FIBERGLASS FAN STACK INSTALLATION INSTRUCTIONS

PREPARATION

1. Check crating for correct number and type of fan stack panels. The total number of panels for each fan stack can be determined by dividing the fan diameter by two and adding one, as shown in the equation below.[1]

# of Panels = {(Fan Diameter) / 2} + 1

It should be noted that an access door panel is standard for fan stacks which are ten feet and taller, and is optional on shorter fan stack heights. The number of panels required will include the access door panel in these instances. It is imperative that the quantity and type of panels are correct before assembling the fan stack.

2. Star Cooling Towers constructs each fan stack from Fiberglass Reinforced Plastic (FRP). To resist corrosion and deterioration, the standard connecting hardware used in each assembly is 304SS, however, other materials are available. The hardware consists of 3/8" TFL bolts, 3/8" nylock nuts, 3/8" large flat washers, also called a fender washers. A fender washer should be used on both the nut and bolt side of the assembly in order to better distribute the load and prevent cracking. FRP stiffening bars are included with most fan stacks. These bars are used to interconnect the overlapping rib of two successive fan stack panels. Star Cooling Towers supplies all fiberglass stiffening bars with the fan stack as required. The hardware count and number of stiffening bars for each fan stack vary depending on the size and dimensions of the stack. A detailed drawing of the fan stack, including a table of hardware and stiffening bar requirements, is shown on the back page of these instructions. Verify the actual fan deck cut circle and panel dimensions with those given in the drawing. To ensure proper installation, these requirements must be verified before proceeding. Adequate planking and scaffolding will be needed to provide safe access to the fan stack during installation.

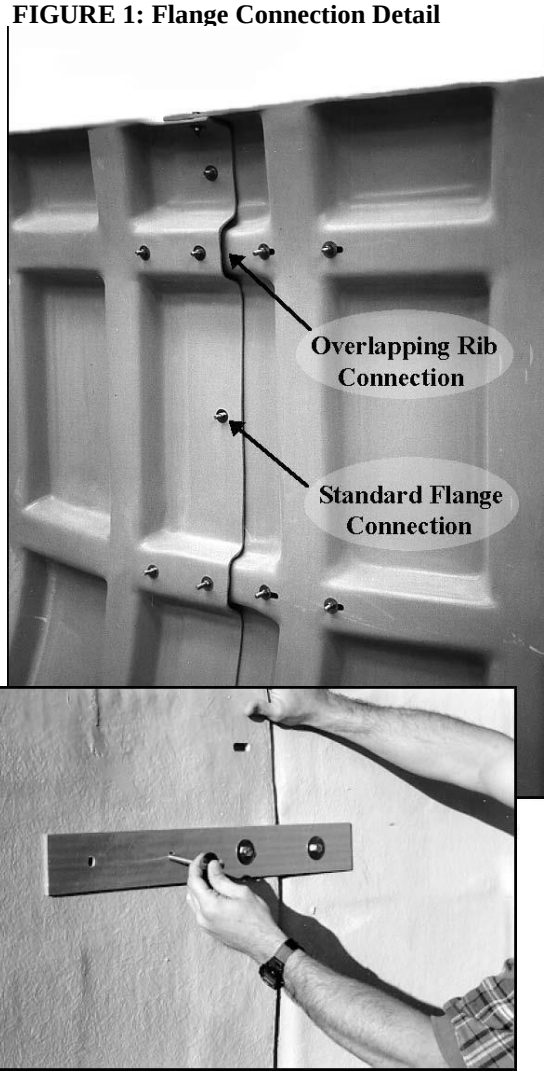
3. Any errors associated with improper fan stack panel type, incorrect number of panels, or inadequate hardware or stiffening bars should be reported immediately to Star Cooling Towers. It is important to note that the actual hardware kits include a 5% margin. This extra hardware is not included in the numbers shown in the hardware list. Discrepancies associated with this extra hardware should NOT be reported to Star Cooling Towers. It should also be noted that the numbers shown in the hardware list are per stack and should be multiplied by the total number of stacks in order to obtain the correct number of hardware and stiffening bars. The hardware requirements do NOT include the hardware needed to anchor the fan stack to the tower fan deck. Selection of the appropriate anchoring hardware is application dependent, and is the responsibility of the cooling tower manufacturer and/or fan stack installer.

[1] Ten foot diameter fan stacks contain only five panels.

ASSEMBLY

1 During assembly, two distinct connection types will be encountered, as labeled in **Figure 1**. The standard flange connection uses a 3/8" x 1 1/4" bolt, a 3/8" nylock nut, and two 3/8" fender washers to secure the fan stack segments. The second type of connection uses an overlapping rib design. This particular connection consists of an overlapping male and female rib of two successive fan stack panels and a fiberglass stiffening bar, to provide strength and reduced vibration. The fiberglass stiffening bar is used in conjunction with four 3/8" x 4 1/2" bolts, four 3/8" nylock nuts, and eight 3/8" fender washers to secure the fan stack panels. A typical installation of the fiberglass stiffening bar is shown in **Figure 2**.

FIGURE 1: Flange Connection Detail



2 Place two fan stack segments on their bottom flanges, overlapping the vertical connection flange as shown in **Figure 1**. The panel containing the male rib and slotted holes should be overlapped to the inside of the female rib. Once the vertical flange of two successive fan stack segments is properly oriented, place two 3/8" x 1 3/4" bolts in the pre-drilled holes of the vertical flange. Place the first bolt at the top portion of the fan stack, preferably the first bolt below the top flange, and place the second bolt in the throat section of the fan stack. These bolts MUST be placed in the standard flange connection positions, and NOT in the ribbed sections. Continue this process with the remaining fan stack segments, until all segments are in position.

FIGURE 2: Fiberglass Stiffening Bar Installation

CAUTION: Be certain that the head of the flange bolt is on the inside of the fan stack and the nut is on the outside of the fan stack, as shown in Figure 3. This is necessary to prevent interference with the fan assembly. In addition, a fender washer MUST be used on both sides of the fan stack in order to prevent cracking the fiberglass. Serious damage and/or injury can result if this procedure is not followed for ALL flange connections.

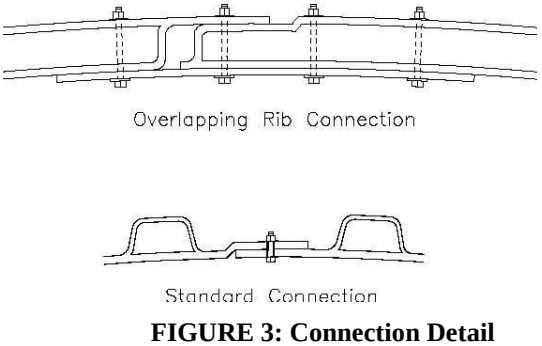


FIGURE 3: Connection Detail

3. If assembling the fan stack on the ground, a radius bar must be used in order to verify that the stack is adjusted correctly to provide a uniform circular pattern in the throat area. If assembling the fan stack on the fan deck, the existing fan, if available, can be used for the same purpose. Adjust the fan stack to provide

approximately ½" to 1" tip clearance around the entire throat area of the fan stack. Once this procedure has been accomplished, tighten the two bolts on each vertical flange. After tightening these bolts, it is important to make sure that the tip clearance has not changed. Any change in tip clearance must be corrected before proceeding further with the fan stack assembly. Once the two bolts in each vertical flange have been tightened and adequate tip clearance has been achieved, place the remaining $^{3}/_{8}$" x $1\,^{3}/_{4}$" bolts in the vertical flange of each segment and tighten. Do not forget to install the top flange bolts as shown in **Figure 4**.

FIGURE 4: Top Flange Bolt Detail

CAUTION: Tighten the nuts slowly and/or use a thread lubricant in order to prevent galling of the bolt assembly.

4. If the fan stack is equipped with horizontal, overlapping ribs, refer to **Figure 2** and **Figure 3** for details on the installation of the fiberglass stiffening bars. The bars should be placed on the inside of the fan stack only. Use four $^{3}/_{8}$" x $4\,^{1}/_{2}$" bolts to secure the stiffening bars to the fan stack, as illustrated in **Figure 2**. Place a fender washer on both the nut and bolt side of the fan stack, and tighten the bolt assembly. Repeat this procedure for each of the overlapping rib connections until all the stiffening bars have been installed.

CAUTION: Be certain that the head of the flange bolt is on the <u>inside</u> of the fan stack and the nut is on the <u>outside</u> of the fan stack, as shown in Figure 3. This is necessary to prevent interference with the fan assembly. In addition, a fender washer MUST be used on both sides of the fan stack in order to prevent cracking the fiberglass. Serious damage and/or injury can result if this procedure is not followed for ALL flange connections.

5. Once all panel-to-panel hardware has been tightened, the fan stack can be anchored to the fan deck. The fan should be rotated, and the tip clearance checked, to verify that the fan stack is properly positioned on the cut circle of the fan deck. This procedure MUST be performed before any anchor bolt holes can be drilled. The bottom flange holes must be field drilled for the anchor bolts. Three anchor bolts should be used to anchor the center of each fan stack panel. These bolts should be placed between each of the four vertical ribs of the panel[2]. A bolt should also be placed at the flange connection of two successive panels. All bolts passing through the joists and joist supports must use a minimum 2" x 4" support block to provide a rigid bolting structure for the anchor bolts. The selection of the appropriate anchoring hardware is application dependent, and is the responsibility of the cooling tower manufacturer and/or fan stack installer.

IMPORTANT: For wood structure cooling towers, it is recommended that AT LEAST 25% of the anchor bolts pass through the fan deck support structure, i.e. the joists and joist supports. The remaining bolts can be connected to the fan deck only.

7. Once the anchor bolts are securely fastened, the fan should be rotated and the tip clearance checked before operating. After verifying the tip clearance, briefly operate the fan, checking for excessive vibration and/or fan interference. If the fan stack interferes with the fan, stop the fan immediately and adjust the stack to provide greater tip clearance. It is recommended that after a brief run-in, the fan stack and anchor hardware be re-tightened to ensure that no connections were loosened due to the fan stack settling during the initial run-in.

[2] Fan stacks which are eight foot in diameter or less contain only three vertical ribs, and therefore require only two center anchor bolts.