Watco Group Engineering Guide

Engineering and design principles for WCN-Wacon and AQUAFAN Cooling Towers

WATCO Engineering Guide

This WATCO Engineering Guide provides System Management requirements and an indicative selection reference including discussion of different air inlet heights. The component section covers engineering criteria for the structure with consideration to profiles, handrails/ladders/platform, fan cones and basins. Separate sections discuss fans, gear drives and drive shafts, plus electric motors and controls as well as sections on water distribution and nozzles, exchange media fill types and air inlet protection.
The WATCO manual also discusses drift eliminators, vibration switches and the WATCO blow down control system. Essential considerations like performance testing and guarantee and site specific sound considerations are covered in detail.

Finally, you will find coverage of special case cooling towers that deal with hot water, turbidity and water contaminated with things like bacterial growth and how to handle salt water. Availability of specification templates is also listed.

Visit our websites for additional white papers on specific subjects related to cooling towers, such as:

- Commissioning of Cooling Towers
- Cooling Tower thermal capability
- Counter flow vs Cross flow Cooling Towers
- Mechanically assembled Cooling tower fills
- Prevention of Legionellosis

WACON Engineering Guide on WCN and AQUAFAN Counter Flow Cooling Towers

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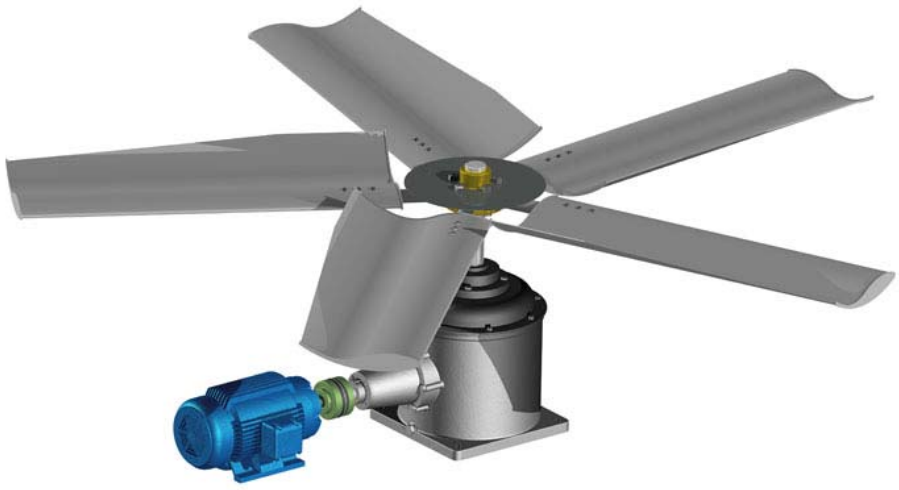

System Design Considerations and System Management

This section presents an overview of the engineering steps needed for a cooling tower design including Water Quality Management, referring to handling biological build up, Evaporation Loss, Blow-down and design parameters.

System Design

Watco always has an open mind for the specific design limitations that are dictated by the client, such as practical limitations in aspects footprint, height or advanced requirements in terms of energy use, noise standards or maintenance.

Based on the limitations several alternatives may be explored where a basic choice for the operational principle of the cooling tower with a specific combination of the cooling tower components (as presented over the next paragraphs) will lead to a specific tailored designed installation that meets the specific limitations and delivers on the design criteria.

Calculation guidelines:

- Range: Temperature difference between the hot and cold system water is referred to as range.
- Approach: The difference between the specified cold water temperature and the wet bulb temperature is the approach.
- Thermal efficiency, where:
  - HWT = Hot Water Temperature
  - CWT = Cold Water Temperature
  - WBT = design Wet Bulb Temperature: (HWT-/-CWT)/(HWT-/-WBT) x 100% = range
- KAV/L: standard for the performance of the cooling tower's infill and determined by the size and relative surface of the infill in relation to the water volume at specific approach temperatures and L/G rations.
- L/G: Ration between liquid and gas in the cooling tower operation. Is used (with KAV/L) to predict the cooling behaviour.
- Cooling tower size parameters:
  - kWh: the heat that the CT is dissipating can easily be expressed in kWh according to following formula:
  - RT
  - RT-CT
- The difference between Chiller Tons and Cooling Tower Tons.

When making such comparisons, it is important to do so only for similar design conditions. When applied under different conditions (approach temperature) there may be substantial differences in the load in tonnage that an installation may be able to handle.

Cooling tower cost:

True cost to a cooling tower purchaser is what WATCO defines as the **Cost of Ownership** comprised of:

- Purchase price of the cooling tower
- Cost of installation
- Cost of electricity
- Accumulated cost of maintenance
- Cost of consumables (chemicals etc)
- Consequential cost of unscheduled down time
- Cost of removing installation at the end of its life time

Cost of Electricity

Evaluated over the full range of load conditions that the cooling tower is expected to handle which includes pumps and the fan.

In processes were the cold water temp below certain level are non-rewarding or possibly harmful there are opportunities for substantial energy savings by optimal control of the process. Especially the Aquafan where pump and fan optimally co-operate, offers the most flexible energy management possibilities.

Consequential cost of unscheduled down time

The cost of unscheduled down time can and probably will run up substantially once kicking in. A blown out gear drive or electromotor may not be an everyday event, but if it does happen, it is not an easy thing to fix. Apart from the possible delay in availability of replacement parts, the repair itself may be difficult to execute, especially when hoisting equipment may be required to have the parts available at the cooling tower (high rise buildings).

WATCO design parameters are based upon the Cost of Ownership philosophy which requires consideration of all the variables beyond first cost.

System Management and Maintenance

Water quality

Consistent cooling water treatment is a must for smooth cooling tower operations. Mineral build up, dust and other impurities together with microbiological contamination affect the operation.

Evaporation Loss

Evaporation is the cooling engine behind cooling tower principles resulting in 0.16% water loss for every centigrade degree of cooling which needs to be replaced.

Blowdown

Mineral build-up from evaporation should be maintained below the Cycle of Concentration (COC) which compares the mineral concentration to the concentration in the supply water to avoid interference with the heat exchanger because of higher viscosity and hygroscopic properties. An acceptable COC is maintained by periodically blowing down part of the system water and replacing this and the evaporated water with fresh (suppletion) water.

Microbiology

Microbiological contamination does call for an effective control program using biocides (required by law in many countries with regards to Legionella dangers).

Foreign matters

In a closed loop system like a cooling tower, handling the build-up in air borne debris is an important design consideration. Dust collecting in the heat exchanger and cold water basins will result in performance deterioration promote bacterial growth. In more severe environments, it will dictate infill selection and may call for side stream filtration.

Quick Selections WCN Modular Counter Flow Conventional Cooling Towers

Final Design Data to be confirmed by WACON-International PTE Ltd		FootPrint		Motor					Fan
		Size	Wet Surface	Power	37/32/27	37/32/28	35/30/27	40/34/31	n
		LxWxH m	m2	kW	°C	°C	°C	°C	rpm
Type:	Fan Diam. (ft)				APPROXIMATE WATER FLOW m3/h				
WCN 8	6	2.4 x 2.4 x 4	5.8	5.5*	**121**	**115**	**109**	**104**	560
WCN 9	6	2.4 x 3 x 4	7.2	7.5*	**151**	**144**	**137**	**130**	560
WCN 10	7	3 x 3 x 3.5	9.0	11*	**189**	**180**	**171**	**162**	440
WCN 11	7	3 x 3.6 x 4.5	10.8	11*	**227**	**216**	**205**	**194**	440
WCN 12	8	3.6 x 3.6 x 4.5	13.0	15*	**272**	**259**	**246**	**233**	440
WCN 13	8	3.6 x 4.8 x 4.5	17.3	18.5	**363**	**346**	**328**	**311**	330
WCN 14	10	4.8 x 4.8 x 5	23.0	22	**484**	**461**	**438**	**415**	330
WCN 15	10	4.8 x 6 x 5.5	28.8	30	**605**	**576**	**547**	**518**	300
WCN 16	12	6 x 6 x 6	36.0	37	**756**	**720**	**684**	**648**	260
WCN 17	12	6 x 7.2 x 6.5	43.2	45	**907**	**864**	**821**	**778**	260
WCN 18	14	7.2 x 7.2 x 7	51.8	55	**1089**	**1037**	**985**	**933**	230
WCN 19	14	7.2 x 8.4 x 8	60.5	55	**1271**	**1210**	**1150**	**1089**	230
WCN 20	14	8.4 x 8.4 x 7.5	70.6	75	**1482**	**1411**	**1341**	**1270**	230
WCN 21	14	8.4 x 9 x 6	75.6	75	**1588**	**1512**	**1436**	**1361**	230
WCN 22	18	9 x 9 x 6.5	81.0	90	**1701**	**1620**	**1539**	**1458**	195
WCN 23	18	9 x 9.6 x 6.5	86.4	90	**1814**	**1728**	**1642**	**1555**	195
WCN 24	20	9.6 x 9.6 x 7	92.2	90	**1935**	**1843**	**1751**	**1659**	165
WCN 25	20	9.6 x 10.8 x 7	103.7	90	**2177**	**2074**	**1970**	**1866**	165
WCN 26	22	10.8 x 10.8 x 7.5	116.6	110	**2449**	**2333**	**2216**	**2100**	145
WCN 27	22	10.8 x 12 x 7.5	129.6	110	**2722**	**2592**	**2462**	**2333**	145
WCN 28	24	12 x 12 x 8	144.0	110	**3024**	**2880**	**2736**	**2592**	135
WCN 29	24	12 x 12.6 x 8	151.2	110	**3175**	**3024**	**2873**	**2722**	135
WCN 30	26	12.6 x 12.6 x 8.5	158.8	110	**3334**	**3175**	**3016**	**2858**	125
WCN 31	26	12.6 x 13.2 x 8.5	166.3	132	**3493**	**3326**	**3160**	**2994**	125
WCB 32	28	13.2 x 13.2 x 9	174.2	132	**3659**	**3485**	**3311**	**3136**	115
WCN 33	28	13.2 x 14.4 x 9	190.1	132	**3992**	**3802**	**3612**	**3421**	115
WCN 34	30	14.4 x 14.4 x 9.5	207.4	132	**4355**	**4147**	**3940**	**3732**	105
WCN 35	30	14.4 x 15.6 x 9.5	224.6	160	**4717**	**4493**	**4268**	**4044**	105
WCN 36	30	15.6 x 15.6 x 10	243.4	160	**5111**	**4867**	**4624**	**4380**	105

* Direct Drive (all others with 5-blade fan, angled gear reducer & composite shaft)

Data only apply to specifications issued after March 2015

For reference only

Quick Selections AQUAFAN Modular Counter Flow Turbine Powered Cooling Towers

Final Design Data to be confirmed by WACON-AQUAFAN.	FootPrint Size LxWxH m	Wet Surface m2	Average Pressure m H2O	Fan Diam. m	37/32/27 °C	37/32/28 °C	35/30/27 °C	40/34/31 °C	Average n rpm
					APPROXIMATE WATER FLOW m3/h				
AQF4 single cell (*)	1.25 x 1.25 x 1.9	1.44	20	1.2	**29**	**27**	**26**	**24**	580
AQF7 single cell (*)	2.15 x 2.15 x 2.4	4.4	18	1.5	**88**	**84**	**79**	**75**	500
AQF 8 1#1 single cell	2.7 x 2.7 x 4	5.8	18	1.8	**115**	**109**	**104**	**98**	480
AQF 8 1#2 double cell	2.7 x 5.1 x 4.5	11.5	18	1.8	**230**	**219**	**207**	**196**	480
AQF 8 1#3 triple cell	2.7 x 7.5 x 5	17.3	18	1.8	**346**	**328**	**311**	**294**	480
AQF 8 1#4 quatro cell	2.7 x 9.9 x 5.	23	18	1.8	**461**	**438**	**415**	**392**	480
AQF 10 1#1 single cell	3.3 x 3.3 x 4.5	9	18	2.1	**180**	**171**	**162**	**153**	390
AQF 10 1#2 double cell	3.3 x 6.3 x 5	18	18	2.1	**360**	**342**	**324**	**306**	390
AQF 10 1#3 triple cell	3.3 x 9.3 x 5.5	27	18	2.1	**540**	**513**	**486**	**459**	390
AQF 10 1#4 quatro cell	3.3 x 12.3 x 5.5	36	18	2.1	**720**	**684**	**648**	**612**	390
AQF 12 1#1 single cell	3.9 x 3.9 x 4.5	13	18	2.4	**260**	**247**	**234**	**221**	330
AQF 12 1#2 double cell	3.9 x 7.5 x 5.0	26	18	2.4	**520**	**494**	**468**	**442**	330
AQF 12 1#3 triple cell	3.9 x 11.1 x 5.5	39	18	2.4	**780**	**741**	**702**	**663**	330
AQF 12 1#4 quatro cell	3.9 x 14.7 x 5.5	52	18	2.4	**1040**	**988**	**936**	**884**	330
AQF 12 2#2 4- cell	7.5 x 7.5 x 5	52	18	2.4	**1037**	**985**	**933**	**881**	330
AQF 12 2#3 6- cell	7.5 x 11.1 x 5.5	78	18	2.4	**1555**	**1477**	**1400**	**1322**	330
AQF 12 2#4 8- cell	7.5 x 14.7 x 6	104	18	2.4	**2074**	**1970**	**1866**	**1763**	330
AQF 12 2#5 10- cell	7.5 x 14.7 x 6	130	18	2.4	**2592**	**2462**	**2333**	**2203**	330
AQF 12 3#3 9- cell	11.1 x 11.1 x 5.5	117	18	2.4	**2333**	**2216**	**2100**	**1983**	330
AQF 12 3#4 12- cell	11.1 x 14.7 x 6	156	18	2.4	**3110**	**2955**	**2799**	**2644**	330
AQF 12 3#5 15- cell	11.1 x 18.5 x 6.5	194	18	2.4	**3888**	**3694**	**3499**	**3305**	330
AQF 12 3#6 18- cell	11.1 x 21.9 x 6.5	233	18	2.4	**4666**	**4432**	**4199**	**3966**	330
AQF 12 4#4 12- cell	14.7 x 14.7 x 6	207	18	2.4	**4147**	**3940**	**3732**	**3525**	330
AQF 12 4#5 20- cell	14.7 x 18.5 x 6.5	235	18	2.4	**4704**	**4469**	**4234**	**3998**	330
AQF 12 4#6 24- cell	14.7 x 21.9 x 7	311	18	2.4	**6221**	**5910**	**5599**	**5288**	330
AQF 12 4#7 28- cell	14.7 x 25.5 x 7	363	18	2.4	**7258**	**6895**	**6532**	**6169**	330

For reference only

Cooling Tower Components

Structure and Infill

Structural Parts (profiles and cladding)

FRP is the preferred and recommended materials of choice bringing the advantages of flexibility, durability and cost in a variety of colours to the job using South East Asia suppliers. All pultrusions meet CTI-137 standards.

WATCO specifies glass and resin rations appropriate to the applied loads with UV and moisture migration protection for layered structural build-up of the pultrusions. This is the material of choice for pultruted profiles, handrails/ladders/platforms and louvers.

Structures from Stainless Steel or HDGS are offered on client's request.

Fan Cones

Fan Cones are a critical design element affecting efficient air flow and overall cooling tower performance. Special attention is paid to minimizing turbulence with a smooth air inlet and maximizing efficiency with a minimum tip clearance. Personnel safety is prime consideration.

Fiber-reinforced plastic is the material of choice because of its light weight, durability and resistance to water. Design parameters conform to CTI standards. Available options include silencers, mesh guards and enhanced shapes to enable velocity recovery.

Basins

Supporting the cooling tower structure is the basin which collects the cooled liquid for re-use or disposal. Proper design calls for a water buffer in the basin or a separate sump for collection of all foreign materials entering the system from the airstream. A blowdown arrangement periodically allows the system to purge itself of this material. Optionally, strainers, filters and/or traps may be included.

Materials of construction may be FRP for smaller installations or reinforced concrete with design recommendations available from WATCO.

Structure - options

Maintaining a high standard of operator safety, WATCO designs focus on ladders with safety cages and full accessibility with proper use of handrails, walking grids, etc. Client's

special requirements are accommodated with walkways, staircases, extra access doors, etc. All WATCO designs meet or exceed OSHA standards.

Air Inlets – Louvers

Mounted in easily removable SST frames, inlet louvers are designed to keep leaves and other debris out and water inside the tower. Made of flame retardant, UV stabilized FRP, they allow maximum air flow in with near-to-zero pressure loss. Special attention is given to noise reduction where that is critical

Air Inlets – Screens

WATCO screen design optimizes air flow into the tower with minimal pressure loss. Design criteria includes reduced noise, minimum splash out, retard ice growth and keep leaves and other debris out of the basin.

Materials are flame retardant, UV stabilized PP or PVC, mounted in easily removable FRP frames. A colour choice is available upon request.

Film Infill

Fill design is the business end of the cooling tower where the water meets the air. WATCO optimized surface design is a light weight, self supporting structure offering a selection of flute sizes to provide the desired balance between water quality and pressure drop. Flame retardant PVC is the conventional choice.

Special on-site welding/glueing is an available option.

Splash Fill

In applications where dirty water may negatively impact the operational life time of a film fill, WATCO offers various splash fill alternatives. Due to the open structure, a splash fill medium is resistant to clogging while the long holdup time of the water in combination with intense turbulence in the air stream guarantees maximum performance.

The fills can be site assembled without use of tools or adhesives and are reusable (after cleaning).

Drift Eliminators

Drift is the water entrained in air leaving the cooling tower with the nuisance potential of spotting cars and windows and the hazard of interfering with downwind power lines, substations and other sensitive areas while minimizing water loss to less than 0.005%. Drift does not include water vapour.

WATCO design criteria seek to balance water loss with pressure loss through appropriate location within the tower structure. Materials are pre-glued, UV protected flame retardant PP or PVC with a selection of colours available.

Mechanics

Fans

Air flow through the cooling tower and fan efficiencies are an ongoing focus of WATCO R&D. Working with leading fan manufacturers like IVI IImed, Howden and Aerotech, we continue to optimize fan selection to provide the best adjustable pitch machines which combined with light weight blades maximizes air flow and minimizes noise and vibration with state of the art efficiencies.

Gear Drives / Drive Shafts

Speed reduction is accomplished with gear drives in preference to higher maintenance and less efficient V-Belt drives. Design incorporates L10 bearing life and service factors are in accordance with CTI Standard 111. Remote oil level indicator is standard with convenient refill locations.

Preferred gear drive supplier is Sumitomo (Japan or Chinese origin). ABB/Siemens is an alternate source.

Electric motors

Appropriate NEMA enclosures are selected suitable for cooling tower conditions that present humidity, dust, chemical fumes and a variety of weather conditions. TEFC with class B insulation is the normal enclosure of choice. Heaters are included to maintain motors above ambient temperature, avoiding condensation.

Source: Bockwoldt with in line vertical gear drive or Electramo.

Motor Controls.
Combination starters with non-fused disconnects in NEMA 4 enclosures are normally selected. Low voltage dynamic braking (to keep motors from rotating when inoperative which will prevent condensation) are included in the WATCO package.

Vibration Isolation and Auxiliary Items

The constant rotational movement in the tower causes vibration and this has (if not limited) impact on the operational life time of the equipment. Vibration can be isolated by the use of springs or synthetic rubbers. Isolators can be installed under tower or under mechanic group.

Auxiliary items include extended oil fill and gauge lines, mechanical, equipment removal device, basin heaters, filter systems, fan brakes/back stops and vibration control switch.

The relevance of CTI Certification in HVAC applied Cooling Towers

CTI is the branch organization of the cooling tower industry that plays an important role in the self regulation process of the industry and helps (potential) buyers in making the right decisions in the process of supplier and equipment selection.

Cooling tower manufacturers can have their installations CTI-certified by means of either a factory test (CTI-105; applicable to standard models of cooling towers) or a field test (CTI-201).

Ad CTI-105:

Obviously, this test applies to standard models rather than tailor-engineered installations.

In HVAC applications job-specific requirements often lead to a tailor made solution, based on available space and other architectural limitations. Deviations from standard models may be expected in terms of box sizing, air inlets or infill height, fan model and power etc. Such tailored installations obviously cannot be subjected to a factory tests, simply because of financial and practical (planning, time delay) factors.

Ad CTI-201:

A field test seems the practical solution for these tailor-made cooling tower solutions. However, also here practical reasons of finance (budget for a field test @ US$ 25,000) and planning (limited testing resources, waiting period of few months or more may apply) come into the picture.

Then, for HVAC installations the following applies:

- In general HVAC installations are slightly/moderately overdesigned from the required design conditions
- In practice, cooling towers are actually rarely subjected to the design conditions (in terms of heat load and WBT).

The inevitable question then presents itself: What is the added value of subjecting a newly installed cooling tower that runs smoothly and that delivers on its promise to a CTI-test, considering the financial and organizational resources involved?

It may be a better approach to agree on a CTI field test as a way to resolve a dispute on cooling tower performance rather than a step in the commissioning process.

For the record, WATCO does not intend to dismiss the importance of field testing as a part of the commissioning process. The aim is to advocate using the test where it has real relevance. That would be in specific industrial applications (power plants, chemical industries etc), where every bit of cooling tower performance directly translates into output.

In HVAC projects where specific requirements call for tailor made solutions, a pragmatic approach with regards to cooling tower performance may be the preferred choice.

Warranty and Performance Guarantee

WACON WCN and Aquafan cooling tower modules are designed to meet precise and specific client specifications and in accordance with the requirements as described by CTI and Eurovent. General engineering stipulations are followed and only top brand mechanical equipment is used.
Our designs are always on the safe side as to exclude operational limitations. We therefore guarantee a thermal performance capability of 100% (with allowable tolerance of +/- 5%).
Where required we support a joint field performance test of the installation according to the test code ATC105 as published by CTI. Where such test demonstrates flaws in the installation WATCO allocates necessary resources to bring the tower in the range of the specified performance.

Standard Warranty Conditions

Our cooling towers are carefully engineered to your requirement and built from highest quality of components. Provided that the service and maintenance instructions and procedures, as laid down in the operational manuals, are followed strictly they can have an operational lifetime that exceeds 25 years. Our warranty conditions are the following:

- 12 months on all components.
- 60 months on the cooling tower structure.
- Warranty protects against material defects or deficiency in performance.
- Faulty maintenance, as well unskilled treatment of the installation, not in accordance with operational recommendations and instructions excludes any warranty claims.
- Warranty periods are from date of start up or date of shipment (add 6 months); whichever comes first.

Manufacturing and Logistics

Manufacturing

WATCO GROUP PTE LTD is an engineering company, rather than a manufacturing company. Following the success of the European car industry we have established that working with a network of renowned suppliers in various continents we keep our hands free to do that what we like and where our core competence lies: installation engineering.

With our project teams in Singapore and Hong Kong we are able to source our materials from the work-shop of the world, South East Asia.
With our European roots and network we have access to the leading European component suppliers as well. Our supplier network has been carefully built up over the years. Having access to reputed and reliable suppliers we can offer the best solutions for any job, anywhere in the world.

Logistics

Options to ship in 20' vs. 40' containers are discussed with project partners, depending on project size and destination. With components from different origins (partial) LCL shipments may be used. Airfreight can be a helpful tool to avoid delay by key components that need longer manufacturing time.

Shipment cost considerations may affect decisions towards pre-assembled vs. on-site assembly of cooling tower infill at times.

Available container sizes can be an issue when special requirements are in place for preassembled cooling towers or cooling tower parts (basins). Special solutions are then available, either in engineering or shipment arrangements.

The text presented on the following pages can be used as a template for specification of the cooling tower section for your projects.

(Word versions are available at request)

TECHNICAL SPECIFICATIONS **WCN SERIES:**

COOLING TOWER PRICIPLE

Induced Draft Modular COUNTER FLOW Evaporative Cooling Tower.

DESIGN CONDITION

Each unit shall have the capacity to cool:		____ m3/h	____ gpm
of water from	(HWT)	____ ºC	____ ºF
to	(CWT)	____ ºC	____ ºF
at an air entering condition of	(WBT)	____ ºC	____ ºF

Cooling Tower (CTI) Standards applied to relevant sections of this specification:

CTI-105	Acceptance Test Code for Water Cooling Towers
CTI-111	Gear Speed Reducers
CTI-131	Fiberglass Reinforced Panels
CTI-136	Thermoplastics used for Film & Splash Fill and Drift Eliminators
CTI-137	Fiberglass Pultruted Structural Components
CTI-203	Industrial Cooling Tower Standard
ESG-152	Structural Design of FRP Components in Cooling Towers
ASTM E84	Test Method for Surface burning characteristics of building materials
NEMA/ICE	Motor standards
AMGA/DIN	Gear Drive standards

MODEL SELECTION

Manufacture as shown on drawing no: induced draft counter flow cooling square shaped cooling tower(s).

STRUCTURE

The structure profiles shall be manufactured in FRP pultrusion. The profiles are bolted with fasteners in SST (304 or 316). The profiles are manufactured according applied standards for flammability rating and UV protection. The structure is designed for a wind speed on any side of the tower of < 30 m/s.
The applied design standards are DIN & ASHRAE codes for FRP structural designs.
Color shall be light grey, equal to RAL 7035 or as per requirement.
All hand rails, cage ladder and stair cases are designed according OSHA / DIN standards.

COOLING TOWER DECK

The cooling tower deck shall be of pultruted FRP reinforced panels with anti-slip deck surface.

Each cell is foreseen with a SST inspection manhole with internal ladder in FRP minimum 60 x 60 cm , 2' x 2'.

FAN BELL SECTION

The fan bell shall be venture-shaped with an inlet radius for optimal fan performance. Color shall be light grey, equal to RAL 7035.

(-OPTION- A safety mesh may be added with following text):

The fan cone shall be covered with a heavy gauge steel wire fan guard.

MECHANICAL GROUP

FAN

The high efficient axial propeller fan shall be heavy duty and statically balanced. The fans shall be manufactured either in aluminum alloy or FRP pultrusions with HDGS hub. The shaft connection shall be with key-lock acc DIN 6885/2. Each fan blade shall be individually adjustable during standstill. The fan shall be installed in a closely fitted cone with venturi air inlet for maximum fan efficiency.

Preferred Brands: Ilmed-IVI Italy
Howden Netherlands/USA
Aerotech India
Moore USA

MOTOR – SHAFT - SPEED REDUCER UNIT

HORIZONTAL ANGLED GEAR DRIVE

The drive unit is engineered with a motor, a flexible composite shaft and an angled gear drive unit.
The angled gear drive is a single/double stage piston reducer with special designed crown wheels to absorb shock loads e.g fan blade pass frequency. The bearings shall be designed for a minimum life time of 40.000 operational hours. The gear drive holds a min. level of oil. The oil line is brought outside the wet air by a SST piping system for fill, drain and level control. All drive equipment shall be manufactured in casted steel and protected with epoxy coating, at least 250 µm.

Preferred Brands: Amarillo USA
Siemens Germany
Sumitomo Japan

COMPOSITE SHAFT

The power transmission between the motor and the gear box is established by a composite shaft, duly designed for the shock free power transmission to the fan. The composite shaft shall be equipped with SST 304/316 flexible couplings. Service Factor > 2.

Preferred Brands: ADDAR/Rexnord USA/EU

MOTOR

The motor shall be TEFC/ICE class II efficiency, protection IP 55 upwards, insulation class F5 with enclosed ball bearings and a service factor of > 1.12. The motor power shall be: ____ V; _____ Hz. Bearing life time > 40.000 hrs of operation.

Preferred Brands: ABB EU/Asia
Electramo Belgium
Brook-Crompton UK
WEG EU/America

DRIVE FRAME

The frame for the mechanical components is in HDGS or SST and holds the setup points for motor and gear drive as well 1 or 2 shaft protectors.

(- OPTION – Instead of traditional motor-shaft-gear drive combination, selection (of smaller units) may look at an integrated unit which would be below specification text):

COMPACT GEAR IN-LINE DIRECT DRIVE

The fan drive shall be a compact angled gear reducer drive (for fans 1800 – 3360 mm) with single stage crown-wheel and piston with double bearing. The bearings shall be designed for a minimum life time of 40.000 operational hours. The motor is directly coupled to the piston shaft. The input and output shaft are equipped with top brand seals. The gear drive holds a min. level of oil. The oil level is to be checked with an internal dipstick. Follow the operational instructions for oil change. All drive equipment shall be manufactured in casted steel and protected with epoxy coating, at least 250 µm. Service Factor > 2.

Preferred Brands: Bockwoldt Germany

WATER DISTRIBUTION SYSTEM

The cooling tower shall have an inlet internal piping #40/PN10 with DIN/ANSI connection flange, which divides the water equally over the wet section. The fill will be watered by a sufficient number of non clogging spray nozzles. The nozzles shall be manufactured by the cooling tower supplier for single source and responsibility. Depending of the inlet temperatures the piping system is made in PVC, ABS, FRP or SST.

HEAT EXCHANGE INFILL

CENTRA PACK – for clean treated cooling water.
The cooling tower fill shall be in PVC or ABS, cross fluted film type design Y-15 for optimum heat transfer efficiency. The fill thickness shall be at least 280 µm and shall

be manufactured by the cooling tower manufacturer for single source and responsibility. The film shall be self-extinguishing for the fire resistance with a flame spread rating of 5 per ASTM E84-81a. It shall also be resistant to rot, decay and biological attack. For standard operating temperatures the fill shall be able to withstand a continuous water temperature of 55 ºC for PVC and 80 ºC for ABS.

(-OPTION- Instead of film fill, selection may call for splash fill with following text)

CENTRA FILL - for contaminated cooling water.
The infill pack consists of a certain level of triangle corrugated profiles. The triangle bars are in cross section towards each other in the tower structure. Due to the extreme labyrinth function of the positions of the corrugated profiles the air flows with intense turbulence in the infill structure. In the same time the water droplets do attach to the profiles and free fall randomly down to lower levels were it is split over the profile angles. The large holdup time of the water in the tower create an efficient exchange of the heat load.

ELIMINATORS

CENTRA DECK

The eliminators shall be in UV-protected PVC or ABS double angle labyrinth design to avoid water in droplets leaving the tower via the exhaust air stream. The efficiency of the drift eliminator shall be < 0.005 % of the circulating water volume.

AIR INLET LOUVRES

LOUVERS:

The air inlet louver avoid splash out of the water and shall be of FRP in SST 304 or 316 holders. The louvers shall be in sections and easily removable.

(-OPTION- Instead of louvers, selection may call for PVC screens with following text)

SCREENS:

The inlet screens avoid splash out of the water as well sun light impact and an additional noise reduction of the falling water and shall be of a FRP fame with labyrinth elements in PVC.

-OPTIONAL ITEMS-

WATER BASIN:

The water basin shall be manufactured in rigid FRP sectional parts for easy installation, long life and durability. Standard basin accessories shall be included as inlet flange with strainer, drain socket and overflow socket. The basin is designed to holding a minimum required water volume for low operation weight and easy maintenance. Vital points are slope designed for full drainage. Color shall be light grey, equal to RAL 7035.

(CAGE) LADDER / STAIRCASE, HANDRAIL:

To be made from FRP pultruted profiles according international DIN/OSHA.SAME standards.

VIBRATION SWITCHES.

FLOAT VALVES or INDUCTIVE LEVEL CONTROL WITH FILL VALVE.

Disclaimer:

Due to continuous improvements in research & development of our products, the data shown in this catalog are subject to change without notice. Please contact your local dealer or www.watco-group.com for updated information. This paper was designed in October 2015.

TECHNICAL SPECIFICATIONS **AQUAFAN SERIES:**

For the technical specifications of AQUAFAN Turbine Powered Counter Flow cooling towers, use the specification of WCN series in which the text in line numbers 52-125 (Sections Mechanical Group and Water Distribution System) is replaced by the following:

FAN:

The high efficient axial propeller fan shall be heavy duty and statically balanced. The fans shall be manufactured of ABS (1800-2400 mm) with stainless steel (304) hub connected to a turbine. Each fan blade shall be individually adjustable during standstill. The fan shall be installed in a closely fitted cone with venturi air inlet for maximum fan efficiency.

TURBINE:

The fan shall be connected to a turbine through which the process water enters the cooling tower. The pressure of the incoming process water shall turn the fan and apply the desired cooling effect. There shall be no electrical parts in the tower.

WATER DISTRIBUTION SYSTEM

The incoming process water shall be distributed evenly over the wet section via the turbine spindle. The water shall have sufficient pressure from the system pump to turn the fan.

Company Profile

Company Name	:	WATCO Group PTE LTD
Company Type	:	Limited Exempt Private Company
Registered in	:	Singapore
Registration number	:	201322647W
Company Address	:	Tower 1, Raffles Place #44-02 Singapore 048616 Telephone +65-31581332
Subsidiaries	:	WACON International (HK) Ltd WACON Guangzhou Trading Ltd
Directors/shareholders	:	Hubert Poels, Managing Director sg.linkedin.com/in/hubertpoels/ Henk Janssen, Operations Director sg.linkedin.com/in/henkjanssen/
Employees	:	12
Annual Turnover	:	US$ 2,500,000
Activities	:	Industrial water cooling solutions
Product lines	:	• Cooling towers • Motorless hydro-powered cooling towers • On-line brushing systems for shell and tube heat exchangers • Enthalpy recovery units
Brief History	:	• Founded as WACON-AQUAVEN BV in 1984 in Netherlands, specialist in cooling towers. • In 2002 moved company headquarters to Hong Kong with focus on cooling tower project engineering, consulting and component supply • In 2013 established new head quarters in Singapore

Background	:	The Group has a long experience in cooling tower engineering. In recent years the development and engineering of energy saving technologies has been given priorities and resulted in the launch of motorless cooling towers and high performance on-line cleaning systems for heat exchangers. Main markets are in South East Asia and Middle East.
Company Websites	:	www.watco-group.co www.wacon.co www.aquafan.co www.egobrush.co