

廷亚冷却塔 TYACHT COOLING TOWER

型式(SERIES):TAC&TAE

(引风逆流密闭式冷却塔、蒸发式冷凝器)
(Induced Draft Closed Circuit Cooler and Evaporative Condenser)

安装、维护说明书 Rigging and Maintenance Procedures

首先感谢贵公司购买廷亚冷却塔。
本说明书以标准型冷却塔为对象，针对安装、运行、操作、检修时的安全，及维持性能等方面进行具体说明。请在使用前先详细阅读本说明。请保存好本说明书，以便随时阅读。

Thank you very much for purchasing TYACHT cooling tower.
This manual covers all the basic information necessary for the cooling tower including installation, operation, and maintenance. Keep this manual handy for your daily inspection.



上海廷亚冷却设备有限公司
SHANGHAI TYACHT COOLING EQUIPMENT CO.,LTD.

CONTENTS

1. Structure.....	12
2. Precaution in design & installation.....	12
3. Storage.....	13
4. Structural steel support.....	13
5. Precaution in rigging.....	13
6. Precaution in trial operation.....	17
7. Precaution in stating operation.....	17
8. Daily operation.....	18
9. Freezing protection.....	19
10. Precaution in inspection.....	20
11. Maintenance of recirculated water system.....	21
12. Fan system.....	22

Precaution in safety

Prior to operation, read this operation manual for your safety.
Please keep the manual handy.

SIGNINDICATION:

 : CAUTION

 : DON'T EVER DO

 : DON'T TOUCH, ENTER

 : DON'T BREAK APART

 : CARRY THIS OUT

 : REQUIRES EARTHING

"CAUTION" indicates there is a possibility of serious wounding and death in consequence of improper usage (handling).

"PRECAUTION" indicates there is a possibility of serious damage of equipments and physical properties in consequence of improper usage (handling).

1. Structure

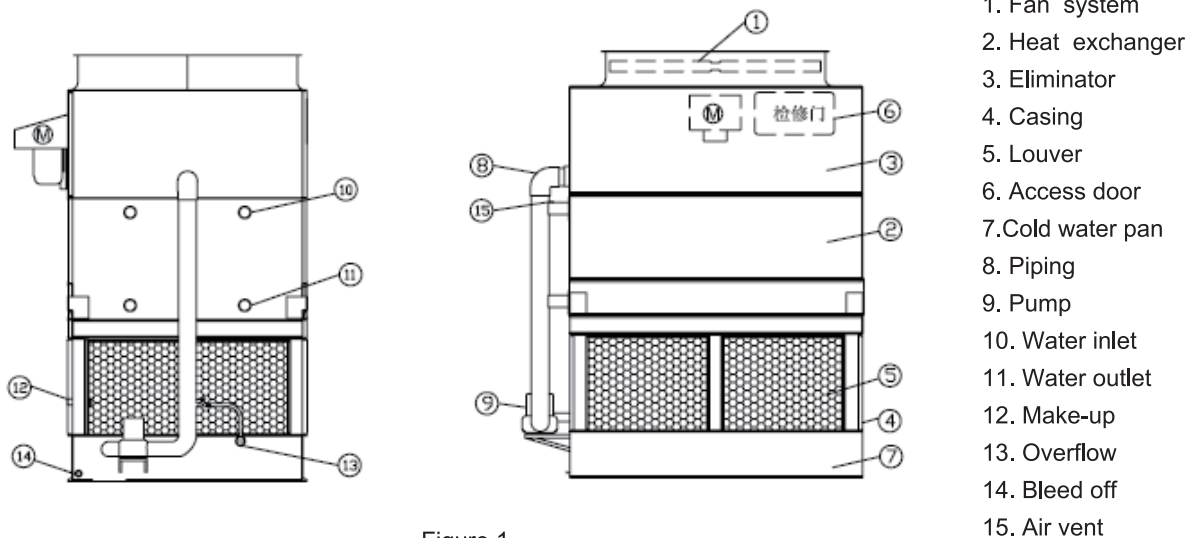


Figure 1

2. Precaution in design & installation

Instruction in erection:

- Select well-ventilated and clean area for the erection.
- Avoid a dusty or acidic location.
- Also avoid any location close to a chimney or exposed to radiant heat from any other heat source.
- Erect the tower vertically to the ground level and fix it with anchor bolts.
- Keep distance between the tower and the obstacle as per the table below. Air volume to the cooling tower may be insufficient if the distance is not secured.
- Exercise care to prevent discharged air from being re-circulated and sucked into the tower (Short-circuit).

Please take the following points into account to design plumbing layout and periphery.

- Check the direction of the piping as per the approval drawing.
- Check the tower foot-layout in accordance with the position, foundation of the vibration isolator and anchor bolt.
- Minimize "UP & DOWN" of piping to avoid excessive pressure loss.
- Though flow control valves are provided for internal piping version, additional valves are recommended for inlet pipe for each tower cell so that inlet water flow for every cell could be balanced.
- Valves are also recommended for external piping version to regulate water flow for each upper basin.
- Pipe size should be equivalent (or above) to the size of connecting flange of circulating water.
- Select circulating water pump with appropriate capacity.
- Make-up water pressure should be within the range of 0.05~0.3MPa.
- Make drainage pipe as short as possible. Select up-sized diameter pipe for long drainage for smooth drain-out.
- Take some countermeasure for drainpipe to avoid clogging.

If heater is adopted in lower basin for winter use, level tank and float switch are also recommended.

3.Storage

Do not place tarps or other coverings over the top of the units if the units are to be stored before installation. Excessive heat can build up if the units are covered causing possible damage to the PVC eliminators or PVC louvers. For extended storage beyond six months rotate the fan and fan motor shaft(s) monthly. Also, the fan shaft bearings should be purged and regreased prior to start-up.

4.Structural steel support

Two structural “I” beams running the length of the unit are required for supporting the unit. These beams should be located underneath the outer flanges of the unit. Three structural “I” beams running the length of the unit are required for supporting the unit. Locate two beams underneath the outer flanges of the unit, and locate one beam longitudinally along the center of the unit.

Mounting holes, 19mm in diameter, are located in the bottom flange for bolting to the structural steel (see certified print for exact bolt hole location). Bolt the bottom section to the steel support before rigging the top section.

Beams should be sized in accordance with accepted structural practices. Maximum deflection of the beam under the unit to be 1/360 of the unit length, not to exceed 13mm. Deflection may be calculated by using 55% of the operating weight as a uniform load on each beam (see certified print for operating weight).

The supporting “I” beams should be level before setting the unit. Do not level the unit by shimming between the bottom flange and the beams.

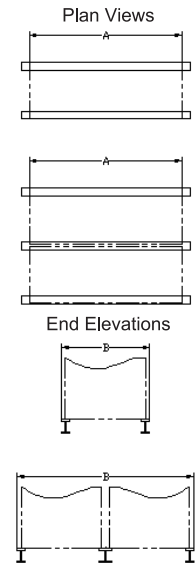


Figure 2

5. Precution in rigging

(1) Rigging Basin Section

Lifting devices are located in the upper corners of the basin section for lifting and final positioning purposes as shown in Figures 3. The hook of the crane must be a minimum dimension of “H” above the top of the section being lifted to prevent undue strain on the lifting devices. See Table 1 for the minimum “H” dimension. These lifting devices should not be used for extended lifts or where any hazard exists unless safety slings are employed under the section. (See “Extended Lifts” section for proper arrangement.) Bolt the basin section to the steel support before rigging the coil/fan section.

Basinsection Length(m)	Min.“H”(m)
1.8	2.4
2.7	2.7
3.6	3.6
5.5	5.2

Table 1

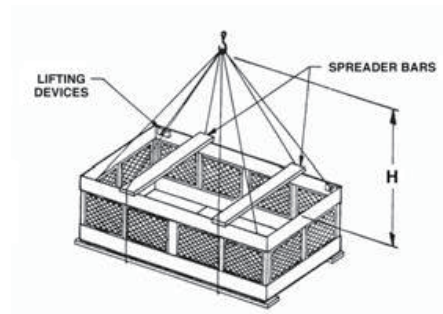


Figure 3

(2)Coil/Fan Section

Four lifting ears are provided in the lower corners of most coil/fan sections for lifting into final position. Use all lifting ears. A spreader beam must be used for lifting the top section(s).

The hook of the crane must be a minimum dimension “H” above the top section being lifted to prevent undue strain on the lifting ears. These lifting devices should not be used for extended lifts or where any hazard exists unless safety slings are employed under the section.

Note: For 2.4m wide models, mount the external motor prior to rigging as detailed in the “External Motor Installation” section.

Basinsection Length(M)	Min.“H”(M)
1.8	2.4
2.7	2.7
3.6	3.6
5.5	5.2

Table 2

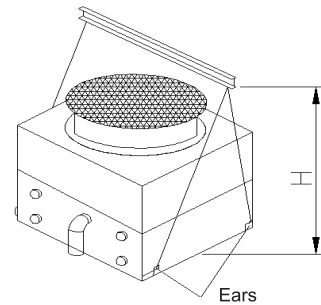


Figure 4

(3) Basin and filling lifts

All ears at four corners of filling section should be used in lifting (See figure 5).

(4) Extended Lifts

Important: The lifting devices and “U” bolts should be used for final positioning only and for lifting where no danger exists. If they are used for extended lifts, safety slings should be provided under the sections. The preferred method for extended lifts is to use slings under the unit. Spreader bars should always be used between the cables at the top of the section to prevent damage to the upper flanges or fan cylinders.

Safety slings and skids should be removed before final positioning of the unit. Refer to minimum “H” dimensions.

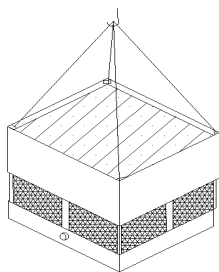


Figure 5

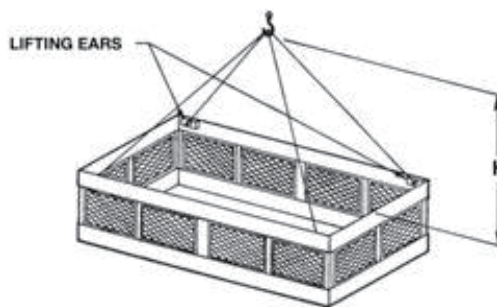


Figure 6

(5) Assembly of the Coil/Fan Section to the Basin

Before assembling the coil/fan section to the basin section, remove any loose parts shipped in the cold water pan. Wipe the flanges on the bottom of the coil/fan section. Check to see that the water distribution and coil connections are in the correct position relative to the basin section (see certified print). Units are also provided with match markings on each section.

Place nuts and bolts in all four corner bolt holes. Then continue to install the rest of the nuts and bolts working from the corners toward the center. Nuts and bolts must be installed in every hole on the side flanges although none are required on the end flanges.

Drift pins are provided in rigging box to assist with alignment.

Lower the coil/fan section to within several inches of the basin section making sure the two sections do not touch and the sealer is not disturbed. Gradually lower the coil/fan section into place onto the mating flange (See figure 8) . Drive nuts and bolts upward in all four corner bolt holes. Then continue to install the rest of the nuts and bolts working from the corners toward the center of the unit. A self-cutter must be installed in every hole on the side flanges although none are required on the end flanges.

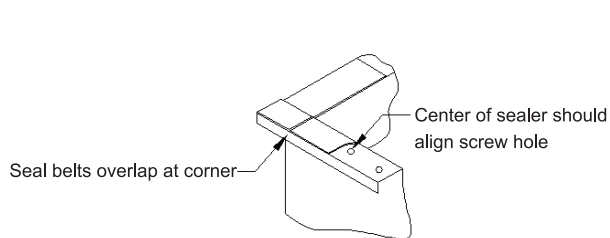


Figure 7

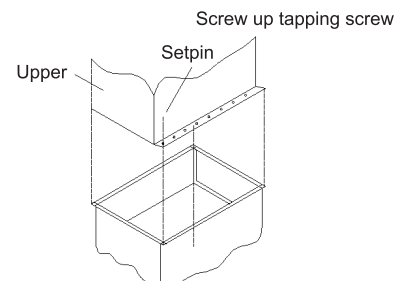


Figure 8

(6) Joining Multi-Cell Units

The equalizer flume is factory installed on one section for field connection to the other. It is important to connect the equalizer flume to balance the water level in the pans for proper pump suction operation. The following procedures are to be performed in sequence.

- (1) Install the basin section with the factory installed flume on it as described earlier.
- (2) Clean the flanges on the equalizer flume on the end to be field connected. Apply a layer of sealer tape on the flange centered between the hole centers and the outside edge. Remove paper backing strip from the sealer tape. (See Figure 10.) Clean the mating surface of the equalizer opening of any dirt, grease or moisture.

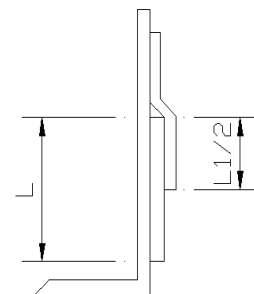


Figure 10

Figure 9

- (3) Rig the second basin section adjacent to the equalizer flume on the steel support. Align the bolt holes in the equalizer flume and equalizer opening with drift pins (drift pins provided by others) while drawing the second basin section against the flanged connection.
- (4) Install bolts, nuts and washers in every hole around the equalizer opening and tighten.
- (5) Bolt the second basin section to the steel support.

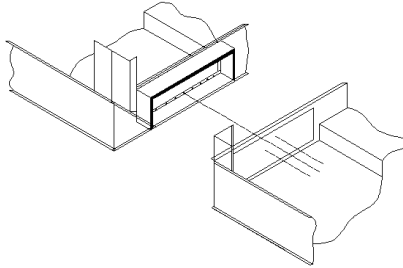


Figure 11

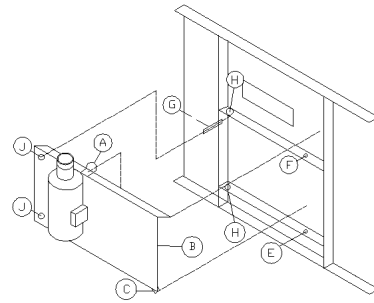


Figure 12

7) External Motor Installation

- (1) Study figure 12 before installing the motor base on the unit.
- (2) Insert the lifting device into "U" bolt A on motor base B.
- (3) Lift the motor base and insert the pivot pin C down into hole E and pivot pin F into hole D.
- (4) Install washer and nut (do not over tighten) on pivot pins. Install jam nut on pivot pin C.
- (5) Insert "J" bolts G into holes H. Install flat washers and cotter pins. Place nuts and washers on threaded portion of "J" bolts. These will be behind the motor base installed in the next step.
- (6) Insert "J" bolts into holes J in the motor base. Install flat washers, lock washer and nuts. Remove lifting device from the "U" bolt on the motor base. Position motor base toward casing of unit for belt installation.
- (7) Install Powerband belt K (Figure 14) around fan sheave and motor sheave. Tighten belt by adjusting nuts on "J" bolts. Do not over tighten the belts. The center of the belt should deflect approximately 3/4" with moderate hand pressure.
- (8) Measure to see that the top and bottom of the motor base are the same distance out from the casing of the unit. This should ensure that the sheaves are properly aligned as they have been pre-set at the factory. As a final check, lay a straight edge from sheave to sheave. There should be four point contact. (See Figure 13.) Adjust the position of the motor sheave as necessary.
- (9) To install Motor Guard L, match up hinges and install hinge pins M. (See Figure 14.)
- (10) Close Motor Guard and install (2) wing bolts N

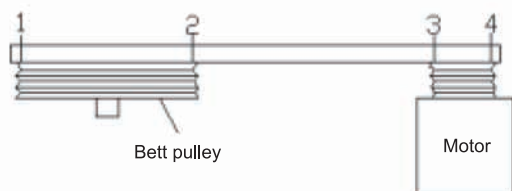


Figure 13

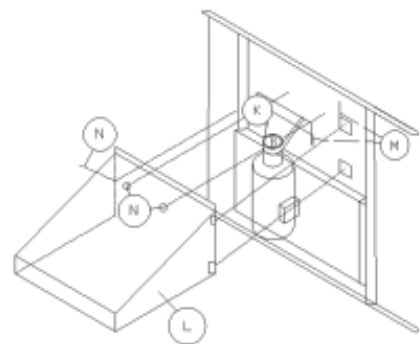


Figure 14

6. Precaution in trial operation

The work such as the early period adjustment of the cooling tower becomes necessary at the time of the trial run. Please confirm the following point without fail.

- ① Confirm that bolt is securely fastened comming every single tower parts.
- ② Do the inspection of the fan. (Structure of the fan is shown in Fig. 6.)
 - Check whether not some obstacle is located nearby to disturb smooth airflow or not.
 - Blade tip should not contact fan casing internal.
 - No loosening of bolt should be found at any connecting portion.
 - Blade-fixing bolt should be re-tightened every 100hrs of operation.
 - Open belt-cover to check type, quantity, and length of V-belt in accordance with specification.
 - Surface of Pulleys (of fan and motor) should be at the same height without having inclination.
 - Check V-belt tension.

7. Precaution in stating operation

It is very important to confirm that nothing serious has happened to the not-in-use tower prior to operation after long-term intermission.

Especially fan unit should be inspected following the inspection procedure on "4. Precaution in trial operation". Also note the followings:

- Enough Lubrication oil of bearing should be enough.
- Check bolt connecting fan unit to tower body is securely fastened.
- Confirm that water is filled in lower basin up to overflow level prior to operation.
- Confirm that no reverse-revolution, abnormal noise and vibration are found before pump start.
- Confirm that amperage marked is below the rated amperage of motor.
- Keep in mind that the excess of electric current may be caused by low voltage.
- Check performance of float valve every time to secure proper water level. If lower basin water is lower in level, tower cannot ensure proper operation in consequence of having air sucked in from strainer.
 - Coming back from the non-use period, clean lower basin and drain (replenish) circulating water after 1 week of operation to remove foreign substance.
 - Make sure to let air out of coil. Water in lower basin should be at proper level prior to operation of spray-water pump.

Starting Sequence

Before starting the unit, check that all access openings, safety screens and covers are in place. Start the unit as outlined below:

- (1) Fill the pan to the overflow level.
- (2) Bump start and check the spray water pump(s) for proper rotation. Directional arrows are found on the pump impeller housing.
- (3) Bump start and check the fan(s) for proper rotation. Directional arrows are placed on the side of the fan cylinder.

8. Daily operation

Items	Confirmation
Surrounding of Cooling tower	<p>Is there any obstacle nearby disturbing airflow?</p> <p>Is there any place nearby happened to have higher ambient temp?</p> <p>Is abnormal noise or excessive vibration found on tower body or pipes?</p>
Unit	<p>Is level of spray water in cold water basin normal? (See Table 3)</p> <p>Is there foreign substance such as leaves, plastic bag, etc. in lower basin?</p> <p>Is there foreign substance stuck in strainer net?</p> <p>Is water circulating up above strainer?</p> <p>Is circulating water changed extremely in color?</p> <p>Is there any extreme change in circulating water temp?</p> <p>Is strainer of float valve clogged?</p> <p>Is float valve working properly?</p> <p>Is make-up water replenished properly? The pressure of make-up water should be 138kpa min. and 345kpa max.</p>
Panel	<p>To prevent the formation of these porous zinc carbonate cells, the interior of the unit must be passivated during start-up and monitored periodically as part of the water treatment program.</p> <p>Units constructed of stainless steel should be inspected annually to ensure that the surface areas remain clean and free of blemishes. Any areas found with surface contamination on stainless steel components should be cleaned thoroughly to restore their appearance and to prevent further corrosion.</p>
Electric Current	Is amperage of fan motor and pump motor normal?

Table 3 Recommended Operating Water Level of Cold Water Pan

Evaporative Condenser Model	Closed Circuit Cooler Model	Water Level (mm)
TAE-B42—C102	TAC-B28R—D88R	150
TAE-D115—D140	TAC-L76R—X2069R04	280

9. Freezing protection

One or more of the countermeasure should be taken against freezing:

Cold water basin

Electric heaters, hot water coils, steam coils or steam injectors may be used to heat the basin water when the unit is shut down. However, the basin heater will not prevent the external water lines, pump or pump piping from freezing. The make-up water supply, overflow and drain lines, as well as the pump and pump piping up to the overflow level must be heat traced and insulated to protect them from damage. Any other connections or accessories at or below the water level must also be heat traced and insulated.

A condenser or cooler cannot be operated dry (fans on, pump off) unless the water is completely drained from the pan. The pan heaters are sized to prevent pan water from freezing only when the unit is completely shut down.

Fluid Cooler Coils

The simplest and most effective way of protecting the heat exchanger coil from freezing is to use an inhibited ethylene or propylene glycol anti-freeze. If this is not possible, an auxiliary heat load must be maintained on the coil at all times so that the water temperature does not drop below 10°C when the cooler is shut down. A minimum recommended flow rate should also be maintained. See Table 4.

Model	Min.Flow
TAC	M ³ /Hr
B28-B36、C43-C57、D56-D88	15.8
L76-L131、E76-E154、F102-F182、 G113-G216、H150-H253、J200-J365	31.7
G225-G432、H300-H507、J400-J730、 F202-F362、G223-G429、H289-H465	63.4
V200-V343、W241-W378、X327-X541	90
V399-V685、W482-W755、X652-X1080、 V436-V686、W483-W756、X653-X1081	180
V792-V1361、W913-W1447、X1243-X2069	360

If an anti-freeze solution is not used, the coil must be drained immediately whenever the pumps are shut down or flow stops. This is accomplished by automatic drain valves and air vents in the piping to and from the cooler. Care must be taken to ensure that the piping is adequately insulated and sized to allow the water to flow quickly from the coil. This method of protection should be used only in emergency situations and is neither a practical nor recommended method of freeze protection. Coils should not be drained for an extended period of time.

When the unit is in operation during freezing weather, some type of capacity control is normally required in order to keep water temperatures from dropping below 10°C. Operating dry with a remote sump is an excellent way of reducing unit capacity at low temperatures. Other methods of capacity control include two-speed motors, VFDs, fan cycling and fan dampers (on forced draft units only). These can be used individually or in combination with dry / remote sump operation.

Notes:

Precaution in electric heater:

- (1) To install heater unit, apply thermostat to avoid unnecessary temp. rise.
- (2) Turn heater on after confirming heat-generating portion is soaked in water. Float-switch or thermostat is recommended for the system.
- (3) For more detail, refer to "Manual of cooling tower heater".

Precaution in anti-freeze solution:

- (1) Application of anti-freeze agent affects tower performance negatively depending on character and concentration of the agent in water. Exercise care in selection taking this fact into account.
- (2) Concentration of the agent in water may happen to be lowered due to unexpected mishaps such as water-leakage. Check the concentration periodically and replenish if necessary.

10. Precaution in inspection

- ⚠️🚫 : Other than the purpose of inspection, do not enter (or climb up on) tower.
- ⚠️ : More than 2 persons are required on duty for safety reason. ⚠️
- ⚠️ : Make sure that fan motor, pump and heater are turned off. ⚠️
- ⚠️🚫 : Do not touch heater even after being turned off.
- ⚠️🚫 : Do not enter (climb up on) tower while fan is in operation.
- ⚠️🚫 : Do not stick hand or foreign substance into fan while in operation.
- ⚠️ : On the top of cooling tower, keep yourself supported safely by having something you can fall back on. ⚠️
- ⚠️ : Electrical wiring should be done by an expert possessing license. ⚠️
- ⚠️ : Make sure that capacity of power supply, control panel, and switching device be appropriate. ⚠️
- ⚠️⚡ : Make sure to carry out earth-wiring first when doing wiring.
- ⚠️ : Do proper wiring to avoid leaking and short-circuit of electricity. ⚠️
- ⚠️ : Run for trial after wiring. ⚠️
- ⚠️🚫 : Products should not be broken apart or dismantled unless done by an expert possessing license.
- ⚠️ : Take precaution against unexpected swallowing (of circulating water) or inhaling (of droplets of circulating water). ⚠️

11. Maintenance of recirculated water system

As the spray water evaporates, it leaves behind the mineral content and impurities of the supply water. If these residuals are not purged from the water distribution system, they will become concentrated and lead to scaling, corrosion, sludge build-up and biological fouling.

To avoid build-up of residuals in the water distribution system, water must be bled off from the system in a maximum amount equal to the rate of evaporation. In addition, water quality must be checked to ensure that the chemistry is balanced and that the water system is free from biological.

Bleed off

Evaporative condensers and closed circuit coolers are normally supplied with a pump assembly on the side of the unit which incorporates a bleed line and valve. It is recommended that the bleed valve on these units be opened fully to guarantee sufficient bleed volume. If the make-up water is relatively free of impurities, it may be possible to decrease the bleed, but the unit must be checked periodically to make sure that no scale forms and that the water chemistry remains balanced.

Open cooling towers and coil products supplied without pumps need to have a bleed line installed on the discharge side of the system pump. A metering connection and globe valve should also be provided. The metering connection is used to determine the bleed water volume. The globe valve is used to regulate flow.

Water Treatment

In some cases, the make-up water will be so high in mineral content that a normal bleed-off will not prevent scaling. Water treatment will be required and a qualified water treatment company familiar with the local water conditions should be consulted. Any water treatment system used in the unit must be compatible with the unit's materials of construction. Although high quality galvanized steel is used in most units, alternate materials of construction such as stainless steel (Type 304 or 316) are increasingly being used.

If a chemical water treatment system is used, the chemicals selected must be accurately metered and concentrations properly controlled.

See Table 5 for recommended levels.

Soft water systems should be avoided as soft water is corrosive to steel. The use of acid should be avoided. If acid cleaning is required, only inhibited acids recommended for use with galvanized steel should be used.

Caution - Never batch load chemicals into unit.

Always regulate chemical feed.

Table 5 Recommended water chemistry

Parameter	Range
PH	6.5 ~ 8.0
Hardness(CaCO ₃)	50 ~ 300 ppm
Alkalinity(CaCO ₃)	50 ~ 300 ppm
Total dissolved solids	<1000 ppm
Total suspended solids	<25 ppm
Bacteria count	<10000 cfu/ml
Chlorides (Cl ⁻)	200 ppm Galvanized steel
Chlorides (Cl ⁻)	400 ppm SUS304
Chlorides (Cl ⁻)	4000 ppm SUS316

Notes: Galvanized steel units require routine passivation when operating with a pH of 8.3 or higher in order to prevent "white rust."



Pressurized Water Distribution Systems

Check the water distribution system monthly to make sure it is operating properly. Always check the spray system with the pump on and the fans off. On forced draft models, remove one or two eliminator sections from the top of the unit and observe the operation of the water distribution system. On induced draft models (except direct drive) lifting handles are provided along the top layer of eliminators. Eliminators can be easily removed from the access door and the distribution system observed. The diffusers are essentially non-clogging and should seldom need cleaning or maintenance.

If the water diffusers are not functioning properly, it is a sign that the pan or system strainer has not been working properly and that foreign matter or dirt have accumulated in the water distribution pipes. The nozzles can be cleared by taking a small pointed probe and moving it rapidly back and forth in the diffuser opening.

If an extreme build-up of dirt or foreign matter occurs, remove the end cap in each branch to flush the debris from the header pipe. The branches or header can be removed for cleaning, but do so only if necessary. Check the strainer in the pan to make sure it is in good condition and positioned properly so that cavitation or air entrainment does not occur.

All Evaporative Condensers and Closed Circuit Coolers, except the ESWA Closed Circuit Cooler, are supplied with ZM spray nozzles as standard. The ZM spray nozzles do not need to be oriented a specific way to achieve proper coil coverage. Figure 1 shows the proper spacing of the ZM spray nozzles.

12. Fan system

Fan Shaft Ball Bearings

Lubricate the fan shaft ball bearings every 1000 hours or every 3 months on induced draft units. Lubricate the fan shaft ball bearings every 2000 hours or every 6 months on forced draft units. Use any of the following waterproof, polyurea inhibited greases which are suitable for operation between -20°F and 350°F . (For colder operating temperatures contact the factory)

Mobil - Polyrex EM

Chevron - SRI

Timkin Corp. - Pillow Block Grease

Feed grease slowly or bearings seals may be damaged. All grease should be purged from the bearings when introducing a different grease.

Most units are supplied with extended grease lines to allow easy lubrication of fan shaft bearings. Induced draft units up to 7.2 meter wide with belt driven fans have extended lube fittings beside the fan casing access door. Twelve, fourteen, twenty-four, and twenty-eight foot wide induced draft units have extended lube fittings located just inside the fan casing access door on the support rail.

Fan Drives

The fan belt tension should be checked at start-up and again after the first 24 hours of operation to correct for any initial stretch. On externally mounted belt-drive units, both J-type adjustment bolts on the motor base should have an equal amount of exposed thread for proper sheave and belt alignment. To check belt alignment on units with externally mounted motors, measure the distance from the motor base to the J-bolt mounting angles to ensure that both sides of the base are located the same distance from the unit. This should ensure that the sheaves are properly aligned since sheaves will have been pre-set at the factory. As a final check, lay a straight-edge from sheave to sheave. There should be four-point contact between the sheaves and the straight-edge. Adjust the position of the motor sheave if necessary. Proper belt tension can be determined by pressing the belt with one finger about midway between the sheaves using moderate pressure. The belt should deflect about 13mm on all models. Check belt tension on a monthly basis.

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Note: Please read operation manual prepared for each TYACHT product
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