

## TMA series Cooling Towers

Service Manual no. MS 02 11 TMA/E

Rev. 3



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Thank you very much for purchasing our equipment and be sure to carefully read this manual before using the machine.

The series TMA cooling towers models 08-55 ÷ 39-866 comply with the European Community directive no. 98/37/CEE.

## INTRODUCTION AND GENERAL SAFETY INFORMATION

### Care / Caution

The objective of this manual is to make available to the purchasers, to the operators and to the maintenance personnel all the indications necessary for the installation, the start-up, the running, the maintenance and the resolution of eventual faults of TMA series cooling towers. Please read carefully this manual before using the unit. You will find information important for the safe usage of TMA series cooling towers.

The residual risks and the related precautions are indicated in each chapter of instructions.

To minimize the risks, it is essential that these instructions are carried out by technically competent personnel to ensure safe and reliable installation and running of the equipment. Moreover it is important that the contractor, the maintenance technician and the user assure themselves that all the personnel assigned to, or responsible for, the installation, the operation and/or the maintenance of the TMA cooling tower have received training based also on this manual, with particular reference to chapters 2 and 3 and to those relevant to their job and/or to their work on the equipment and that this occurs prior to the start-up of the cooling tower. The instructions in the manual must be scrupulously respected and followed. Many accidents are due to an incorrect usage of the equipment.

In the event of any difficulty in interpreting these instructions, it is essential to consult Decsa for help and advice.



The plant must NOT be put into operation prior to having clarified all possible doubts.

## STANDARDS AND IMPORTANT SAFETY INFORMATION

The reference standards for the design and the construction of these units and for the related instructions for the user are as follows :-

- EN 418
- EN 292/1
- EN 292/2
- EN 294
- EN 953 for the design of the protective screens
- EN 60204/1
- EN 60335/1
- EN 60439/1
- ISO 7000 for symbols of danger, forbidden actions, usage + info
- ISO 3874 for lifting
- EN 563

For the installation, the adjustment,, the maintenance and the eventual demolition of the unit, safety at work procedures in accordance with the following directives must be respected :

- 89/391/CEE
- 89/394/CEE
- 89/654/CEE
- 89/655/CEE
- 89/686/CEE
- 89/695/CEE and eventual subsequent modifications

In general terms it should be remembered that the personnel assigned to the works must employ the usual personal protection equipment and overalls, always avoiding the use of loose clothing, jewellery and covering long hair.

**PERMITTED USES** : the cooling tower is foreseen exclusively for the cooling of water as per the description of the unit and in accordance with the selection data of the quotation and of the related order. Respect at all times the maximum temperature for the heat exchange surface = 55°C . Other temperatures and/or applications are not admissible if not previously agreed with the manufacturer in the design and quotation phase. Decsa Srl will not accept any responsibility for injury to persons and/or damage to other objects due to a non-respect of these limitations.

The unit must be earthed. For protection during a thunder storm or when the unit is left unattended and unused for a long time, turn off the power supply to the unit. This will prevent damage to the unit due to lightning or power line surges. Provided that the cooling tower is connected-up with standard-compliant components, installed in accordance with the standards, there will be no further electrical risk due to the cooling tower.. In any case a differential line-breaker must be provided for all the electrical equipment of the cooling tower.

After connecting the motors, check for the correct direction of rotation of fans.

Shut-off Device (by others) – to be provided and installed near the cooling tower for the operations of adjustment, maintenance and replacement of components. According to the EN 60204-1 standard, an emergency stop must be such that the rearming of the shut-off device, with which the tower is equipped, does not permit a new start. Consequently the eventual use of the said device for emergency stops will require the presence of another switch, to be connected, in series with the switch of the shut-off

device itself, to the central control panel in such a way that the electric current is shut-off also at the central panel when the shut-off device is activated.

## **RESIDUAL RISKS AND RELATED PRECAUTIONS**

Do not approach the unit when it is operating. Beware of corners and edges.

### Characteristics of the mechanical protection devices

The protection devices (screens) are robust, do not introduce further risks, are external to the danger zones and do not obstruct the field of vision. The installation work does not require the removal of these protective screens but the maintenance operations could require it. Such removal does however necessitate the use of suitable tools (and in any case the cooling tower should be fitted with a shut-off device, by others, to be employed at the time of such operations).

The protective mesh screens on the air discharge are well anchored in position and held by nuts and bolts, hence requiring tools (2 spanners) for their removal.

**CAUTION** : owing to the “wedge-in” system of the angled screens at the top of the cooling tower, these remain in place even without their fixings (whereas the flat screens do not remain in place by themselves). The presence of the related nuts and bolts must be ensured after every operation or work intervention.

### Further Mechanical Protection Devices

In the case of installation of the cooling tower in an area accessible to exposed persons, the end-user must provide a standards-compliant enclosure since the area around the cooling tower is to be considered a potential danger zone and, without an enclosure, third-party outsiders could possibly remove a protective screen equipping the tower, creating in consequence greater risks for other exposed persons (and/or domestic animals)

### Access to the upper area of the cooling tower

Employ a suitable standards-compliant ladder. In the case of more prolonged and complex intervention on the motor-fan sets the use of a state-of-the-art scaffolding, compliant to current safety standards, is recommended. The tower is equipped with access doors to the droplet eliminators inside. After installation of the unit, one could eventually fit (by others) the access doors with safety micro-switches. The dangers to be avoided by the operators and other exposed persons are twofold: access to the fans, possibly running and close contact with the flow of humid air, entraining droplets of chemically treated water. The disadvantage of employing a safety device would be the possible shut-down of the fans, with the consequent reduction in cooling capacity at some moment when the cooling requirement is highest, in the case of mistaken opening or non-programmed entry into the unit.

The hot and humid ambient may favour the growth of micro-organisms. For specific recommendations consult a specialised water treatment supplier.

### **Protection against Biological Risks**

The recirculating water system of a cooling tower may contain chemicals or biological contaminants, which could be harmful if inhaled or ingested. Accordingly, personnel who may be exposed directly to discharge airstream and associated drift, mists generated during operation of the water distribution system and/or compressed air, should **this** be used to clean portions or components of the recirculating water system, should wear respiratory protection equipment approved for such use by local occupational health and safety authorities.



## Prevention of Biological Risks

**Location** Each cooling tower should be located and positioned to prevent the introduction of discharge air into the ventilation system of the building on which the tower is located and of adjacent buildings.

### Biological control

Blow down with or without chemical treatment for scale and corrosion control is not adequate for control of biological contamination. The growth of algae, slimes and other micro-organisms, if unchecked, will reduce system efficiency and may contribute to the growth of potentially harmful micro-organisms, in the recirculating water system. Accordingly, a biocide treatment programme specifically designed to address biological control should be initiated when the system is first filled with water and administered on a regular basis thereafter in accordance with supplier's instructions. For specific recommendations consult a competent water treatment supplier.

Note : It is recommended that operators and maintenance technicians refer also to the Eurovent guide 9-5 (2° Ed. 2002) for the prevention of biological contamination in evaporative cooling systems.

### Dangers of mechanical origin

Never place hands or introduce foreign bodies in the air inlet and outlet of the unit.  
Never open inspection doors when the unit is in operation (rotating machinery).

Maintenance operations should never be performed when the unit is in operation. Be sure that the unit has been disconnected before entering the dangerous area or inside the unit itself (rotating machinery inside).

Warning signs and indications about the residual risks present on the unit



#### CAUTION DANGEROUS EQUIPMENT:

*read carefully this manual of instructions for use before performing any operation of the unit.*



#### CAUTION DANGER OF ELECTROCUTION :

do not manipulate electrically live items without having previously disconnected the unit from the mains electricity supply . Work on the electrical installation should only be performed by very expert personnel, qualified in such matters.



#### IT IS FORBIDDEN TO CLEAN, LUBRICATE or WORK ON THE UNIT DURING ITS OPERATION :

It is forbidden to perform lubrication or cleaning works with the unit in operation.

**CAUTION: IT IS FORMALLY FORBIDDEN TO WORK ON OR PERFORM WORKS OF ANY KIND NEAR TO THE COOLING TOWER WHEN IT IS IN OPERATION.**

## **FURTHER APPLICATION NOTES:**

Cut-out devices linked to vibration (“vibro-switch” type) can be supplied on request for critical situations (and would be for connection to the electrical control panel).

Alarm devices are NOT envisaged.

Information systems are NOT envisaged. The health and safety of exposed persons could be put at risk by the malfunction of a unit that operates unsupervised only if, for example, a cooling tower were to no longer cool a process which as a consequence would become dangerous ( of the “thermal runaway” type ). Such a usage of the cooling tower represents a danger linked to the plant itself and it is advisable to fit such a user circuit with an audible or visible alarm device.

Motors and other electrical accessories for use in explosive atmospheres are available on request. The standard electrical equipment is not explosion-proof.

## **FURTHER RESIDUAL RISKS:**

Only for the larger and higher capacity TMA cooling powers, close to the motor-fan set : Danger for the sense of hearing (take into account the sound pressure levels in the design phase).

Only for the eventual scale-removal washing (with inhibited sulphamic acid) from the heat exchange surface : possible danger due to the presence of corrosive fluids.

## DESCRIPTION OF THE UNIT

TMA series cooling towers are machines of relatively simple design and operation: their purpose is the cooling of water by means of the evaporative principle, that is rejecting heat by evaporating a small percentage of the water itself.

The main components of the unit are essentially the water sump, inlet air grills, evaporative wet deck fill, headers and nozzles for spraying water, drift eliminators, axial fans complete with electric motors, casing.

The water is supplied to the tower by connecting it to a system with circulating pumps, connected to the users. From the inlet header the water is distributed through a spraying system to the upper part of the fill, through which it flows to the sump. At the same time the air induced by fans is drawn upwards in counter current through the fill; the air stream boosts the evaporating process rejecting the heat from water. From the sump, the water is pumped, in a closed circuit, back to the user items being cooled.

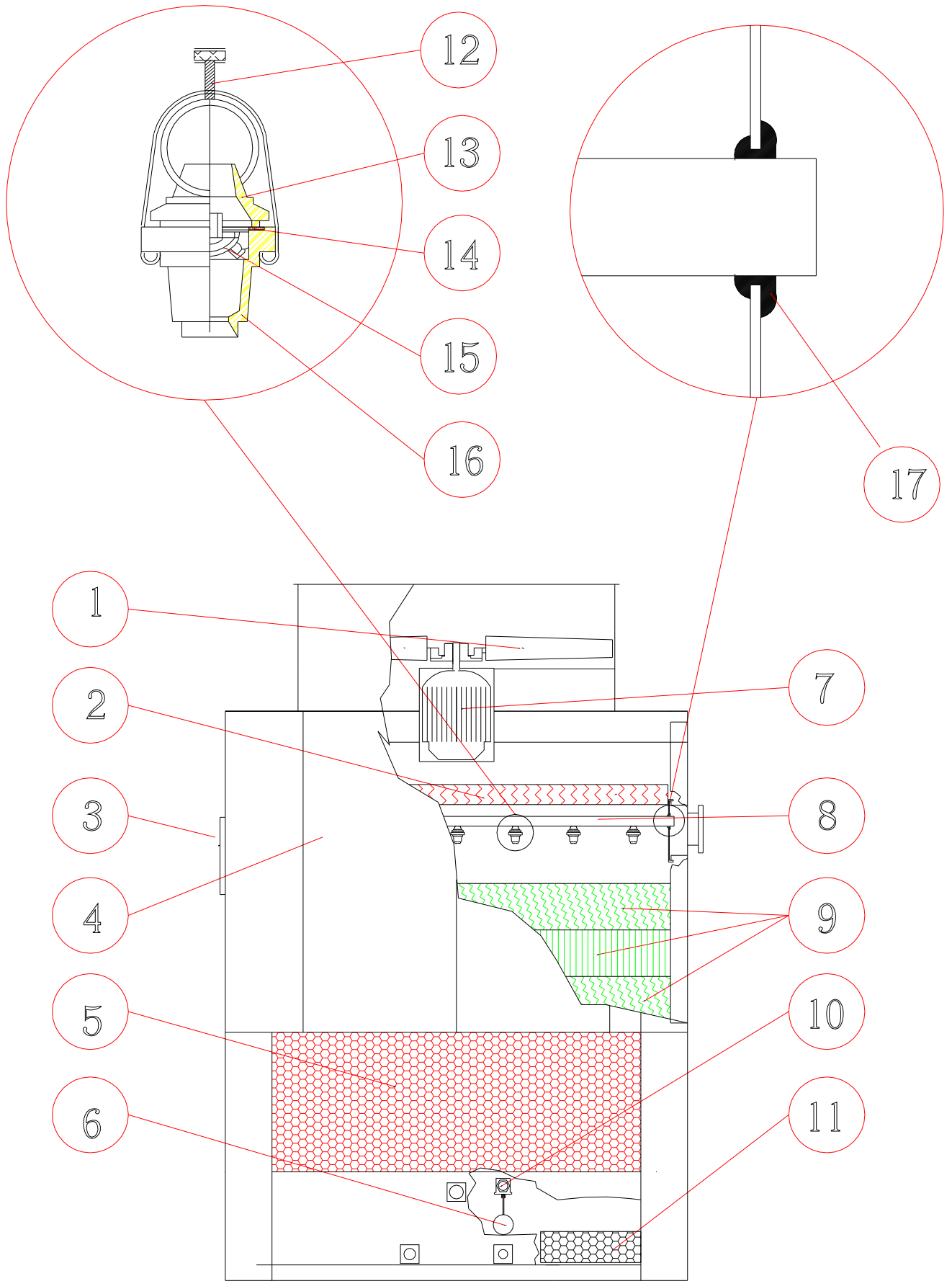
The quantity of water evaporating varies as a function of the actual heat load on the cooling tower at a given moment. Moreover it diminishes when the outside ambient temperature decreases in the winter / low season since the effect of the sensible heat exchange between the hot water to be cooled and the induced draught of air becomes significant. The temperature of the water leaving the cooling tower is determined by the design wet bulb temperature of the intake air : its value will in any case ( for a reasonable selection ) be 3 – 4°C above the summer design wet bulb temperature. TMA units are selected and quoted on a “job-to-job” basis for each project and are normally foreseen for usage at the summer operating conditions shown in the quotation.

It should be remembered that, when designing a cooling plant to include a TMA evaporative cooling tower, it is necessary to consider several important aspects:

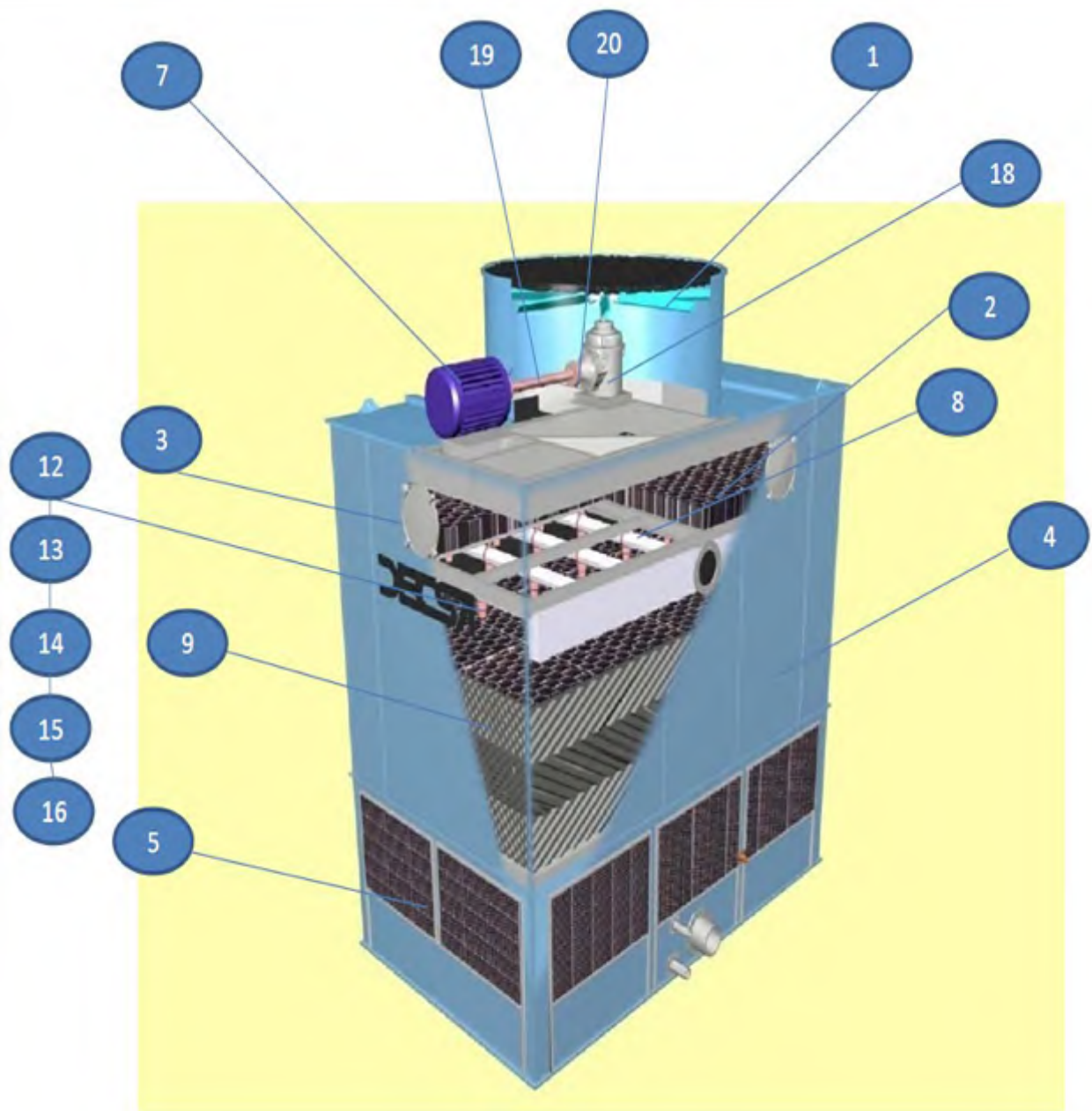
- \* Layout / Location
- \* Piping
- \* Antifreeze protection
- \* Water treatment
- \* Sound level limitations - with respect also to capacity control [ i.e. the type and/or the control of the fan motors ]

The characteristics of the TMA models are listed in an appropriate table in appendix I

REFERENCE TABLE . DIRECT-DRIVE MODELS		
Description	Reference no.	Material
Axial fan	1	Metal
Drift eliminator	2	PVC
Inspection door	3	Fibreglass
Side panel	4	Metal
Air inlet grilles	5	Polypropylene
Float ball	6	PVC
Electric motor	7	Metal
Secondary header for nozzles	8	Polypropylene
Wet deck (heat exchange) fill	9	PVC
Make-up valve	10	Brass
Water filter	11	Stainless steel
Fixing collar with pommel	12	Stainless steel
Tapered connection	13	PVC
Nozzle gasket	14	Rubber
Nozzle impeller	15	Moplen
Main body of nozzle	16	Moplen
Header gasket	17	EPDM (rubber)



<b>REFERENCE TABLE - MODELS WITH MECHANICAL DRIVE SYSTEM</b>		
Description	Reference no.	Material
Axial fan	1	Steel + Aluminium
Drift eliminator	2	PVC
Inspection door	3	Fibreglass
Side panel	4	Galvanised steel
Air inlet grilles	5	Polypropylene
Float ball	6	PVC
Electric motor	7	Metal
Secondary header for nozzles	8	Polypropylene
Wet deck (heat exchange) fill	9	PVC
Make-up valve	10	Brass
Water filter	11	Stainless steel
Fixing collar with pommel	12	Stainless steel
Tapered connection	13	PVC
Nozzle gasket	14	Rubber
Nozzle impeller	15	Polypropylene
Main body of nozzle	16	moplen
Header gasket	17	EPDM (rubber)
Orthogonal gearbox	18	Cast iron + Steel
Drive transmission shaft	19	Steel
Lamellar joint	20	Stainless steel



## LOCATION

Consult the related detailed guidelines of Decsa Srl both for the general aspects of correct location of cooling towers and for the aspects specific to the installation to be built.

TMA cooling towers offer maximum flexibility of outside installation. The vertical air discharge ensures that the operation of the tower is not affected by wind strength and direction.

It is necessary, however, to keep in mind some basic installation rules which, if not observed, will impair correct operation of the cooling tower.

It is important that the air intakes to the cooling tower are not obstructed. Exact values for the distances to be respected between tower and full walls are based upon the velocity of the drawn air in the corridors created between them: this matter is covered in detail in our layout guidelines.

Avoid air recirculation. In choosing the site of installation it is important that this aspect is duly taken account of.

The warm, saturated air discharged from the cooling tower must be able to freely disperse into the surrounding atmosphere; if a part of this saturated air is recirculated back through the tower, the latter's efficiency is compromised.

A cooling tower should thus not be installed close to walls or obstacles higher than the tower itself which impede the easy dispersion of the discharged air to the surroundings.

Do not obstruct the air intake and discharge.

The air is the means by which the heat of the water is rejected to the surrounding atmosphere. Good air circulation is thus fundamental to obtain the best results from your cooling tower.

Ensure therefore that all the air intakes are free of obstacles and that the air can be freely discharged in the correct manner.

Protective roofing is not admissible.



## Multiple TMA cooling towers in a row

When installing several TMA cooling towers in a row, or as a group, one must ensure that the operation of each single tower does not affect the operation of the others; for the minimum layout distances to be respected please contact our engineering dept..

When installing three or more towers, particular care should be taken to avoid the danger of air recirculation, above all for the towers in the central position.

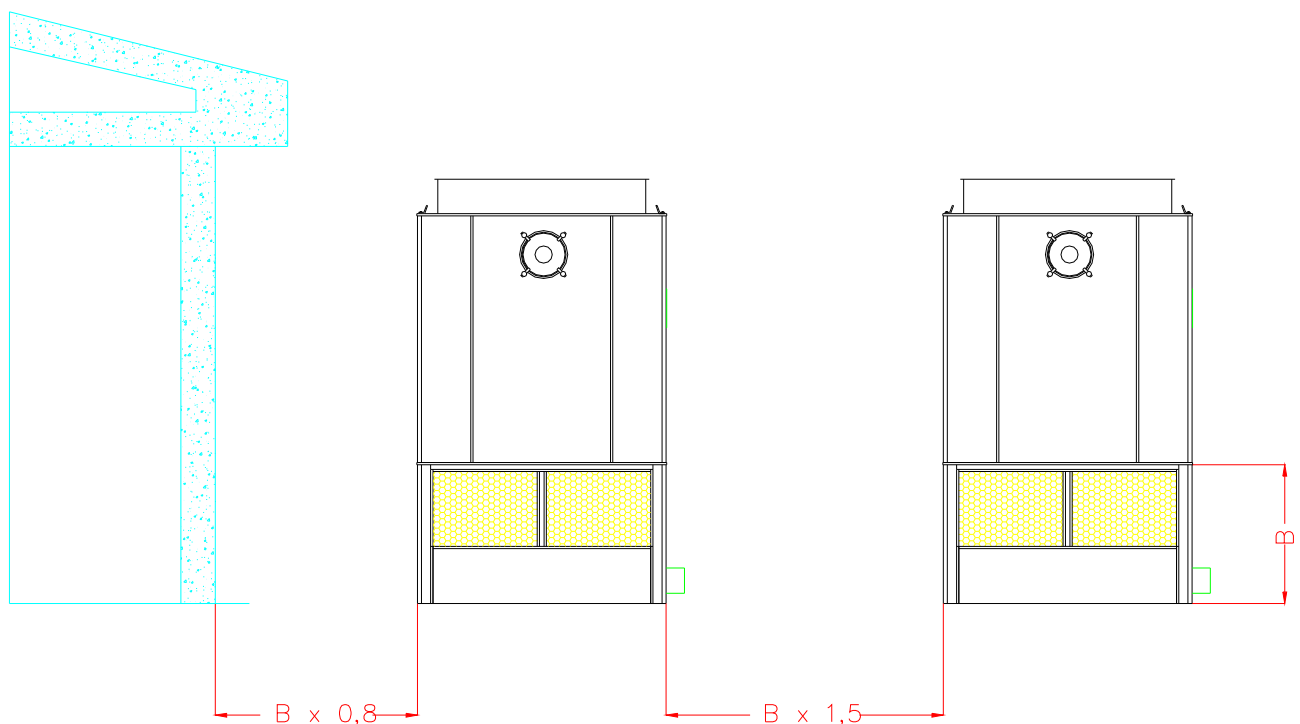
## TMA Cooling towers without basin/sump

When installing one or more cooling tower (supplied less basin/sump) above a concrete sump, apart from the aspects previously described, verify that the cross-section available for airflow is sufficiently large.

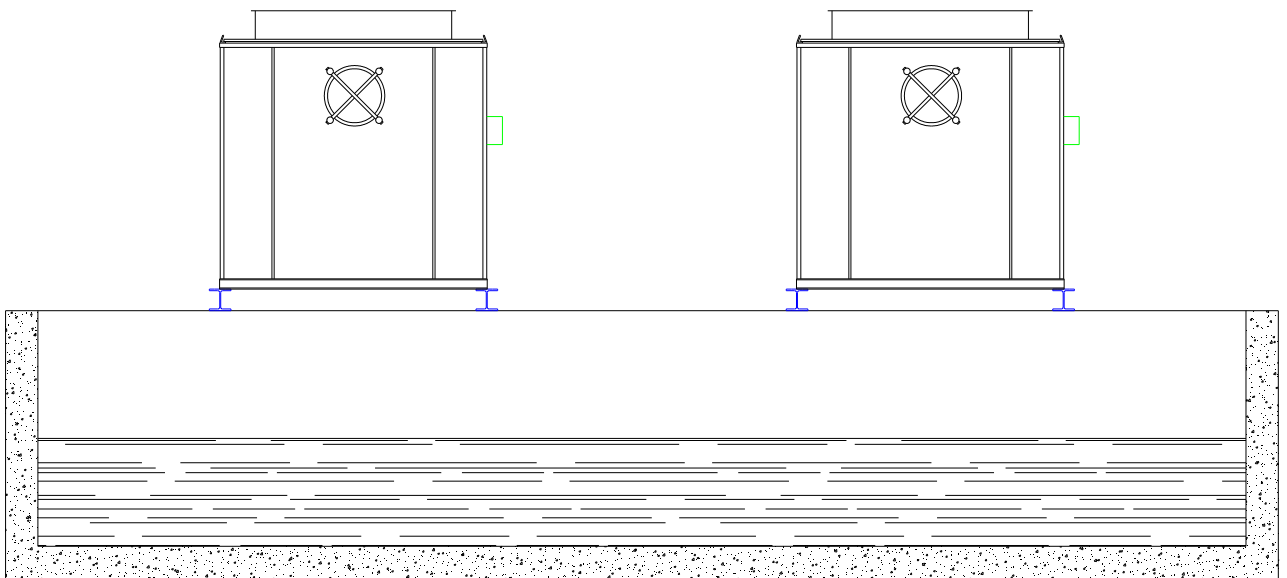
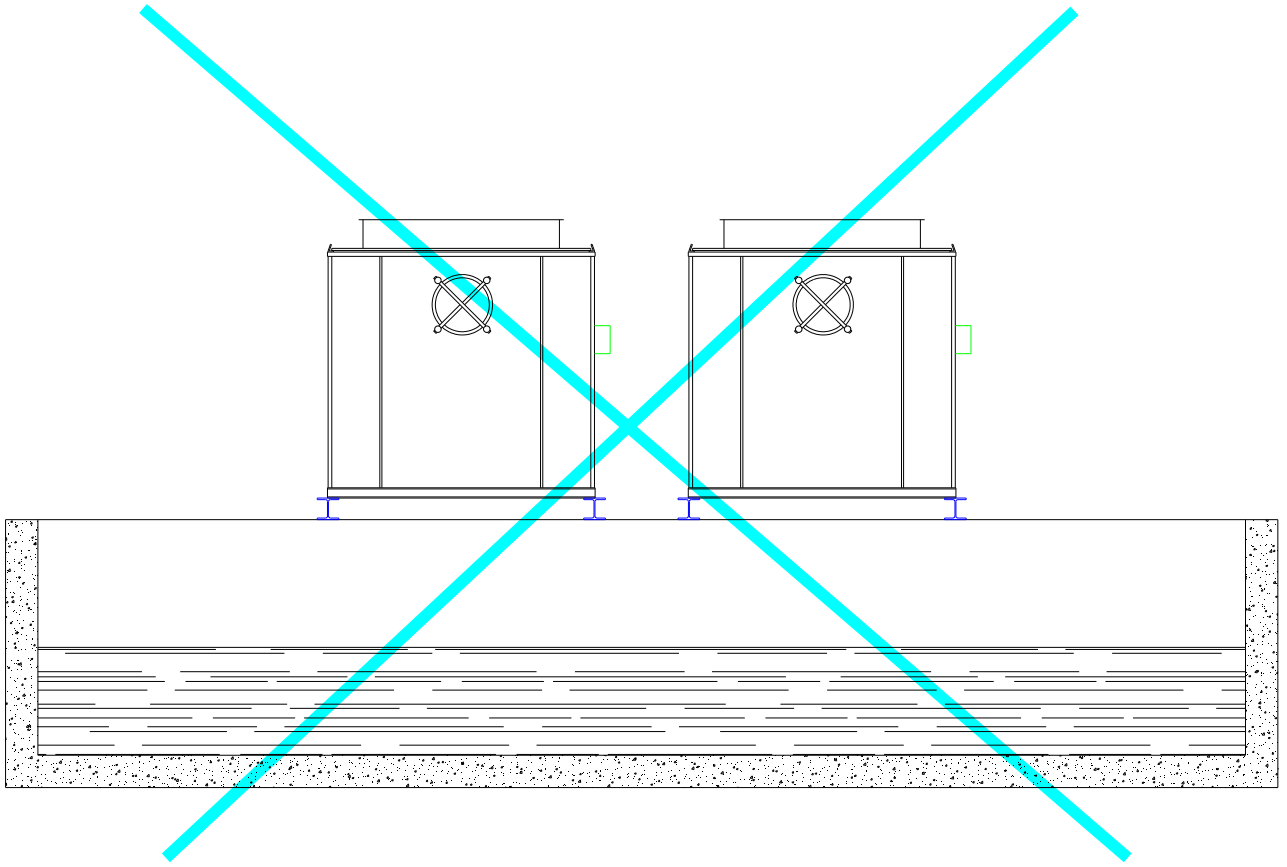
## Free area to be respected

Taking account of all the aspects previously cited, it will be necessary to leave enough space around the tower for maintenance operations; in particular maximum accessibility is needed at the side where the main water connections are located, at the inspection manholes/doors, for access to and maintenance of the inside of the unit and at the side where the pan connections are located.

It can be observed that the rules and suggestions presented here are of a general nature. Given the great variety of practical cases it is difficult to provide definite indications but our layout guidelines do provide more specific indications for various types of tower location; our engineering dept. can be contacted to obtain any further information necessary. .



The dimension "B" is to be found in the TMA series technical catalogue



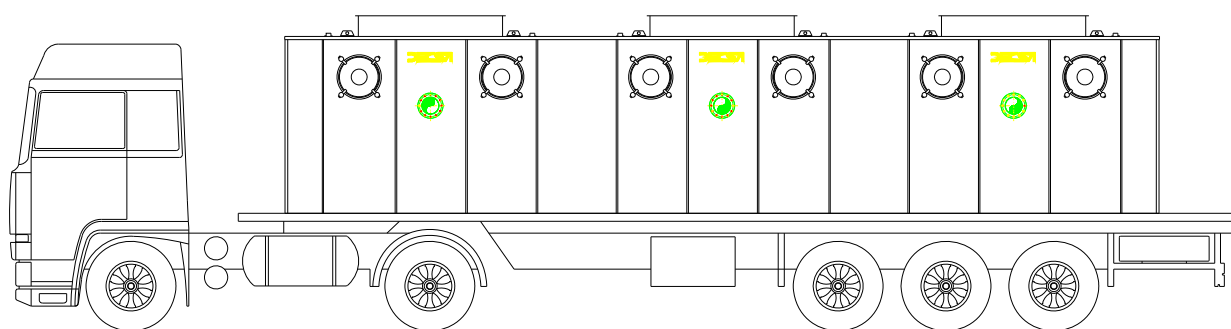
## SHIPPING

TMA series cooling towers are normally shipped divided horizontally in two sections: the upper section includes the fan section, the drift eliminators, the water distribution system and the wet deck fill whilst the lower section includes the water collecting basin (with the related connections).

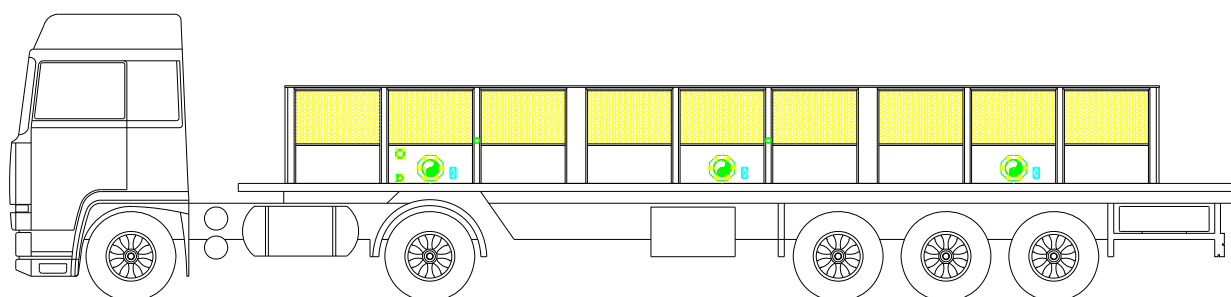
The reassembly operations at the site shall be carried out at the Purchaser's care and expense, following our instructions provided. Any accessory equipment, such as marine-style access ladders, railings, etc., shall be always shipped disassembled and also their reassembly at the site shall be carried out at the Purchaser's care and expense.

Completely assembled shipment of these towers must be especially requested when placing the order.

The towers divided in two sections are delivered along with a sufficient special gasket and the (nuts and) bolts necessary for the reassembly: this kit is placed inside the inspection door and there is a label to indicate this.



Upper section



Lower section

Upon receipt of the goods, ensure the presence and integrity of all the components, communicating any apparent anomaly to Decsa Srl with suitable notes made directly on the delivery documents.

## LIFTING

All series TMA cooling towers are equipped with external lifting ears (Fig. 3). Whereas the pans/sumps of the towers are fitted with lifting ears located on the inside of their uppermost flange.

It is indispensable that these lifting ears are all, always tensioned and that the lifting cables act vertically and avoid breakages or deformations and danger during lifting.

When moving only the lower, water-collecting basin section, respect scrupulously the scheme, paying particular attention to the slings and spacers.

The lifting ears must in any case be used for small movements or for final positioning, whereas for extended lifts (such as from ground to the top of a building,) a suitable robust platform under the unit should be used .

CAUTION: SUSPENDED LOADS 

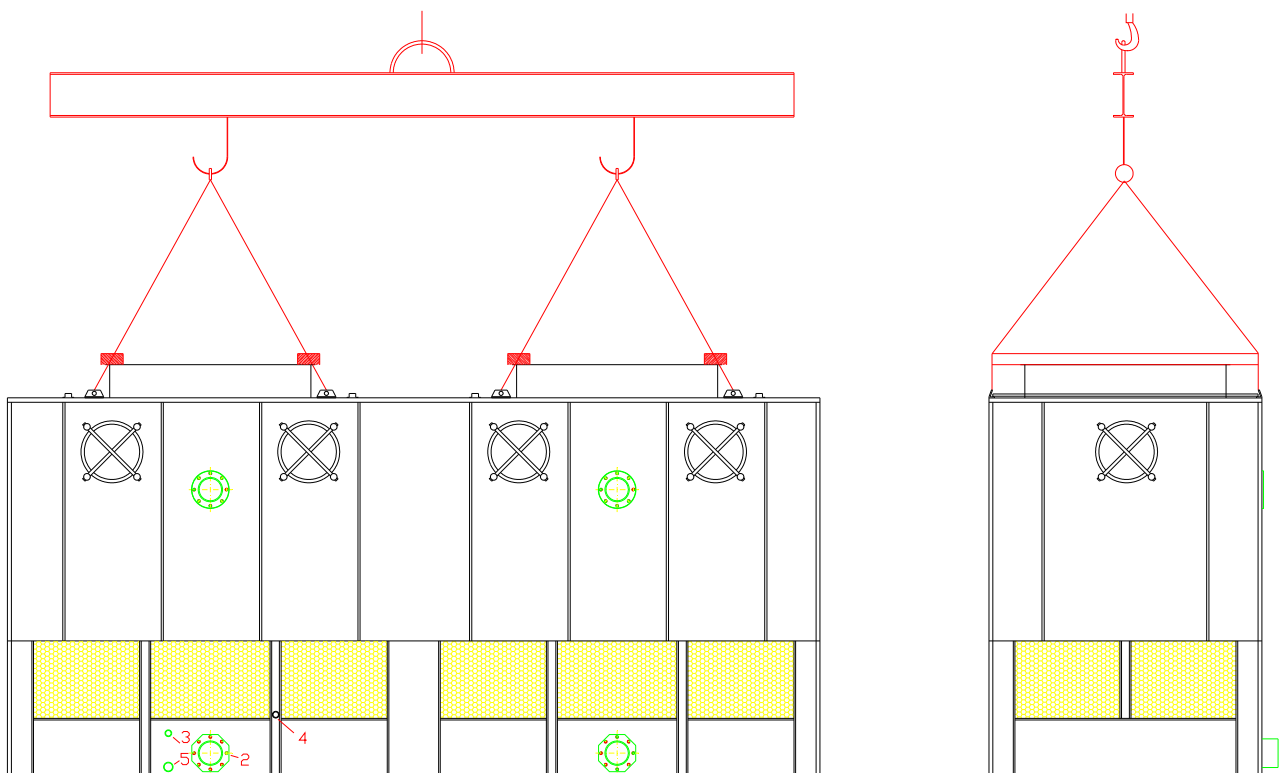


Figure 3

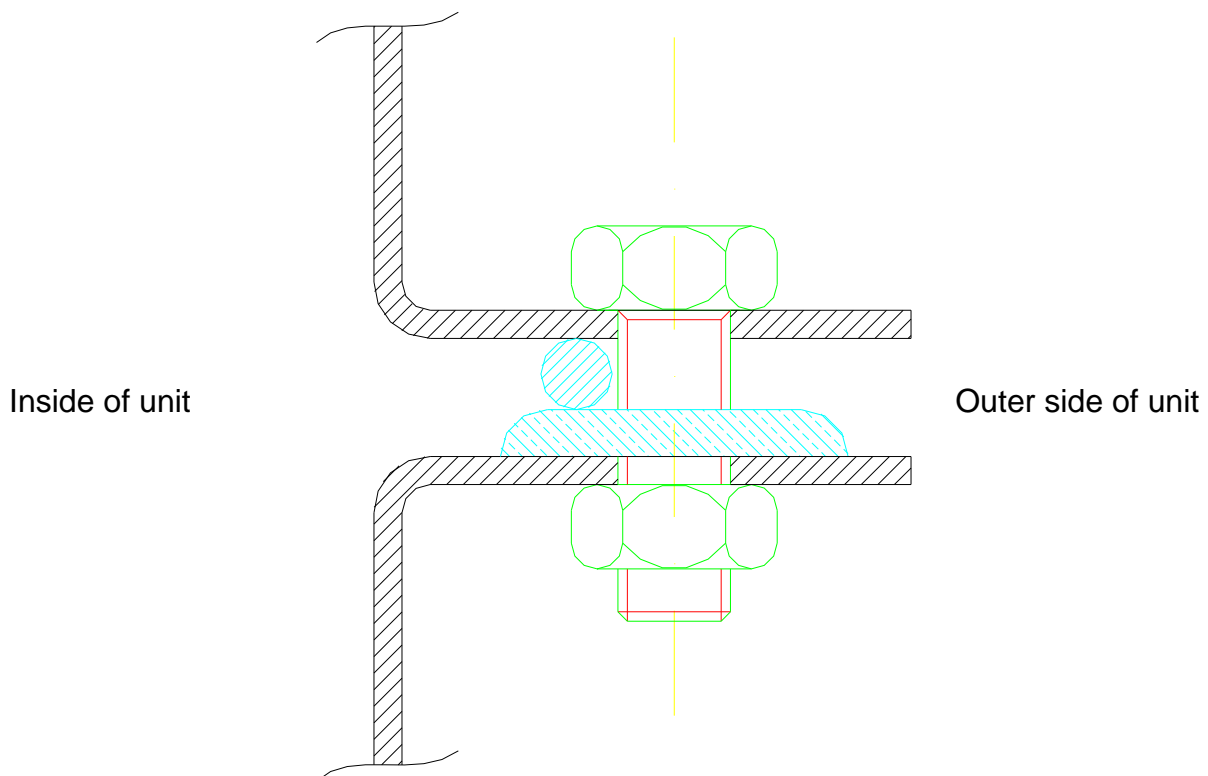
## REASSEMBLY (RIGGING)

When re-assembling, proceed as follows (Fig. 1):

- a) Place the lower section of the unit on a flat surface, having first ensured that the upper edge has not been damaged during transportation. Clean carefully.
- b) Cut a suitable length of sealer-gasket, remove paper protection from one side and press gasket onto base top flange. Remove paper on the other side and drill holes in the gasket in correspondence with the connection holes.
- c) Place the bead sealer over the tape sealer-gasket in the area between the holes and the inside of the unit (see sectional drawing below).
- d) Lift, in accordance with the instructions of paragraph "Lifting", the upper section of the unit and place it in position with the help of metal pins inserted into the holes of upper and lower flanges. If the holes do not correspond, it means that either the lower or the upper section of the unit are not level; this may depend upon the support platform or on the way in which the upper section has been hoisted during assembly.

In some cases, if it proves to be difficult to obtain perfectly flat surfaces, it may be more convenient to re-drill some of the holes. In this case be sure to previously remove the gasket from the holes. It is necessary to perfectly centre all the holes before lowering the upper section (Fig. 2)

- e) Push bolts into place, and tighten.
- f) If the unit has been supplied divided into two sections for ease of transport, connect the plastic bleed-off pipe to the pipe-connector fitted above the over-flow connection.



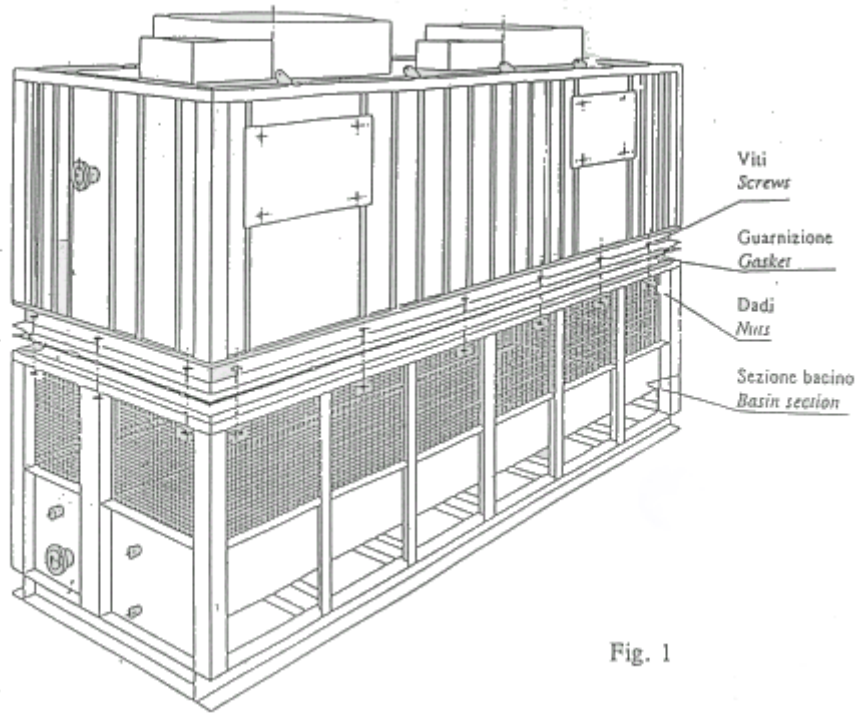
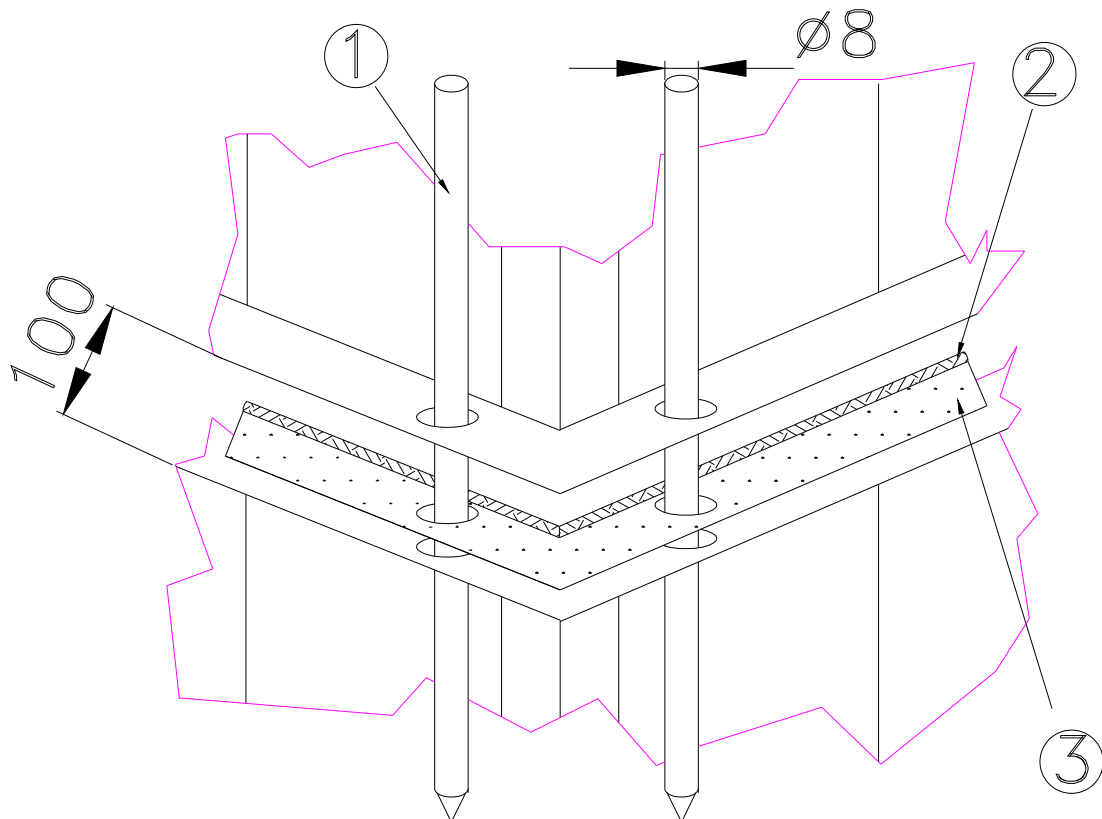


Figure 2



- 1) Guide pin 2) Bead sealer-gasket 3) Flat / tape sealer-gasket

Use 2 pins in each corner

## INSTALLATION

Over and above the indications provided in the chapter on "Location" it is necessary to ensure beforehand that the supporting surface on which the tower is installed will be able to bear its operating weight (therefore with water in the tower), as indicated in the TMA catalogue. TMA series cooling towers do not normally require additional support structures.

TMA cooling towers must rest uniformly on a perfectly level and horizontal base. If the cooling tower must for some reason be installed on metal profiles, with or without the interposition of vibration isolators, apart from the lateral beams, one or two central support beams must also be provided.

As cooling towers are normally placed in the open air and often on top of buildings, it is necessary to take precautions against effects from wind action: the base frame should be anchored by means of bolts and steel wires should be connected to the upper lifting ears.

Generally speaking, the indications given above must also be taken into account when installing a TMA tower less sump/basin (above a concrete sump).

As far as water connections are concerned, given their dependence mainly on the particular installation, general rules cannot apply. We suggest do however suggest the following:

### Caution

- While welding the flanges to water **inlet and outlet connections**, care must be taken not to damage surface finish of the paintwork and panel sealing, wet deck fill and nozzles. For this purpose wet rags should be inserted at the base of the connections.
- The piping must be supported independently of the cooling tower and not impose any load upon it.
- The tower must be placed on the **highest point** of the water circuit to avoid emptying the system when the pump is stopped. If this is not possible, a check valve on the water outlet and an air relief valve must be fitted.
- Water circulating **pumps** must always be placed at a lower level than that of the water level in the tower.
- Water pipes must be properly **sized** and installed so that normal expansion and contraction is possible.
- In installations with **two or more towers**, care must be taken to balance pressure drops in the various pipe branches and level equalisation pipes must be connected to sumps.
- Make-up pressure head must be at maximum of 2 bar.
- **Maximum operating pressure at water inlet connection must be 0,8 bar. Higher pressure values may seriously damage the water distribution system inside the unit.**
- Before tightening the bolts and nuts of the flanged connection, check the alignment of the flanges themselves and that they are in parallel planes.
- It is also advisable to install shut-off valves on each tower to enable separate maintenance of each; these valves are also useful to even out differences in water flow to each tower. Whereas the possibility of this shut-off is convenient, the possibility of adjustment to balance the flows is very important.

## Sealing of Leakages

During transportation and lifting the units can be submitted to stresses that damage the sealing, which will result in water leakage during operation.

To eliminate these leakages it is essential to proceed as follows:

- 1) Sealing must always be made from the inner side of joints.
- 2) Seal only perfectly dried surfaces.
- 3) Remove previous sealants.
- 4) Accurately degrease.
- 5) Do not seal only the area where a leakage is taking place, but rather seal an excess length at both ends.
- 6) Apply the sealant (with the extruder for that purpose) in a sufficient, but not excessive quantity, and as uniformly as possible.
- 7) If necessary, slightly press the sealant to allow the penetration between the surfaces.
- 8) Do not use the unit for at least 24 hours. If the sump has been sealed, it is advisable to protect the unit with plastic sheets to avoid rain reaching the recently sealed area.

Naturally only suitable and good quality sealant must be used (single-component, non-acetic silicon).

Our Engineering Department will be glad to provide you with any further advice you may need.



## Electric wiring – Electric wiring diagram

The electric wiring is an operation which should be performed by particularly qualified personnel (even better if they are specialists)

- Check the integrity along the whole length of the cable to be used for the connection and then proceed with wiring-up as per the wiring diagrams.
- The minimum cross-section of the connecting cables should be chosen on the basis of the voltage, the installed power and the distance between the power source and the user point as per the following table:

Motor power “P” [kW]	Cable cross- section “S” [mm <sup>2</sup> ]
0,09	1,5
0,12	1,5
0,18	1,5
0,25	1,5
0,37	1,5
0,55	1,5
0,75	1,5
0,9	1,5
1,1	1,5
1,5	1,5
1,8	1,5
2,2	1,5
3	2,5
4	2,5
5,5	4
7,5	4
9	6
11	6
15	10
18,5	10
22	16
30	25
37	25
45	35
55	35

Check that the primary electricity line to which the unit is to be connected has the same voltage and frequency as that foreseen for the operation of the unit .

- Effect “state of the art” wiring.

All live components must be earthed. All connecting cables – phases + earth – must be connected in such a manner that it is impossible to tear them away or damage them in any fashion (even for those items at low voltage).

Always check that the earthing wires are not those to neutral and vice-versa; i.e. the earthing wires must make an effective earthing. The neutral must be employed as such and the earthing wire exclusively for that purpose.

Refer to the electric wiring diagrams for wiring-up the motors in appendix III

## Electric Wiring

The unit must be earthed

For the **electric wiring** the following considerations are applicable:

- a) A Fan motors up to 7,5 kW size are suitable for an electrical connection with direct-on-line start. For larger size fan motors, star/delta soft start systems must be foreseen to prevent excessive wear of the motors and of the transmission system (if any). If two speed motors Dahlander type are installed, motors must be started at low speed and switched at high speed immediately after. During the opposite procedure (commuting from high to low speed) provide for a system of delay in the switching (at least 15 seconds) in order to avoid overloading the motor winding. Thermal overload protection of the fan motors should be provided, calibrated for 1,1 x the motor power. A cooling tower equipped with a fan motor of nominal output > 3 kW requires a second power supply line. The nominal voltage of the electrical control circuit should not exceed 250V
- b) s If the motor of the cooling tower is remotely controlled by a centralised control panel, it is advisable to install an isolating switch in the immediate vicinity of the tower for the complete safety of any maintenance operation.
- c) C For winter operation it is advisable to install electric heaters (with incorporated safety thermostat) in the tower sump in order to be sure that all the water contained in the sump cannot freeze. Electric wiring separate from that of the fan motor is necessary.

The sump heater must be controlled by an independent thermostat (not included in our supply), follow-up linked to the pump remote control switch and adequately protected against short-circuiting. The bulb of the heater thermostat must be placed in the water sump, as far as possible from the electric heaters and near the sump bottom.

- d) When operation with a VSD with frequency variation is required, check that the rotation speed of the motor-fan set is included in the design limiting values; in case of doubt, these values can be provided by our engineering dept. Do not ever start-up a unit (piloted by frequency variation) without knowledge of the maximum admissible speed of fan rotation, otherwise the fans risk damage, and without having checked the resonance speed and ensured that it will be avoided.
- e) Wiring of the motors.  
The electric motors installed on our evaporative cooling equipment normally have class F insulation with IP55 protection. This high protection grade is the best guarantee of good and long lasting operation in the humid environment in which the motors are normally installed.

However it is important that while connecting the motor, particular care is given to the tight fastening of the cable-entries of the terminal box and to the fastening of the cover of the same terminal box. A bad fastening of the cable-entry and/or of the cover of the terminal box, would make the motor subject to water infiltration, which would seriously damage the bearings and the windings.

Even if the following are only general rules of good technical practice, we wish to remind whoever installs the wiring that after having wired-up the motor, it is important to check that:

- 1) the wiring is in accordance with the electric characteristics with which the motor should operate and that the direction of rotation is correct;
- 2) the cable-entry is perfectly tightened preventing any water infiltration;
- 3) in case the connecting box has a number of holes for wires, the ones that are not used should be tightly closed with an hermetic plug;
- 4) while reassembling the cover of the terminal box, the gasket should be correctly placed so as to ensure perfect impermeability.

Do not operate the unit if the above conditions are not attained.

f) All electrical connections must be effected according to current local regulations.

### **Caution**

- To effect electric wiring or other works it is prohibited to walk on the uppermost surface of the cooling tower if it is not equipped with a walkway for that purpose. To access the motors it will therefore be necessary to protect the zone where the operator must pass with planks of wood or with other suitable means.
- If the fan motor is controlled by an inverter (VSD with frequency variation), particular attention should be paid to its programming, in order to avoid the operation at "critical" speeds.
- In order to avoid unexpected wearing out of the motor, it is recommend to not exceed the ceiling of 5 starts per hour..

g) The electric motors from 0,55 kW (L80) up to 22 kW (L180) are equipped with pre-lubricated bearings, which do not necessitate any lubrication and their operating life is about 30.000 hours.

The motors from 30 kW (L200)m up to 45 kW (L250) are equipped with open bearings, requiring lubrication . The bearings have an automatic grease discharge device.

The bearing chambers are to be pre-filled with grease to not more than half of their capacity, since an excessive grease quantity makes the bearings run hot. It is recommended to refill the bearings with grease every 1500 hours of motor operation, or at least once every 6 months.

Lithium grease must be used for lubrication. The refilling of bearings with grease can be made through the greasing nipple fastened in the bearing cover on both sides of the motor. Before refilling the grease nipple must be cleaned.

It is recommended to completely change the grease in the bearings of motors with speed:

up to 1500 rpm (50 Hz)  
1800 rpm (60 Hz) after 10.000 working hours, but not later than after 2 years

Precautions for particularly lengthy installation and/or periods of storage

- If the unit is to remain inactive for long periods, or if site work becomes drawn out it is wise to take the following precautions:

- the electric motors are designed and built to work in a humid air flow, however these components are not perfectly water-tight; some manufactures in fact adopt condensate drain holes, to permit the motor to expel (whilst running) the residual humidity inside the stator.

- Such refinements are designed to serve their purpose during the normal usage of the motor and, in the particular case of long shut-downs, these holes can be the cause of water infiltration and give rise to blockage of the rotating parts.

- The bearings at the two ends of the rotor are of a self-lubricating type and, as described for the condensate drain holes, serve their purpose correctly during normal motor usage; a long period of inactivity can give rise to wear of these elements for lack of lubrication.

To avoid running into the above-listed problems a regular, periodic operation of the motors must be programmed,; if that were not possible it is recommend to remove the electric motor and any gearbox and to store it in a dry area not subject to sudden variations in temperature.

### **START-UP**

Fan control (by others) must be such that the fan motor is activated only after start-up of the cooling water pump.

Before initial start-up verify the alignment of all the section of the unit and the correct emplacement of the various components. Check that all the air discharge screens are in place and that the related **fixings** are tightened. Ensure that all the installation work, adjustments and connections have been completed.

### **Protection against Biological Risks**

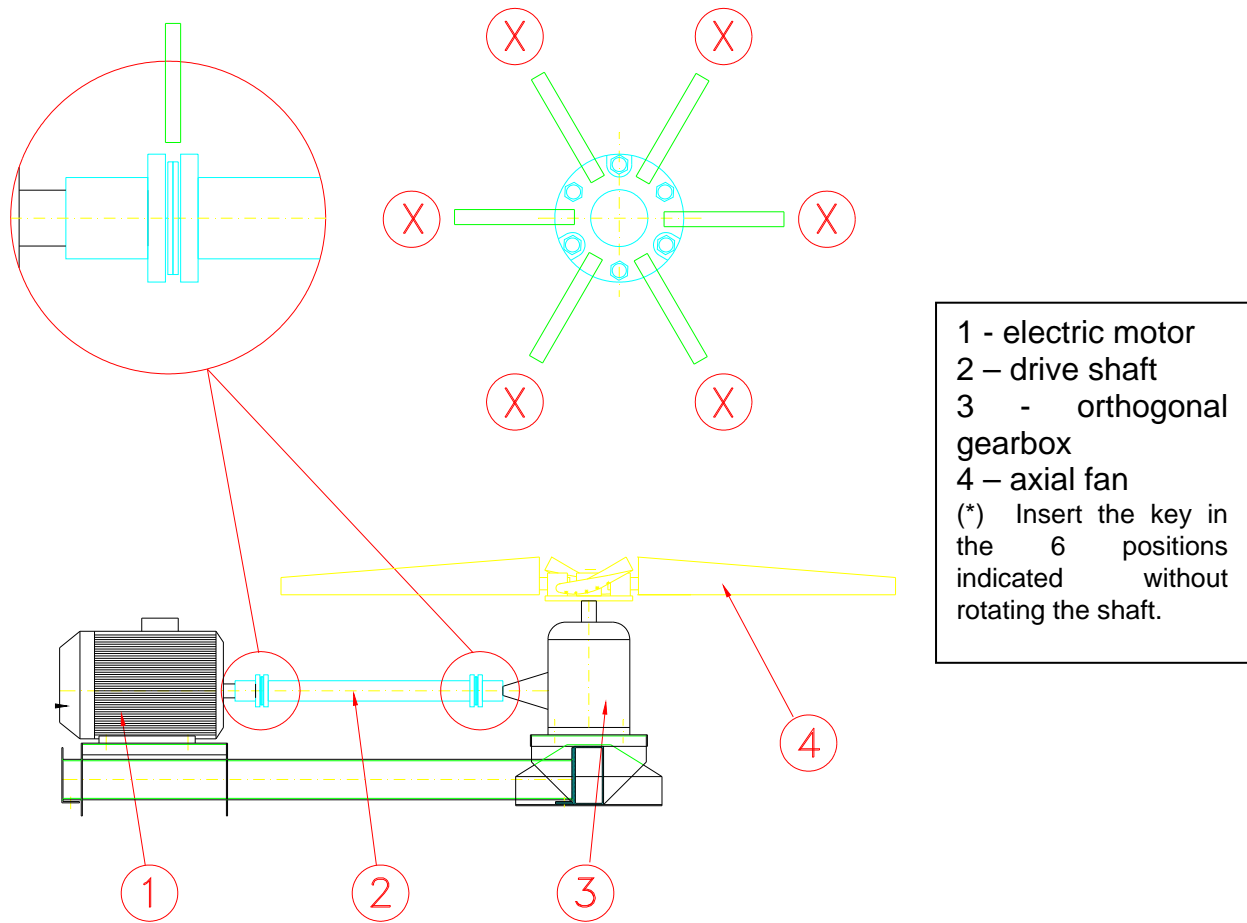
The recirculating water system of a cooling tower may contain chemicals or biological contaminants, which could be harmful if inhaled or ingested. Accordingly, personnel who may be exposed directly to discharge airstream and associated drift, mists generated during operation of the water distribution system and/or compressed air, should **this** be used to clean portions or components of the recirculating water system, should wear respiratory protection equipment approved for such use by local occupational health and safety authorities.

Each TMA unit is tested at the factory before shipment, however the following items should be checked prior to initial start-up:

if the float valve has been secured for shipment, free it. The float valve on the make-up water connection is adjusted at the factory, but it may be necessary to check for proper operation. The float valve should be completely closed when the level in sump is approximately 20 mm. below the overflow connection. Conversely the water level should not be too low, as this should enable air to be drawn into the pump, which would cause rapid wear of the impeller. Moreover the insufficient water sprayed over the fill would cause reduced efficiency and rapid scaling. This defect becomes apparent from an intermittent noise of water discharge from the spray nozzles during tower operation. This phenomenon is on the other hand quite normal at the initial start-up of the cooling tower, up until the complete purging of air from the piping. The fine adjustment of the float ball is made by loosening the nut which fixes the float ball to the lever arm and moving the float ball vertically. In some models it is also possible to adjust the angle of the lever arm with an appropriate nut. Whereas movement of the float ball away from the float valve, along the lever arm, further contrasts the make-up water pressure .

- check that the fans are free to rotate and in the right direction.
- In the case of anomalous vibrations of moving parts, shut-off immediately the unit and contact our Engineering Dept. (refer also to the Trouble Shooting / Faults Guide)

- If the drive system is of a mechanical type with orthogonal gearbox, the correctness of the alignment of the drive shaft must be checked after about 12 hours of operation, using the calibrated key supplied, for that purpose, together with the unit (see the schematic drawing shown below):




During the initial period of operation, foreign matter deposited in the sump may reach the nozzles. It is therefore advisable to frequently clean the nozzles during the initial period of operation as irregular or reduced spraying may reduce the efficiency and increase scaling.

When the water level in the pan/sump descends, air is drawn in by the pump suction and cavitation is induced. Maintaining the correct water level is therefore important.

The fan system can be started only after the set-up and stabilisation of the water circulation and only when the latter is operational.

**List of Tools required:**

series of spanners; 1 adjustable spanner; series of Allen screwdrivers ; air compressor equipped with flexible tube for removal of dirt / residues ( and eventually a paint pistol for touch-ups ).

Caution: do not leave tools inside the tower after a start-up or shut-down operation 

## INITIAL AND SEASONAL START-UP

	OPERATION	RESIDUAL RISKS	PRECAUTIONS
1	Inspection of the conditions of the unit in general (possible cleaning and/or touch-up of galvanised components)	Mechanical (rotating parts) Biological (chemical)	Use shut-off device Use regulation personal protection and safety equipment (follow instructions for usage of zinc spray)
2	Cleaning and washing of inlet grilles, pan/sump and water filter	Biological (and possibly chemical from water treatment)	Use regulation personal protection and safety equipment
3	Adjustment of float valve and water level	Biological (and possibly chemical from water treatment)	Use regulation personal protection and safety equipment
4	Inspection of nozzles for absence of deposits or scale	Biological (and possibly chemical from water treatment) Mechanical (raising the drift eliminators)	Use regulation personal protection and safety equipment Use shut-off device
5	Inspection of fill pack/heat exchange surface for absence of deposits or scale	Biological (and possibly chemical from water treatment)	Use regulation personal protection and safety equipment
6	Check on and adjustment of bleed-off water	Biological (and possibly chemical from water treatment)	Use regulation personal protection and safety equipment
7	Check for unusual vibration and/or noise	Mechanical (rotating parts)	Do not access the zone of rotating machinery without having first activated the shut-off device
8	Verification of voltage and absorbed current	Mechanical (rotating parts)	Effect measurements at the control panel and not at the motor
9	Check drive system (where applicable)	Mechanical (rotating parts)	Use shut-off device
10	Check tightness of motor fixing bolts and fan screen fixings	Mechanical (rotating parts)	Use shut-off device
11	Periodic running check of fans and verification of correct direction of rotation and of unobstructed operation	Mechanical (rotating parts)	Visual inspection with fan screens fixed in place.
12	Check oil level of orthogonal gearbox (where applicable)	Mechanical (rotating parts)	Use shut-off device

**AFTER 24 HOURS of operation with normal heat load:-**

	OPERATION	RESIDUAL RISKS	PRECAUTIONS
1	Check water level in the pan/sump	Biological (and possibly chemical from water treatment)	Use regulation personal protection and safety equipment Use shut-off device
2	Inspection of nozzles for absence of deposits liberated by the flow of water	Biological (and possibly chemical from water treatment) Mechanical (raising the drift eliminators)	Use regulation personal protection and safety equipment
3	Inspection of fill pack/heat exchange surface for absence of deposits freed by the water flow	Biological (and possibly chemical from water treatment)	Use regulation personal protection and safety equipment
4	Check for unusual vibration and/or noise	Mechanical (rotating parts)	Do not access the zone of rotating machinery without first having activated the shut-off device
5	Recheck of mechanical drive system (where applicable)	Mechanical (rotating parts)	Use shut-off device
6	Recheck tightness of motor fixing bolts and fan screen fixings	Mechanical (rotating parts)	Use shut-off device

**SEASONAL SHUT-DOWN**

	OPERATION	RESIDUAL RISKS	PRECAUTIONS
1	Inspection of the conditions of the unit in general (possible cleaning and/or touch-up of galvanised components)	Mechanical (rotating parts) Biological (chemical)	Use shut-off device Use regulation personal protection and safety equipment (follow instructions for usage of zinc spray)
2	If the cooling season < 6 months make a running check of fans and verify correct direction of rotation and of unobstructed operation	Mechanical (rotating parts)	Visual inspection with fan screens fixed in place.
3	Cleaning and washing of inlet grilles, pan/sump and water filter and then drainage of pan/sump	Biological (and possibly chemical from water treatment)	Use regulation personal protection and safety equipment
4	Close the make-up valve and drain the associated piping	Biological (and possibly chemical from water treatment)	Use regulation personal protection and safety equipment
5	If the cooling season < 6 months, change of oil in the orthogonal gearbox (where applicable)	Mechanical (rotating parts)	Use shut-off device

## OPERATION / RUNNING

**PERMITTED USES** : the cooling tower is foreseen exclusively for the cooling of water as per the description of the unit and in accordance with the selection data of the quotation and of the related order. Respect at all times the maximum temperature for the heat exchange surface = 55°C. Other temperatures and/or applications are not admissible if not previously agreed with the manufacturer in the design and quotation phase. Decsa Srl will not accept any responsibility for injury to persons and/or damage to other objects due to a non-respect of these limitations.

### **Protection against Biological Risks**

The recirculating water system of a cooling tower may contain chemicals or biological contaminants, which could be harmful if inhaled or ingested. Accordingly, personnel who may be exposed directly to discharge airstream and associated drift, mists generated during operation of the water distribution system and/or compressed air, should this be used to clean portions or components of the recirculating water system, should wear respiratory protection equipment approved for such use by local occupational health and safety authorities.

### **Biological control**

Blow down with or without chemical treatment for scale and corrosion control is not adequate for control of biological contamination. The growth of algae, slimes and other micro-organisms, if unchecked, will reduce system efficiency and may contribute to the growth of potentially harmful micro-organisms, in the recirculating water system. Accordingly, a biocide treatment programme specifically designed to address biological control should be initiated when the system is first filled with water and administered on a regular basis thereafter in accordance with supplier's instructions. For specific recommendations consult a competent water treatment supplier.

Note : It is recommended that operators and maintenance technicians refer also to the Eurovent guide 9-5 (2° Ed. 2002) for the prevention of biological contamination in evaporative cooling systems.

When the water level in the pan/sump descends, air is drawn in by the pump suction and cavitation is induced. Maintaining the correct water level is therefore important.

The fan system can be started only when the water circulation is operational.

It is important that attention is given to quality of water to avoid build up of scale, which reduces the heat exchange and consequently the thermal efficiency of the equipment.

As water is sprayed over the fill, a portion of it evaporates, thus increasing the concentration of salts in the remaining circulating water. A bleed-off connection is supplied with each unit: this allows an increase in the quantity of fresh water coming into the sump, thus diluting the salts and reducing the scaling effect of water. The bleed-off tube is complete with a tap that should be adjusted according to the hardness of the water.

As the quality of water is extremely important for the operation of an evaporative cooling unit, we strongly recommend to contact a specialised company to request a suitable water treatment. Reputable water treatment companies are perfectly aware of the problems connected with evaporative cooling equipment and will suggest the most suitable treatment programme.

Please note that the warranty for TMA units is valid only for operation with water of very good quality. The recommended parameters for the circulating cooling water are as follows:-



Appearance	possibly clean and colourless. Absence of sand, suspended solids < 50 ppm
pH	7 - 9,5 (in any case the pH is related to the equipment present in the system)
Conductivity	max. 6000 $\mu$ S/cm
Total hardness	< 2000 ppm CaCO <sub>3</sub> if the total alkalinity tends to zero; otherwise in relation to the total alkalinity
Calcium hardness	related to the chemical treatment applied. In any case < 1500 ppm CaCO <sub>3</sub> if the total alkalinity tends to zero
Total alkalinity	related to the chemical treatment applied. In any case < 1000 ppm CaCO <sub>3</sub>
Chlorides	< 1500 ppm Cl <sup>-</sup> . If in presence of AISI 304 < 300 ppm Cl <sup>-</sup>
Iron	< 3 ppm Fe

In case of excessive or strange noise and/or vibration, refer to the trouble-shooting and faults guide.

Several towers in parallel: if the plant includes more than one tower operating in parallel in the same circuit, the pans/basin must be connected with equalizing lines with related valve to avoid differences in water level and water loss (see the chapter concerning installation)

Antifreeze protection: in the absence of a remote sump or of electric pan heaters, drain the pan/sump and the related piping at the end of the cooling season and keep everything dry until the next period of employment.

When operation with a VSD with frequency variation is required, check that the rotation speed of the motor-fan set is included in the design limiting values; in case of doubt, these values can be provided by our engineering dept. Do not ever start-up a unit (piloted by frequency variation) without knowledge of the maximum admissible speed of fan rotation, otherwise the fans risk damage, and without having checked the resonance speed and ensured that it will be avoided.

A correct air flow is important for the proper operation of the cooling tower – see the chapter concerning location.

Check systematically that all the air discharge screens are in place and that the related fixings have been tightened.

## MAINTENANCE

Although cooling towers are relatively simple machines, they are usually subject to very adverse operating conditions. The need for maintenance of the TMA series cooling towers are very limited, but inevitably, to extend good performance of the tower over the years, some maintenance service operations must be effected regularly. Listed below are to be found the main maintenance operations that must be regularly effected. Please note that the indicated frequency may have substantial variations depending on the actual operating conditions of a given unit.

### RESIDUAL RISKS AND RELATED PRECAUTIONS AS PER THE TABLES OF INSTRUCTIONS IN THE CHAPTER ON START-UP

#### Caution

As already emphasized in the chapter on "Installation", it is prohibited to walk on the uppermost surface of the cooling tower if it is not equipped with a walkway for that purpose.

	OPERATION	First Start-up	Weekly	Monthly	6 monthly	Annually
1	Inspection of the conditions of the unit in general (possible touch-up of galvanised components)	X				X
2	Cleaning and Washing of pan/sump and filter	X		X		
3	Adjustment of make-up valve and water level	X			X	
4	Inspection of nozzles	X		X		
5	Inspection of fill pack / heat exchange surface	X		X		
6	Inspection of drift eliminators	X		X		
7	Inspection of inlet grilles/louvers	X		X		
8	Check and adjustment of bleed-off	X			X	
9	Check on vibrations and/or unusual noise	X		X		
10	Check voltage and absorbed current	X				X
11	Check drive system (where applicable)	X			X	
12	Periodic fan operation and check on their direction of rotation and unobstructed operation	X			X	
13	Check of oil level in orthogonal gearbox (where applicable)	X	X			
14	Change of oil in orthogonal gearbox (where applicable)				X	
15	Draining of pan/sump					X

At the end of every maintenance operation check that all the air discharge screens are in place and that the related fixings have been tightened.

#### List of Tools required:

series of spanners; 1 adjustable spanner; series of Allen screwdrivers ; air compressor equipped with flexible tube for removal of dirt / residues ( and eventually a paint pistol for touch-ups )

Caution: do not leave tools inside the tower after a maintenance operation



1) **Painting**

Thoroughly check all the painted parts of the unit to detect possible areas where rust or corrosion has occurred. In this case, clean the part with a metal brush and apply a rust treatment product, such as Ferox of Arexons, Noverox, etc. . These products will convert rust into inert salts (follow the manufacturer's instructions). After two or three days, remove any excess product and apply good quality paint compatible with the existing one.

The external standard paint protection of Decsa units is ensured by an epoxy primer coating layer and a Polyurethanic final layer, colour code RAL 5014. The Decsaprot execution includes an extra internal protection against corrosion by epoxy primer and bitumastic coating . The Decsaprot execution is an option supplied on requested.

For any touch-up or repair of galvanised components, follow the instructions provided by the manufacturer of the cold zinc spray.

2) **Basin and water filter flushing**

Empty the basin so as to eliminate all impurities. Wash the water filter, removing it if necessary.

3) **Make-up valve and water level check**

Check the float valve of the make-up to ensure correct operation. Tighten the bolts if necessary.

4) **Inspection of nozzles**

Inspect nozzles to be sure that all of them give a full and continuous spray and are not obstructed or scaled by foreign matter.

If necessary, remove the nozzles; this operation can be accomplished without any tool as the nozzles are in rubber and can be removed by pulling them gently with alternate rotations. The reassembly operation can be facilitated by wetting the connecting collar.

5) **Check on fill pack / heat exchange surface**

As scaling builds up because of improper water treatment and/or irregular spraying, a frequent check of the fill may save considerable damage to the unit. Uniform scaling would mean that water treatment is inefficient, whereas localised scaling means that one or more nozzles are not spraying correctly.

6) **Check on drift eliminators**

Check the correct positioning and integrity.

7) **Check on inlet grilles/louvers**

Check the correct positioning and absence of dirt inside.

8) **Check bleed-off water**

The bleed water pipe is complete with a tap that should be regulated according to the water conditions. Based upon experience and regular checks, the bleed-off tap should be suitably adjusted to avoid scaling and simultaneously save water.

9) **Check vibrations**

Any fault with the fan and/or electric motor, can cause vibrations of the unit. If this occurs, immediately stop the unit and check the reasons of vibrations. Serious damage to the unit can thus be spared. The water circulating pump should also be checked for vibrations.

10) **Check voltage** and absorbed current of the motors – measurements to be made at the control panel and not directly on the motors themselves

#### 11) **Check of the drive system**

For those units equipped with gearbox drive it is best to verify on a regular basis the alignment, the fixing bolts and the good condition of the whole. Such a check must be effected every six months. Within the scope of this overall check it is appropriate to recheck the correctness of the alignment of the drive shaft, making use of the calibrated key supplied for that purpose with the unit (see schematic drawing in the chapter on Start-up).

#### 12) **Regular fan operation**

If the unit is not operating for long periods of time, it is necessary to programme regular start-up of fan(s), in order to prevent the excessive drying of bearings and gaskets.

#### 13) **Check on oil level in the orthogonal gearbox**

For those models fitted with a mechanical (gearbox) drive, it is recommended to check weekly the oil level via the spy-hole fitted for that purpose, topping up if necessary. If oil losses are apparent or if there is abnormal noise or vibration at the gearbox, shut-down the cooling tower and search for the causes of the anomaly. Special precautionary measures are necessary during periods of inactivity, since the internal components are not then protected by the oil as they are during operation, and are thus exposed to oxidation and corrosion. We suggest that the gearbox should be operated for five minutes once a week, in order to distribute the oil over the gear cogs and the other internal components. If the gearbox is to remain inactive for long periods, it is recommended to fill it completely with oil, through the air vent located in the upper part, readjusting the level before the restart of operation.

#### 14) **Change of oil in the orthogonal gearbox**

Use only oil for gearboxes and gear cogwheels, with oxidation inhibitor, compliant with AGMA (American Gear Manufacturers Association) standard no. 250.04. The AGMA no. and the viscosity are indicated below.

For start-up temperatures below  $-7^{\circ}\text{C}$ , an oil heater is necessary: this can be supplied with the gearbox or added later.

### **LUBRICANT**

- AGMA No. : 5
- Viscosity (cSt) at  $40^{\circ}\text{C}$  : 198-242
- Quantity : 4 l

The following indications are simply examples:

- Esso Terrestic 220
- Gulf Harmony 220
- Mobil DTE Oil BB
- Shell Turbo 220
- Texaco Regal 220 R&O

The original oil must be replaced after four weeks of operation.

It is recommended to drain the existing oil when it is at the operating temperature, and to refill the gearbox with oil of the type and in the quantity indicated. Normally speaking the oil should be replaced after 2500 hours of operation or every six months, whichever is sooner. For operation under particularly harsh conditions, increase the frequency of the oil changes. The horizontal and vertical shafts are fitted with greased holding-seals which do not require further greasing.

**15) Draining of pan/sump**

Units with seasonal operation should be drained at the end of the cooling season to avoid freezing. If the unit is shut down during the winter season, it is advisable to protect it with a water-tight covering.

## TROUBLE-SHOOTING AND FAULT GUIDE

FAULT	CAUSE	REMEDY
The fans do not operate.	No electric power to the motor. The motor is blocked. The fan is blocked. The mechanical drive system (where applicable) is not completely connected up.	Repair the electrical connections. Free the motor. Free the fan(s). Verify and complete the connection of the drive system (where applicable)
The fans vibrate.	Unbalanced fan impeller(s). Loosened keying.	Balance the impeller(s). Tighten the keying on the shaft.
The fans operate, but draw insufficient air.	Backward rotation.	Interchange the electrical connections so as to obtain the correct direction of rotation.
“Clanging” (metallic noise) of fans.	One or more impeller(s) is/are striking against the casing. Loosened keying. Foreign bodies or tools in the transmission or fans	Repair the casing or the impeller(s).  Tighten the keying. Remove objects or tools
The motor is noisy.	Damaged ball bearings. If the noise is magnetic, faulty motor. One phase is missing.	Repair or replace the motor.  Check the connection.
Other noise and/or vibrations	Unbalanced fan impeller(s). Worn belts Foreign bodies, dirt or scale in the water distribution system	Check and balance impeller(s). Replace belts Inspection and clean the water distribution system
One or more nozzles do not spray.	Clogging.	Remove the clogging items.
One or more nozzles spray irregularly.	Partial scaling or clogging	Clean or descale the nozzles.
The fill pack is uniformly scaled.	The circulating water is scaling.	Treat the water.
The fill pack is scaled in some areas.	The water distribution is not uniform.	Check the nozzles to obtain a uniform water distribution.
The water cooling is insufficient. (effect demonstrated by an increase in inlet and outlet temp.)	Water flow less than design value Probable scaling of the fill pack Reduced air flow from the fans  Recirculation of wet discharge air Intake of hot air from other sources/units	Adjust the water flowrate Totally or partially replace the fill. Check the fans and drive system (where applicable) Check downward air velocity Install deflectors/barriers

Water carry-over at the drift eliminators (droplet entrainment)	Excessive air flow. Eliminators incorrectly positioned. Partial scaling or clogging of eliminators	Reduce the air flow. Reposition the drift eliminators. Replace those eliminators which are scaled or clogged
Water leakage along the joints between panels.	Damage to sealing during transportation and/or installation.	Restore water tightness in accordance with the instructions in this manual
Excessive water loss via overflow.	Make-up float valve open too far Lack of equalizing line between towers in parallel in the same circuit	Lower the float ball. Effect the equalization of the pans/sumps
The water level in the sump is much lower than the overflow.	Make-up float valve insufficiently open	Raise the float ball.
The water suction into the sump entrains air (cavitation).	Water level too low	Adjust the float valve. Raise the float ball

**SPARES PARTS**

**COMPONENTS LIST**

**TMA models**

Description	U.M.	08-55	08-58	08-67	08-76	08-84	08-90	08-96	08-103	08-109	11-131	11-145	11-153	20-191	20-207	20-219	21-161	21-276	21-291	31-392
Electric motor	no.	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	3
Axial fan diam. 1250 mm	no.	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Axial fan diam. 1600 mm	no.	-	-	-	-	-	-	1	1	1	-	-	-	2	2	2	-	-	-	-
Axial fan diam. 1800 mm	no.	-	-	-	-	-	-	-	-	-	1	1	1	-	-	-	2	2	2	3
Drift eliminators	set	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
HeadR(carrying nozzles) L=1,8 m	no.	5	5	5	6	6	6	5	5	5	-	-	-	10	10	10	-	-	-	-
Header (carrying nozzles) L=2.1 m	no.	-	-	-	-	-	-	-	-	-	7	7	7	-	-	-	14	14	14	-
Header (carrying nozzles) L=2.4 m	no.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
Header (carrying nozzles) L=2.9 m	no.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nozzle 20A / 20B / 20C	no.	30	30	30	36	36	36	-	-	-	-	-	-	-	-	-	-	-	-	-
Spring collar of nozzle	no.	-	-	-	-	-	-	15	15	15	28	28	28	30	30	30	56	56	56	84
Tapered linkage for nozzle	no.	-	-	-	-	-	-	15	15	15	28	28	28	30	30	30	56	56	56	84
Nozzle gasket	no.	-	-	-	-	-	-	15	15	15	28	28	28	30	30	30	56	56	56	84
Nozzle body	no.	-	-	-	-	-	-	15	15	15	28	28	28	30	30	30	56	56	56	84
Nozzle impeller	no.	-	-	-	-	-	-	15	15	15	28	28	28	30	30	30	56	56	56	84
Gasket for secondary header	no.	5	5	5	6	6	6	5	5	5	7	7	7	10	10	10	14	14	14	21
Decsapack	set	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Inspection door	no.	4	4	4	4	4	4	4	4	4	4	4	4	6	6	6	6	6	6	8
Plastic bolt for inspection door	no.	12	12	12	12	12	12	12	12	12	12	12	12	18	18	18	18	18	18	24
Inlet grilles	set	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Make-up float valve	no.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
Water filter in AISI 304	no.	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	3



COMPONENTS LIST		TMA models													
Description	U.M.	31-435	31-458	14-166	14-179	24-331	24-358	34-497	34-537	19-195	19-211	29-390	29-422		
Electric motor	no.	3	3	1	1	2	2	3	3	1	1	2	2		
Axial fan diam. 1250 mm	no.	-	-	-	-	-	-	-	-	-	-	-	-		
Axial fan diam. 1600 mm	no.	-	-	-	-	-	-	-	-	-	-	-	-		
Axial fan diam. 1800 mm	no.	3	3	1	1	2	2	3	3	1	1	2	2		
Drift eliminators	set	1	1	1	1	1	1	1	1	1	1	1	1		
Header (carrying nozzles) L=1,8 m	no.	-	-	-	-	-	-	-	-	-	-	-	-		
Header (carrying nozzles) L=2,1 m	no.	-	-	-	-	-	-	-	-	-	-	-	-		
Header (carrying nozzles) L=2,4 m	no.	21	21	8	8	16	16	24	24	-	-	-	-		
Header (carrying nozzles) L=2,9 m	no.	-	-	-	-	-	-	-	-	8	8	16	16		
Nozzle 20A / 20B / 20C	no.	-	-	-	-	-	-	-	-	-	-	-	-		
Spring collar of nozzle	no.	84	84	32	32	64	64	96	96	40	40	80	80		
Tapered linkage for nozzle	no.	84	84	32	32	64	64	96	96	40	40	80	80		
Nozzle gasket	no.	84	84	32	32	64	64	96	96	40	40	80	80		
Nozzle body	no.	84	84	32	32	64	64	96	96	40	40	80	80		
Nozzle impeller	no.	84	84	32	32	64	64	96	96	40	40	80	80		
Gasket for secondary header	no.	21	21	8	8	16	16	24	24	8	8	16	16		
Decsapak	set	1	1	1	1	1	1	1	1	1	1	1	1		
Inspection door	no.	8	8	4	4	6	6	8	8	4	4	6	6		
Plastic bolt for inspection door	no.	24	24	12	12	18	18	24	24	16	16	24	24		
Inlet grilles	set	1	1	1	1	1	1	1	1	1	1	1	1		
Make-up float valve	no.	2	2	1	1	1	1	2	2	1	1	2	2		
Water filter in AISI 304	no.	3	3	1	1	2	2	3	3	1	1	2	2		

COMPONENTS LIST		TMA models															
Description	U.M.	14-145S	14-179S	24-289S	24-358S	34-434S	34-537S	19-211S	29-422S	19-189S	19-248	19-260	19-288	29-498	29-520	29-577	19-218S
Electric motor	no.	1	1	2	2	3	3	1	2	1	1	1	1	2	2	2	1
Axial fan diam. 2600 mm	no.	-	-	-	-	-	-	-	-	1	1	1	1	2	2	2	1
Axial fan diam. 2100 mm	no.	1	1	2	2	3	3	1	2	-	-	-	-	-	-	-	-
shaft	n.	1	1	2	2	3	3	1	2	1	1	1	1	2	2	2	1
Drift eliminators	set	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Header (carrying nozzles) L=2.4 m	no.	8	8	16	16	24	24	-	-	-	-	-	-	-	-	-	-
Header (carrying nozzles) L=2.9 m	no.	-	-	-	-	-	-	8	16	10	10	10	10	20	20	20	12
Spring collar of nozzle	no.	32	32	64	64	96	96	40	80	50	50	50	50	100	100	100	60
Tapered linkage for nozzle	no.	32	32	64	64	96	96	40	80	50	50	50	50	100	100	100	60
Nozzle gasket	no.	32	32	64	64	96	96	40	80	50	50	50	50	100	100	100	60
Nozzle body	no.	32	32	64	64	96	96	40	80	50	50	50	50	100	100	100	60
Nozzle impeller	no.	32	32	64	64	96	96	40	80	50	50	50	50	100	100	100	60
Gasket for secondary header	no.	8	80	16	16	24	24	8	16	10	10	10	10	20	20	20	12
Decsapak	set	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Inspection door	no.	4	4	6	6	8	8	4	6	4	4	4	4	6	6	6	4
Plastic bolt for inspection door	no.	12	12	24	24	32	32	16	24	16	16	16	16	24	24	24	16
Inlet grilles	set	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Make-up float valve	no.	1	1	1	1	2	2	1	2	1	1	1	1	2	2	1	1
Water filter in AISI 304	no.	1	1	2	2	3	3	1	2	1	1	1	1	2	2	2	1

COMPONENTS LIST	TMA models									
Description	U.M.	19-262S	19-300	19-316	29-525S	29-600	29-633	39-746	39-780	39-866
Electric motor	no.	1	1	1	2	2	2	3	3	3
Axial fan diam. 2600 mm	no.	1	1	1	2	2	2	3	3	3
Axial fan diam. 2100 mm	no.	-	-	-	-	-	-	-	-	-
shaft	n.	1	1	1	2	2	2	3	3	3
Drift eliminators L=500	set	1	1	1	1	1	1	1	1	1
Drift eliminators L=1200	set	1	1	1	1	1	1	1	1	1
Secondary Header (carrying nozzles) L=2.4 m	no.	-	-	-	-	-	-	-	-	-
Secondary Header (carrying nozzles) L=2.9 m	no.	12	12	12	24	24	24	30	30	30
Spring collar of nozzle	no.	60	60	60	120	120	120	150	150	150
Tapered linkage for nozzle	no.	60	60	60	120	120	120	150	150	150
Nozzle gasket	no.	60	60	60	120	120	120	150	150	150
Nozzle body	no.	60	60	60	120	120	120	150	150	150
Nozzle impeller	no.	60	60	60	120	120	120	150	150	150
Gasket for secondary header	no.	12	12	12	24	24	24	30	30	30
Decsapack	set	1	1	1	1	1	1	1	1	1
Inspection door	no.	4	4	4	6	6	6	8	8	8
Plastic bolt for inspection door	no.	16	16	16	24	24	24	32	32	32
Inlet grilles	set	1	1	1	1	1	1	1	1	1
Make-up float valve	no.	1	1	1	2	2	2	2	2	2
Water filter in AISI 304	no.	1	1	1	2	2	2	3	3	3

At the end of every parts change operation check that all the air discharge screens are in place and that the related fixings have been tightened.

List of Tools required:

series of spanners; 1 adjustable spanner; series of Allen screwdrivers ; air compressor equipped with flexible tube for removal of dirt / residues ( and eventually a paint pistol for touch-ups )

Caution: do not leave tools inside the tower after a parts replacement operation



## **DECOMMISSIONING, DISMANTLING AND DISPOSAL**

If the unit, whether it be for wear, irreparable damage or other reasons, must be decommissioned and dismantled, it will be advisable to separate the non-metal parts such as rubber, plastic, etc. before sending it for disposal/ scrapping.

The non-metal parts are mainly the heat exchange fill in PVC, the water distribution headers, water nozzles and the float ball of the water make-up valve.

### **Protection against Biological Risks**

All those components which have been in contact with the recirculating water of the cooling tower, i.e. fill pack, drift eliminators, water distribution system and the spray nozzles, may still contain chemicals or biological contaminants at the time of disposal, hence the exposed personnel should wear respiratory protection equipment approved for such use by local occupational health and safety authorities.

Electric motors of fans have the winding in copper wire, for which a separate disposal is recommended.

All electrical components and accessories are in any case “special waste” and must be disposed of as such.

## Appendix I

**Characteristics/Engineering Data**

TMA Model	Thermal Capacity kW (*)	Air flowrate m <sup>3</sup> /s	No. of fans and motors – T= transmission/drive	Power rating of each motor kW
08-55	547	10.36	1	4
08-58	580	10.36	1	4
08-67	673	11.25	1	5.5
08-76	756	13.33	1	5.5
08-84	840	15	1	7.5
08-90	897	15.56	1	11
08-96	955	17.78	1	7.5
08-103	1036	19.44	1	11
08-109	1092	19.44	1	11
11-131	1309	26.39	1	11
11-145	1450	27.22	1	15
11-153	1529	27.22	1	15
20-191/CT	1910	35.56	2	2 x 7.5
20-207/CT	2072	38.89	2	2 x 11
20-219/CT	2184	38.89	2	2 x 11
21-261/CT	2618	52.78	2	2 x 11
20-276/CT	2762	54.44	2	2 x 15
21-291/CT	2912	54.44	2	2 x 15
31-392/CT	3927	79.17	3	3 x 11
31-435/CT	4350	81.67	3	3 x 15
31-458/CT	4586	81.67	3	3 x 15
14-145S	1448	29.44	1T	11
14-166	1657	31.11	1	15
14-179	1792	31.94	1	18.5
14-179S	1792	31.94	1T	18.5
24-289S	2896	58.89	2T	2 x 11
24-331	3314	62.22	2	2 x 15
24-358	3584	63.89	2	2 x 18.5
24-358S	3584	63.89	2T	2 x 18.5

The maximum water temperature in the standard towers is 55°C.

(\*) Nominal thermal capacity / heat rejected at the following conditions: w.b. 24°C  
– water inlet/outlet temp. 35°/30°C.

- The models whose no. is followed by the designation “CT” are compatible with container shipment, but are not necessarily the most economical.

- The models whose no. is followed by the designation “S” are “silenced”/lower noise compared to others of equal capacity, but are more costly.

## Characteristics/Engineering Data

TMA Model	Thermal Capacity kW (*)	Air flowrate m <sup>3</sup> /s	No. of fans and motors – T= transmission/drive	Power rating of each motor kW
34-434S	4344	88.33	3T	3 x 11
34-497	4971	93.33	3	3 x 15
34-537	5376	95.83	3	3 x 18.5
34-537S	5376	95.83	3T	3 x 18.5
19-195	1951	36.39	1	18.5
19-211	2112	37.50	1	22
19-211S	2112	37.50	1T	18.5
29-390	3902	72.78	2	2 x 18.5
29-442	4224	75	2	2 x 22
29-442S	4224	75	2T	2 x 18.5
19-189S	1895	47.22	1T	15
19-248	2488	50.14	1T	22
19-260	2600	48.75	1T	22
19-288	2888	51.50	1T	30
29-498	4976	100.28	2T	2 x 22
29-520	5200	97.50	2T	2 x 22
29-577	5776	103	2T	2 x 30
19-218S	2187	53.33	1T	18.5
19-262S	2625	53.33	1T	22
19-300	3004	56.39	1T	30
19-316	3167	56.39	1T	30
29-525S	5250	106.67	2T	2 x 22
29-600	6008	112.78	2T	2 x 30
29-633	6334	112.78	2T	2 x 30
39-746	7464	150.42	3T	3 x 22
39-780	7800	146.25	3T	3 x 30
39-866	8664	169.27	3T	3 x 30

The maximum water temperature in the standard towers is 55°C.

(\*) Nominal thermal capacity / heat rejected at the following conditions: w.b. 24°C  
– water inlet/outlet temp. 35°/30°C.

- The models whose no. is followed by the designation “CT” are compatible with container shipment, but are not necessarily the most economical.

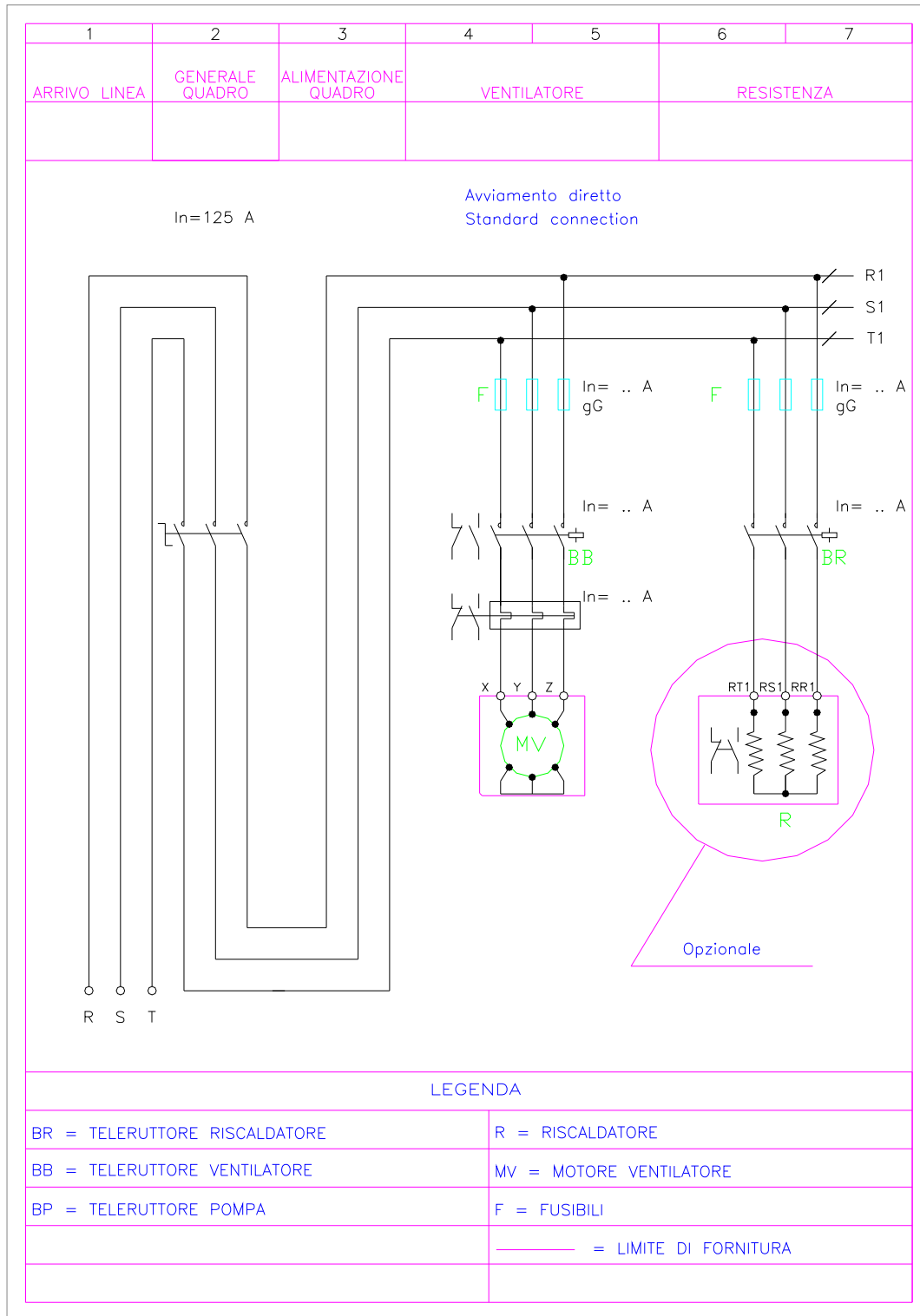
- The models whose no. is followed by the designation “S” are “silenced”/lower noise compared to others of equal capacity, but are more costly.



# Appendix III : Electric Wiring Diagrams for the connection of the fan motors

## Motor with direct on line start

1-SUPPLY LINE IN 2-MAIN CONTROL PANEL 3-SUPPLY TO PANEL 4-FAN 6-HEATER RESISTANCE



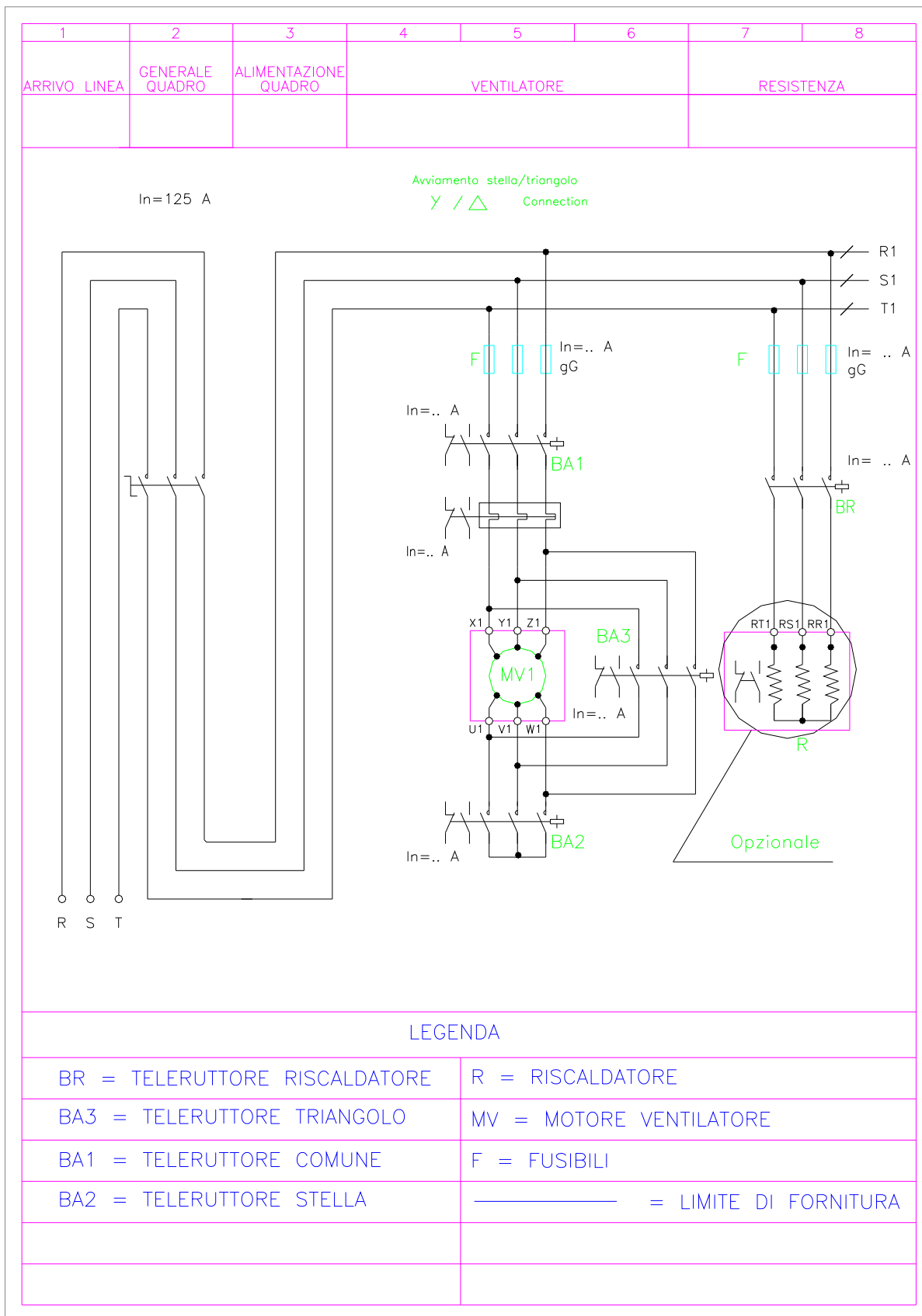
### ELEMENTS

KEY BR = REMOTE CONTROL SWITCH FOR HEATER R = HEATER MV = FAN MOTOIR F = FUSES

BB = REMOTE CONTROL SWITCH FOR FAN BP = REMOTE CONTROL SWITCH FOR PUMP ----- = LIMIT OF SUPPLY

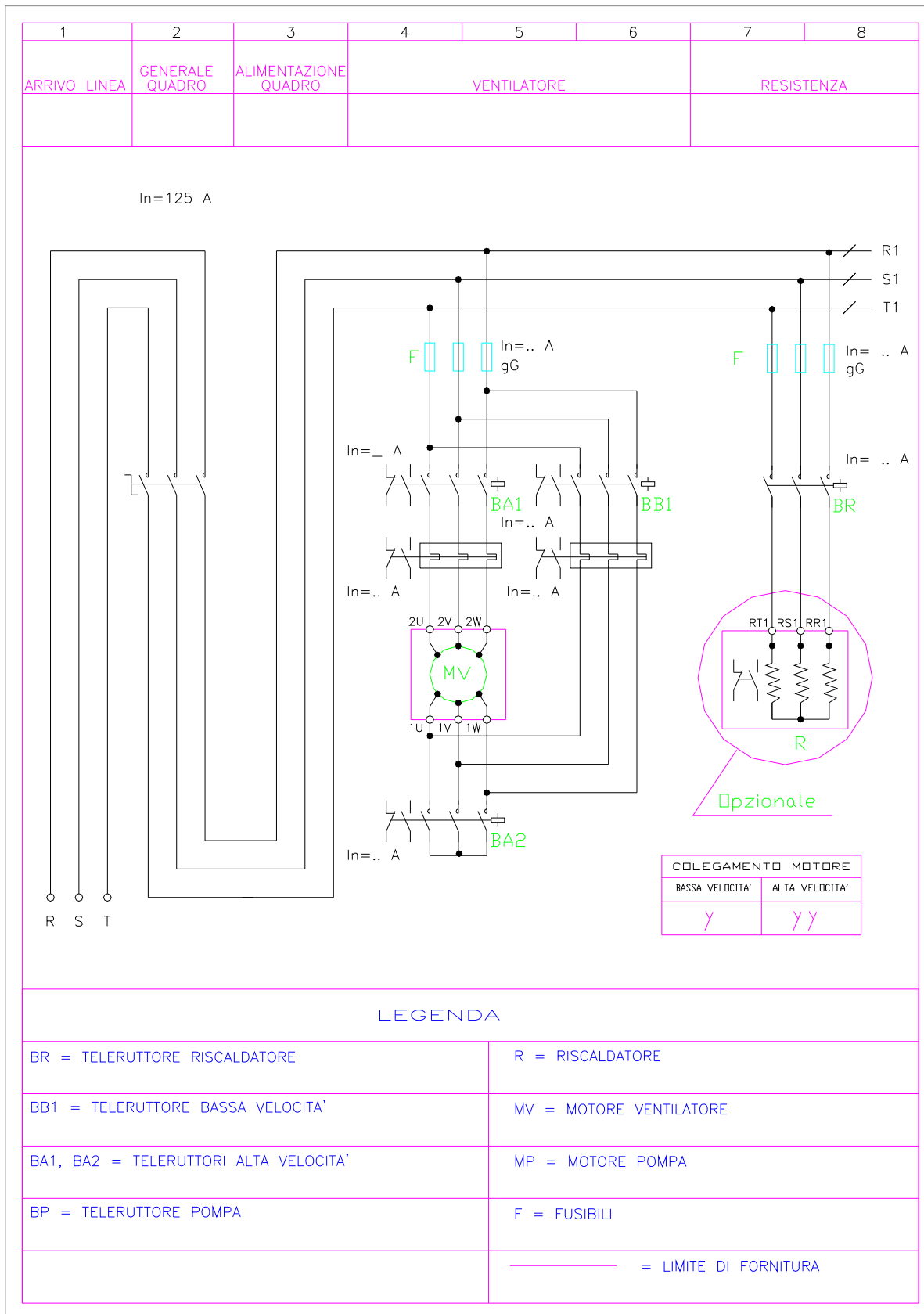


# Motor with star / delta start



KEY BA1 = COMMON REMOTE CONTROL SWITCH  
 BA2 = REMOTE CONTROL SWITCH FOR STAR  
 BA3 = REMOTE CONTROL SWITCH FOR DELTA

# Two speed Dahlander motor



KEY BB1 = REMOTE CONTROL SWITCH FOR LOW SPEED  
 BA1, BA2 = REMOTE CONTROL SWITCHES FOR HIGH SPEED

### IDENTIFICATION DATA

The TMA series units have a name-plate which indicates the model no. and the serial no.. For any information whatsoever or for a spare part one must make reference to these indications.

Example:

		Decsa srl 27058 Voghera - Italy Via Cappelletta, 1 Tel. ++39 0383 69411 Fax 62244 www.decsa.it / e-mail: info@decsa.it	
Model / Modèle Modell / Modello	TMA XX-XXX	Mass Kg. / Masse Kg. Gewicht Kg. / Massa Kg.	XXXXX
Order / Commande Bestellung / Ordine	XX/XXXXXX-X	Type of section / Type de section Typ des Abschnitts / Tipo di sezione	

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