

Sample Specification for Procurement of Operation and Maintenance Services for Fresh Water Cooling Towers

It is the basic responsibility of owners of fresh water cooling towers to properly operate and maintain their cooling towers and, for this purpose, they should arrange regular inspections, timely maintenance and periodic testing of water quality of their cooling towers in accordance with the Code of Practice for Fresh Water Cooling Towers (CoP(FWCT)) and guidelines on Good Operation and Maintenance Practice of Fresh Water Cooling Towers issued by the Electrical and Mechanical Services Department (EMSD).

2. The following sample tender specification for operation and maintenance of fresh water cooling towers serves to assist owners of towers and management agencies (“users”) in procuring cooling tower operation and maintenance services. It is intended to provide typical specification of requirements for common operation and maintenance services with regard to the above Code of Practice and guidelines for reference by users. Users may consider using relevant parts of the requirements contained in this sample specification for their own procurement documents for operation and maintenance of their cooling towers.

3. The sample specification is not meant to suit the needs of all users, and therefore should not be indiscriminately copied. Users should carefully consider their own circumstances and needs, in order to maintain the cooling towers in safe operational and hygienic conditions by meeting requirements in the CoP (FWCT) including control of bacterial quality, and avoid nuisance to the public contravening the Public Health and Municipal Services Ordinance. Users may modify the sample specification as appropriate to suit their own installations, taking into account of the configuration and conditions of their cooling towers, specific requirements on the quality and level of operation and maintenance services, and availability of technical support services to the users etc.

4. For cooling towers which have joined the Fresh Water Cooling Towers Scheme (“FWCT Scheme”) administered by the EMSD, the owners are reminded of their obligations to comply with the Scheme requirements, including proper operation and maintenance, upkeep of monthly operational and water quality records by Form CT3, annual audit and submission of an audit report to the EMSD. For cooling towers which have not yet joined the FWCT Scheme, their owners are highly recommended to make application to the EMSD to do so. Please visit the follow website on more details of the FWCT Scheme: https://www.emsd.gov.hk/en/energy_efficiency/fwct_scheme/index.html

Sample Specification for Operation and Maintenance of Fresh Water Cooling Tower Installation

1. GENERAL REQUIREMENTS

1.1 General

The Contractor shall inspect, serve, repair, operate and maintain the cooling tower installation(s) to meet the functional requirements. The Contractor shall properly operate and maintain the cooling tower installation(s) in a good and uncontaminated condition and minimize nuisance to surrounding area and public. The operation and maintenance requirements in this Specification generally follow the Code of Practice for Fresh Water Cooling Towers and guidelines on Good Operation and Maintenance Practice of Fresh Water Cooling Towers published by the Electrical and Mechanical Services Department. Unless specified otherwise, “cooling tower” in this Specification will denote “fresh water cooling tower” for brevity.

1.2 Cooling Tower Installation

The cooling tower operation and maintenance works shall comprise supply of materials and labour necessary for carrying out the following works to the cooling tower installations as listed in the Annex 1 Equipment Schedule and those subsequently added:

- (a) Water treatment of the cooling tower installation(s);
- (b) Preventive and planned routine maintenance of the cooling tower installation(s);
- (c) Cooling water quality monitoring, water sampling and bacterial tests;
- (d) Remedial actions for water sampling results at or above control thresholds;
- (e) Corrective maintenance and repair of the cooling tower installation(s).

1.3 Site Visits before Submitting Tender

Before completing and submitting tenders, the tenderers are advised to visit the cooling tower installation sites to appreciate and familiarize the extent of work.

1.4 Maintenance Log Book

The Contractor shall maintain a maintenance log book at each installation. The log book shall be provided by the Employer [see a sample sheet of log book at Annex 2] and kept at appropriate places on site by the Contractor. Every attendance and detail of work done to the installation(s) shall be entered into the log book by the Contractor so as to form a maintenance record, and/or to certify the Contractor’s attendance visits as required by this Contract.

1.5 Stock of Spare Parts

The Contractor shall keep adequate stocks of chemicals, spare parts, equipment and other components which are necessary to maintain the clean and satisfactory operating and water quality conditions of the installation(s) at all the times.

1.6 Taking over of Existing Installation(s)

The maintenance of the installation(s) is currently carried out under a maintenance contractor. With effect from the commencement date of the Contract, the Contractor shall take over the above responsibility and shall carry out the Works for those existing cooling tower installation(s) in accordance with the requirements of this Particular Specification.

1.7 Handover of Installations to the Employer prior to the Termination or Expiry of the Contract

One month prior to the termination or expiry of the Contract, the Contractor shall arrange a

schedule handover to the Employer for all Installations of the Contract. The Contractor shall ensure that the Installations are in good working order, clean and satisfactory operation condition at the time of handover.

2. EXTENT OF WORKS

2.1 Operation and Preventive Maintenance

2.1.1 General Requirement

The Contractor shall carry out operation and preventive maintenance for all parts of the cooling tower installation(s) in accordance with the requirements set out in this Section 2.1.

The Contractor shall carry out all necessary preventive maintenance for any part of the cooling tower installation(s) with a view to ensuring that the equipment and accessories are operated in clean, safe, reliable, efficient and effective conditions.

The costs of operation and preventive maintenance for the installations and all the associated equipment, devices and accessories, etc. shall be included in the unit rates for entered by the Contractor in the Schedule of Rates.

The Contractor may be required to carry out preventive maintenance works outside normal working hours (including Sundays and public holidays) without any cost implication.

In addition, the Contractor shall repair or replace at no additional cost to the Employer any part/component/equipment of an installation, which is proved to be defective by reason of the Contractor's negligence, inadequate servicing and maintenance, poor performance and workmanship, use of incorrect materials or materials of inferior quality.

2.1.2 Water Treatment

The Contractor shall operate and maintain water treatment facilities according to the manufacturer's recommendation.

The Contractor shall refill all chemicals, the cost of which shall be included in the unit rate for that entered in the Schedule of Rates.

Water treatment work should be carried out under the direction of competent technical personnel. Chemicals should be handled with care by personnel wearing appropriate protective clothing, including goggles, gloves, face-shield and chemical-proof apron to prevent contact with the agents. Personnel involved in water treatment work should be trained in safety procedures, including proper use and maintenance of protective equipment, thorough hand washing and drying after work.

2.1.3 Periodic Running of Standby Unit(s) and Temporary Shut-down

The cooling tower system shall be kept in regular use whenever possible. When the system is used intermittently or installed as a standby unit, the Contractor shall run the standby unit including water treatment facilities at least one hour per week.

If the system is intended to be put out of use for more than a week, the Contractor shall either:

- (a) keep it full of treated water which shall be checked (for biocide levels and water quality) and circulated once a week; or
- (b) fully drain off the system water and dry the system by mechanical fan, and then cover and shut off the inlet and outlet pipes leading to the cooling tower(s) to prevent water from entering the system.

In either case, the cooling tower(s) temporarily shut-down shall be isolated from the water supply mains to avoid back contamination. Drain valve shall be opened at all times to prevent

accumulation of water in the tower basin in rainy days. The Contractor shall carry out full re-commissioning including cleaning and disinfection before the system is brought into service again.

2.1.4 Routine Inspection and Preventive Maintenance

The Contractor shall regularly inspect and properly maintain the cooling tower installation(s) in accordance with the frequencies and requirements set out in this Section. Inspection and maintenance shall cover cooling towers and their associated mechanical equipment, water treatment facilities and water tanks.

2.1.4.1 Weekly routines

The Contractor shall:

- (i) Check cooling water for clarity, odour, surface debris, algae and temperature.
- (ii) Check water level of basin and the foaming condition of the cooling tower.
- (iii) Check bleed-off valves, strainers, drains and float valves for proper operation.
- (iv) Check operation condition of water treatment dosing equipment, and check water treatment chemicals or materials for adequacy and safety.
- (v) Check operation conditions of the cooling tower fan and drive, water treatment dosing facilities, and water pumps.
- (vi) Drain stagnant water in dead-legs if any by manual purging for at least 15 minutes each.
- (vii) Run all standby condensing water-side equipment at least one hour.
- (viii) Check quantity of chemicals and refill if necessary.
- (ix) Check any water leakage from make-up tank and bleed-off tank.
- (x) Check float valves and level sensors of make-up tank and bleed-off tank.

2.1.4.2 Monthly routines

The Contractor shall:

- (i) General
 - Check cooling water for clarity, odour, surface debris, algae and temperature and ensure that the cooling water be properly dosed with biocides or alike by chemical treatment devices (or disinfected by physical treatment devices if adopted instead) to prevent microbial growth.
 - Check internal surface condition of cooling towers for scale, rust, sludge, and biofilm accumulation, in particular the water basin. The Contractor shall remove them by scrubbing and cleaning.
 - Check sprays and distribution deck for proper water distribution.
 - Check for proper operation of bleed-off valves and other valves of the installation.
- (ii) Water Basin
 - Check basin sides and corners of cooling towers for any leakage or overflow.
 - Inspect suction screen and clean away any accumulated debris.

- Assure float valves and make-up water controls operating freely and maintain proper water level.

(iii) Tower Framework

- Inspect the tower framework visually for any deterioration and test its members for soft spots with a screw driver or other pointed tool.
- Check and clean all air inlet corrugated GRP louvers.
- Grease vibration isolation springs.
- Remove corrosion and rust and carry out touch-up painting.
- Inspect the general condition and check tightness of framework bolts for safe use.

(iv) Fills and Drift Eliminators

- Check condition/ cleanliness of fills and drift eliminators, and remove any accumulated dirt.
- Check that fills are intact and in place with no sagging or gaps in packs.

(v) Make-up and Bleed-off Water Tanks

- Check tank sides and corners for any leakage or overflow.
- Assure float valves and water level controls operating freely and maintain proper water level.
- Inspect the support framework of the tanks visually for any deterioration.
- Inspect suction and discharge of bleed-off water tank and clean away any accumulated debris.

2.1.4.3 Quarterly routines

The Contractor shall:

- Adjust and lubricate fans, pumps and motors bearings.
- Adjust and lubricate all moving parts of valves.
- Clean the water distribution pipework including nozzles.

2.1.4.4 Half yearly routines

The Contractor shall:

- Clean, desludge and disinfect water basin and internal surfaces of cooling towers as follow:
 - circulate first biocidal in the system;
 - circulate chlorinated water of 5 ppm for 6 hours and then drain;
 - manually clean and desludge internal surfaces;
 - refill and recirculate chlorinated water for 6 hours and then drain.

Dechlorinate the water in (b) and (d) by a neutralizer (e.g. sodium thiosulphate) before draining.

- Fully clean fills and drift eliminators.

- (iii) Remove and clean end caps in each header.
- (iv) Clean and disinfect make-up and bleed-off water tanks, following similar procedures in Water Supplies Department's guide to cleansing of fresh water storage tanks [see Annex 5].
- (v) Wash accessible areas of the towers and fill pack.

2.1.5 Monitoring of Water Quality

The Contractor shall arrange regular water sampling and testing of cooling water to monitor water treatment effectiveness, including bacterial tests which shall be conducted by laboratories accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS). The bacterial testing of cooling water shall include the following:

- (a) Monthly testing of heterotrophic colony count (HCC)
- (b) Quarterly testing of total legionella count

[Note for information and necessary adjustment for total legionella count testing (not to be included in the specification): Monthly testing of total legionella count should be conducted for cooling tower installations at medical and health facilities such as hospitals, general clinics, specialist clinics; community support facilities for the elderly, such as residential elderly homes, social centre for the elderly; establishments providing health care and services for the sick and infirm.]

The Contractor shall collect water samples from a water sampling point, if available in the cooling tower system, which should be located away from the chemical dosing point, water inlet and bleed-off position. Sampling tap and hose, if provided, shall be run with cooling water for at least 30 seconds prior to sampling. If such a sampling point is not available, water samples may be collected from the cooling tower basin or the location where cooling water falls from the fill into the basin.

The Contractor shall carry out investigation, review water treatment programme and take corresponding remedial actions according to Section 2.1.7 when cooling water sampling result(s) is/are at/above the respective control thresholds below:

	Lower control threshold (cfu/mL)	Upper control threshold (cfu/mL)
Total legionella count	10	1,000
Heterotrophic colony count (HCC)	100,000	5,000,000

[Note (not to be included in the specification): The following clause should be added for cooling towers which have joined the FWCT Scheme. For cooling towers not yet joined the Scheme, owners are also encouraged to adopt the following requirement as far as practicable]

The Contractor shall also sample, measure, test and record the operation and water quality parameters as listed in the Form CT3 issued by the EMSD for the FWCT Scheme [see a sample form at Annex 4] on a monthly basis. The Contractor shall complete the Form and submit to the Employer for record.

2.1.6 Cooling Tower Inspection and Water Sampling by Government Authorities

The Contractor shall provide assistance (such as access to the cooling tower installation(s), shutdown of the installation(s), opening of covers and locks and etc.) to Government Authorities (e.g. Electrical and Mechanical Services Department, Department of Health) when required by them for inspection and water sampling of the cooling towers.

2.1.7 Remedial Actions for Cooling Water Sampling Results at or above Bacterial Control Thresholds

When cooling water sampling results are found at or above the respective lower or upper bacterial control thresholds as stipulated in Section 2.1.5, no matter that the water sampling is conducted by the Contractor, Government Authorities or third party employed by the Employer, the Contractor shall carry out remedial actions in accordance with the requirements set out in this Section.

2.1.7.1 On-line Disinfection

The Contactor shall carry out on-line disinfection when:

- (a) Total legionella count is detected to be ≥ 10 cfu/mL and $< 1,000$ cfu/mL; or
- (b) HCC is detected to be $\geq 100,000$ cfu/mL and $< 5,000,000$ cfu/mL.

The Contactor shall carry out on-line disinfection for the cooling tower system according to the following procedures:

- (i) Add biodispersant and circulate through the cooling tower system prior to on-line disinfection (dosage as recommended by the Cooling Tower Specialist Contractor).
- (ii) Dose a biocide of different chemical composition, or similar composition at a higher concentration, to the cooling tower system in addition to that of the regular water treatment programme.
- (iii) Circulate the biocide through the cooling tower system for the time specified by the biocide manufacturer.
- (iv) Return the system to normal operation.
- (v) Re-test cooling water samples to ascertain the water bacterial quality has resumed normal (i.e. below the lower control thresholds).

2.1.7.2 Emergency Decontamination

The Contactor shall carry out emergency decontamination when:

- (a) Total legionella count is detected to be 1,000 cfu/mL or more; or
- (b) HCC is detected to be 5,000,000 cfu/mL or more; or
- (c) on-line disinfection, as well as, cleaning and disinfection are not effective in controlling Legionella and heterotrophic colony count in cooling tower water.

The Contactor shall carry out emergency decontamination for the cooling tower system according to the following procedures:

- (i) Prohibit entering the vicinity of the cooling tower(s).
- (ii) Circulate biodispersant throughout the system before disinfection (dosage as recommended by the cooling tower system services providers).
- (iii) Add sodium hypochlorite to the system water to obtain a measured concentration of 50mg/L (ppm) of free chlorine.
- (iv) Circulate the system water with the fans off for a period of at least 6 hours.
- (v) Maintain the free chlorine level at an absolute minimum of 20 mg/L (ppm) at all times.
- (vi) After 6 hours, de-chlorinate and drain the system.

- (vii) Clean thoroughly the basin, fill, drift eliminator, fan and water distribution system.
- (viii) Refill with fresh water and add sodium hypochlorite.
- (ix) Recirculate without using the fan, at 20mg/L (ppm) of free available chlorine for 6 hours.
- (x) De-chlorinate and drain the system.
- (xi) Refill, recirculate and take water samples for testing.
- (xii) Re-commission system when total legionella count and HCC levels are detected below the lower control thresholds as stipulated in Section 2.1.5.

2.1.8 Operation and Maintenance Records

The Contractor shall keep proper records of system operation, routine inspection, water sampling results and maintenance work by using the sample log sheet in Annex 2. The operation and maintenance records shall be made readily available for inspection and reproduction when required by authorized public officers.

2.2 Corrective Maintenance and Repair Services

The Contractor shall carry out corrective maintenance and repair work for any part of the cooling tower installation(s) in accordance with the following requirements:

- (i) The Contractor shall, at any time during the Contract Period attend fault calls and carry out all necessary repair works for any part of the cooling tower installation(s).
- (ii) The Contractor shall provide all necessary consumables and minor parts at his own cost. Such consumables and minor parts shall include, but not be limited to: “O” rings, gaskets, seals, bolts, nuts, washers, pins, locks, bearings, belts, valves, actuators, dampers, pipe/tube fittings, thermostats, switches, isolators, fuses, buttons, indicators, control/protective relays, meters, contactors, current transformers, etc.
- (iii) The cost for the corrective maintenance is deemed to be included in the unit rate entered in the Schedule of Rates.
- (iv) For replacement of major parts other than those specified in item (ii) above, the Contractor shall obtain prior acceptance of the Employer. The Contractor shall submit a quotation to the Employer for consideration.
- (v) The Contractor shall submit the Employer full justifications to support that the replacement of the parts is due to genuine operational need and not due to any negligence or default of the Contractor in execution of the works.
- (vi) All provision of parts shall include a guarantee period of 1 year for their normal operation except damage by vandalism or other causes beyond the Contractor’s control. If necessary, the Contractor shall obtain similar back-to-back guarantee from relevant manufacturers or suppliers of the subject parts provided by the Contractor.
- (vii) The Employer reserves the right to provide consumables and parts not included in item (ii) above for the execution of works by the Contractor.

3. SUPPLY AND INSTALLATION OF WATER TREATMENT FACILITIES (Optional for a cooling tower installation without proper water treatment facilities)

The Contractor shall design, supply, install, test and commission a complete set of automatically controlled water treatment system to the cooling tower installation completed with chemical dosing pumps, chemical storage tanks, sensors, control devices, control wiring, associated pipe

works and electrical works.

The automatic water treatment system shall include, but not limited to, the following:

- (i) The system shall continuously or intermittently treat the cooling water with chemicals to control corrosion, scaling and microbial growth.
- (ii) Water treatment chemicals shall be added by automatic dosing devices which may either be of metered dosing type or proportional dosing type to suit the application.
- (iii) Water treatment chemicals shall include one inhibitor to control corrosion and scaling, and two different biocides to control microbial growth.
- (iv) The two different biocides shall be injected alternatively at periodic intervals to avoid microorganisms to develop resistance against the biocides.

The Contractor shall provide a guarantee period of 1 year for its normal operation except vandalism or other damage to the subject parts beyond the Contractor's control. If necessary, the Contractor shall obtain similar back-to-back guarantee from manufacturers or suppliers of the subject parts provided by the Contractor.

4. SCHEDULE OF RATES

The tenderer shall complete and submit the following Schedule of Rates together with the tender. The unit rates shall cover both the cooling tower installation(s) and all associated equipment, instruments, devices, accessories, fittings, and supports etc.

A. Operation and Maintenance

Item	Description	Unit Rate in HK\$ per month	Quantity	Total in HK\$
1.	Routine operation and maintenance for cooling tower installation and associated equipment according to the Specification (per month): Breakdown of item 1 (for reference only) (a) Preventive maintenance and inspection (b) Corrective maintenance and repair services (c) Water sampling and bacterial tests (d) Water treatment chemicals and other consumables	_____ per month _____ _____ _____	_____ months (to be input by the Employer)	_____

B. Provision of Water Treatment Facilities (Optional item – see Section 3 of the Specification)

2.	Supply and installation of water treatment facilities according to the Specification (per installation):	_____	1 installation	_____
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EQUIPMENT SCHEDULE - EXISTING COOLING TOWERS INSTALLATION

(To be provided by the Employer as appropriate)

A. Cooling Tower

Item	Technical Information	Cooling Tower No. 1	Cooling Tower No. __
1.	Cooling tower ID/ref. no. (if any)		
2.	Physical location (e.g. roof/ podium / indoor)		
3.	Year of installation (if known)		
4.	Brand / Make (if known)		
5.	Type of cooling tower (i.e. Induced draft counter flow/ Induced draft cross flow/ Forced draft counter flow/ Forced draft cross flow/ etc.)		
6.	Casing material (i.e. Stainless steel/ Fiberglass/ etc.)		
7.	Overall dimension (L x W x H) (mm) or (Dia x H) (mm)		
8.	No. of cell(s) (No.)		
9.	No. of fan(s) (No.)		
10.	Circulating water flow rate (liter/sec)		
11.	Air flow rate (liter/sec)		

B. Water Treatment Facility (if available)

Item	Technical Information	Water treatment facility No. 1	Water treatment facility No. __
1.	Type of water treatment facility (i.e. Chemical water treatment/ Filtration system/ Ozone disinfection system/ etc.)		
2.	Brand / Make of water treatment facility (if known)		

Operation and Maintenance Records for Cooling Tower System

For the period: _____

A. System Description

Record	Details
Building Name & Building Address	
Cooling tower type	
Number of cooling tower in system	
Heat rejection capacities of the cooling towers	
Building owner's name / contact details*	
Cooling tower owner's name and contact details*	
Cooling tower system operation team details*	
Water treatment services provider's name and contact details*	
Water sampling / laboratory contractor's name and contact details*	

* To include company name, contact person's business and after hours telephone numbers

B. Weekly / Monthly Records for the month () of year ()

	<u>Procedures</u>	<u>Date of Action</u>				
		Week 1	Week 2	Week 3	Week 4	Monthly
1.	Check cleanliness, organic fouling and physical debris					
2.	Inspect for slime and algal growth					
3.	Inspect for deterioration of materials damage to components, blockages and corrosion					
4.	Inspect for correct operation of fans, motors and pumps					
5.	Inspect water leaks from seams					
6.	Inspect misshaped exterior or collapsed internal supports					
7.	Inspect supporting framework					
8.	Inspect fill and drift eliminator					
9.	Check condition and operation of ball valve					
10.	Check fan thermostat (if equipped)					
11.	Check sprays and distribution deck					
12.	Check bleed-off rate					
13.	Refill chemicals (if necessary)					

C. Quarterly / 6-monthly / Yearly Records for the year ()

<u>Procedures</u>		<u>Date of Action</u>			
		Quarter 1	Quarter 2	Quarter 3	Quarter 4
1.	Lubricate fan and pump bearings / gearbox				
2.	Drain basin and clean distribution deck fill and drift eliminator				
3.	Check security of all bolts and fittings				
4.	Clean fan blades				
5.	Clean all components as required				

D. Monthly Water Sample Bacterial Test Records for the year ()

Bacteria Test		Testing Laboratory	Date of Test	Test Results (cfu/mL)	Action
Heterotrophic colony count	Month 1				
	Month 2				
	Month 3				
	Month 4				
	Month 5				
	Month 6				
	Month 7				
	Month 8				
	Month 9				
	Month 10				
	Month 11				
	Month 12				
Total legionella count	Month 1				
	Month 2				
	Month 3				
	Month 4				
	Month 5				
	Month 6				
	Month 7				
	Month 8				
	Month 9				
	Month 10				
	Month 11				
	Month 12				

Note: The Contractor may modify or develop their own operation and maintenance records format to suit the particular configuration and needs of the cooling tower installation. The record format shall be submitted to the Employer for approval before use.

RECOMMENDED SPARE PARTS LIST
(to be input by the Employer)

Item	Description	Quantity
1.		
2.		
3.		

(For cooling towers which have joined the Fresh Water Cooling Towers Scheme)

Form EMSD EE CT3

Fresh Water Cooling Towers Scheme

Summary of Operational Information for Cooling Tower Installation

(Records kept by Owners of Cooling Towers)

Date: _____

Part A

Operational information of the cooling towers for the month of _____ in Year _____

Building name and address of cooling towers: _____

1. Operational information of cooling towers and water sampling results of the above month are summarized in Part B of this Form.
2. This is also to record that
 - (a) The cooling tower shell is in *good/ fair/ bad condition.
 - (b) The supporting framework of the cooling tower shell is in *good/ fair/ bad condition.
 - (c) The maintenance carried out for each cooling tower of the installation has been recorded according to the requirements of the Scheme document.

(Remark: If the cooling tower shell and/ or the supporting framework for the cooling tower is/ are in bad condition, please use a separate sheet to describe details and planned action if any):

Signature of Owner or his Representative: _____

Full Name of Owner or his Representative: _____

Company Chop: _____

Company: _____

Tel No.: _____

Fax No.: _____

Email: _____

Correspondence Address: _____

Date: _____

Part B

Operational Information of cooling towers (for Month: _____ Year: _____):

EMSD Cooling tower registration no.:	PS-	
Owner's cooling tower ref. no.:		
Daily operating time:	from	to
Energy consumption for all water-side equipment in the month:		kWh
Make-up water volume (<i>Total water consumption in the month</i>):		m ³
Bleed-off volume (<i>Total bleed-off volume in the month</i>):		m ³

1. Cooling water sampling results

Water sampling date: _____

Parameters	Sampling Results	Cooling Water Quality Criteria
Monthly sampling (<i>see Notes 1 to 4</i>)		
Water Temperature	°C	Optimal temperature for the system design and current operating conditions
Heterotrophic colony count	cfu/mL	Less than 100 000 cfu/mL
Conductivity	µS/cm	Less than 1 500 µS/cm
Total dissolved solids	ppm	Less than 1 000 ppm
Suspended solids	ppm	Less than 150 ppm
Calcium hardness	ppm	Less than 500 ppm
pH		7 – 10
Residual biocide concentration (1)	mg/L	Follow manufacturers' specifications
Residual biocide concentration (2)	mg/L	
Residual inhibitor concentration (1)	mg/L	
Residual inhibitor concentration (2)	mg/L	
Quarterly sampling		
Total legionella count (see Note 1)	cfu/mL	Less than 10 cfu/mL
- Legionella pneumophila Sg1	cfu/mL	
- Legionella pneumophila Sg2-14	cfu/mL	
- Legionella other species	cfu/mL	
Chloride as mg/L (Cl)	mg/L	Less than 200 mg/L
Sulphate as mg/L (SO ₄)	mg/L	Less than 200 mg/L
Total iron as mg/L (Fe)	mg/L	Less than 1.0 mg/L
Total alkalinity	ppm	80 – 500 ppm

* delete as appropriate

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EMSD EE CT3 (Rev. 12/2016)

2. Bleed-off water sampling results

Water sampling date: _____

Parameters	Sampling Results	Bleed-off Water Quality Criteria
Quarterly sampling (see Note 5)		
Colour (H.U.)	H.U.	Less than 20 H.U.
Turbidity (N.T.U.)	N.T.U.	Less than 10 N.T.U.
Threshold Odour No. (T.O.N.)	T.O.N.	Less than 100 T.O.N.
Ammoniacal Nitrogen	mg/L	Less than 1 mg/L
Suspended Solids	mg/L	Less than 10 mg/L
Dissolved Oxygen	mg/L	Larger than 2 mg/L
5-day Biochemical Oxygen Demand	mg/L	Less than 10 mg/L
Chemical Oxygen Demand (COD)*	mg/L	Refer to EPD's Technical Memorandum on Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters
Synthetic Detergents	mg/L	Less than 5 mg/L
E. Coli/ 100mL	counts	Less than 1 000 counts

3. Temporary Shut-down of Cooling Tower (if applicable)

Cooling towers to be shut-down	EMSD Registration No.: PS-		
Date of Temporary Shut-down: (dd/mm/yyyy)	From		*a.m./ p.m.
	To		*a.m./ p.m.
Action taken, either (a) or (b):			
(a) kept full of treated water and circulated once a week:	*Yes / No		
(b) fully drain off the system water and dry the system by mechanical fan, and then cover and shut off the inlet and outlet pipes leading to the cooling tower(s):	*Yes / No		

Note 1: HCC should be tested every month and legionella should be tested every three (3) months unless otherwise required for validation of the effectiveness of water treatment. Water sampling for cooling tower systems installed at medical and health care premises should be carried out at least once a month for both HCC and legionella tests.

Note 2: HCC and legionella should be tested in accordance with the current edition of APHA 9215B and AS3896 respectively or equivalent.

Note 3: Copies of the laboratory test reports on HCC and legionella should be accompanied with this form.

Note 4: Cooling water samples should be tested every month unless otherwise required.

Note 5: Bleed-off water samples should be tested every three (3) months unless otherwise required. The bleed-off water should be treated to achieve the Water Supplies Department's Water Quality Objectives of Sea Water for Flushing Supply (At Distribution) when necessary.

* delete as appropriate

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EMSD EE CT3 (Rev. 12/2016)

Personal Data Privacy Statement

Purpose of Personal Data Collection

1. The personal data provided by means of this form will be used by the Government for the following purposes:
 - a. activities relating to the processing of the submission in this form;
 - b. activities relating to requirements stipulated in the Fresh Water Cooling Towers Scheme; and
 - c. facilitating communication between Government and yourself.

Classes of Transferees

2. Upon receipt of your information submission, all personal data that are collected in this form and all documents submitted along with this form will be kept at the Electrical and Mechanical Services Department and will be disclosed to the data users of the department only for activities relating to the Fresh Water Cooling Towers Scheme.

Access to Personal Data

3. You have a right of access and correction with respect to personal data as provided for in sections 18 and 22, and Principle 6 of Schedule 1 of the Personal Data (Privacy) Ordinance. Your right of access includes the right to obtain a copy of your personal data provided by this form

Enquiries

4. Enquiries concerning the personal data collected by means of this form, including the making of access and correction, should be submitted in writing and addressed to the Director of Electrical and Mechanical Services by posting to Electrical and Mechanical Services Department, 3 Kai Shing Street, Kowloon, Hong Kong, or via email info@emsd.gov.hk. For other enquiries relating to the Fresh Water Cooling Towers Scheme, please call 3757 6156 or contact the 1823 Call Centre.

Reference: Water Supplies Department's Guide to Cleansing of Fresh Water Storage Tanks

Steps for cleansing of water tanks:

- (a) close the inlet and outlet valves of the water tank;
- (b) empty the water tank through the washout pipe;
- (c) thoroughly scrub and cleanse the water tank and the inlet/out pipes with fresh water;
- (d) drain away the water through the washout pipe;
- (e) scrub the water tank thoroughly with a solution of chloride of lime or bleaching powder containing not less than 50 parts per million of chlorine solution . (For chloride of lime or bleaching powder contains 33% of available chlorine in weight, a 50 parts per million chlorine solution can be prepared by mixing 15 grams of chloride of lime or bleaching powder in 100 litres of water.);
- (f) rinse the water tank thoroughly with fresh water;
- (g) drain away the water through the washout pipe; (h) open the inlet valve to refill the water tank with water;
- (i) open the outlet valve, and the water tank is ready for use.

GUIDANCE NOTES FOR OCCUPATIONAL SAFETY AND HEALTH

1. Sufficient personal protective equipment shall be provided to the personnel responsible to carry out inspection and maintenance work of a cooling tower system. Recommended list of personal protective equipment required related to different job nature is shown in Table 1.
2. Training in safe work procedure, including the use and maintenance of protective equipment shall be provided to the personnel carrying out cooling tower system commissioning.
3. Water treatment may involve the application of relatively aggressive and toxic chemicals in an environment, which is difficult to control. Safety of plant and personnel is the major concern. All personnel involved must be fully conversant with the safe handling of the products, which form part of the water treatment regime. Water treatment chemicals shall be handled with care according to the manufacturer's instructions.
4. Material safety data sheet (MSDS) and relevant recognized data sheet for the chemicals used in water treatment process shall be provided by water treatment services providers and included in the operation and maintenance manual. MSDS and relevant warning / safety label shall be provided on the surface of water treatment chemical bucket. The MSDS and labels shall be properly protected against water and chemical damage.
5. Workers shall practice with a high standard of personal hygiene. Adequate washing facilities shall be provided and made easily accessible.
6. Water treatment programme for a cooling tower system shall be established by a competent service provider and complied with the requirements specified in this Specification.
7. Eye wash bottles or washing basin with fresh water tap shall be provided adjacent to water treatment chemicals tanks or any appropriate location for emergency use. However, the water contained in the eye wash bottle shall be replaced periodically.
8. Water treatment chemical shall be stored at an appropriate location to facilitate chemical handling. Mechanical / natural ventilation shall be provided to the room entirely / partially used for water treatment chemical storage.
9. Electrical fittings and luminaries serving water treatment chemical storage area shall be weather-proof and corrosion resistant type.
10. Warning signs shall be erected to alert for operation and maintenance personnel of the potential hazard caused by cooling tower; and to restrict the unauthorised access to cooling towers.
11. Workers exposed to hazardous substances and engaged in processes of cleaning and disinfection and water treatment shall undergo regular health surveillance with a medical practitioner. In the event that the worker develops respiratory, cutaneous and other symptoms when exposed to hazardous chemicals, immediate medical attention shall be sought.

Table 1: Recommended List of Personal Protective Equipment

Job	Potential Hazard	Respirator and Clothing
Testing and commissioning	Aerosol	Half face piece, capable of filtering smaller than 5µm particulates, ordinary work clothing
Inspection	Aerosol	Half face piece, capable of filtering smaller than 5µm particulates, ordinary work clothing
Water Sampling	Aerosol	Half face piece, capable of filtering smaller than 5µm particulates, ordinary work clothing
High pressure spraying	Aerosol	Respirator as above, waterproof overalls, gloves, boots, goggles or face shield
Chemical treatment with sodium hypo-chlorite solution in ventilated space	Spray mist and very low concentration chlorine	Half face piece, acid gas and particulate respirator, goggles or face shield, overalls, gloves, and boots
As above, confined space	Unknown chlorine concentration, high mist, possible lack of oxygen	To comply with the requirement under The Factories and Industrial Undertakings (Confined Spaces) Regulation