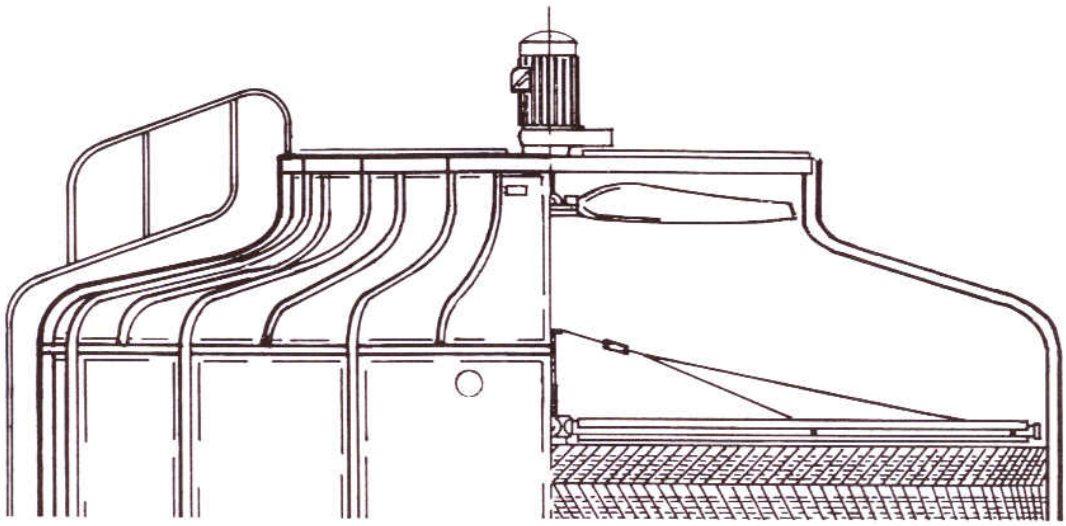
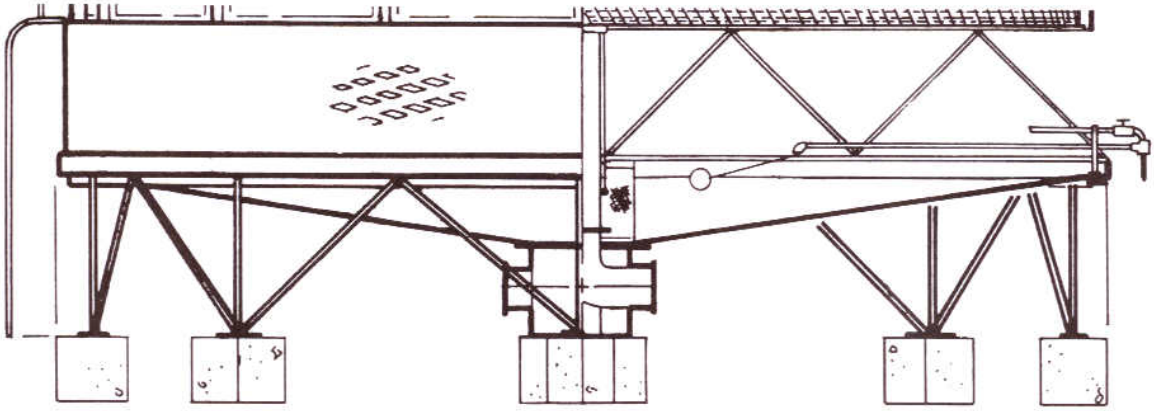
# PROTEC® COOLING TOWERS, INC.

## ENERGY - EFFICIENT COOLING TOWERS



# OPERATING AND MAINTENANCE MANUAL



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CTI*

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## COMMITTED TO SAVING ENERGY

# OPERATING AND MAINTENANCE MANUAL

A Protec Cooling Tower is manufactured for optimum performance and the least maintenance possible in mind.

Protec Cooling Towers are anti-corrosive and offer long-life, yet it is very important that a regular maintenance schedule is followed. A maintenance schedule guarantees optimal performance keeping energy-efficiency throughout the entire system.

All instructions must be followed for our limited warranty to be valid.

**PLEASE REVIEW THE FOLLOWING NOTES:**

We are not responsible for any down time caused by any failure of our equipment. If our equipment is used as part of a critical process, you must take precautions, such as spare parts or spare equipment, to minimize down time.

Installation and wiring should be as per National and Local Codes.

Use precautions to avoid personal or property damage.

Before reaching into the top of the tower, always disconnect the fan motor.

WARNING

WATER TREATMENT MUST BE SUPPLIED AND/OR APPLIED BY A PROFESSIONAL IN THE FIELD IN ORDER TO AVOID FILL DAMAGE. IT IS THE USER'S/OWNER'S RESPONSIBILITY TO TREAT THE WATER IN ORDER TO STOP BIOLOGICAL CONTAMINANTS AND AVOID, AMONG OTHER BACTERIUM, THE LEGIONNELLA BACTERIA, WHICH IS KNOWN TO CAUSE LEGIONNAIRE'S DISEASE.

**PREPARATION FOR START-UP:**

**CLEANING:** Before adding water, the basin should be cleaned using a hose and/or a brush and drained to flush out any debris left over during the assembly process.

**FILL UP:** Fill the water basin up to 11/2" below the overflow intake and adjust the float valve to maintain said level.

**NOTE:** The tower should be at the highest point of installation. When the pump is started, make sure the water level is maintained by the make-up valve. Before reaching into **the top of the tower, always disconnect the fan motor.**

**WATER DISTRIBUTION:** Turn the water distribution pipes by hand, to make sure that they can rotate freely. Make sure there is no dirt inside the distribution header or pipes.

When steady flow is accomplished, check the distribution pipes rotation as per Illustration No. 1 on this page.

Check that the water is distributed evenly over the full surface of the fill.

**MANUAL FAN TEST:**

1) Spin fan by hand to insure proper installation and alignment, being properly fastened observe that the blades are not making contact with any internal parts of the tower (casing).
2) Check the motor wiring. The electrical rating has to agree with the plate on the cooling tower and on the motor.
3) For fan assemblies with belts or gears (Motor 7.5 h.p. and larger) star-delta or soft start starter is recommended to extend the life of the drive.
4) Check for loose nuts and bolts especially at the motor mountings.
5) Run the fan momentarily to check the rotation, which should be clockwise when viewed from above.
6) Run the fan for two to three hours to check that no vibration develops.

**IMPORTANT NOTE:** If the tower has not been in operation for more th month check the insulation of the motor with 5OOv Megger Insul. Tester, the reading should be 1 Megaohm or above. If it is less, the motor should be opened for inspection and must be dried to avoid short circuiting.

Chart No. 1:
Distribution pipes rotation speed.

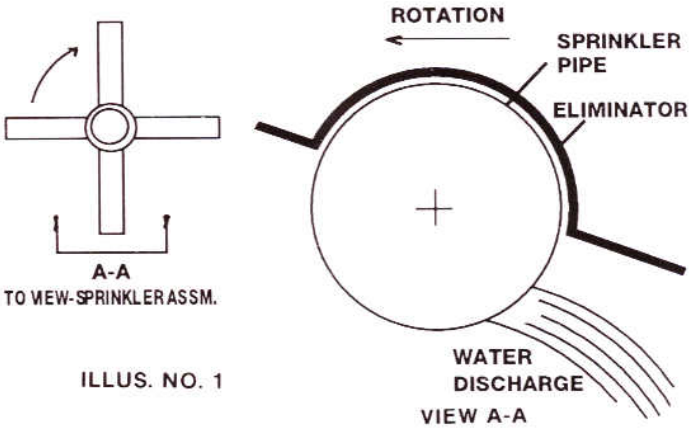
| MODEL PCT | 8-30 | 40-60 | 80-250 | 300-350 | 400-700 | 800-1000 |
|---|---|---|---|---|---|---|
| RPM | 7-12 | 5-8 | 5-7 | 3.5-5 | 2.5-4 | 2-3 |

Chart No. 1 Notes:

1) Rotation speed must be within these values. Even though, there are designed for larger RPM, in order to avoid damage of the bearings do not exceed these values.
2) The distribution openings must be located under the pipe and should be between 0°and 5° to the vertical. **See Illus. No. 1** on this page.
3) The rotation speed is increased by increasing the angle to the vertical and decreased by decreasing the same. **See Illus. No.1.**
4) Rotation should be clockwise when viewed from above.

## SPRINKLER PIPE END VIEW A-A

(VIEWED THROUGH INSPECTION WINDOW)




ILLUS. NO. 1

**MAINTENANCE:**

WATER DISTRIBUTION SYSTEM:

DISTRIBUTION HEADER:

If the water distribution system's rotation slows down or stops, first check whether the water circulation rate is normal. If so, then the distribution header should be checked for dirt. **Before reaching Into the top of the tower, always disconnect the fan motor.**

a) For models PCT-8 through PCT-80 refer to **Illus. No. 2** on this page.
   1) Remove the threaded cap (1).
   2) Remove the nut (2) and the washer (3), then lift off the top section (6).
   3) Clean parts with water. (Do not use acid PH less than 3).
b) For models PCT-100 through PCT-1000 refer to **Illus. No. 3** on this page.
   1) Remove the threaded cap (1) and take the nut (2) off.
   2) Pull the rotary parts off from the fixed section. (This will allow checking for any dirt.)
   3) To replace the lower bearing (6) or oil seal (7), unscrew (4) ... (10).
   4) To reassemble, follow the same steps, but in reverse.

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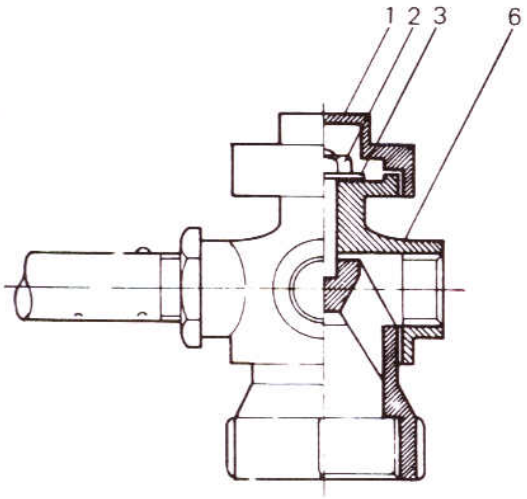
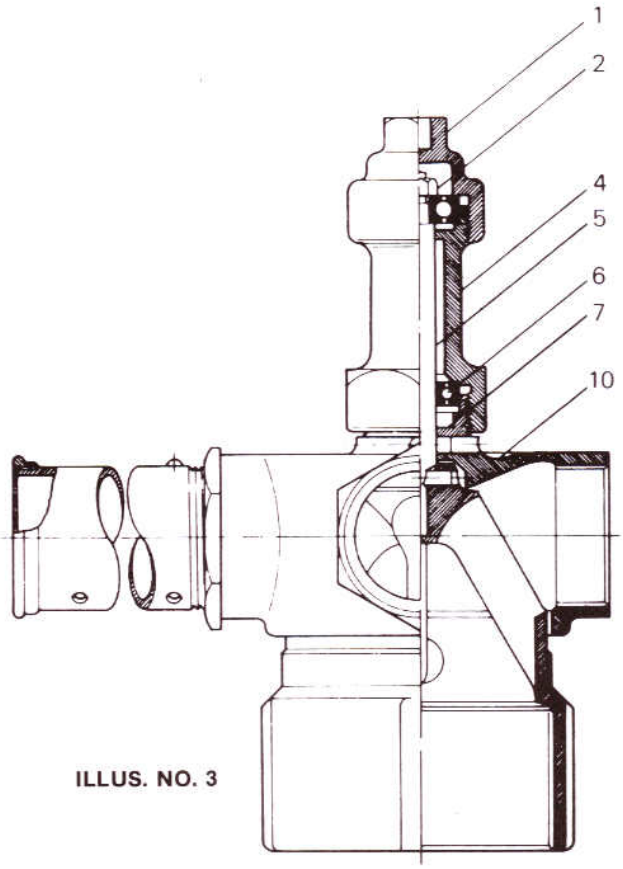



ILLUS. NO. 2




ILLUS. NO. 3

**IMPORTANT NOTE:**
1) When passing the oil seal (7) over the center pole (5), avoid damage to the lips of the oil seal.
2) The oil seal should be replaced every 2 to 3 years.
3) When replacing the sprinkler head bearings, pack them adequately with grease.

**DISTRIBUTION PIPES:**
Cleaning of the distribution pipes is performed as follows:
1) Mark the original position before removing any of the distribution pipes. The distribution openings should be under the pipe at 0°-5° to the vertical.
2) For model PCT-8 through PCT-80 slacken the distribution pipe lock nuts, then unscrew the pipe and remove it to be flushed.
3) For models PCT-100 through PCT-1000 unscrew the cap at the end of the pipe and let the water from the distribution header flush it.

**CASING:**
If the casing becomes soiled, wash it with soap and water.

**BASIN:**
Inspect the water basin for accumulated dirt, when necessary scrub and flush through the drain, regularly clean the strainer located inside the basin. (Please refer to maintenance schedule).

**FILL:**
When the proper water treatment is performed our fill material will not deteriorate. Inspect it as indicated in our maintenance schedule.

**WARNING:**
**WATER TREATMENT MUST BE SUPPLIED AND/OR APPLIED BY A PROFESSIONAL IN THE FIELD IN ORDER TO AVOID FILL DAMAGE. IT IS THE USER'S/OWNER'S RESPONSIBILITY TO TREAT THE WATER IN ORDER TO STOP BIOLOGICAL CONTAMINANTS AND AVOID, AMONG OTHER BACTERIUM, THE LEGIONNELLA BACTERIA, WHICH IS KNOWN TO CAUSE LEGIONNAIRE'S DISEASE.**

**NOTE:**
It is recommended to wear eye protection at all times wher viewing or inspecting any cooling tower performance from the top. When working on our cooling towers you should be protected complying with OSHA requirements.
Do not stand or walk directly on the fill. Always place harc cardboard or plywood on the fill to distribute the load and avoic damage.
**Before reaching into the top of the tower, always disconnect the fan motor.**

**SPEED REDUCER:**
1) PCT-8 thru PCT-200 are direct driven and **Illus. No. 4 and No. 5** should be ignored.
2) Belt Drive - Model PCT-250 through PCT-500 are standard with belt drive and optional with gear drive.
3) Gear Drive - Model PCT-250 through PCT-500 are optional with gear drive, Model PCT-600 through PCT-1000 are standarc with gear drive.

**Before reaching into the top of the tower, always disconnect the fan motor.**

Spin the fan by hand to see if it rotates freely and smoothly.

*Gear Box Speed Reducer.

Before start-up, fill gear box with oil as indicated below. Motor car not be started if gear drive is not full of oil.
Recommended Oil: SAE 90
Capacity: 0.5 Gallons

Note: After the first 100 hours of operation the oil should be changed. After that, refer to the maintenance schedule.

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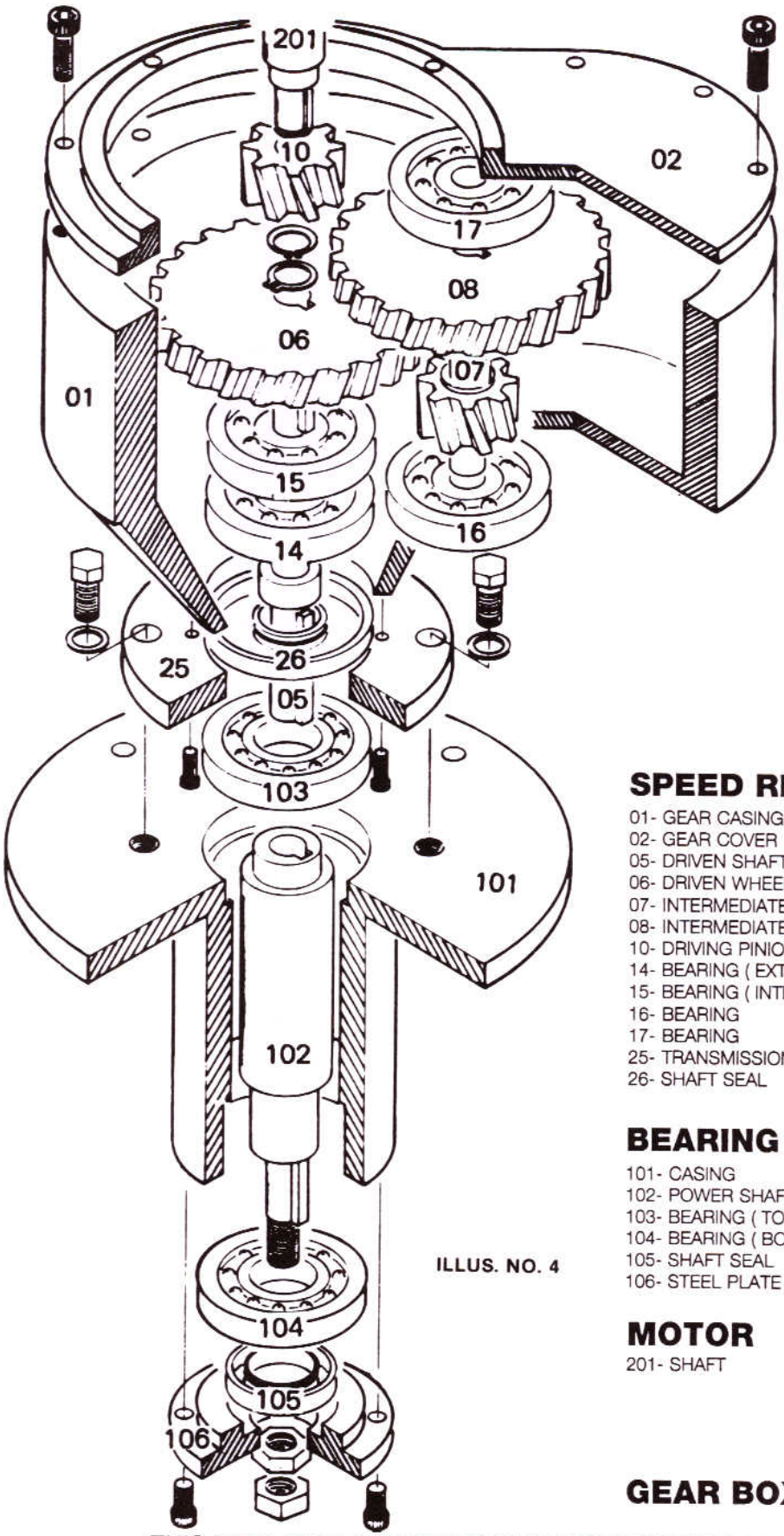
# GEAR SPEED REDUCER




ILLUS. NO. 4

## SPEED REDUCER

01- GEAR CASING
02- GEAR COVER
05- DRIVEN SHAFT
06- DRIVEN WHEEL
07- INTERMEDIATE PINION
08- INTERMEDIATE WHEEL
10- DRIVING PINION
14- BEARING ( EXTERIOR )
15- BEARING ( INTERIOR )
16- BEARING
17- BEARING
25- TRANSMISSION FLANGE
26- SHAFT SEAL

## BEARING BOX

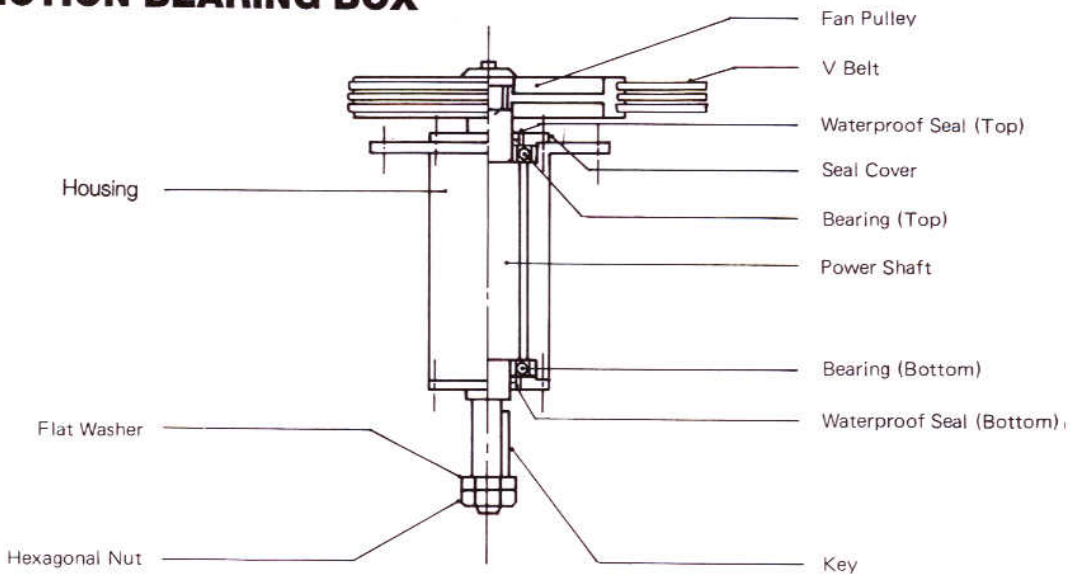
101- CASING
102- POWER SHAFT
103- BEARING ( TOP )
104- BEARING ( BOTTOM )
105- SHAFT SEAL
106- STEEL PLATE COVER

## MOTOR

201- SHAFT

## GEAR BOX COMPONENTS

## CROSS - SECTION BEARING BOX




ILLUS. NO. 5

## CHART No. 2

## V-BELT DRIVE SPECIFICATIONS

| | MOTOR | | MOTOR SIDE | | FAN SIDE | | | VEE-BELT | | BEARING No. |
|---|---|---|---|---|---|---|---|---|---|---|
| MODEL | HP | POLE | PULLEY | SHAFT | PULLEY | SHAFT | TYPE | QTY | RPM | TOP& BOTTON |
| PCT-250 | 7 1/2 | 4 | 5" | 32mm | 20" | 38mm | B-94" | 3 | 410 | 6212 |
| PCT-300 | 10 | 4 | 5" | 32mm | 20" | 38mm | B-94" | 3 | 410 | 6212 |
| PCT-350 | 10 | 4 | 5" | 32mm | 20" | 38mm | B-94" | 3 | 410 | 6212 |
| PCT-400 | 15 | 4 | 5" | 42mm | 24" | 50mm | B-102" | 4 | 340 | 6312 |
| PCT-500 | 15 | 4 | 5" | 42mm | 24" | 50mm | B-102" | 4 | 340 | 6312 |

## CHART No. 3
## MOTOR AND DRIVES RPM

| MODEL | MOTOR | | BELTS | GEARS |
|---|---|---|---|---|
| PCT | HP | RPM | RPM | RPM |
| 8-10 | 1/4 | 1200 | N/A | N/A |
| 15-20 | 1/2 | 1200 | N/A | N/A |
| 30 | 1 | 1200 | N/A | N/A |
| 40-50 | 2 | 1200 | N/A | N/A |
| 60-80 | 2 | 900 | N/A | N/A |
| 100-150 | 3 | 900 | N/A | N/A |
| 175-200 | 5 | 720 | N/A | N/A |
| 250 | 7.5 | 1800 | 410 | N/A |
| 300-350 | 10 | 1800 | 410 | N/A |
| 400-500 | 15 | 1800 | 340 | N/A |
| 600-700 | 20 | 1800 | N/A | 310 |
| 800-1000 | 30 | 1800 | N/A | 310 |

The above data is suitable for 60-HZ operation only.

## CHART No. 4
## WATER DISTRIBUTION HEADER BEARINGS

| COOLING TOWER MODEL | BEARING No. | TOP | BOTTOM |
|---|---|---|---|
| PCT - 60 & 80 | | 77R10 | 77R10 |
| PCT - 100 & 125 | | 6301ZZ | 6003ZZ |
| PCT - 150, 175, 200 | | | |
| 250, 300, 350, & 400 | | 6303ZZ | 6004ZZ |
| PCT - 500, 600 & 700 | | 6205ZZ | 6206ZZ |
| PCT - 800 & 1000 | | 6206ZZ | 6009ZZ |

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# MAINTENANCE SCHEDULE

| | Fan | Motor | Speed Reducer | Fan Shaft Bearings | Eliminators | PVC Fill | Water Basin | Sprinkler System | Structural Members | FRP Casing | Float Valve | Bleed Rate | Drive Shaft | Flow Control Valves | Suction Screen |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Inspect for clogging | | | | | W | W | | W | | | | | | | W |
| 2. Check for unusual noise or vibration | D | D | D | | | | | | Y | | | | D | | |
| 3. Inspect keys and set screws | | S | S | S | | | | | | | | | S | | |
| 4. Lubricate | | Q | | Q | | | | | | | | | | | |
| 5. Check oil seals | | | S | | | | | | | | | | | | |
| 6. Check oil level | | | W | | | | | | | | | | | | |
| 7. Check oil for water and dirt | | | M | | | | | | | | | | | | |
| 8. Change oil (at least) | | | S | | | | | | | | | | | | |
| 9. Check water level/quality | | | | | | | D | | | | | | | | |
| 10. Check flow rate | | | | | | | | | | | | M | | | |
| 11. Check for leakage | | | | | | | S | S | | | S | | | | |
| 12. Inspect general condition | | | | | Y | Y | Y | | S | Y | Y | | S | S | |
| 13. Tighten loose belts | S | S | S | S | | | | | Y | R | | | S | | |
| 14. Clean | R | S | R | | R | R | S | R | | | R | | R | R | W |
| 15. Repaint | | R | R | | | | | | | | | | | | |
| 16. Completely open and close | | | | | | | | | | | | | | S | |

D – daily; W – weekly; M – monthly; Q – quarterly; S – semi-annually; Y – yearly; R – as required.

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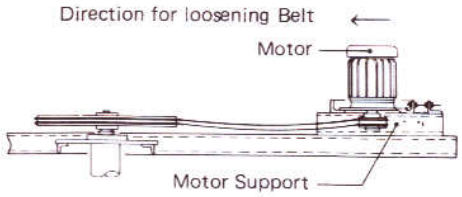
# TROUBLE ANALYSIS TABLE

| TROUBLE | CAUSES | ADJUSTMENT |
|---|---|---|
| **Rise in Cooling Water Temperature** | 1. Excessive or inadequate cooling water flow<br>2. Irregular flow of air<br>3. Short circuiting of air from tower outlet<br>4. Irregular rotation of distribution pipes<br>5. Improper flow of air<br>6. Blocking of the fill<br>7. Slackened or severed belt | 1. Adjust to the specified flow<br>2. Improve Ventilation<br>3. Improve Ventilation<br>4. Remove dirt and scale<br>5. Adjust the angle of fan blades<br>6. Clean the blocked area<br>7. Adjust or replace belts |
| **Abnormal Water Flow** | 1. Blocking of the distribution pipe openings.<br>2. Blocking of strainer mesh<br>3. Blocking in fill<br>4. Water level decrease in the water basin<br>5. Improper selection of water pump | 1. Clean distribution pipes<br>2. Remove strainer and clean<br>3. Adjust float valve or quick water make up system<br>4. Replace pump with proper size pump<br>5. Clean fill or replace |
| **Noise and Vibration** | 1. Fan blade tips touching casing<br>2. Bending of fan shaft<br>3. Loose bolts<br>4. Motor's bearing damaged<br>5. Damage in fan and / or motor<br>6. Speed reducer bearings problems and / or oil not enough ( When applicable ) | 1. Adjust fan mounting<br>2. Adjust at specialized shop<br>3. Tigten loose bolts<br>4. Repair or replace motor<br>5. Replace fan<br>6. Check bearings and / or oil level |
| **Excessive Current** | 1. Drop in voltage<br>2. Fan blades pitch angle of the fan blades<br>3. Motor damaged<br>4. Overload due to excessive air flow | 1. Check supply voltage<br>2. Adjust fan blade angle<br>3. Repair or replace motor<br>4. Adjust fan blades angle |
| **Water Carry Over** | 1. Irregular rotation of distribution pipes<br>2. Blocking of the fill<br>3. Improper installation of eliminator<br>4. Excessive circulating water<br>5. Excessive air flow | 1. Adjust the angle of the distribution pipes and check the distribution header<br>2. Eliminate blockage at fill<br>3. Improve & repair eliminator<br>4. Adjust water flow<br>5. Adjust fan blades angle |

## BELT ADJUSTMENT

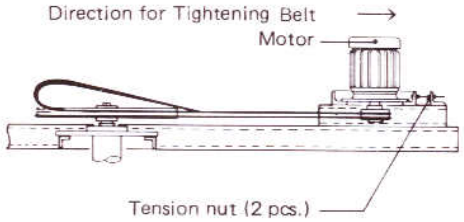
Belt tension must be checked before starting motor and if adjustments are needed tighten tension bolts as shown on **Illus. No. 8.**




**ILLUS. NO. 6**

## AFTER AND DURING OPERATION

Make the first inspection within one or two days of full operation after start-up. Make necessary adjustments since belts may stretch a little after the initial start-up.
**Make sure before reaching into the top of the tower to always disconnect the fan motor.**

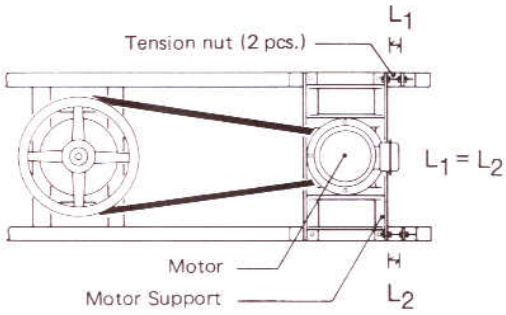



**ILLUS. NO. 7**

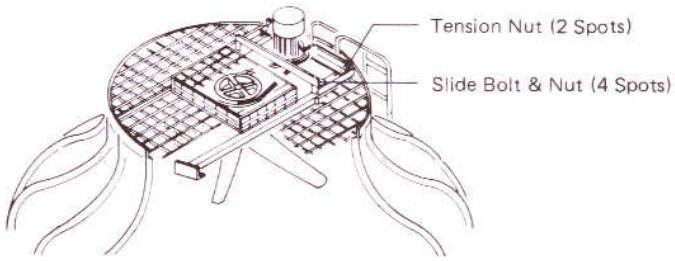
## BELT REPLACEMENT

Refer to Illustrations 8 & 9 for belt replacement:

A - Loosen slide bolt and nuts (4 pcs).
B - Loosen tension nuts (2 pcs) and slide motor toward the center. Remove the old belts.
C - Hook the new belts to the grooves of both motor and fan side pulley.
D - After new belts are in place adjust it within the framework of permissible tension.
E - Tightening bolts and nuts is the reverse of loosening. Change all belts simultaneously. Do not mix new and old belts. **(Illus. No. 9).**
F - After new belts have been installed repeat the process of adjustment found under the **"After and During Operation"** heading on this page.




**ILLUS. NO. 8**




**ILLUS. NO. 9**

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