (20) 3/8" capscrews on top cover and remove top cover. Can use socket on hub. Turn hub to maximum pitch and knock cover loose.
6. With hub at maximum pitch, lift silicone diaphragm and catch diaphragm plate with vise grips. Unscrew spring rod and remove.
7. To install new diaphragm, make sure all actuator bearing blocks are flat on top of the piston sleeve. Make sure roll pin in piston lines up with piston sleeve.
8. Install diaphragm plate. (Make sure plate is clean and plate lines up on roll pin.)
9. Lay on new diaphragm and line up holes. Lay bead of silicone rubber $\frac{1}{8}$ " inch around hole in diaphragm. Install top plate and install air washer on spring rod. Brush grease on air washer.
10. Raise to high pitch and catch diaphragm plate with vise grip and install and tighten spring rod.
11. Turn hub to low pitch and turn diaphragm holes where diaphragm holes are offset to right of threaded holes in bottom cover (will just see edge of threads).
12. Place top cover over match mark and diaphragm holes. Place nineteen (19) capscrews in top cover holes. (Do not start threads). Raise hub to high pitch while looking through holes in cover where bolt is missing. Turn socket slowly until bolts drop in diaphragm. Hold up and hand start all twenty (20) cap screws.
13. Raise up and down to maximum and minimum pitch several times to stretch diaphragm. After screws are started, check edge of top cover to make sure diaphragm is under cover. If not, use screw driver to press diaphragm under cover.
14. Hold at maximum pitch. Install hub spring, spring washer and nut and hand tighten. Add three (3) turns preload.
15. Tighten twenty (20) 3/8" capscrews in pairs opposite each other to 20-25 ft-lb torque.
16. Take off hub spring and hold in high pitch. Replace jam nuts and set at measurement noted in **step #4**. Jam nuts together.
17. With hub still at maximum pitch, install hub spring, washer and nut. Hand tighten nut, then replace preload turns removed in **step #2**. Make sure the "O" ring is in top cover.
18. Replace spring housing over roll pins and install four (4) 3/8 cap screws.
19. Apply air pressure and check for leaks.
20. Check oil level.
21. If hub has valve positioner, recheck starting point. If starting point is incorrect reset starting point. See section on Valve Positioner in this manual.
22. Hub is ready to turn.

VALVE POSITIONER

To install valve positioner,

Note: Make sure maximum pitch angle of blades is sufficient to pull desired motor amps. If not, readjust blades to higher angle before installing positioner.

1. Disconnect instrument air line from rotary joint.
2. Remove rotary joint and spring housing.
3. Unscrew hub spring pre-load nut.
4. Remove spring washer and hub spring.
5. Check maximum pitch angle (blade leading edge down) using bevel protractor at blade tip. Check minimum pitch angle (blade leading edge up).
6. Select proper range spring. Total pitch travel is defined as maximum pitch minus minimum pitch. Select the range spring with the nearest larger travel from Table 3.
Example: $+10^{\circ}$ minus -13° = 25° total pitch travel. From Table 3 a Yellow-White-Yellow spring is chosen for a 1000W AV Hub.
7. Hold blades at desired minimum pitch angle and adjust low pitch limit stop nut until it just contacts hub. Tighten jam nut to secure.
8. Install hub spring and spring washer. Turn sockets to maximum pitch (so spring rod is all the way up). Tighten pre-load nut hand tight until it just contacts spring washer.
9. Install spring housing (with O-Ring).
10. Install rotary joint spacer, addition o-ring and $\frac{1}{2}$ " NC x 1- $\frac{1}{2}$ " cap screws. (Rotary joint spacer not required for 15° range spring.)
11. Install range spring guide with retainer ring into spacer or directly into spring housing if spacer is not used.
12. Install range spring selected in step 6 onto range spring holder with a counter-clockwise wringing motion. Range spring holder will be packed with grease as shipped; if not add grease to bearing. Add grease under fiber retainer in range spring holder on 2000 and older 1000W series hubs. Install range spring holder sub-assembly in spring housing, so that range spring sits on spring washer.
13. Unscrew rotary joint adapter from rotary joint shaft, if installed.
14. Install copper flare gasket on rotary joint shaft and screw on base plate. Tighten securely as the joint must be airtight.
15. Insert feedback rod into torque sleeve and install 1-1/8" long spring pin. Space spring pin evenly.
16. Slip rod and torque sleeve into rotary joint shaft and engage spring pin into slots of base plate.
17. Install range spring holder subassembly on other end of feedback rod. Use a $\frac{1}{2}$ " wrench. Note: These are left hand threads.
18. Install gasket for valve positioner and using 6 cap screws provided. Install valve positioner on base plate. Recess in torque sleeve fits over nut on end of valve positioner shaft.
19. Using sealing compound or pipe dope, install male elbow into "supply" port and male connector into "instru" port. Align connectors as shown on diagram.
20. Install valve positioner assembly, which now includes rotary joint, into spring housing. Make sure bearing seat engages thrust bearing in range spring holder. Use care to prevent damage to O-ring seal.
21. Install six cap screws with 7/16" wrench. Torque to 4-5 ft-lb.
22. Install instrument air hose (3-15 psi) to connection marked INSTRU.
23. Install air supply hose to connection marked SUPPLY.
24. Install supply pressure regulator furnished. The supply pressure regulator must be adjusted to 30 psi if yellow hub spring is installed and 45 psi if green or white hub spring is installed. For reverse acting hubs (2104PR or 1106 WPR) use 45 psi with yellow hub spring.



**Valve Positioner Assembly
Figure 2**

NOTE: The standard range springs provide a 12 psi instrument air span (3 to 15 psi). This is not adjustable and is a function of total pitch travel (see step 6) and the range spring selected. The starting point (usually 3 psi) is the only adjustment necessary on the Moore Valve Positioner.

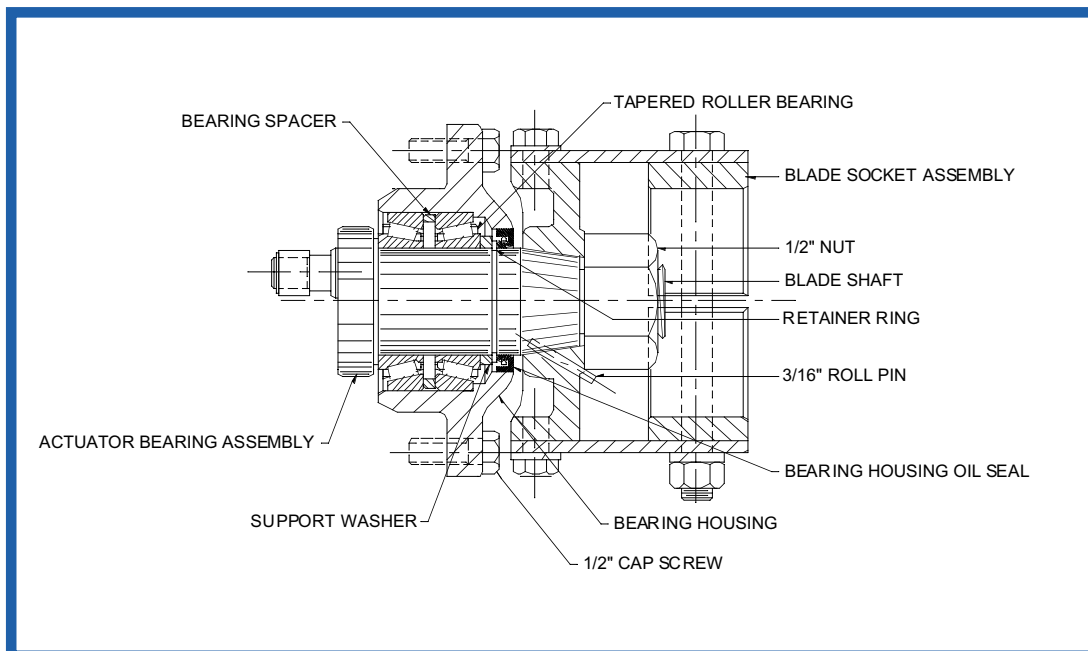
To set Valve Positioner Starting Point,

1. Remove top cap on valve positioner and run adjustment screw all the way down.
2. Apply supply air pressure. Apply 3 psi instrument air pressure. Back off adjustment screw until hub socket just starts to move. Replace cap and hub is ready to operate.

NOTE: For split range operations, instrument spans other than 12 psi, or other special operating requirements, contact Hudson Products Fan Engineer.

NOTE: The standard range springs provide a 12 psi instrument air span (3 to 15 psi). This is not adjustable To Remove Tapered Roller Bearings from Bearing Housing

1. Drain oil from hub. See Hub Lubrication section in this manual.
2. Remove (4) 1/2" cap screws and take housing out of hub.
3. Remove or break off 3/16" roll pin with a chisel.
4. Note alignment of blade socket cap screws to actuator bearing assembly.
5. Unscrew actuator bearing assembly.
6. Clamp large end of blade shaft in special fixture to avoid torquing actuator bearing.
7. Unscrew one 1/2" nut from blade shaft.
8. Remove blade socket from blade shaft.
9. Press blade shaft out of bearing housing
10. Remove retainer ring and support washer from blade shaft. Remove bearing shims under support washer, if any.
11. Bearing spacer will have two slots opposite one another. Using a small chisel or punch, insert into slots and break into two pieces. Remove spacer from bearings.
12. To remove bearing from blade shaft you need a support washer cut in half to go between the two bearings up against blade shaft or a piece of metal similar to it.
13. With support washer (metal piece) inserted between the two bearings you will then be able to pull or press bearings off.
14. With bearings removed, clean shaft by lightly sanding around oil seal area. Also file area where roll pin went in.
15. To remove oil seal from bearing housing, press inward. Clean and lightly sand area. Check for grooves in bearing housing.



**Blade Socket/Bearing Housing Assembly
Figure 3**

To Rebuild and Install the Tapered Roller Bearing Assembly

A Hudson Fan Engineer should approve use of this procedure for hub models other than Universal 1000 series.

NOTE: High temperature gloves should be worn for all operations below.

1. Preheat over to 350°F.
2. Place bearings in oven with bearing spacer between cups. Preheat time is 20 minutes minimum, 45 minutes maximum. **Do not leave in oven longer than 45 minutes.**
3. "Set fixture" consists of a tube about 6 inches long, 2.18D x .25 wall. Place set fixture on arbor press table.
4. Place each bearing set on set fixture and insert blade shaft through bearing set until bearings seat against shoulder on blade shaft. A slight "tap" with arbor press may ensure bearings are lined up straight on shaft. Do not let bearings drop as impact may damage races.
5. Let bearing set cool for 30 minutes minimum.
6. Install support washer and retainer ring on shaft.
7. Using feeler gage, measure clearance between outboard bearing race and support washer.
8. Remove washer and retainer ring and install bearing shim that will allow 0-0015 final clearance between bearing and retainer ring. Standard aluminum shims are .002, .003, .005 and .010 thick. Shim to suit.
9. Replace support washer and retainer ring.
10. This completes assembly of bearings onto shaft. Bearings should rotate with slight effort after cooling.
11. Preheat oven to 350°. Clean bearing housings and preheat 45 minutes.
12. Blade shaft and bearings should be resting on flange in upright position.
13. Place Bearing housing over bearings and install by hand making sure bearings contact inner shoulder of housing.
14. Let cool 30 minutes. Blade shaft should be able to rotate with light to medium effort.
15. Pack oil in between dual lips of oil seal and press seal into housing.
16. Assembly is complete. Store in cool dry place away from contamination by dust.
17. Replace actuator bearing assembly.
18. After Bearing Housing Assembly is complete, align blade socket cap screws with actuator bearing assembly as noted before removal. Torque Blade Socket with 1-1/2" nut at 400 ft-lbs. To blade shaft. Next, drill 3/16" hole against 1-1/2" nut at a 45-degree angle through socket into blade shaft. Insert a 3/16" x 1-1/2" Roll Pin into 3/16" hole 1" deep. **Bearing housings are match marked with same # as hub body. Match marks when replacing.**

To Remove Ball Bearings from Bearing Housing for 2000 Series AV Hubs:

1. Drain oil from hub. See Hub Lubrication section in this manual.
2. Remove 4-1/2" capscrews and take housing out of hub.
3. Remove or break off 3/16" roll pin.
4. Clamp large end of blade shaft into fixture.
5. Unscrew 1" bolt from blade shaft.
6. Note alignment of blade socket cap screws to actuator bearing assembly.
7. Unscrew actuator bearing assembly.
8. Remove blade socket from blade shaft.
9. Place the bearing housing on an arbor press with flange down. Make sure that there is a 2" to 3" hole or slot in the table directly under the hole in the housing. Using a press with at least a 1-1/2" square end, press the shaft out of the housing.
10. Remove Retainer Ring from Blade Shaft.
11. Using a fixture that has an I.D. of 2-1/4" and an O.D. of 2-3/4" and a length of 5", press the shaft out of the bearing assembly.
12. With bearings removed, clean shaft by lightly sanding around oil seal area. Also file area where Roll Pin went in.
13. To remove Oil Seal from bearing housing, press inward. Clean and lightly sand area.
14. Check for grooves in Bearing Housing.

To Install Ball Bearing for 2000 Series AV hubs

1. Place blade shaft on press table with large diameter down. Place one bearing onto shaft. Then place one spacer on top of the first bearing on the shaft. Then place the second bearing over the spacer on the shaft.
2. Using a fixture that has an I.D. of 2-1/4" and an O.D. of 2-3/4" and a length of 5", press the "Bearing-Spacer-Bearing" group down until it bottoms out. Do not over press.
3. Place the bearing retainer ring onto the shaft by hand and slide it down until it snaps firmly into its slot.
4. Place the small end of the bearing housing down on the press table. Insert the shaft seal with the lip facing down (towards the small end of the housing).
5. Using a flat plate as a fixture, that is at least " thick and has a diameter of at least 3", press the seal into place. The seal will be flush with the large diameter surface of the housing.
6. Place the bearing housing on the press with the flange down. Make sure that there is a 2" to 3" hole or slot in the table directly under the hole in the housing. Put a thin coat of oil on the seal. Place the shaft assembly (small end first) into the bearing housing. Slide it down until the first bearing contacts the housing. Make sure that the oil seal lip does not reverse itself.
7. Using an arbor press with at least a 1-1/2" square end, press the shaft into the housing. Release pressure when bearings bottom out in the housing. Do not over press.
8. Assembly is complete. Store in a cool dry place away from contamination or dust. When ready to install into hub, place assembly into fixture.
9. Replace actuator bearing assembly.
10. Blade Socket should be installed on blade shaft. Align blade socket cap screws with actuator bearing assembly as noted before removal. **Torque 1" bolt to 600 ft-lbs.**
11. Place gasket on housing. Install housing on hub and tighten 4 cap screws.
12. Next drill 3/16" hole against 1" bolt straight against edge of socket into blade shaft. Insert a 3/16" x 1-1/2" Roll Pin into 3/16" hole 1" deep.

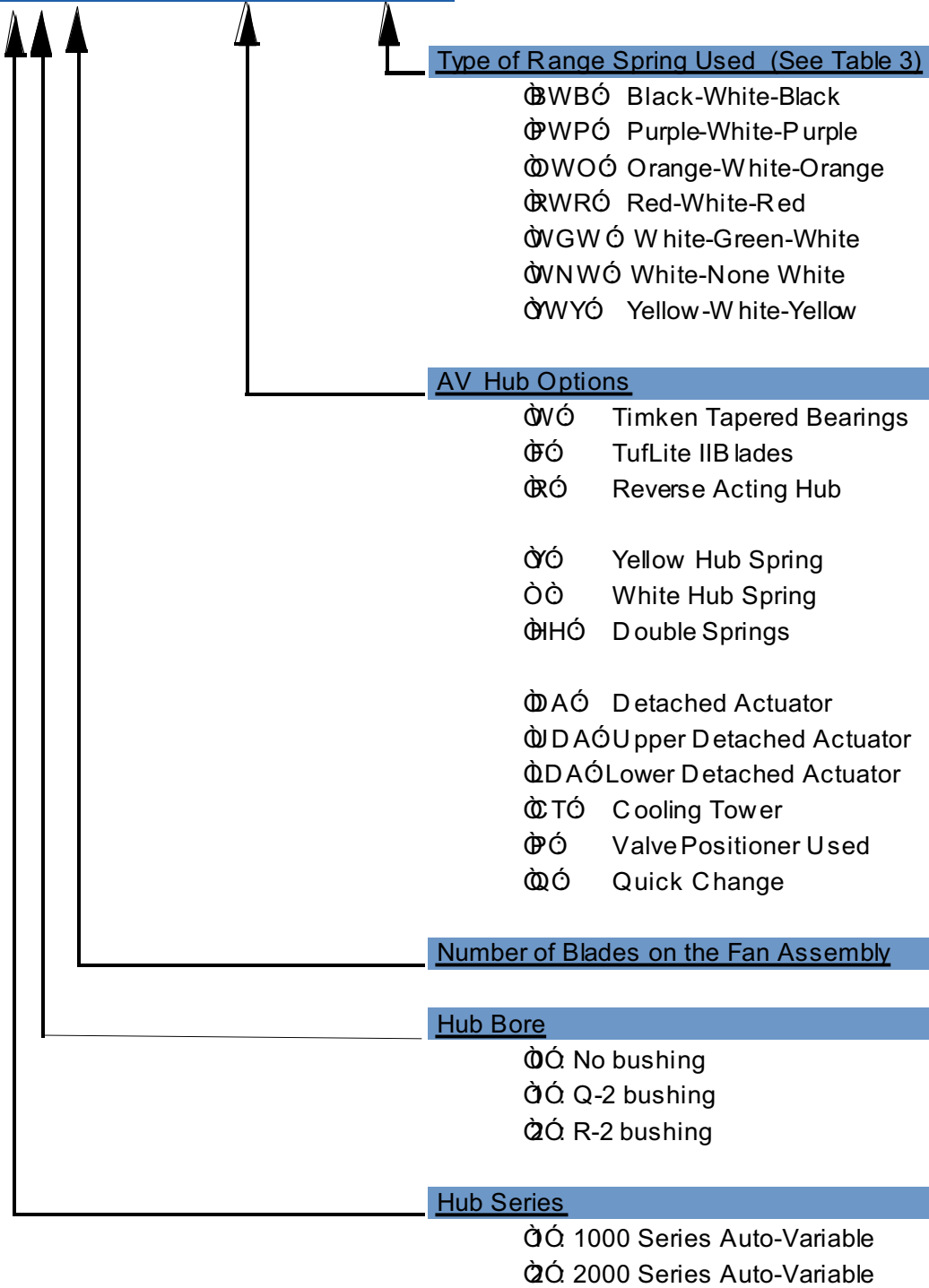
Bearing housings are match marked with same # as hub body. Match marks when replacing.

TROUBLESHOOTING

Problem	Possible Cause/Diagnosis	Solution
Blades won't change pitch	Grease buildup or corrosion in valve positioner bearing and/or range spring	Clean out grease and/or corrosion.
	Start point on valve positioner has been set incorrectly	Reset start point on valve positioner
	Vent hole has been covered by rust; vacuum has formed in hub	Clean rust from vent hole
	Incorrect pressure on supply or instrument air lines	Make sure correct pressure is being supplied to supply (see Chart #2) and instrument (3-15 psi). Add 20 psi to specified supply pressure to valve positioner when fan is not running. Make sure air line is connected to correct port.
	Hub not holding air pressure	Check diaphragm and O-rings for leaks. Make sure all fittings are tight.
	Valve positioner or rotary joint not functioning.	Take valve positioner off spring housing, press on bottom of valve positioner or rotary joint, you should get air.
	Bearings are frozen.	Remove main spring and rotate blades. Blades should move.
Blades turn less than full travel	Incorrect pressure on supply or instrument air lines	Make sure correct pressure is being supplied to supply (see chart #2) and instrument (3-15 psi). Add 20 psi to specified supply pressure to valve positioner when fan is not running. Make sure air line is connected to correct port.
	Improper range spring	Make sure range spring will cover degree of total travel (positive plus negative pitch angles)
	Low pitch stop nuts set incorrectly	Reset low pitch stop nuts to provide full travel.
Vibration	Blades loose in clamp/socket	Retighten blade clamp bolts (H blades). Adjust retaining ring and blade socket cap screws (B blades)
	One blade is loose. The rest are tight	Change bad bearing housing or sleeve.
	Hub out of alignment	Check run-out on coupling and top of hub. Total indicated run-out should be less than .005"
Oil leaks around blade shaft.	Bad seal and/or gasket around bearing housing.	Remove bearing housing and check condition of gasket and bearing housing oil seal.
Pitch changes uncontrollably.	Incorrect range spring installed in valve positioner	Install correct range spring. Check range spring color code chart.
Low motor load.	Not enough compression on spring.	Add turns to pre-load nut.
	Wrong pitch angle	Reset negative pitch angle.

AUTO-VARIABLE® HUB PART NUMBERING SYSTEM

P/N 1206WFHHCTP WNW



Type of Range Spring Used (See Table 3)

- ⓅWBÓ Black-White-Black
- ⓅWPÓ Purple-White-Purple
- ⓅWOÓ Orange-White-Orange
- ⓅWRÓ Red-White-Red
- ⓅVGW Ó White-Green-White
- ⓅVNW Ó White-None White
- ⓅWYÓ Yellow-White-Yellow

AV Hub Options

- ⓅVÓ Timken Tapered Bearings
- ⓅÓ TufLite IIB lades
- ⓅRÓ Reverse Acting Hub

- ⓅYÓ Yellow Hub Spring
- ⓅÒ White Hub Spring
- ⓅHÓ Double Springs

- ⓅAÓ Detached Actuator
- ⓅDAÓ Upper Detached Actuator
- ⓅDAÓ Lower Detached Actuator
- ⓅTÓ Cooling Tower
- ⓅPÓ Valve Positioner Used
- ⓅQÓ Quick Change

Number of Blades on the Fan Assembly

Hub Bore

- ⓅÓ No bushing
- ⓅQ-2 Q-2 bushing
- ⓅR-2 R-2 bushing

Hub Series

- ⓅÓ 1000 Series Auto-Variable
- ⓅQÓ 2000 Series Auto-Variable

HUDSON

Products Corporation

1307 Soldiers Field Drive
Sugar Land, Texas 77479-4072
Post Office Box 20029
Sugar Land, Texas 7777496-0029
Phone: (281) 275-8100
Fax: (281) 275-8388
1-800-634-9160 (24 Hours)
EMAIL: HUDSON.products@HUDSONproducts.com
<http://www.HUDSONproducts.com>

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