

*/ Marley HP7000 Fan /*

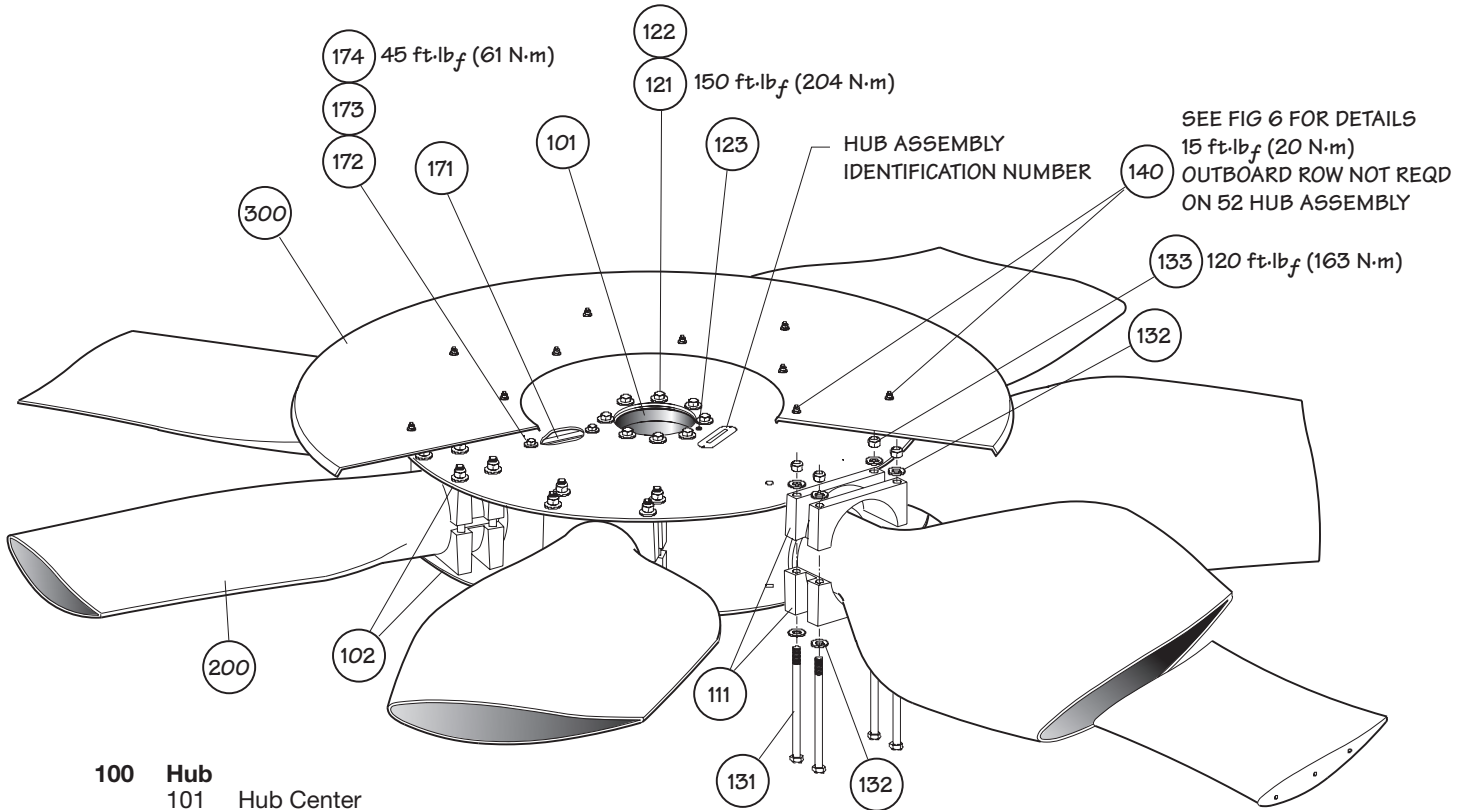
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*User Manual 97-1342B*

**SPX**

COOLING TECHNOLOGIES

# Fan Components



- 100 Hub**
- 101 Hub Center
- 102 Hub Plate
- 110 Kit-Blade Clamp**
- 111 Blade Clamp
- 120 Kit-Center Hub Hardware**
- 121 Cap Screw 5/8"
- 122 Flat Washer 5/8"
- 123 Pin 1/2"
- 130 Kit-Blade Clamp Hardware**
- 131 Machine Bolt 3/4"
- 132 Flat Washer 3/4"
- 133 Locking Hex Nut 3/4" or Hex Nut 3/4" and Lock Washer 3/4"
- 134 Thread Lubricant
- 140 Kit-Hub Cover Hardware**
- 141 Machine Bolt 3/8"
- 142 Flat Washer 3/8"
- 143 Lock Washer 3/8"
- 144 Hex Nut 3/8"
- 145 Locking Hex Nut 3/8"
- 146 Spacer
- 150 Kit-Balance Hardware**
- 160 Manual**
- 170 Kit-Hub Brace**  
*required for 76" Hub Assemblies*
- 171 Hub Brace
- 172 Machine Bolt 1/2"
- 173 Flat Washer 1/2"
- 174 Locking Hex Nut 1/2"
- 200 Blade**
- 300 Hub Cover**

**Figure 1 – Typical Fan Assembly**

*actual component appearance may vary*

Order No. \_\_\_\_\_

Trial Pitch Angle \_\_\_\_\_

Final Pitch Angle \_\_\_\_\_

Speed-rpm \_\_\_\_\_

Contract hp \_\_\_\_\_

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## Fan Hub Installation

The following instructions detail the process for installing a Marley HP7000 fan on a Marley Geareducer® with a tapered fan (output) shaft utilizing a bolted fan hub retention plate or a straight fan shaft using a split taper bushing. Installation on other gear reduction units may be different. Contact your Marley sales representative for supplemental instructions if required.

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### Note

***If the fan installation is for a Marley 36, 38, 3600, or 4000 model Geareducer, or uses a U1 split taper bushing on a straight (output) shaft, refer to the applicable instructions below.***

1–Remove the retention plate and hardware from the top of the Geareducer shaft. Thoroughly clean the fan shaft, fan shaft key, and the fan hub center bore to remove any debris and/or protective coatings. After cleaning, apply a coat of anti-seize compound to the top 7" (180mm) of the fan shaft.

2–Prior to hub installation, fully seat the key in the fan shaft keyway. The key is a tight fit across the width and must never be altered.

3–Raise the fan hub above the fan shaft for installation. Slowly lower the hub onto the shaft with the keyways properly aligned. Make certain the key does not slide down during installation. Stake the key in the keyway with a center punch if necessary.

The fan shaft key should be approximately centered in the engaged portion of the hub when engaged on the shaft. Verify the center hub is fully seated by visual inspection.


4–Install the retention plate and hardware. Torque bolts to 70 ft·lb<sub>f</sub> (95 N·m).

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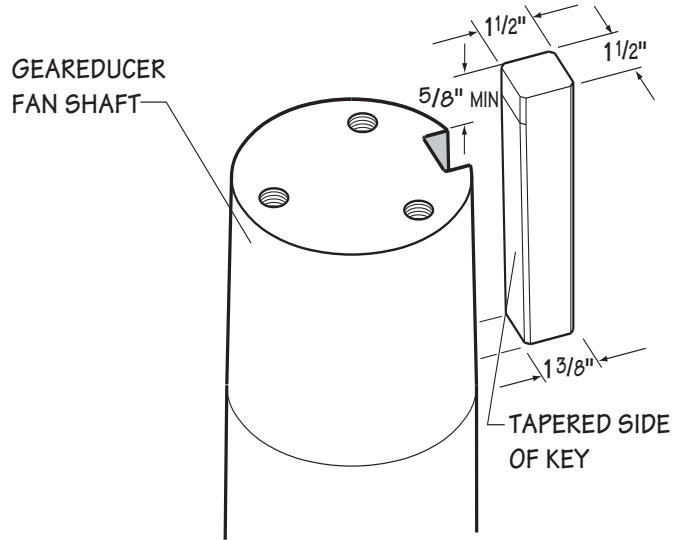
### 36 and 38 Geareducer

***36 and 38 Series Geareducers use a tapered fan shaft key. Correct key installation is imperative for proper and safe operation. The following instructions detail installation for these applications.***

1–Remove the retention plate and hardware from the top of the Geareducer. Thoroughly clean the fan shaft, fan shaft key, and the hub center bore to remove any debris and/or protective coatings. After cleaning, apply a coat of anti-seize compound to the top 7" (180mm) of the fan shaft.

2–Install the 36 and 38 Series Geareducer fan shaft key in the fan shaft keyway as shown in **Figure 2**. The key is a tight fit across the width and must never be altered. 

## Fan Hub Installation

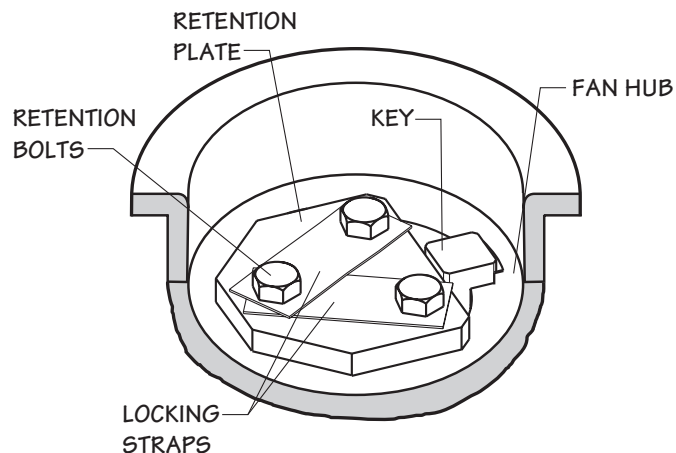


**Figure 2**  
**36 and 38 Geareducer**

3—Raise the hub assembly above the fan shaft for installation. Slowly lower the assembly onto the shaft with the keyways aligned. Make certain the key does not slide down during installation. Stake the key in the keyway with a center punch if necessary.

After the hub assembly is installed the bottom end of the key must extend through the bottom of the center hub, and the top end of the key must extend  $\frac{5}{8}$ " (16mm) minimum above the top of the fan shaft. Do not force the key down once these criteria are met.

4—**Figure 3** illustrates proper retention plate and hardware installation. The retention plate is designed to allow clearance for the fan shaft key, and when properly installed will not extend over or interfere with the key in any way. Torque the retention bolts to 70 ft·lb<sub>f</sub> (95 N·m) then turn up the locking strap corners to prevent the bolts from loosening.



**Figure 3**  
**36 and 38 Geareducer**

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## Fan Hub Installation

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### U1 Split Taper Bushing

*The U1 split taper bushing provided with the fan installation kit will be either a Type 1 or a Type 2 bushing. A Type 1 bushing will use the fan shaft key provided with the Geareducer. A Type 2 bushing uses an integral key that is shared by the output shaft and the fan hub keyways. To distinguish which type of bushing is provided, refer to Figure 4.*

1—Remove the fan shaft key from the top of the Geareducer shaft and discard if a Type 2 split taper bushing is being used. Thoroughly clean the fan shaft and fan hub center bore to remove any debris and/or protective coatings. After cleaning, apply a coat of anti-seize compound from the end of the fan shaft down to the length of the shaft keyway.

2—Remove the U1 split taper bushing from its packaging. Discard and replace the 5/8-11NC black steel cap screws provided within the bushing packaging with the 5/8-11NC stainless steel cap screws provided with the fan installation kit. Thoroughly clean the bushing center bore and outside taper (barrel) surface to remove any protective coating. After cleaning, apply a thin coat of anti-seize compound to the outer taper surface of the bushing.

3—Aligning the outside taper (barrel) bushing key with the keyway of the hub bore, loosely start the Type 1 or Type 2 bushing into the bore of the hub. The three (3) threaded holes in the hub must be aligned with the non-threaded holes in the bushing flange—**Note, the two (2) threaded holes in the bushing flange are used only for disassembly.** Apply anti-seize compound to the threads of the 5/8-11NC stainless steel cap screws. Insert the cap screws through the non-threaded holes in the bushing flange and thread them by hand into the hub two or three turns only.

4—If a Type 1 split taper bushing is being used, prior to installing the bushing-hub assembly onto the fan shaft, fully seat the key in the fan shaft keyway. The key is a tight fit across the width and must never be altered.

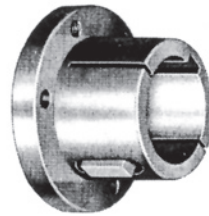


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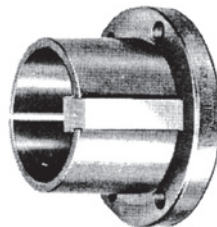
## Fan Hub Installation

5—Position the bushing-hub assembly over the Geareducer fan shaft. Carefully align the bushing bore keyway with the previously installed shaft key—or if using a Type 2 split taper bushing, align the shared hub/bushing key with the fan shaft keyway. Lower the assembly onto the shaft. The assembly must slide onto the output shaft enough to ensure the shaft key runs the entire length of the bushing bore. It may be necessary to slightly wedge open the split taper bushing for easier engagement of the fan shaft into the bushing bore. This can be accomplished by driving a wedge into the bushing flange split.

6—Using a torque wrench, tighten the stainless steel cap screws sequentially until each is tightened to 140 ft·lb<sub>f</sub> (190 N·m). When the cap screw torque is at or near 140 ft·lb<sub>f</sub> (190 N·m), make at least two more sequential rounds to assure all cap screws are to the required torque value.



***Type 1 U1 Split Taper Bushing***



***Type 2 U1 Split Taper Bushing***

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**Figure 4**

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## Fan Blade Installation

Marley HP7000 fan blades are manufactured to equal moment weight and blade clamps to equal static weight. The blades and clamps can be installed in any position without affecting fan balance.

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### Note

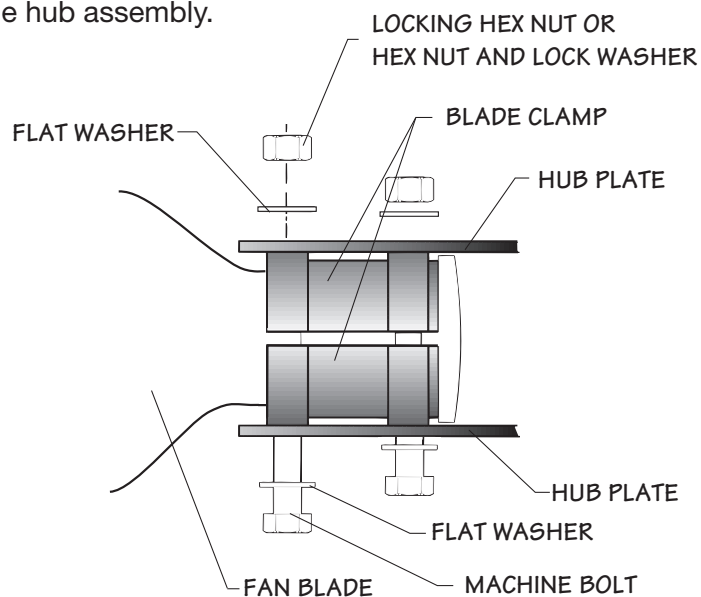
***At the end of the blade shank on a nameplate is inscribed a letter code (i.e. "A" or "B" etc.). When installing or replacing blades use only blades with the same letter code.***

1—Lubricate the 3/4" bolt and 3/4" hex-nut threads with thread lubricant. Set the hardware aside.

2—Remove one set of blade clamps from the hub assembly. Blade clamps are installed on the hub assembly at the factory with spacers for shipping purposes. Remove and discard the spacers. Position the blade clamps around the shank of a blade with the machined-face end of the blade clamp against the blade safety shoulder. See **Figure 4**. Large nylon cable ties can be used to hold blade clamps on the blade during installation providing easier assembly.

3—Insert the blade with blade clamps around the shank and with the concave blade side (TOP) on the discharge side between the hub assembly plates as shown in **Figure 5** and **Figure 6**. Vertically align the four bolt holes in the clamps and plates. Install four lubricated 3/4" bolts, eight 3/4" flat washers, (four 3/4" lock washers if hardware material is monel), and four 3/4" hex nuts, engaging the nuts only three to four threads as shown in **Figure 5**. Do not tighten the hardware until all the blades have been installed. The blade must be free to rotate in the clamp for pitch adjustment.

4—Repeat until all blades, clamps, and hardware have been installed in the hub assembly.



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**Figure 5**

## Adjusting Fan Blade Pitch

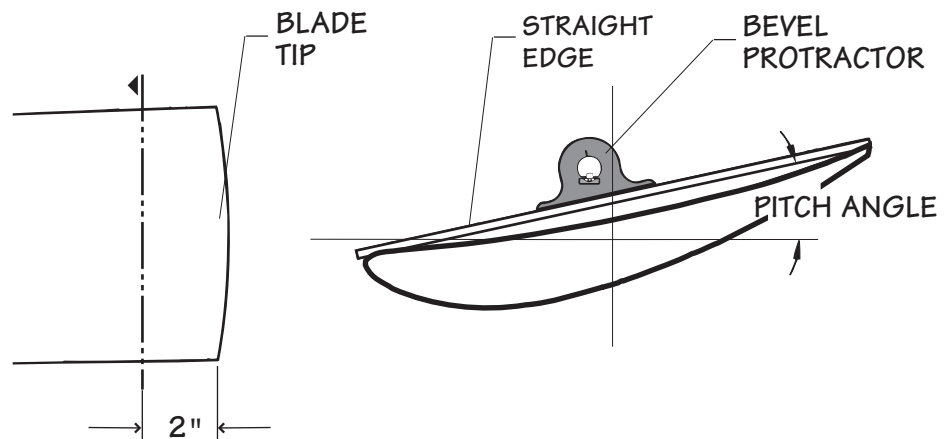
**The trial pitch is the calculated setting for design conditions (water rate, heat load, air density, and brake horsepower). The trial pitch is provided (see page 2).**

1—Select a position on the fan circumference and rotate each blade to this common location when setting or checking blade pitch. Support the blade tip to maintain a common rotation plane while setting the fan pitch. The pitch is set within 2" (51mm) of the blade tip by placing a bevel protractor on top of a parallel sided straight edge that extends across blade width as shown in **Figure 6**.

2—Pull the blade outward so the safety shoulder is in contact with the blade clamp, then set the pitch. See **Figure 5**. Blades should be within  $\pm 1/4^\circ$  of the desired pitch angle. After the desired setting is obtained, progressively tighten the 3/4" hex nuts to 120 ft·lb<sub>f</sub> (163 N·m) torque. Recheck the pitch angle. If required, loosen the hex nuts and reset the pitch as necessary until the proper pitch angle is obtained with the 3/4" hex nuts at 120 ft·lb<sub>f</sub> (163 N·m) torque.

3—Repeat step 2 for all blades.

4—Check the vertical blade-tip track variation. The allowable vertical variation from a reference plane is  $\pm 1$ " (25mm). If a blade's tip track is out of tolerance, loosen the 3/4" hardware and change the blade tip support location higher or lower as required to adjust the tip track. Recheck blade pitch angle.



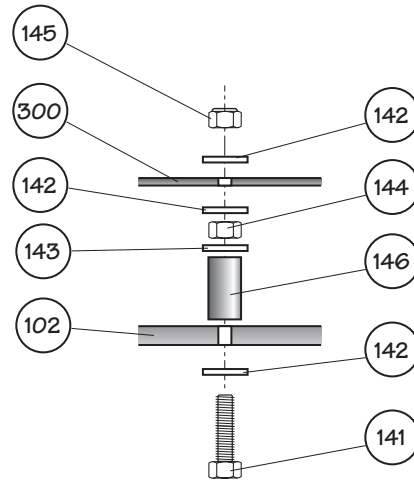
**Figure 6**



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## Hub Cover Installation

Install the hub cover as shown in **Figure 1** and **Figure 7**. Tighten all hex nuts to 15 ft·lb<sub>f</sub> (20 N·m) torque.



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**Figure 7**

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## Fan Maintenance

Preventative maintenance will prolong useful life and assure continued trouble-free operation. After the first week and subsequently at six month intervals:

- Torque all hardware to specifications referenced in this manual.
- Visually inspect the fan for airborne debris damage, contact with fan cylinder segments, and corrosive attack. Correct any situations determined detrimental to fan operation.
- Remove any accumulated scale or dirt.
- Clear blade drain holes.

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## Service

Proper identification of your fan is necessary to insure you receive correct replacement parts. The Marley cooling tower serial number can be used to determine the fan and any components installed and maintained as original equipment on a Marley cooling tower. The fan diameter and moment weight class from the blade nameplate (see **Figure 8**) is required to identify blades for replacement. The fan hub assembly identification number (see **Figure 1**) is required to identify a replacement hub assembly or repair components. Please provide the Marley sales office or sales representative the necessary information when ordering replacement fans or components.

Blades can be replaced without rebalancing the entire fan.

If rebalancing is desired, contact the Marley sales office or representative in your area.



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**Figure 8–Blade Nameplate**

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## Motor Load

The corrected horsepower should be close to but not exceed the contract horsepower specified by Marley. Determine corrected horsepower using the following equation.

$$HP_C = \frac{VOLTS_A \times AMPS_A \times DENSITY_D}{VOLTS_N \times AMPS_N \times DENSITY_A} \times HP_N$$

HP <sub>C</sub>	=	Corrected Horsepower	VOLTS <sub>N</sub>	=	Nameplate Volts
VOLTS <sub>A</sub>	=	Actual Volts	AMPS <sub>N</sub>	=	Nameplate Amperage
AMPS <sub>A</sub>	=	Actual Amperage	HP <sub>N</sub>	=	Nameplate Horsepower
DENSITY <sub>A</sub>	=	Actual Air Density	DENSITY <sub>D</sub>	=	Design Air Density

Actual volts and amperage must be obtained with the fan running and the specified rate of water flowing over the tower after the motor and Geareducer have reached operating temperature (approximately 30 minutes of operation).

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### Note

***Measurements taken on motors operating with Variable Frequency Drive controls may read up to 15% high from errors in measuring the approximated sine wave. Instruments capable of measuring a squared off wave form accurately should be used for measuring power in this situation.***

***Do not exceed 30 sec/hour total motor starting time as motor may overheat.***

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