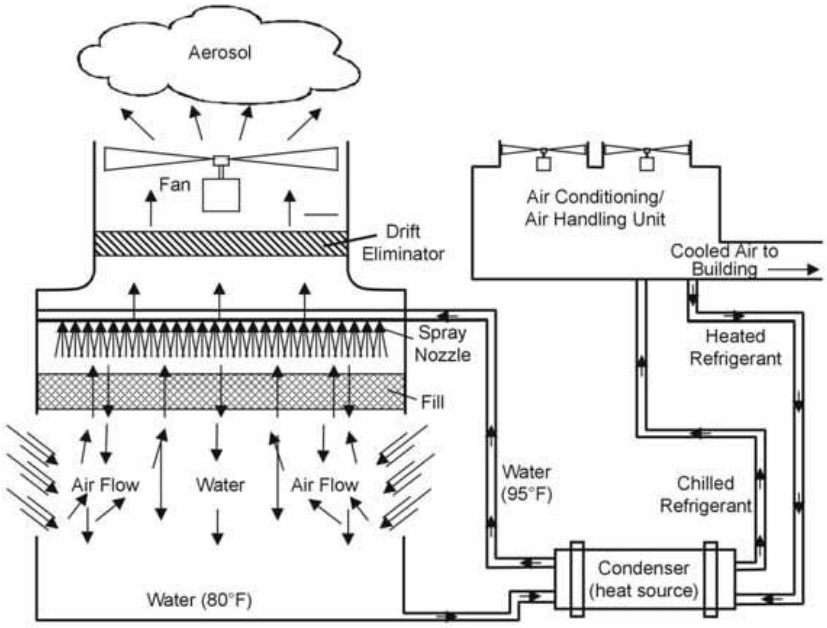
ATTACHMENT 4

NYSIF – Albany Office

Cooling Tower Maintenance

Program and Plan



This program is intended to meet the requirements of the August 2015 NYS DOH Emergency Regulations for Legionella control in cooling towers. This document is intended for use by the facility indicated. Any unauthorized use or reproduction of this document for any facility other than that intended is strictly prohibited.

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August 2017

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Program Responsibilities

The following persons are responsible for the management, implementation and completion of this program:

FACILITY:	New York State Insurance Fund 15 Computer Drive West Albany, NY 12205
PERSON RESPONSIBLE FOR PROGRAM DEVELOPMENT, SUPERVISION AND REPORTING TO THE DOH AS REQUIRED	Megan McClune, Contract Management Specialist 3 New York State Insurance Fund 15 Computer Drive West Albany, NY 12205 E-Mail: contracts@nysif.com
PERSON RESPONSIBLE FOR MAINTENANCE: **MAINTENANCE SUPERVISOR**	Lori O'Connor, Building Manager 3 New York State Insurance Fund 15 Computer Drive West Albany, NY 12205 E-Mail: PropertyServicesAlb15@nysif.com
PERSON/ENTITY WHO CONDUCTS QUARTERLY INSPECTIONS:	B&L Control Service, Inc 1448 Saratoga Road Ballston Spa, NY 12020 E-Mail: bandlcontrol@gmail.com Phone: (518) 273-0500
PERSON/ENTITY WHO COMPLETES ANNUAL INSPECTION AND CERTIFICATION:	
PERSON/ENTITY WHO TREATS THE COOLING TOWERS:	B&L Control Service, Inc 1448 Saratoga Road Ballston Spa, NY 12020 E-Mail: bandlcontrol@gmail.com Phone: (518) 273-0500

This program is intended to meet the requirements of the August 2015 NYS DOH Emergency Regulations for Legionella control in cooling towers. These regulations can be found in the Appendix B. A copy of this plan shall be provided to each responsible party identified above. This document is intended for use by the facility indicated. Any unauthorized use or reproduction of this document for any facility other than that intended is strictly prohibited.

General

The following cooling towers are present at the Facility. All have been registered by the Facility with the NYS Department of Health. Details can be found in Appendix C.

Cooling Tower System

Plan Review and Availability

This plan will be reviewed on an annual basis by the New York State Insurance Fund (NYSIF). Each year, by November 1st, the "Person Responsible for Program Development and Supervision" will ensure that a NYS licensed professional engineer or appropriately trained environmental consultant meeting the requirements of the regulations, certifies to the Department of Health, that all cooling towers were inspected, tested, cleaned, and disinfected in compliance with the DOH regulations, that the condition of the cooling towers is appropriate for intended use, and that a maintenance program and plan has been developed and implemented.

A copy of this plan will be kept on the premises where the cooling tower is located. It will be made available to the local of state Department of Health immediately upon request. In addition to this plan, the Owner should ensure that all manufacturer's recommended operating, maintenance and repair procedures be followed. In rare circumstances that the manufacturer's procedures may differ from this plan, the manufacturer's recommendations should be followed and/or the Owner should check with a licensed professional.

Plan Authority and References

- NYS Department of Health Emergency Regulations
- ASHRAE 188 (2015*) Legionellosis: Risk Management for Building Water Systems (ANSI/ASHRAE 188-2015)*
- ASHRAE Guideline 12 (2000) *Minimizing the Risk of Legionellosis Associated with Building Water Systems*
- Cooling Technology Institute (CTI) Legionellosis. *Guideline: Best Practices for Control of Legionella, CTI Guidelines WTB-148 (08)*
- OSHA eTools: Legionnaires Disease, https://www.osha.gov/dts/osta/otm/legionnaires/index.html
- Centers for Disease Control and Prevention, *Guidelines for Environmental Infection Control in Health-Care Facilities; Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC); U.S. Department of Health and Human Services Centers for Disease Control and Prevention (CDC) Atlanta, GA 30333 (2003)*

Routine Inspection, Cleaning and Treatment

All cooling towers will be subject to weekly, monthly and quarterly inspections. In addition, NYS requires that all towers be inspected and tested not less than once every ninety days during use by a NYS Licensed Professional Engineer or other competent person as outlined in the regulations.

Weekly Inspections: Weekly Inspections are performed by Contracted Maintenance staff (B&L Control Service) or by On-Site Maintenance staff and include the following:

(i) Visual inspection of the cooling tower and associated equipment for any maintenance issues;
(ii) Testing of biocide concentrations in the water using a suitable test kit;
(iii) Reading of make-up water meter readings;
(iv) Visual check of conductivity levels;
(v) Recording of biocide concentration, conductivity level and water meter reading along with any other observed maintenance items in an on-site log maintained by the cooling tower equipment.

Monthly Inspections: Monthly Inspections are performed by Contracted Maintenance staff (B&L Control Service) and include the following:

(i) Visual inspection of the cooling tower and associated equipment for any maintenance issues;
(ii) Supply and testing of biocide equipment and chemicals;
(iii) Supply and testing of corrosion control equipment chemicals;
(iv) Check of water make-up connections and control;
(v) Check for proper functioning of the conductivity control;
(vi) Check for proper functioning of all dosing equipment;
(vii) Monthly HPC microbe testing.
(viii) Completion of a monthly inspection form (Contractor supplied) and delivery of form to On-Site Maintenance Supervisor identified on Page 3 of this plan.

Quarterly Inspections: Quarterly Inspections are performed by Contracted Professionals and include the following:

(i) Visual inspection of the cooling tower and associated equipment for the presence of organic material, biofilm, algae, and other visible contaminants;
(ii) Visual check of the general condition of the cooling tower, basin, packing material, and drift eliminator;
(iii) Check of water make-up connections and control;
(iv) Check for proper functioning of the conductivity control;
(v) Check for proper functioning of all dosing equipment;
(vi) Completion of a formal Quarterly Inspection Report to be provided to the person Responsible for the inspection program identified on Page 3 of this plan.

Should any inspection show visible debris in the basin and/or other objectionable conditions, corrective action will be commenced immediately under the direction of the Maintenance Supervisor.

Routine Treatment Program

Proper biocides must be applied as part of any treatment program. All persons who apply biocides must hold the proper class commercial pesticide applicator certification, or pesticide technician status, from the NYS Department of Conservation, and act within the scope of the regulations. All chemicals used in the treatment and cleaning of cooling towers will be approved by the Department of Corrections and Community Supervision and an MSDS will be found in the Appendix. All biocides used will be registered with the NYS Department of Conservation as required.

The following is all equipment and chemicals that will be used for the purpose of treating the open recirculating loop:

(i) Properly Sized Biocide Metering Pump **(Advance Model B130x1-PFS1 or Equal)**
(ii) Properly Sized Corrosion Control Metering Pump **(Iwaki Model EZB11D1 or Equal)**
(iii) Chemical Holding Tanks with Secondary Containment as applicable
(iv) Biocide and Corrosion Control Chemicals are included in Appendix G

Recommended minimum chemical residuals are dependent on the disinfectant being used at the time. ASHRAE 12-2000 recommends that the types of biocides used for disinfection be alternated on a regular basis to avoid the selection and growth of resistant strains of microbes. It is also commonly recommended to utilize more than one type of biocide in addition to alternating methods. Free halogens shall be tested using an on-site test kit as recommended by the chemical provider. The residual level will be measured at each cooling tower sump. All information will be documented in a service log maintained on-site.

Continuous Application of Halogens (CTI WTB-148 (08) Recommendations:)

- Maintain continuous free residuals of 0.5 to 1.0 ppm as Cl2 in the cooling towers hot returns. Ensure adequate distribution. Effectiveness decreases with increasing pH; bromine is relatively more effective at higher pH (8.5-9.0)
- Stabilized halogen products should be added according to the label instructions.
- Discharge of water to surface water will require dehalogenation.
- Adding biodispersants may aid in the penetration, removal, and dispersion of biofilm and often increases the efficacy of the biocide.
- Continuous halogen programs may also require periodic use of nonoxidizing biocides in order to control biofilms and other organisms. The use of additional chemicals must be per the recommendations of the NYSDEC certified biocide applicator or Professional Engineer.

Hyperhalogenation (CTI WTB-148 (08) Recommendations:)

Hyperhalogenation as practiced is the maintenance of a minimum of 5 ppm free halogen for at least 6 hours. Periodic hyperhalogenation will discourage development of large populations of Legionella and their host organisms. Consequently, periodic hyperhalogenation may eliminate the need for conducting more complicated and higher risk off-line emergency disinfection procedures. Periodic on-line hyperhalogenation may also be necessary for systems:

- That have process leaks;
- That have heavy biofouling;
- That use reclaimed water as makeup;
- That have been stagnant for a long time;
- When HPC testing exceed 100,000 CFU/ml or
- When Legionella testing exceed 100 CFU/ml

Make-Up Water Maintenance

All potable water systems used to provide make-up water for cooling towers must be equipped with a reduced pressure zone backflow prevention device to prevent potential contamination of the drinking water system. The make-up water source for the cooling tower serving the facility is from the drinking water system serving the building. Backflow prevention devices must be inspected and certified by a NYS Department of Health certified Backflow Tester on an annual basis. Records of the inspection should be maintained on NYSDOH Form 1013 (or latest version) and maintained on-site.

Proper operation of the make-up water system and valves is important for the operation of the cooling tower systems. Valves and water usage should be checked in conjunction with the weekly inspections.

Biological Testing and Remedial Action Plans

HPC Activity

At each weekly or monthly inspection service visit, a dip slide or HPC will be taken from each basin and analyzed. The biocide regimen will be presumed adequate if the dip slide is found to be less than 10,000 CFU/ml. If the dip slide is *greater than 10,000 CFU/ml* the biocide regimen will be immediately examined and modified to correct conditions. Retesting will occur within 30 calendar days. Modification to the treatment regimen may be required.

All results and actions will be logged in the monthly service reports and in the on-site log.

Reference: Cooling Technology Institute WTB-148

Parameter	Dipslides	Agar Pour Plate or Petri film	Microscopic Examination
Plank tonic Counts (bulk water)	<10,000 CFU/ml	<10,000 CFU/ml	No higher life forms
Sessile Counts (surfaces)	<100,000 CFU/cm^2	<100,000 CFU/cm^2	No higher life forms
Deposits	NA	NA	No higher life forms

Legionella Activity

In addition to HPC monitoring, it is recommended that legionella culture testing be completed by a certified laboratory on a quarterly basis or if HPC activity is noted. Non-emergency Legionella sampling should also be conducted at the following triggers:

- Failure of a dosing system or indications of maintenance conditions that may have permitted amplification of microbial population.
- When the tower is off-line for more than 5 days.
- When the HPC count exceeds 10,000 CFU/ml

Results from Legionella testing will result in the immediate corrective actions found in Appendix 4-A of the NYSDOH regulations for levels that exceed ≥ 10 CFU /ml.

Emergency Legionella Sample Collection

Per NYS regulations, emergency sample collection and submission of samples for Legionella culture testing will be conducted in the case of events including, but not limited to:

(i) Power failure of sufficient duration to allow for the growth of bacteria;
(ii) Loss of biocide treatment sufficient to allow for the growth of bacteria;
(iii) Failure of conductivity control to maintain proper cycles of concentration;
(iv) A determination that one or more cases of Legionellosis is or may be associated with the cooling tower, based upon epidemiologic data or laboratory testing; and
(v) Any other conditions determined by maintenance or regulatory personnel.

Sample collection will be coordinated with the contracted service provider identified on Page 2. Results will be interpreted immediately upon receipt and corrective actions will be immediately implemented. All records and analysis will be maintained on-site.

The samples must be analyzed by a laboratory with New York State ELAP certification. The results will trigger immediate action based on Appendix 4-A in the regulations. All results and actions will be logged in the service reports and on-site logs and maintained on site for regulatory review.

DOH Appendix 4-A - Interpretation of Legionella Culture Results from Cooling Towers

LEGIONELLA TEST RESULTS IN CFU/ML	APPROACH	PRESCRIBED ACTION
No detection (< 10 CFU /ml)	Maintain treatment program and Legionella monitoring.	**Online disinfection** means – Dose the cooling tower water system with either a different biocide or a similar biocide at an increased concentration than currently used. **Online decontamination** means – Dose the recirculation water with a chlorine-based compound equivalent to at least 5 mg/l (ppm) free residual chlorine for at least one hour; pH 7.0 to 7.6. **System decontamination** means – Maintain 5 to 10 mg/l (ppm) free residual chlorine for a minimum of one hour; drain and flush with disinfected water; clean wetted surface; refill and dose to 1 – 5 mg/l (ppm) of free residual chlorine at pH 7.0 – 7.6 and circulate for 30 minutes. Refill, re-establish treatment and retest for verification of treatment.
For levels at ≥ 10 CFU /ml but < 1000 CFU /ml perform the following:	Review treatment program. Institute immediate **online disinfection** to help with control Retest the water in 3 – 7 days. • Continue to retest at the same time interval until two consecutive readings show acceptable improvement, as determined by a person identified in 10 NYCRR 4.6. Continue with regular maintenance strategy. • If < 100 CFU /ml **repeat online disinfection** and retest. • If ≥100 CFU /ml but < 1000 CFU /ml further investigate the water treatment program and immediately perform **online disinfection**. Retest and repeat attempts at control strategy. If ≥ 1000 CFU /ml undertake control strategy as noted below.
For levels ≥ 1000 CFU /ml perform the following:	Review the treatment program Institute immediate **online decontamination** to help with control Retest the water in 3 – 7 days. • Continue to retest at the same time interval until two consecutive readings show acceptable improvement, as determined by a person identified in 10 NYCRR 4.6. Continue with regular maintenance strategy. • If < 100 CFU /ml **repeat online disinfection** and retest; • If ≥ 100 CFU /ml but < 1000 CFU /ml further investigate the water treatment program and immediately perform **online disinfection**. Re-test and repeat attempts at control strategy. If ≥ 1000 CFU /ml carry out **system decontamination**

Emergency Disinfection and Decontamination Plan

This procedure will be used typically where HPC >100,000 CFU/ml or legionella >1000 CFU/ml. It will be employed and modified under the direction of contracted professionals or properly trained staff.

Procedure for Cleaning Cooling Towers and Related Equipment

Reference: Centers for Disease Control and Prevention "Guidelines for Environmental Infection Control in Health-Care Facilities," Page 225, Item 4.

I. Perform these steps prior to chemical disinfection and mechanical cleaning.

A. Provide protective equipment to workers who perform the disinfection, to prevent their exposure to chemicals used for disinfection and aerosolized water containing Legionella spp. Protective equipment may include full-length protective clothing, boots, gloves, goggles, and a full- or half-face mask that combines a HEPA filter and chemical cartridges to protect against airborne chlorine levels of up to 10 mg/L.

B. Shut off cooling tower.
1. Shut off the heat source, if possible.
2. Shut off fans, if present, on the cooling tower/evaporative condenser (CT/EC).
3. Shut off the system blowdown (i.e., purge) valve.
4. Shut off the automated blowdown controller, if present, and set the system controller to manual.
5. Keep make-up water valves open.
6. Close building air-intake vents within at least 30 meters of the CT/EC until after the cleaning procedure is complete.
7. Continue operating pumps for water circulation through the CT/EC.

II. Perform these chemical disinfection procedures.

A. Add fast-release, chlorine-containing disinfectant in pellet, granular, or liquid form, and follow safety instructions on the product label. Use EPA-registered products, if available. Examples of disinfectants include sodium hypochlorite (NaOCl) or calcium hypochlorite (Ca[OCl]2), calculated to achieve initial free residual chlorine (FRC) of 50 mg/L: either a) 3.0 lbs [1.4 kg] industrial grade NaOCl [12%–15% available Cl] per 1,000 gallons of CT/EC water; b) 10.5 lbs [4.8 kg] domestic grade NaOCl [3%–5% available Cl] per 1,000 gallons of CT/EC water; or c) 226 0.6 lb [0.3 kg] Ca[OCl]2 per 1,000 gallons of CT/EC water. If significant biodeposits are present, additional chlorine may be required. If the volume of water in the CT/EC is unknown, it can be estimated (in gallons) by multiplying either the recirculation rate in gallons per minute by 10 or the refrigeration capacity in tons by 30. Other appropriate compounds may be suggested by a water-treatment specialist.

B. Record the type and quality of all chemicals used for disinfection, the exact time the chemicals were added to the system, and the time and results of FRC and pH measurements.

C. Add dispersant simultaneously with or within 15 minutes of adding disinfectant. The dispersant is best added by first dissolving it in water and adding the solution to a turbulent zone in the water system. Automatic-dishwasher compounds are examples of low- or non-foaming, silicate based dispersants. Dispersants are added at 10–25 lbs (4.5–11.25 kg) per 1,000 gallons of CT/EC water.

D. After adding disinfectant and dispersant, continue circulating the water through the system. Monitor the FRC by using an FRC-measuring device with the DPD method (e.g., a swimming pool test kit), and measure the pH with a pH meter every 15 minutes for 2 hours. Add chlorine as needed to maintain the FRC at >10 mg/L. Because the biocidal effect of chlorine is reduced at a higher pH, adjust the pH to 7.5–8.0. The pH may be lowered by using any acid (e.g., muriatic acid or sulfuric acid used for maintenance of swimming pools) that is compatible with the treatment chemicals.

E. Two hours after adding disinfectant and dispersant or after the FRC level is stable at >10 mg/L, monitor at 2-hour intervals and maintain the FRC at >10 mg/L for 24 hours.

F. After the FRC level has been maintained at >10 mg/L for 24 hours, drain the system. CT/EC water may be drained safely into the sanitary sewer. Municipal water and sewerage authorities should be contacted regarding local regulations. If a sanitary sewer is not available, consult local or state authorities (e.g., a department of natural resources or environmental protection) regarding disposal of water. If necessary, the drain-off may be dechlorinated by dissipation or chemical neutralization with sodium bisulfite.

G. Refill the system with water and repeat the procedure outline in steps 2–7 in I-B above.

III. Perform mechanical cleaning.

A. After water from the second chemical disinfection has been drained, shut down the CT/EC.

B. Inspect all water-contact areas for sediment, sludge, and scale. Using brushes and/or a low pressure water hose, thoroughly clean all CT/EC water-contact areas, including the basin, sump, fill, spray nozzles, and fittings. Replace components as needed.

C. If possible, clean CT/EC water-contact areas within the chillers.

IV. Perform these procedures after mechanical cleaning.

A. Fill the system with water and add chlorine to achieve an FRC level of 10 mg/L.

B. Circulate the water for 1 hour, then open the blowdown valve and flush the entire system until the water is free of turbidity.

C. Drain the system.

D. Open any air-intake vents that were e closed before cleaning.

E. Fill the system with water. The CT/EC may be put back into service using an effective water treatment program.

In addition to this plan, all required actions for positive legionella cultures specific by NYS DOH will be followed, including procedures for online disinfection, online decontamination, and system decontamination.

Online disinfection means – Dose the cooling tower water system with either a different biocide or a similar biocide at an increased concentration than currently used.

Online decontamination means – Dose the recirculation water with a chlorine-based compound equivalent to at least 5 mg/l (ppm) free residual chlorine for at least one hour; pH 7.0 to 7.6.

System decontamination means – Maintain 5 to 10 mg/l (ppm) free residual chlorine for a minimum of one hour; drain and flush with disinfected water; clean wetted surface; refill and dose to 1 – 5 mg/l (ppm) of free residual chlorine at pH 7.0 – 7.6 and circulate for 30 minutes. Refill, re-establish treatment and retest for verification of treatment.

Start Up and Shut Down Plan

Cooling tower systems need to be shut down to manage hazardous conditions associated with operation of fans during untreated water conditions and to address any of the following conditions (Reference: ASHRAE 188 Section 7.2.5):

- Shutdown that includes all chemical pretreatment steps, pump cycling protocols, and procedures for system drainage for shutdown periods longer than five days;
- Startup from a drained system;
- Start up from an undrained (stagnant) system that exceeds five days.

Shut-Down (Reference: ASHRAE Guidelines 12-2000 Section 7.6.3)

All manufacturer recommended shut down and start-up procedures should be followed for mechanical equipment and systems, as applicable. Refer to the manufacturer's O&M Manual for the unit for shut down procedures. When the system is to be shut down for a period of more than three days, it is recommended that the entire system (cooling tower, system piping, heat exchangers, etc.) be drained to waste. When draining the system is not practical during shutdowns of short duration, the stagnant cooling water must be pretreated with an appropriate biocide regimen before tower start-up.

Start-Up for Drained Systems

- Clean all debris, such as leaves and dirt from the cooling tower.
- Fill the system with water. While operating the recirculation pump and prior to operating the cooling tower fans, execute one of the two alternative biocidal treatment programs described below:

    1) Treat with a biocide that had been used prior to shut down. Utilize the services of the water treatment supplier. Maintain the maximum recommended biocide residual (for the specific biocide) for a sufficient period of time (residual and time will vary with the biocide) to bring the system under good biological control.
    2) Treat the system with sodium hypochlorite to a level of 4 to 5 mg/L (ppm) free chlorine residual at a pH of 7.0 to 7.6. The chlorine residual must be held at 4 to 5 mg/L (ppm) for six hours, measurable with standard commercial water test kits.

- Once one of these two biocidal treatments has been successfully completed, the fan can be turned on and the system returned to service. Resume the standard water treatment program (including biocidal treatment).

Start-Up for Undrained (Stagnant) Systems

- Remove accessible solid debris from the cooling tower sump and from any remote storage tank(s) that may be used.
- Perform one of the two biocide pretreatment procedures (described in "Start-Up for Drained Systems") directly to the cooling tower sump or remote storage tank. Do not circulate stagnant bulk cooling water over cooling tower fill or operate cooling tower fans during pretreatment.
- Stagnant cooling water may be circulated with the main cooling system pump(s) if tower fill is bypassed. Otherwise, add approved biocide directly to the bulk water source and mix with either manual or by sidestream flow methods. Take care to prevent the creation of aerosol spray from the stagnant cooling water from any point in the cooling water system.
- After biocidal pretreatment has been successfully completed, the cooling water should be circulated over the tower fill with fans off. When biocide residual is maintained at a satisfactory level for at least six hours, the cooling tower fans may be operated.

Recordkeeping

All documents on findings, deficiencies, corrective actions, cleaning and disinfection, tests performed and certifications pursuant to the regulations and plan, must be maintained for at least three years.

Discontinued Use

The Facility will notify the Department of Health within 30 days after removing or permanently discontinuing use of a cooling tower. The notice will include a statement that such cooling tower has been disinfected and drained in accordance with the procedures set forth in the shutdown plan.

Electronic Registration and Reporting

The following items are required to be reported to the NYS Department of Health using the statewide electronic system used for registration:

	Action Item	**Timeframe Required**
i	Registration Changes	10 days
ii	Date of last routine culture sample collection, sample results, and date of any required remedial action	10 days
iii	Date of any legionella sample collection, sample results, and date of any required remedial actions	10 days
iv	Date of last cleaning and disinfection	10 days
v	Dates of start and end of any shutdown for more than five days	10 days
vi	Date of last certification and date due	10 days
vii	Date of last inspection and date due	10 days
viii	Dates of discontinued use	30 days
ix	Any other pertinent requirements Identified by NYSDOH	

Appendices

Appendix A- Plan History Log

Track all significant changes to the plan.

Date	*Initials*	*Summary of Changes*
September 1, 2017		***Revised Plan Implementation Date***

Appendix B

NYS Department of Health Regulations

ATTACHMENT 4

Subpart 4-1 - Cooling Towers

Effective Date:
Wednesday, July 6, 2016
Statutory Authority:
Public Health Law, Section 225(5)(a)

Section 4-1.1 - Scope

4-1.1 Scope.

All owners of cooling towers shall comply with this Subpart.

Effective Date:
Wednesday, July 6, 2016
Doc Status:
Complete
Statutory Authority:
Public Health Law, section 225(5)(a)

Section 4-1.2 - Definitions

4-1.2 Definitions.

As used in this Subpart, the following terms shall have the following meanings:

(a) *Bacteriologic culture sampling and analysis.* The term *bacteriologic culture sampling and analysis* means the collection of a water sample for the measurement of live culture growth of the aerobic bacterial populations by heterotrophic plate count (HPC), dip slides, or similar method used by the industry and according to the manufacturer's directions.

(b) *Building.* The term *building* means any structure used or intended for supporting or sheltering any use or occupancy. The term shall be construed as if followed by the phrase "structure, premises, lot or part thereof" unless otherwise indicated by the text.

(c) *Cooling Tower.* The term *cooling tower* means a cooling tower, evaporative condenser, fluid cooler or other wet cooling device that is capable of aerosolizing water, and that is part of, or contains, a recirculated water system and is incorporated into a building's cooling process, an industrial process, a refrigeration system, or an energy production system.

(d) *Legionella culture sampling and analysis.* The term *Legionella culture sampling and analysis* means the collection of a water sample for the measurement of the live culture of *Legionella* involving the use of specialized media and laboratory methods for growth to determine the species and serogroup.

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(e) *Owner.* The term *owner* means any person, agent, firm, partnership, corporation or other legal entity having a legal or equitable interest in, or control of, a cooling tower or the premises where the cooling tower is located. In all instances, the legal owner of the building shall be deemed an owner within the meaning of the Subpart. Further, where a tenant owns a cooling tower that services the tenant's leased premises, the tenant is an "owner" within the meaning of this Subpart. Additionally, if a tenant does not own the cooling tower but has a lease or contractual arrangement to maintain the cooling tower, the tenant shall be deemed an agent having control of the cooling tower, and thus an "owner," for purposes of this Subpart.

Effective Date:
Wednesday, July 6, 2016
Doc Status:
Complete
Statutory Authority:
Public Health Law, section 225(5)(a)

Section 4-1.3 - Electronic registration and reporting

4-1.3 Electronic registration and reporting.

(a) *Registration.* All owners of cooling towers shall register such towers with the department, using a statewide electronic system designated by the department, prior to initial operation, and whenever any owner of the cooling tower changes. Such registration shall include, at a minimum, the following information:

(1) street address of the building at which the cooling tower is located, with building identification number, if any;

(2) name(s), addresses(es), telephone number(s), and email address(es) of the owner(s) of the cooling tower;

(3) name of the manufacturer of the cooling tower;

(4) model number of the cooling tower;

(5) specific unit serial number of the cooling tower, if available;

(6) cooling capacity of the cooling tower;

(7) cooling tower system volume, inclusive of all piping, basin(s), and sump;

(8) intended use of the cooling tower;

(9) whether the cooling tower operates year-round or seasonally and, if seasonally, start and end date of operation;

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(10) whether systematic disinfection in accordance with section 4-1.7 of this Subpart is maintained manually, through timed injection, or through continuous delivery;

(11) whether maintenance is performed by in-house personnel, by a contractor, or by other parties; and

(12) year the cooling tower was placed into service.

(b) *Reporting.* Effective upon adoption of the regulation, at intervals of no more than 90 days while a cooling tower is in use, the owner of the cooling tower shall report to the department using the statewide electronic system:

(1) date of last bacteriological culture sample collection, the analysis result(s), and date of any required remedial action, pursuant to section 4-1.4(b)(1) of this Subpart;

(2) date of last *Legionella* culture sample collection, the analysis result(s), and date of any required remedial action, pursuant to section 4-1.4(b)(2) - (4) of this Subpart;

(3) date of last inspection, pursuant to section 4-1.8 of this Subpart;

(4) date of last certification, pursuant to section 4-1.8 of this Subpart;

(5) date of removal or permanent discontinued use of the cooling tower, if applicable; and

(6) such other information as shall be determined by the department.

(c) The department shall make data in the statewide electronic system publicly available, as appropriate. The statewide electronic system shall be made fully accessible and searchable to any local health department. Nothing in this Subpart shall preclude a local health department from requiring registration and reporting with a local system or collecting fees associated with the administration of such system.

(d) Where both a landlord and a tenant are considered “owners” of a cooling tower pursuant to Section 4-1.2 of this Subpart, either the owner or the tenant shall register the cooling tower. However, both parties are obligated to ensure that registration and reporting are completed as required by this Subpart.

Effective Date:
Wednesday, July 6, 2016
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Statutory Authority:
Public Health Law, section 225(5)(a)

Section 4-1.4 - Maintenance program and plan

4-1.4 Maintenance program and plan.

ATTACHMENT 4

(a) By September 1, 2016, and thereafter prior to initial start-up of a newly installed cooling tower, the owner shall obtain or update a maintenance program and plan for each cooling tower, developed in accordance with section 7.2 of Legionellosis: Risk Management for Building Water Systems (ANSI/ASHRAE 188-2015), 2015 edition with final approval date of June 26, 2015, at pages 7-8, incorporated herein by reference. The latest edition of ASHRAE 188-2015 may be purchased from the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400, or toll free 1-800-527-4723. Copies are available for inspection and copying at: Center for Environmental Health, Corning Tower Room 1619, Empire State Plaza, Albany, NY 12237.

(b) In addition, the maintenance program and plan shall include the following elements:

(1) a schedule for routine bacteriological culture sampling and analysis to assess microbiological activity at intervals not to exceed 30 days while the cooling tower is in use, and that requires additional bacteriological culture sampling and analysis, as needed, to validate process adjustments;

(2) a schedule for routine *Legionella* culture sampling and analysis within 14 days of seasonal start-up and, thereafter, at intervals not to exceed 90 days while the cooling tower is in use. Cooling towers in use year-round must sample at intervals not to exceed 90 days, and within two weeks after start-up following maintenance;

(3) in addition to the routine *Legionella* culture sampling and analysis required by paragraph (2) of this subdivision, conditions that require immediate *Legionella* culture sampling and analysis, which shall include, but are not limited to:

(i) power failure of sufficient duration to allow for the growth of bacteria;

(ii) loss of biocide treatment of sufficient duration to allow for the growth of bacteria;

(iii) failure of conductivity control, or any other control methods, to maintain proper cycles of concentration;

(iv) a determination by the department or local health department that one or more cases of legionellosis is or may be associated with the cooling tower, based upon epidemiologic data or laboratory testing; and

(v) any other conditions specified by the department or local health department.

(4) provisions requiring immediate and appropriate action, including remedial action, in response to bacteriological and *Legionella* culture analyses. For *Legionella* culture analyses, such provisions shall include, but not be limited to, taking all responsive actions required by Appendix 4-A, including contacting the local health department within 24 hours pursuant to the conditions specified in section 4-1.6 of this Subpart;

(5) provisions requiring that any and all *Legionella* culture analyses must be performed in accordance with section 4-1.5 of this Subpart;

(6) a shutdown and disinfection plan for removing or permanently discontinuing use of a cooling tower;

ATTACHMENT 4

(7) provisions requiring treatment and manual or automated flushing of any piping, basin, sump, or wetted surface during idle conditions; and

(8) provisions requiring cleaning and disinfection prior to startup of a stagnant cooling tower that has been shut down without treatment and recirculation for more than five consecutive days.

Effective Date:
Wednesday, July 6, 2016
Doc Status:
Complete
Statutory Authority:
Public Health Law, section 225(5)(a)

Section 4-1.5 - Legionella culture analysis

4-1.5 *Legionella* culture analysis.

All *Legionella* culture analyses must be performed by a laboratory that is approved to perform such analysis by the New York State Environmental Laboratory Approval Program (ELAP).

Effective Date:
Wednesday, July 6, 2016
Doc Status:
Complete
Statutory Authority:
Public Health Law, section 225(5)(a)

Section 4-1.6 - Notification

4-1.6 Notification.

(a) The owner of a cooling tower shall notify the local health department within 24 hours of receipt of a *Legionella* culture sample result that exceeds 1,000 colony forming units per milliliter (CFU/mL). The local health department shall notify the state department of health with 24 hours of receipt of such a report.

(b) The owner shall notify the public of such test results in a manner determined by the local health department or, in the event that the department elects to determine the manner of public notification, by the department.

Effective Date:
Wednesday, July 6, 2016
Doc Status:
Complete
Statutory Authority:

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Public Health Law, section 225(5)(a)

Section 4-1.7 - Disinfection

4-1.7 Disinfection.

(a) Any person who disinfects a cooling tower shall be a commercial pesticide applicator or pesticide technician who is qualified to apply biocide in a cooling tower and certified in accordance with the requirements of Article 33 of the Environmental Conservation Law and 6 NYCRR Part 325, or a pesticide apprentice under the supervision of a certified applicator.

(b) The name and certification number of the applicator or the business name and registration number of the company providing the disinfection shall be maintained on-site in accordance with section 4-1.9 of this subpart.

(c) Only biocide products registered by the New York State Department of Environmental Conservation for use in cooling towers or pesticidal devices produced in a USEPA registered establishment may be used in disinfection.

(d) The terms “disinfect” and “disinfection” in this Part means the control of microorganisms or microbial growth. The term “disinfection” shall not include the cleaning of a cooling tower through application of detergents, penetrants, brushes or other tools, high-powered water, or any other method that does not involve the use of a pesticide, as defined in 6 NYCRR Part 325.

Effective Date:
Wednesday, July 6, 2016
Doc Status:
Complete
Statutory Authority:
Public Health Law, section 225(5)(a)

Section 4-1.8 - Inspection and certification

4-1.8 Inspection and certification.

(a) Inspection.

(1) All owners of cooling towers shall ensure that such towers are inspected prior to seasonal start-up and at intervals not exceeding every 90 days while in use. Year-round towers shall be inspected at intervals not exceeding every 90 days and prior to start-up, following maintenance.

(2) All inspections shall be performed by a: New York State licensed professional engineer; certified industrial hygienist; certified water technologist; environmental consultant or water treatment professional with training and experience performing inspections in accordance with current standard industry protocols including, but not limited to ASHRAE 188-2015, as incorporated by section 4-1.4 of this Subpart.

ATTACHMENT 4

(3) Each inspection shall include an evaluation of the:

(i) cooling tower and associated equipment for the presence of organic material, biofilm, algae, debris and other visible contaminants;

(ii) general condition of the cooling tower basin, remote sump, packing material, and drift eliminators;

(iii) water make-up connections and control, including backflow protection and/or airgaps as needed;

(iv) proper functioning of the conductivity control; and

(v) proper functioning of all water treatment equipment, including, but not limited to, pumps, timers, valves, and strain gauges.

(4) Any deficiencies found during inspection shall be reported to the owner for immediate corrective action. A person qualified to inspect pursuant to subdivision (a) of this section shall document all deficiencies, and all completed corrective actions.

(b) *Certification.* By November 1, 2016, and by November 1st of each year thereafter, the owner of a cooling tower shall obtain a certification from a person identified in subdivsion (a) of this section, that such cooling tower has a maintenance program and plan, and that all activities within that plan or required by this Subpart were implemented, including but not limited to:

(1) all bacteriological culture sampling and analysis;

(2) all *Legionella* culture sampling and analysis, including any immediate *Legionella* culture sampling and analysis performed pursuant to paragraphs (b)(3) and (b)(4) of section 4-1.4 of this Subpart;

(3) any disinfection performed pursuant to section 4-1.7 of this Subpart; and

(4) all inspections performed pursuant subdivision (a) of this section.

(c) *Reporting.* All inspection findings, deficiencies, and corrective actions, and all certifications, shall be reported to the owner, who shall retain such information, in accordance with section 4-1.9 of this Subpart.

Effective Date:
Wednesday, July 6, 2016
Doc Status:
Complete
Statutory Authority:
Public Health Law, section 225(5)(a)

Section 4-1.9 - Recordkeeping

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4-1.9 Recordkeeping.

The owner of a cooling tower shall maintain records for at least three years of all sampling and analyses; disinfection schedules and applications; inspection findings, deficiencies, and corrective actions; and certifications. An owner shall maintain a copy of the maintenance program and plan required by this Subpart on the premises where a cooling tower is located. Such records and plan shall be made available to the department or local health department immediately upon request.

Effective Date:
Wednesday, July 6, 2016
Statutory Authority:
Public Health Law, section 225(5)(a)

Section 4-1.10 - Enforcement

4-1.10 Enforcement.

(a) The department or local health department may require any owner to conduct *Legionella* culture sampling and analysis, following a determination, based upon epidemiologic data or laboratory testing, that one or more cases of legionellosis are or may be associated with a cooling tower.

(b) An officer or employee of the department or local health department may enter onto any property to inspect a cooling tower for compliance with the requirements of this Subpart, in accordance with applicable law, and may take water samples as part of such inspections.

(c) Where an owner does not register, have a maintenance program and plan, obtain certification, disinfect, perform or obtain culture sampling and analysis, or inspect a cooling tower within the time and manner set forth in this Subpart, the department or local health department may determine that such condition constitutes a nuisance and may take such action as authorized by law. The department or local health department may also take any other action authorized by law.

(d) A violation of any provision of this Subpart is subject to all civil and criminal penalties as provided for by law. Each day that an owner remains in violation of any provision of this Subpart shall constitute a separate and distinct violation of each such provision.

Effective Date:
Wednesday, July 6, 2016
Statutory Authority:
Public Health Law, section 225(5)(a)

Section 4-1.11 - Variances and waivers

4-1.11 Variances and waivers.

(a) Variances. In order to allow time for compliance with this Subpart, an owner may submit a written application to a local health department for a variance from any provision of this Subpart,

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for a period not exceeding 90 days, accompanied by an explanation of why such variance will not present a danger to public health. With the approval of the department, the local health department may approve such application for a variance in writing, subject to any conditions that the department or local health department may deem appropriate to protect public health. The local health department or department may revoke such variance upon a determination that the variance may present a danger to public health.

(b) Waivers. The department may issue a written general or specific waiver with respect to any provision of this Subpart, subject to any conditions the department may deem appropriate, where the department is satisfied that such waiver will not present a danger to public health. The department may revoke such waiver upon a determination that the waiver may present a danger to public health.

Effective Date:
Wednesday, July 6, 2016
Statutory Authority:
Public Health Law, section 225(5)(a)

Section 4-1.12 - Severability

4-1.12 Severability.

If any provisions of this Subpart or the application thereof to any person or entity or circumstance is adjudged invalid by a court of competent jurisdiction, such judgment shall not affect or impair the validity of the other provisions of this Subpart or the application thereof to other persons, entities, and circumstances.

Effective Date:
Wednesday, July 6, 2016
Statutory Authority:
Public Health Law, section 225(5)(a)

Appendix C

Proof of Cooling Tower Registration

Appendix D

Contract with Inspection/Treatment Entity

Include in this section a copy of the Contract with **B&L Control Service Inc.**

along with proof of NYSDEC Biocide application license

Appendix E

Maintenance and Service Logs

for

Backflow Prevention Equipment

Include in this section a copy of Annual Backflow Certifications

Installation, Maintenance, & Repair Series 709/LF709/709DCDA

Double Check Valve Assemblies
Double Check Detector Assemblies

Sizes: ¾" – 10" (20-250mm)

⚠ WARNING

Read this Manual BEFORE using this equipment.

Failure to read and follow all safety and use information can result in death, serious personal injury, property damage, or damage to the equipment.

Keep this Manual for future reference.

THINK SAFETY FIRST

Local building or plumbing codes may require modifications to the information provided. You are required to consult the local building and plumbing codes prior to installation. If this information is not consistent with local building or plumbing codes, the local codes should be followed.

Need for Periodic Inspection/Maintenance: This product must be tested periodically in compliance with local codes, but at least once per year or more as service conditions warrant. Corrosive water conditions, and/or unauthorized adjustments or repair could render the product ineffective for the service intended. Regular checking and cleaning of the product's internal components helps assure maximum life and proper product function.

NOTICE

For Australia and New Zealand, line strainers should be installed between the upstream shutoff valve and the inlet of the backflow preventer.

Its important that this device be tested periodically in compliance with local codes, but at least once per year or more as service conditions warrant. If installed on a fire sprinkler system, all mechanical checks, such as alarm checks and backflow preventers, should be flow tested and inspected internally in accordance with NFPA 13 and NFPA 25.

Testing

For field testing procedure, reference IS-TK-DL, IS-TK-7, IS-TK-9A, IS-TK-99E AND IS-TK-99D at www.watts.com

For other repair kits and service parts, reference PL-RP-BPD at www.watts.com

For technical assistance, contact your local Watts representative.

8" (200mm) 709 OS&Y shown

Installation Instructions

Watts Series 709 and LF709 Double Check Valve may be installed in either a vertical or horizontal position.

Install valve inline with arrow on valve body pointing in the direction of flow.

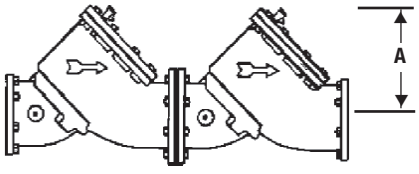
They should always be installed in an accessible location to facilitate testing and servicing.

Pipe lines should be thoroughly flushed to remove foreign material before installing the unit. A strainer should be installed as shown, ahead of backflow preventers to prevent discs from unnecessary fouling.

⚠ CAUTION

Do not install with strainer when backflow preventer is used on seldom-used water lines which are called upon during emergencies, such as fire sprinkler lines, etc.

It is important that Series 709 and LF709 be tested periodically in compliance with local codes, but at least once a year or more often, depending upon system conditions. (Reference IS-TK-7 at www.watts.com).



Clearance Required for Servicing

SIZE		DIMENSION	
		A	
in.	*mm*	*in.*	*mm*
2½" – 3	65-80	10	250
4	100	15	380
6	150	15	380
8	200	23	580
10	250	25	640

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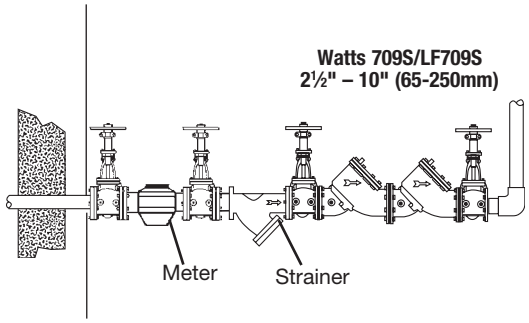
Installation Instructions

Series 709/LF709/709DCDA

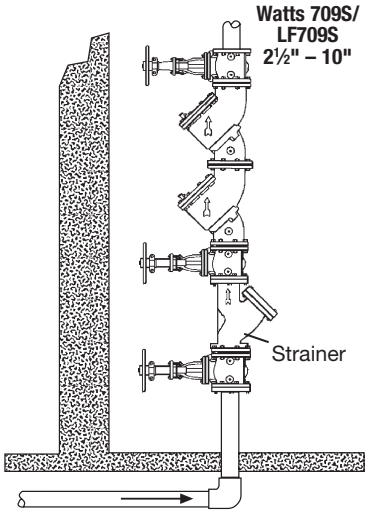
Indoor Installations

For indoor installations, it is important that the valve be easily accessible to facilitate testing and servicing.

Horizontal



Vertical



For indoor installations, it is important that the valve be easily accessible to facilitate testing and servicing.

NOTICE

Outdoor Installations

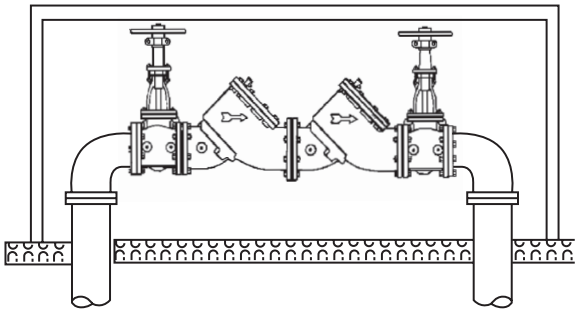
In area where freezing conditions do not occur, Series 709 and LF709 can be installed outside of a building. The most satisfactory installation is above ground and should be installed in this manner whenever possible.

It is generally recommended that backflow preventers never be placed in pits unless absolutely necessary and then only when approved by local codes. In such cases, a modified pit installation is preferred or an above ground insulated enclosure.

WattsBox Insulated Enclosure Available in Aluminum or Fiberglass

For more information, reference ES-WB at www.watts.com

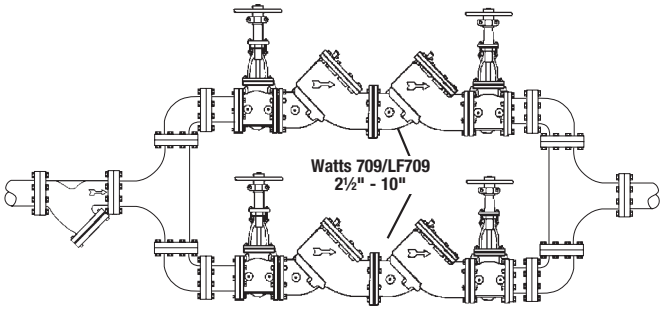
Above Ground Insulated Enclosure



Parallel Installations

Two or more Series 709 and LF709 devices may be piped in parallel (where approved) to serve a large supply pipe main. This type of installation is employed whenever it is vital to maintain a continuous supply of water where interruptions for testing and servicing would be unacceptable. It also has the advantage of providing increased capacity where needed beyond that provided by a single valve.

For two valve installations the total capacity of the devices should equal or exceed that required by the system. Capacity table shows the size of the Series 709 and LF709 devices required to meet a certain capacity. The quantity of devices used in parallel should be determined by the engineers judgement based on the operating conditions of a specific installation.



Capacity Required for System

450 GPM	640 GPM	1000 GPM	2000 GPM	3000 GPM	5000 GPM
Two 2½"	Two 3"	Two 4"	Two 6"	Two 8"	Two 10"
Devices	Devices	Devices	Devices	Devices	Devices

Table shows total capacity provided with dual valve installations of various sizes.

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Service, Replacement Parts and Maintenance

Series 709/LF709/709DCDA

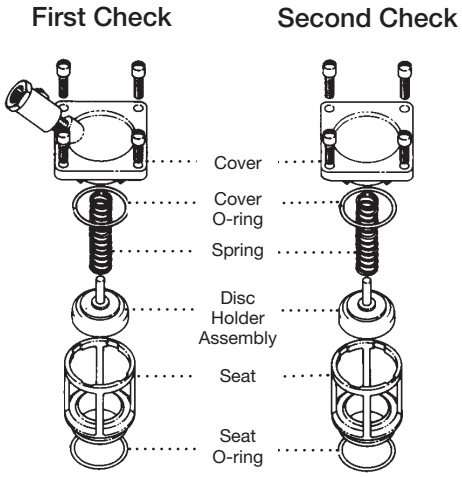
¾" – 2" (20-50mm)

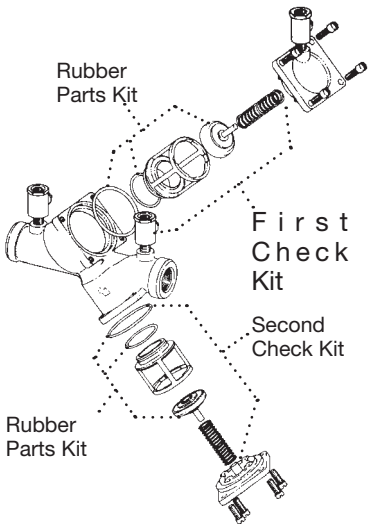
1. After removing the cover screws, the check comes out with the cover.
2. Holding the check Valve module in both hands, rotate the assembly ¼ turn. This will disengage the disc and spring assembly into individual components. The disc assembly may be cleaned or replaced. O-rings should be cleaned or replaced as necessary and lightly greased with the FDA approved silicon grease. Reassemble the check valve module in the reverse order.

NOTICE

The springs of the first and second check valves are interchangeable.

(Before servicing, be certain water is turned off or shutoff valves are closed)





For repair kits and parts, refer to Backflow Prevention Products Repair Kits & Service Parts price list PL-RP-BPD on **www.watts.com**

2½" – 10" (65-250mm) and 3" – 10" (80-250mm)

1. Remove hatch cover bolts.

NOTICE

The 709 and LF709 is designed so that, when the bolts are backed off ½", all the spring load is released from the cover and retained by the check module.

⚠ CAUTION

Be sure to verify this before removing all the bolts.

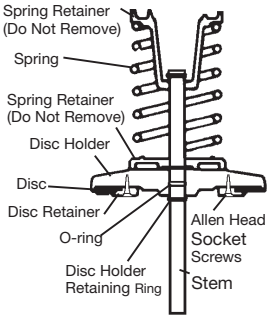
2. Lift check valve module straight out, taking care not to hit and damage seat ring.
3. The seat ring may be removed and replaced by pulling out the two wire retainers. The wire retainers are 10" long. One is drawn out clockwise and the other is drawn out counterclockwise.
4. With the retainer wires removed, the seat ring can be lifted straight up and removed.

⚠ CAUTION

The check valve disc and spring assembly are in compression. The spring load is captured by the two spring retainers and the stem. The spring retainers are not to be removed for servicing. If there is a need to replace the spring, spring retainer or stem, replace the disc and spring assembly. If the disc holder has been damaged by freezing or severe water hammer, it can be replaced in the field. Remove the disc holder retaining ring and slide the disc holder off the stem. Remove the o-ring from the stem and replace with a new one. Apply grease to the o-ring and slide the new disc holder into place. Re-install the retaining ring.

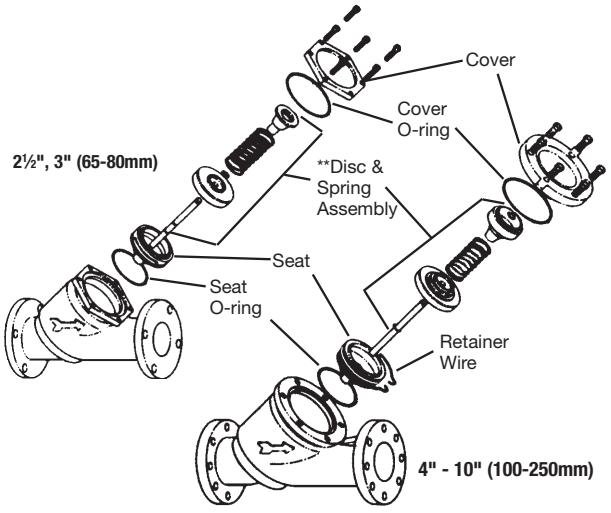
NOTICE

The disc holder should not be removed when servicing only the disc, remove allen head screws holding the disc retaining plate and replace disc.



⚠ WARNING

Spring assembly is factory assembled. **DO NOT DISASSEMBLE.



***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

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Troubleshooting Guide — Series 709/LF709/709DCDA

Symptom	Cause	Solution
1. Check valve fails to hold 1.0 PSID minimum	a. Debris on check disc sealing surface	Disassemble and clean
	b. Leaking gate valve	Disassemble and clean or repair
	c. Damaged seat disc or seat o-ring	Disassemble and replace
	d. Damaged guide holding check open	Disassemble and clean or replace
	e. Weak or broken spring	Disassemble and replace spring
2. Chatter during flow conditions	a. Worn, damaged or defective guide	Disassemble and repair or replace guide
3. Low flows passing through mainline valve	a. Mainline check fouled	Disassemble and clean
	b. Meter strainer plugged	Disassemble and clean
	c. Damaged mainline seat disc or seat	Disassemble and replace
	d. Broken mainline spring	Disassemble and replace

WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.
For more information: www.watts.com/prop65

WATTS®

A Watts Water Technologies Company

ISO 9001-2008 CERTIFIED

USA: Tel: (978) 688-1811 • Fax: (978) 794-1848 • www.watts.com
Canada: Tel: (905) 332-4090 • Fax: (905) 332-7068 • www.watts.ca

Appendix F

CT Manufacturer O&M Manuals

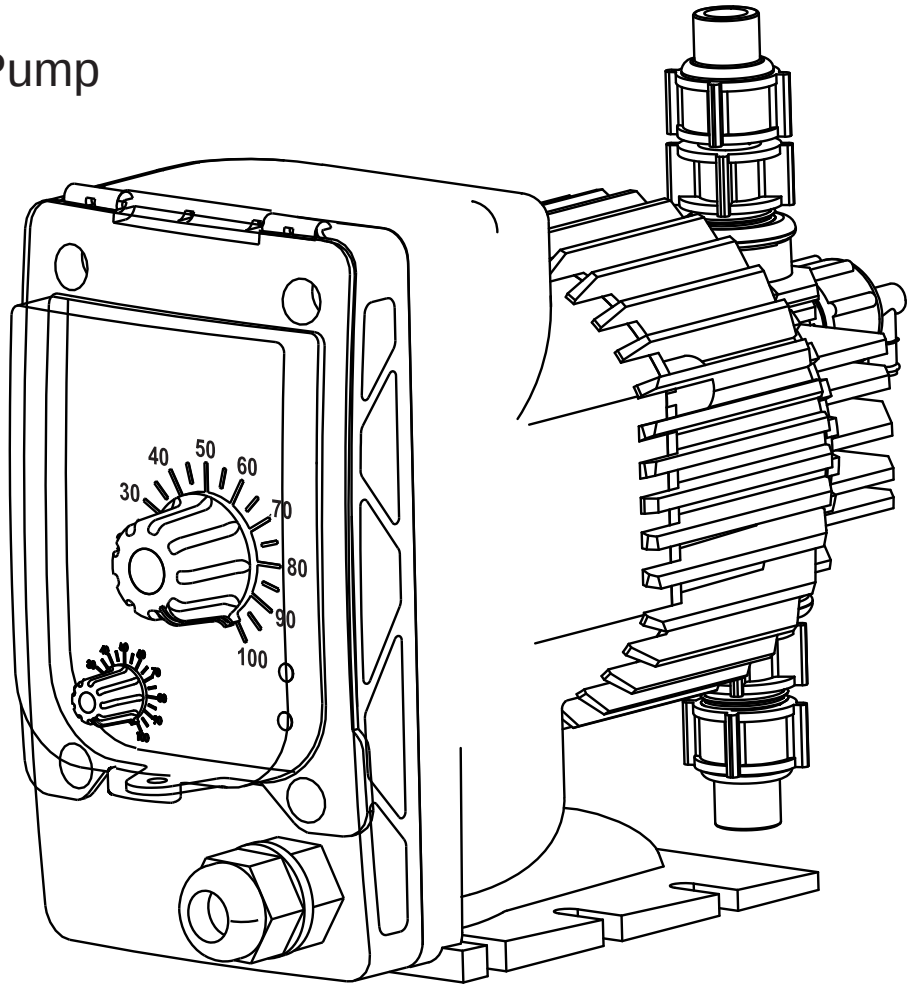
Include in this section a copy of any Manufacturer recommended maintenance programs

ATTACHMENT 4

Advantage Controls — Manual

MicroTron
Series B

Chemical Metering Pump



Installation
Maintenance
Repair
Manual

Advantage Controls
P.O. Box 1472
Muskogee, OK 74402
Phone: 800-743-7431
Fax: 888-686-6212
www.advantagecontrols.com
email: support@advantagecontrols.com

Intertek

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Table of Contents

Manufacturer's Product Warranty

Advantage Controls warrants units of its manufacture to be free of defects in material or workmanship. Liability under this policy extends for 24 months from date of installation. Liability is limited to repair or replacement of any failed equipment or part proven defective in material or workmanship upon manufacturer's examination. Removal and installation costs are not included under this warranty. Manufacturer's liability shall never exceed the selling price of equipment or part in question. Advantage disclaims all liability for damage caused by its products by improper installation, maintenance, use or attempts to operate products beyond their intended functionality, intentionally or otherwise, or any unauthorized repair. Advantage is not responsible for damages, injuries or expense incurred through the use of its products.

The above warranty is in lieu of other warranties, either expressed or implied. No agent of ours is authorized to provide any warranty other than the above.

30 Day Billing Memo Policy

Advantage Controls maintains a unique factory exchange program to ensure uninterrupted service with minimum downtime. If your unit malfunctions, call 1-800-743-7431, and provide our technician with Model and Serial Number information. If we are unable to diagnose and solve your problem over the phone, a fully warranted replacement unit will be shipped, usually within 48 hours, on a 30 Day Billing Memo.

This service requires a purchase order and the replacement unit is billed to your regular account for payment. The replacement unit will be billed at current list price for that model less any applicable resale discount. Upon return of your old unit, credit will be issued to your account if the unit is in warranty. If the unit is out of warranty or the damage not covered, a partial credit will be applied based upon a prorated replacement price schedule dependent on the age of the unit. Any exchange covers only the controller or pump. Electrodes, liquid end components and other external accessories are not covered.

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I. Introduction

This manual covers all facets of operation of the Advantage MicroTron™ pump, including unpacking, mounting, electrical and plumbing connection, and start-up. Safety, maintenance and repair, warranty, and factory information is also provided. Please read this manual completely before proceeding. Observe safety protocols and heed all warnings and precautions.

Model Numbering

MicroTron™ Series B pump model numbers define the output, pressure and control functions present on a particular pump. Your pump may be supplied with one or more of the options described in this manual. To determine what features apply to your pump, check the model number label located on the pump.

Model Number Example **B 1 30 X 1 – K F C 1 - S**

Pressure Rating
- **1** = 110 150 and or 75 psi
- **2** = 250 psi

Gallon Per Day Rating

Control Options
- **X** = Stroke Length Adjust
- **E** = External Pacing
- **D** = Dual output 10-50 gph or 0-125 spm
- **F** = Hall effect meter input ÷ by 9
- **L** = Limit Timer

Voltage
- **1** = 120 volt - 50/60 Hz - .35A with USA plug
- **2** = 240 volt - 50/60 Hz - .65A no plug
- **3** = 240 volt - 50/60 Hz - .65A with specified plug
- **4** = 12 volt dc
- **5** = 240 volt USA plug

Pump Head Material
- **K** = Kynar
- **S** = 316 Stainless

Seat Material
- **V** = Viton
- **F** = Teflon
- **H** = Hypalon

Check Ball
- **C** = Ceramic
- **D** = Ceramic/single on discharge (pressure relief)
- **S** = Stainless

Tubing Connections
- **1** = 3/8” PE, models up to 150 psi
- **2** = ¼” PE, 250 psi models
- **P** = ¼” MNPT
- **V** = 3/8” Clear flexible suction tubing

Special Options
- **S** = 3-function injection valve

NOTE: This list represents our most popular options. **If you have an option not covered, contact the factory or your dealer for more details.**

II. Unpacking

The MicroTron™ pump has been shipped as a complete package, ready for installation. If the shipping carton shows any signs of damage, notify the shipping company immediately upon receipt. Advantage Controls cannot be held responsible for damage from shipping.

Unpack the carton and insure the following items are present:

1. Metering pump
2. Suction, discharge and priming tubing
3. Foot valve and weight
4. Injection fitting
5. Instruction manual

III. Safety Considerations

NOTE: All MicroTron™ pumps are primed with water before leaving the factory. If the solution to be pumped is not compatible with water, disassemble the pump fluid end before use. After disassembly, thoroughly dry the pump head, valves, and seals before pump is reassembled and used.

A. Chemical Compatibility

MicroTron™ metering pumps are designed to work with most liquid chemicals depending upon your pump's liquid end materials of construction. A chemical resistance chart is available for determining specific compatibility with a wide variety of chemicals. If you have further compatibility questions, contact Advantage Controls service department at 1-800-743-7431.

B. Safety and Preparation

Always wear the proper protective clothing and gear when working around chemicals and chemical metering pumps. Safety glasses, gloves, and aprons are critical in preventing accidental exposure to dangerous chemicals. Liquids under pressure can present a special hazard when a line or seal is punctured resulting in the spraying of chemical many yards away. If a chemical spillage occurs, consult the Material Safety Data Sheet (MSDS) for specific instructions regarding the chemical being used.

IV. Installation

A. Location

Select a mounting location convenient to the chemical supply as well as a source of power for the pump. Do not install the pump in a location where the ambient temperature exceeds 120 degrees F (50°C). Higher temperatures will affect the output as well as the useful life of the pump. While the MicroTron™ pump is suitable for most outdoor installations, do not use the standard poly tubing in direct sunlight. If you must mount pump in direct sunlight or under bright fluorescent lights use ultra-violet resistant tubing, consult your distributor or the factory. Accessory item R00225 (plastic mounting bracket) is recommend for a secure installation.

B. Electrical

1. The **Standard** MicroTron™ pump has a voltage regulated internal power supply capable of operating in the range of approximately 95 to 135 VAC and will draw 0.6 amp typically using .066 kw. Use a supply voltage of 100 to 120 VAC for best results. The 3-wire grounded plug must be used in a 3-wire wall plug.

2. With a 240 volt option, the MicroTron™ pump has a voltage regulated internal power supply capable of operating in the range of approximately 195 to 260 VAC and will draw 0.3 amp typically using .066 kw. Use a supply voltage of 210 to 250 VAC for best results.

CAUTION: Never remove ground wire from plug!

C. Plumbing

1. Tubing Connections

The MicroTron™ pump uses carefully matched components to achieve a predictable metering output. This predictability can only be maintained if all fitting sizes remain unaltered. **Do not** attempt to reduce tubing size. All tubing connections should be double checked to insure against leakage. If hazardous chemicals are being pumped, use shielding around discharge tubing.

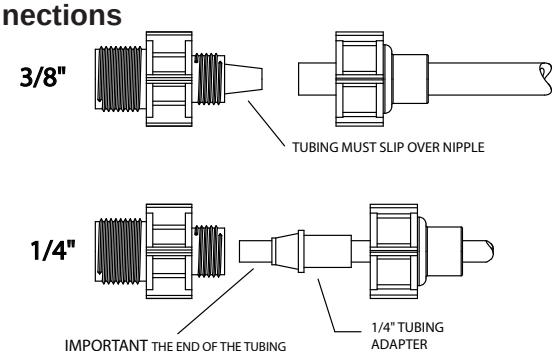
NOTES:
1. **Clear flexible tubing is not intended for pressurized use.**
2. **When cutting lengths of tubing for your installation, ensure a clean, square cut. Use short lengths of tubing and as few connections as possible.**
3. **There is an approximate 2.5 psi capability lost for ever 1 foot of vertical rise of the discharge tubing to the injection point.**

2. Tubing Nuts

Do not overtighten the tubing connectors. Tighten the fittings no more than 1/4 turn after the fitting contacts the seal. Hand tighten only. **Do not use a wrench or pliers** as they may damage the fittings. Do not use Teflon tape except on NPT fittings. **Be sure to observe applicable local plumbing codes.**

WARNING: Clear flexible tubing is not intended for pressurized use.

3. Tubing Connections



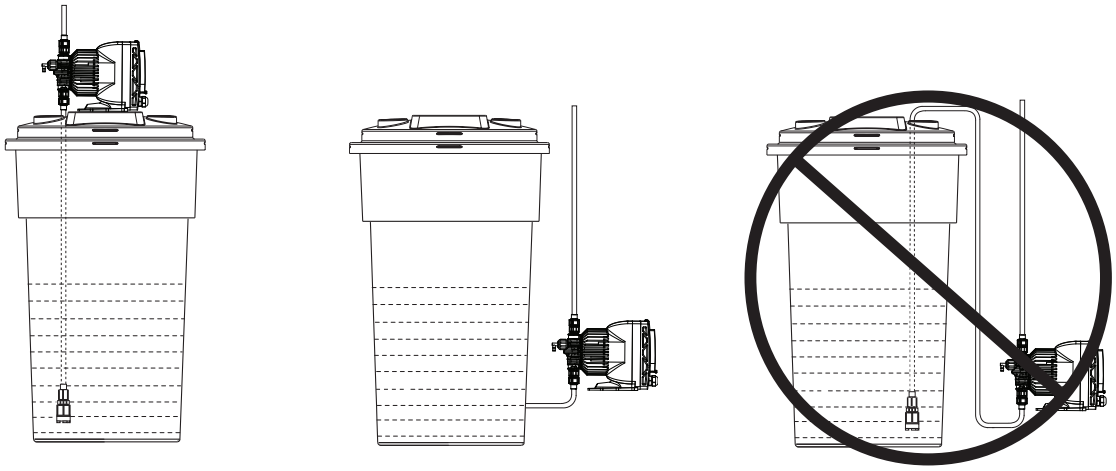
4. Suction Lift vs Flooded Suction Applications

Suction Lift Installation
Mount the MicroTron™ pump around the top of the solution tank, not to exceed 5 feet from pump to bottom of tank.

Flooded Suction
This installation is recommended for very low outputs, solutions that gasify and/or high viscosity solutions. Priming is easier and loss of prime is reduced. Failure of the pump diaphragm or rupture of the solution tubing can cause loss of solution in the tank.

ATTACHMENT 4

Suction lift | Flooded Suction | Not recommended



5. Wall Mounting

The fluid end portion (head assembly) of the pump is set up to accommodate mounting of the pump to the chemical container, either as a flooded suction, or a suction lift.

The pump head must be kept in a vertical position for proper operation. The head can be removed and rotated 90° if needed to keep the inlet and outlet valves in a vertical position.

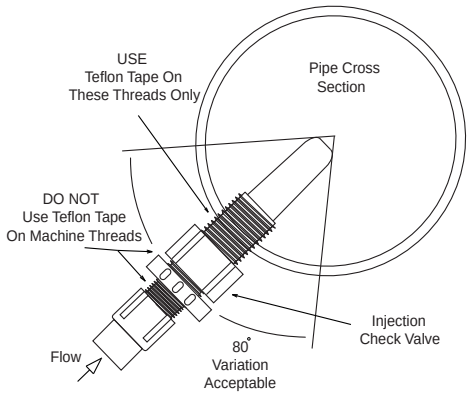
6. Foot valve installation

A weight is provided to hold the tubing and foot valve in a vertical position at the bottom of the tank. **Do not allow the foot valve to lay horizontally in the chemical container.** This defeats the action of the valve and causes the pump to lose prime. Keep suction tubing reasonably short and avoid high spots or bends.

7. Injection valve installation

The injection valve is designed to prevent a back flow and to inject chemical into the line. To work properly, this valve must be mounted within 45 degrees of vertical (see drawing). One end of the injection valve is 1/2" MNPT. Install this end into the piping system. Use Teflon tape on this fitting only. Connect the pump's discharge tubing to the opposite end of the injector. Do not use Teflon tape or joint compound on this fitting. Connect tubing between this fitting and the pump discharge fitting at the pump head.

NOTE: When installation is made into a line with zero pressure or when pumping into an open vessel, use the optional three function injection valve which provides back pressure and anti-syphon capabilities.



8. Optional Three Function Valve.

The optional 3-function valve injection assembly provides three functions in one injection valve assembly.

Anti-siphon feature allows metering of liquids “down hill” or into the suction side of a circulating pump. It provides protection against an accidental application of suction pressure at the fluid injection point. Its Teflon coated diaphragm provides a positive anti-siphon action.

Back pressure function permits metering into atmospheric discharge (open container) without overpumping.

Line check permits removal of discharge tubing without release of system fluid.

9. Priming / Degassing Valve Connection

Connect the clear poly tubing to the outlet of the bleed or priming valve. Position the free end of this tube in the chemical container. Standard head configurations include a priming valve built into the head. Clear poly tubing should be connected to the outlet of this valve, the other end of the tube should be placed in the chemical container above the fluid level.

V. Start-Up

A. Priming the pump

Plug in pump, set stroke to 100% and strokes per minute to maximum speed. While pump is operating, if fluid begins moving, no further priming is required. If fluid is not moving, open bleed valve approximately one turn until fluid begins to move. When suction line fills, close bleed valve. Do not over tighten bleed valve. Damage may occur.

B. Adjusting feed rate

The standard Model B allows for the exact setting of the pumps stroking rate (speed) on the pump’s control panel. Standard strokes per minute settings available are: 1, 2, 3, 4, 5, 6, 7, 10, 15 and increase by 5 thereafter up to the maximum of 125 (B-155 models have a max speed of 160 strokes/minutes).

C. Stroke length

The stroke length can be adjusted on all MicroTron™ pumps. This adjustment is a mechanical adjustment made using the large knob on the control panel. To avoid damage to the pump, this adjustment should only be made while the pump is running at a high stroking rate.

D. Calculating Output

A pump’s output per minute can be determined by dividing the maximum rated gallons per day by 1440 (minutes per day). For example, a 30 gallons per day (gpd) pump at a maximum stroke length and speed setting of 125 strokes per minute (spm) will pump 0.000167 gallons per stroke (gps).

30 ÷ 1440 = 0.0208 gpm ÷ 125 spm = 0.000167

With this value and the pump’s speed setting (strokes per minute) you can calculate your pump’s output at it’s rated pressure. A 30 gpd pump set at 50 strokes per minute:

50spm x .000167gps x 1440 (minutes per day) = 12.02 gallons per day

Reducing the stroke length will reduce the pump's output again. If the example pump above had it's stroke length reduced to 50% the 12.02 gallons per day output is reduced to 6.01. (example: 12.02 gpd x 0.50 = 6.01 gpd)

A higher product viscosity will reduce the output. Pressures lower than the pump's rating can increase the output.

E. Optional Features

A pump's output per minute can be determined by dividing the maximum rated gallons per day by 1440 (minutes per day). For example, a 30 gallons per day (gpd) pump at a maximum stroke length and speed setting of 125 strokes per minute (spm) will pump 0.000167 gallons

1. External Pacing

The external pacing option allows the speed of the pump to be controlled by an external device like a flow meter that gives dry contact switch closures. The pump sends out a 5 volt D.C. current to read a switch closure. Each time the pump sees the switch closure it strokes once, up to its maximum strokes per minute rate.

2. Hall Effect Meter Pacing

This option is like the external pacing only the pump divides the incoming switch closures by 9 before stroking on time. This is a three wire connection: D.C. voltage, signal and ground.

3. External Stop

Pumps with this option are allowed to stroke as long as they see a closed condition from a dry contact source like a flow switch or drum level wand. When an open condition is seen the pump is not allowed to stroke.

VI. Maintenance

The Advantage MicroTron™ pump is designed for long service life with minimum maintenance. If for any reason, maintenance is necessary or desirable, the MicroTron™ pump is easily maintained.

Before any maintenance or service is performed, observe the following precautions:

1. Disconnect the MicroTron™ pump from power source.
2. Drain chemical from discharge tubing.
3. Disconnect discharge tubing from pump.
4. If the MicroTron™ pump is used in a flooded suction application, remove foot valve from chemical container.
5. Observe relevant safety protocols when handling parts which have been in contact with hazardous chemicals.

A. Diaphragm Replacement

1. Remove fluid end cover by lightly prying it loose from the fluid end.
2. Remove the four screws attaching the fluid end to pump body.
3. Remove the fluid end from the pump body.
4. Unscrew the diaphragm from the pump shaft in a counter-clockwise direction. Be careful that diaphragm support ring does not fall out.
5. Do not allow sharp or abrasive objects to come in contact with pump parts.

6. Inspect end of shaft to assure that threads are in good condition. Replace shaft bellows if necessary. No further disassembly is recommended.
7. Screw new diaphragm onto pump shaft until it bottoms out on shoulder of shaft. It is not necessary to tighten further.
8. Replace fluid end. Make sure that screws are evenly tightened.
9. Reconnect plumbing and power. Prime the pump.

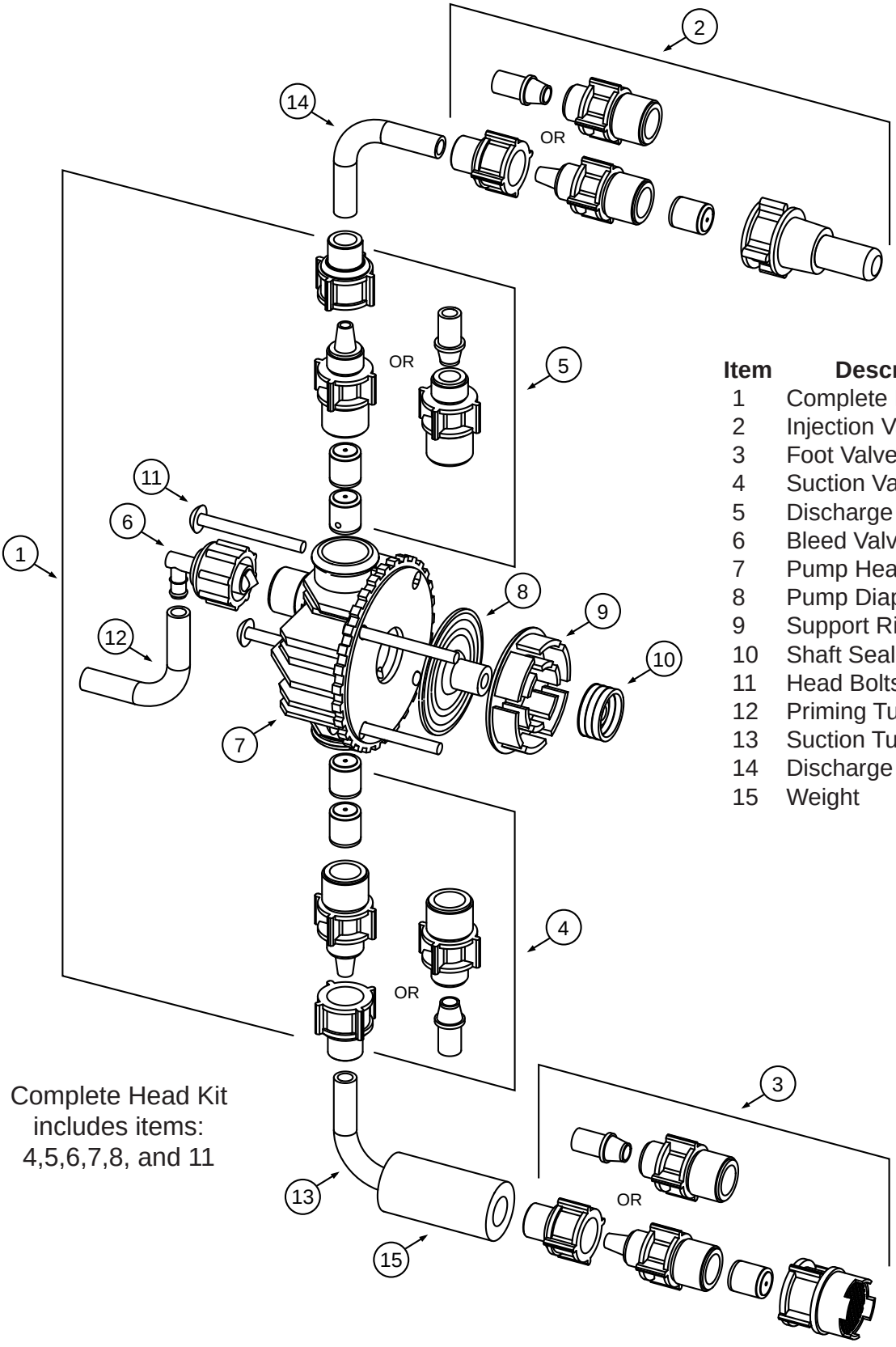
B. Suction and Discharge Check Valve Replacement

1. Disconnect suction tubing from pump.
2. Unscrew fitting from pump head.
3. Remove check valve from suction fitting and replace.
4. Remove O-ring from cavity in fluid end.
5. Remove check valve from suction side pump and replace.
6 Install new O-ring in cavity of fluid end.
7. Replace valve fitting with check valve in fluid end.
8. Replace fluid end. Make sure that screws are evenly tightened.
9. Reconnect plumbing and power. Prime the pump.

NOTES:
1. **Tighten pump head screws after pump's initial week of operation.**
2. **When installing check valves, remember that the seats are always installed at the bottom.**

ATTACHMENT 4

C. Liquid End Diagram



Item	Description
1	Complete Head Kit
2	Injection Valve
3	Foot Valve
4	Suction Valve
5	Discharge Valve
6	Bleed Valve Assembly
7	Pump Head
8	Pump Diaphragm
9	Support Ring
10	Shaft Seal
11	Head Bolts
12	Priming Tube
13	Suction Tubing
14	Discharge Tubing
15	Weight

Complete Head Kit includes items: 4,5,6,7,8, and 11

ATTACHMENT 4

D. Replacement Parts

Getting the right materials of construction for your spare parts is easy. Using positions 7-10 of the pump model number, example: B130X1-**PFCV**. Find the assembly needed and add the codes of your pump's liquid end after the standard prefix part number for the assembly.

Note: For standard pumps using the short model number (example: B130) use the following liquid end codes.

a. 110 psi models use **-PVC1.**
b. 250 psi models use **-PVC2.**

Part Assemblies

Item	Description	Part Number
1	Complete Head Assembly 110 psi	CKR-1- __ __ __ __
	Complete Head Assembly 150 & 250 psi	CKR-2- __ __ __ __
2	Injection Valve Assembly	INJ- __ __ __ __
Optional	3-Function Injection Valve	3FV- __ __ __ __
3	Foot Valve Assembly	FTV- __ __ __ __
4	Suction Valve Assembly.	SUC- __ __ __ __
5	Discharge Valve Assembly.	DIS- __ __ __ __
6	Priming Valve Assembly	PRI- __ __ __ __

Body	Seat	Ball	Connection
K- Kynar	V- Viton	C- Ceramic	1- 3/8" Tube
S- 316 Stainless	F- Teflon	D- Single	2- 1/4" Tube
	H- Hypalon	S- Stainless	3- 3/8" Tube
			K- 3/8" Tube
			P- 1/4" Pipe
			U- 3/8" UV
			V- 3/8" Clear Suction

Single Parts

7	Pump Head 110 psi	R00026 - __
	Pump Head 150 & 250 psi	R00039 - __
8	Diaphragm 110 psi	R00007
	Diaphragm 150 & 250 psi	R00006
9	Support Ring 110 psi	R00069
	Support Ring 150 & 250 psi	R00068
10	Shaft Seal	R00050
11	Head Bolts	R00045
12	Priming Tubing	R00255
13	Suction Tubing 3/8" Clear	R00255
	Suction Tubing 3/8" PE	R00122
	Suction Tubing 1/4" PE	R00097
14	Discharge Tubing 3/8" PE	R00122
	Discharge Tubing 1/4" PE	R00267
15	Weight, Suction Tubing	R00139

ATTACHMENT 4

VII. Trouble Shooting

PROBLEM	CAUSE	REMEDY
Pump does not achieve or maintain prime	Air trapped in suction line	Straighten suction line so as to eliminate high spots.
	Foot valve contaminated or improperly installed	Inspect foot valve screen and assure that foot valve is in a vertical position below fluid level.
	Excessive lift	Maximum suction lift is 5 feet with water or fluids of similar specific gravity; less with heavier liquids such as acids. Mount pump in a lower position relative to the chemical container.
	Suction fittings not properly tightened	Check fittings. Overtightening may cause restriction. Conversely, if **any** leakage occurs, pump will suck air and fail to prime.
	Worn or contaminated check valves	Inspect check valves in fluid end for cleanliness. Clean or replace as necessary.
	Split or pinch in suction tube	Inspect suction tube through its full length to assure that there are no splits at the connections or other restrictions. Move any objects or equipment which impinges upon suction tube or reroute as required to assure a smooth transition from foot valve to pump.
	Low chemical level	Check fluid level in chemical supply tank.
Insufficient fluid	Stroke adjustment set too low	Check operation of stroke limiter knob. If pump delivers too low adjustable rate, check settings. Readjust as required.
	Worn or contaminated check valves	Inspect, clean or replace as necessary.
	Obstruction in suction line	Check suction line for obstructions, clogging, kinks or pinch points.
	Clogged foot valve screen	Clean or replace foot valve screen.
	Output (system) pressure too high	Relocate the injector to a lower pressure part of the system.
	Diaphragm worn or torn	Replace diaphragm, making sure that it is screwed on fully to shoulder of shaft.
	Electronic failure	Consult dealer or factory.

ATTACHMENT 4

Excessive fluid	Failure or lack of antisiphon valve	Inspect or add anti-siphon valve. This is caused when system is in a vacuum condition or valve in delivery applications with flooded suction which feeds systems at very low pressures.
	Excessive stroke rate	Lower the stroke rate if adjustable on your pump.
	Improper stroke length	Reduce stroke length.
Pump will not pump	System pressure too high	Check system pressure to assure that it is within system rated parameters of the pressure.
	Diaphragm improperly installed	Make sure that diaphragm is screwed fully unto shaft.
	Check valves worn or clogged	Clean or replace as required.
Pump will not run not plugged in	Pump not turned on or not plugged in	Check outlet with meter to assure that correct or voltage is present and that power supply cord is in good condition and plugged in.
	Electronic failure	Consult dealer or factory.
Excessive noise	Pump not primed	Prime pump.
	No output pressure	Add an anti-siphon valve to provide 25 PSI restriction on pump discharge.

ATTACHMENT 4

Application Notes:

ATTACHMENT 4

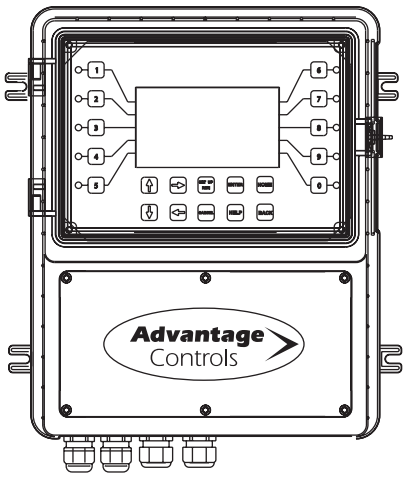
Application Notes:

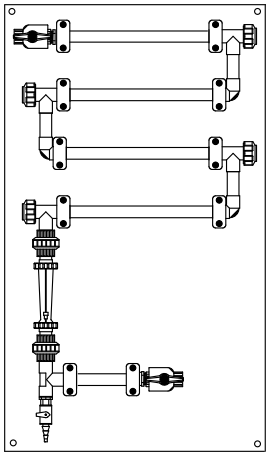
ATTACHMENT 4

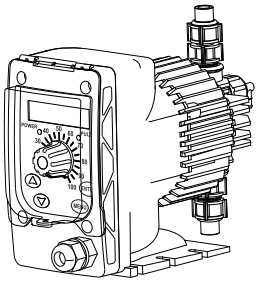
Get the Advantage in Water Treatment Equipment

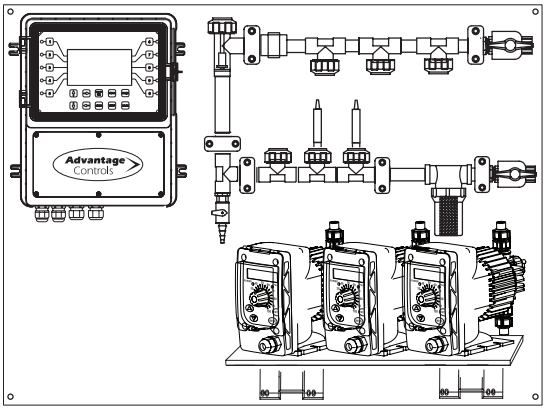
Advantage Controls can give you the *Advantage* in products, knowledge and support on all of your water treatment equipment needs.

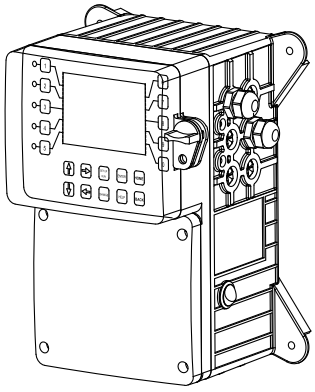
- Cooling Tower Controllers
- Boiler Blow Down Controllers
- Blow Down Valve Packages
- Solenoid Valves
- Water Meters
- Chemical Metering Pumps
- Corrosion Coupon Racks
- Chemical Solution Tanks
- Solid Feed Systems
- Feed Timers
- Filter Equipment
- Glycol Feed Systems
- Pre Fabricated Systems











ATTACHMENT 4

Johnson Controls

Form 440.10-SED1 (MAY 2008)

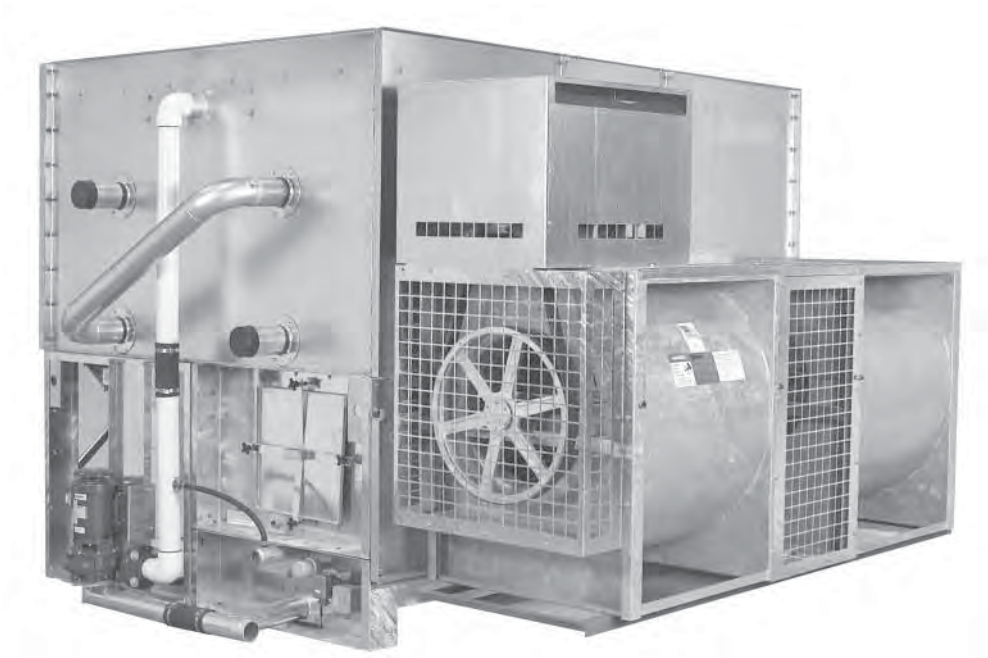
SPECIFICATIONS - ENGINEERING DATA - DIMENSIONS

Replaces: E140-700 SED (DEC 01)

Imeco EFC/IDFC

EVAPORATIVE FLUID COOLERS

For Water or Water – Glycol Mixtures



Contents

EFC EVAPORATIVE FLUID COOLERS

JOHNSON CONTROLS COMMITMENT TO QUALITY

Johnson Controls stands alone in offering the premium corrosion protection of Hot Dip Galvanized After Fabrication. As an option, all casing components and fan sections can be galvanized after fabrication. This provides maximum corrosion protection for all components.

Johnson Controls customers can now enjoy the added value provided by the first comprehensive computer software program designed to aid in faster, more accurate analysis and selection of cooling equipment. The program readily accesses information concerning performance, weight, size, and capacity, and is available for all product lines.

Johnson Control's experience and commitment to serving the needs of the cooling equipment markets have led to the development of the industry's broadest line of evaporators, evaporative condensers, and evaporative closed circuit fluid coolers.

OUTSTANDING ENERGY SAVING

The water saving, energy saving EFC evaporative fluid cooler will provide fast payback and many years of trouble-free service because of its proven performance and reliability. Once through water consumption costs are reduced by 95% because of the recirculating process of the EFC spray system.

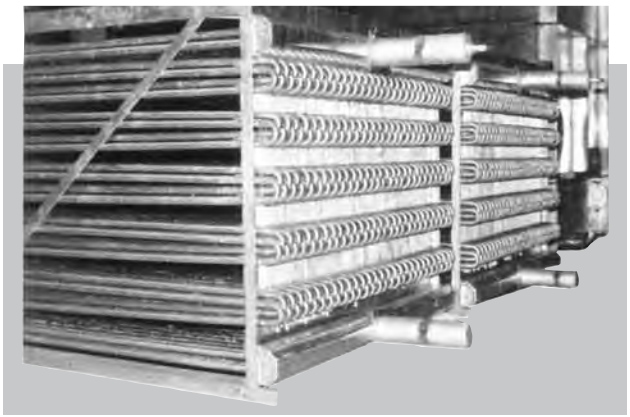
The EFC can efficiently and economically cool many fluids that are chemically compatible with carbon steel to within 5°F of the wet bulb temperature. The closed circuit design of the EFC prevents the fluid being cooled from contacting the water spray and forced air. There is no danger of contaminating the fluid being cooled since it is at a pressure greater than atmospheric on the evaporative coolant side.

Johnson Controls offers in 228 models with a range of cooling capacities to choose from to precisely match your design load and operating requirements.

HOT DIP GALVANIZED AFTER FABRICATION THE JOHNSON CONTROLS ADVANTAGE

Hot Dip Galvanized After Fabrication is the most effective method of protection against corrosion. Applied by immersing fabricated articles in a bath of molten zinc, the galvanized coating is metallurgically bonded to the underlying steel and forms an impervious barrier between the steel and the corrosive environment. It does not adhere to the surface like paint; it becomes part of the surface. At the interface, the zinc and steel are combined into an iron-zinc alloy that will not peel away or crumble.

Hot Dip Galvanized After Fabrication corrosion protection withstands rough handling during shipping and erection. If small areas of the coating are mechanically damaged, the zinc on neighboring areas will protect the exposed steel from corrosion by sacrificial action. If the steel is only painted, under-film rust causes the paint to blister and peel away. Furthermore, because galvanizing is accomplished by total immersion, all parts of the steel fabrication become fully coated and protected, including areas that are inaccessible and hard to reach with paints.



COOLING COIL

EFC fluid coolers utilize ERW .060" wall tube coils to ensure long life. Coil circuits are staggered in the direction of the air flow to ensure optimal air turbulence and water coverage across the coil for maximized heat transfer performance. All circuits are adequately pitched to provide free and complete drainage.

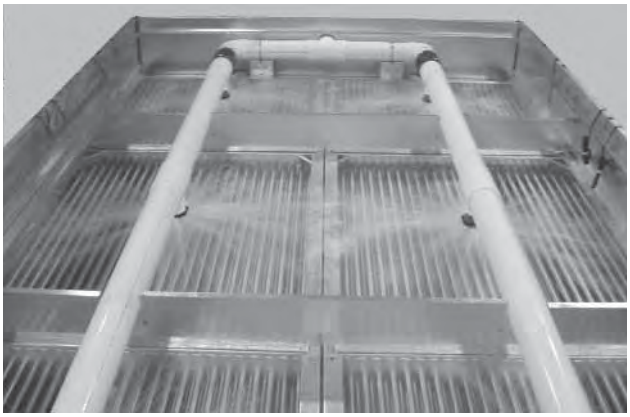
The cooling coil assembly is supported by a welded structural steel frame. The entire coil assembly including the framework is *Hot Dip Galvanized After Fabrication* to provide the best possible protection against corrosion.

The complete coil assembly is tested two times with 450 psig air pressure under water before and after galvanizing. This two-time testing procedure assures unquestionable coil integrity.

SPRAY ASSEMBLY

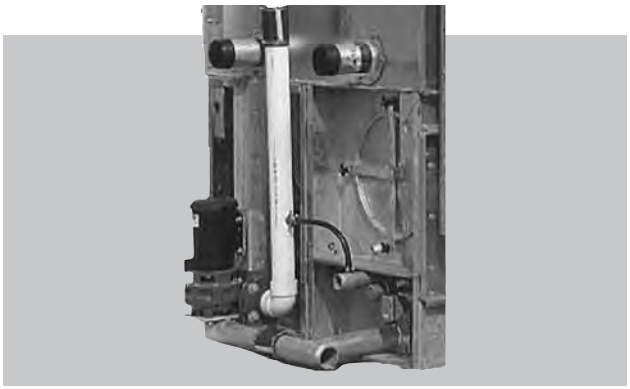
The EFC-C noncorroding PVC spray pipes provide complete and even water coverage from low pressure, closely spaced, nonclogging ABS spray nozzles. This efficient spray arrangement creates an overlapping spray pattern that gives excellent coverage throughout the coil, reducing scale formation under all operating conditions.

The EFC-P noncorroding PVC spray pipes provide complete and even water coverage from low pressure, large orifice, clog-resistant nozzles. This efficient spray system provides complete and continuous water coverage to maximize lifetime fluid coller capacity, reducing scale formation under all operating conditions.



PUMP AND SPRAY PIPING

The spray water circulating pump is a close-coupled centrifugal unit with a ductile iron housing, closed impeller, mechanical seal, and is driven by a TEFC motor with a 1.15 service factor. The pump is mounted vertically under an all-weather hood to permit self draining and is completely piped, using schedule 40 PVC pipe, to the spray system inlet connection. The piping includes a bleed line with adjustable valve located between the pump discharge and overflow connection to meter the necessary water bleed-off.



MOISTURE ELIMINATORS

The EFC multiple break design eliminator provides very efficient removal of water droplets and mist from the air stream. These small, highly efficient eliminators can easily be removed for coil and spray assembly inspection.

The eliminators are constructed of noncorroding PVC for maximum protection against even the most corrosive atmospheres.

Optional, heavier duty moisture eliminators are available to increase eliminator life and withstand frequent handling without damage. Heavy-duty, bolted, PVC eliminators provide a lightweight, but durable alternative. The eliminator blade thickness is increased by a factor of 40. Eliminators are also available in steel, mounted in a heavy-gauge steel framework, *Hot Dip Galvanized After Fabrication*.

WATER PAN SECTION

The entire pan assembly is constructed of welded, heavy-gauge steel**.** The large circular-access opening on the pump end of the pan provides easy access for internal inspection and periodic maintenance. The brass float valve and the *Hot Dip Galvanized After Fabrication* strainer are conveniently located near the access opening for easy adjustment and cleaning.

FAN MOTOR

TEFC, ball-bearing motors with a 1.15 service factor are standard on all EFC fluid coolers. Fan motors are mounted on heavy duty frames and easily accessible for belt adjustment.

COIL CASING

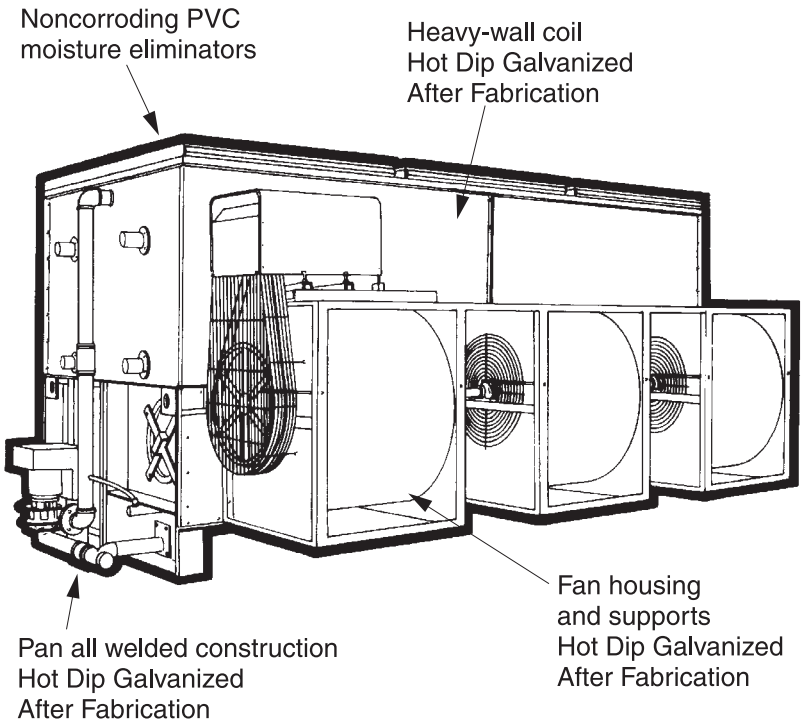
EFC coil casings are constructed of heavy-gauge galvanized steel. All casing panels are flanged. Internal structural members are used to provide added integrity. As an option, the entire casing is available *Hot Dip Galvanized After Fabrication* to provide the highest level of corrosion protection.

FACTORY TESTING

All EFC units are fabricated, assembled, and tested at the factory to ensure consistent high quality construction and performance before shipment. This ensures trouble-free installation and lasting service.

HIGH QUALITY FLUID COOLER COMPONENTS

- HEAVY-WALL STEEL COILS ARE *Hot Dip Galvanized After Fabrication*
- FAN HOUSING IS CONSTRUCTED OF HEAVY-GAUGE STEEL AND IS *Hot Dip Galvanized After Fabrication*
- PITCHED COIL FOR COMPLETE DRAINAGE
- STAGGERED TUBE COIL FOR MAXIMUM HEAT TRANSFER
- LARGE, SLOW SPEED FANS
- EASY BELT ADJUSTMENT
- SOLID BRASS FLOAT VALVE WITH PLASTIC FLOAT
- OVERSIZED STRAINER
- FULL COVERAGE, LARGE-ORIFICE, CLOG-REDUCING NOZZLE FOR CONTINUOUS SPRAY COVERAGE
- CONVENIENT EXTENDED LUBRICATION POINTS FOR SIMPLIFIED SERVICE



EFC-C SERIES
CENTRIUGAL FLUID COOLERS

The EFC-C series of evaporative fluid coolers utilize large diameter, forward curved centrifugal fans. Centrifugal fans are inherently quiet compared to axial fans and can operate against greater static pressures. Equipped with optional capacity control dampers, EFC-C evaporative fluid coolers are ideally suited for applications requiring close control of leaving fluid temperature.

During periods of low ambient wet bulb temperature or light loads, operating energy can be reduced by furnishing EFC-C evaporative fluid coolers with capacity control dampers, two-speed fan motors or optional pony-motor fan system. The pony-motor fan system utilizes two, single-speed fan motors and drive assemblies on either end of the fan shaft. One motor is sized for maximum performance and the other motor is sized for approximately 1/3 of the design horsepower and 2/3 of design fan speed. The motors operate independently and provide control similar to that achieved with a two-speed/two-winding fan motor, with the additional benefit of standby capacity.

FAN SECTION

All EFC-C fluid coolers use-heavy duty, forward-curved centrifugal fans selected to operate at low rpm for long life, quiet operation. Fans are mounted on a steel shaft supported by oversized, self-aligning, heavy-duty ball bearings with extended lubrication points for easy service.

Fan wheels are constructed of heavy-gauge steel and are *Hot Dip Galvanized After Fabrication*. The fan housing is constructed of heavy-gauge steel. All fans and belt guards meet OSHA requirements.

V-belt drives are designed for a minimum of 150% of the fan motor nameplate horsepower. Rugged motor bases are provided with conveniently located belt adjustment.

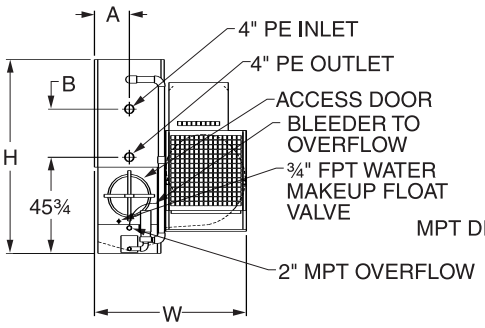
Motor covers provide complete protection against all weather conditions.

WATER PAN SECTION

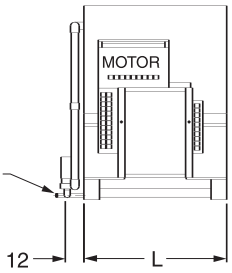
The pan is constructed with heavy-gauge steel. All component parts are welded together to form a solid one-piece pan assembly.

EFC-C SERIES ENGINEERING DATA

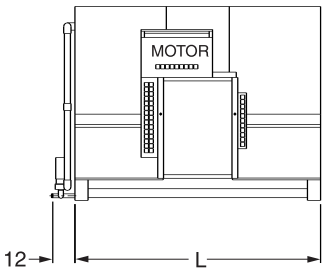
END VIEW



EFC-C 112-113



EFC-C 122-123



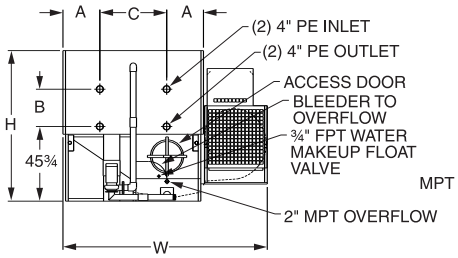
EFC-C Model	CFM	Fan Motor HP[1]	Spray Water GPM[2]	Pump Motor HP[2]	Remote Sump Water In	Remote Sump Sump Drain	Remote Sump Gal.[3] Req'd	Dimensions (Inches) Height H	Dimensions (Inches) Length L	Dimensions (Inches) Width W	Dimensions (Inches) Ctrs B	Tube Coil Weights Unit[4] Shipg	Tube Coil Weights Unit[5] Oprtng	Tube Coil Weights Hvst Sect.	HTR kW
112-0	6,800	3	40	0.5	2.5-MPT	3-FPT	55	87.750	57	66.25	18.375	1,680	2,260	1,190	3.0
112-1	6,700	3	40	0.5	2.5-MPT	3-FPT	55	92.250	57	66.25	22.875	1,890	2,510	1,400	3.0
112-2	6,600	3	40	0.5	2.5-MPT	3-FPT	55	99.625	57	66.25	30.250	2,020	2,680	1,530	3.0
112-3	6,500	3	40	0.5	2.5-MPT	3-FPT	55	106.875	57	66.25	37.500	2,220	2,980	1,730	3.0
112-4	6,400	3	40	0.5	2.5-MPT	3-FPT	55	113.625	57	66.25	44.250	2,400	3,200	1,910	3.0
113-1	9,500	5	60	0.75	2.5-MPT	3-FPT	75	92.250	57	77.75	22.875	2,470	3,330	1,980	3.0
113-2	9,400	5	60	0.75	2.5-MPT	3-FPT	75	99.625	57	77.75	30.250	2,670	3,590	2,180	3.0
113-3	9,300	5	60	0.75	2.5-MPT	3-FPT	75	106.875	57	77.75	37.500	2,980	4,020	2,490	3.0
113-4	9,200	5	60	0.75	2.5-MPT	3-FPT	75	113.625	57	77.75	44.250	3,230	4,330	2,740	3.0
122-1	14,700	7.5	90	1	2.5-MPT	4-FPT	125	92.250	117	72.5	22.875	3,230	4,610	2,560	4.5
122-2	14,700	7.5	90	1	2.5-MPT	4-FPT	125	99.625	117	72.5	30.250	3,510	4,940	2,840	4.5
122-3	14,600	7.5	90	1	2.5-MPT	4-FPT	125	106.875	117	72.5	37.500	3,960	5,570	3,290	4.5
122-4	14,400	7.5	90	1	2.5-MPT	4-FPT	125	113.625	117	72.5	44.250	4,290	5,980	3,620	4.5
123-1	20,500	15	120	1.5	2.5-MPT	4-FPT	175	92.250	117	84	22.875	3,940	5,800	3,270	6.0
123-2	20,500	15	120	1.5	2.5-MPT	4-FPT	175	99.625	117	84	30.250	4,360	6,350	3,690	6.0
123-3	20,500	15	120	1.5	2.5-MPT	4-FPT	175	106.875	117	84	37.500	5,090	7,300	4,420	6.0
123-4	20,500	15	120	1.5	2.5-MPT	4-FPT	175	113.625	117	84	44.250	5,600	8,020	4,930	6.0

1. Fan motor HP is for free air delivery with 0" external static pressure.
2. Remote units are supplied less water-circulating pump(s), float valve(s), and related piping.
3. Values account for water in unit and piping–remote sump must also be sized for volume in field-erected spray distribution supply and drain pipes.
4. Shipping weights include water-circulating pumps.
5. Operating weights include water-circulating pump, water in the coils, and normal water operating level in the sump.

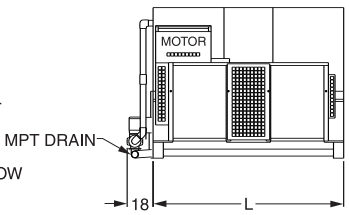
All data in this catalog is subject to change without notice. The standard right hand arrangement as shown has air inlet side on the right when facing coil connection end. Left hand arrangement can be furnished upon request.

Do not use for construction–product drawings available on request.

END VIEW



EFC-C 222-223



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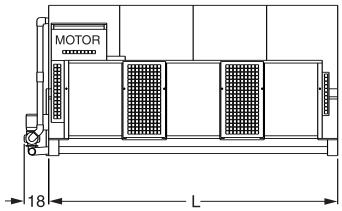
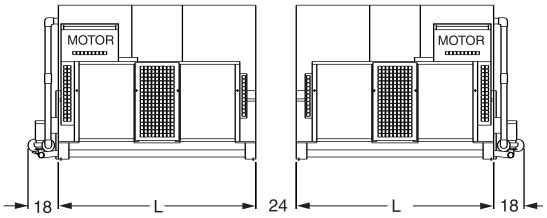
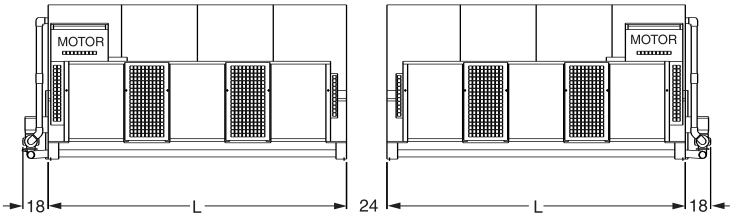


EFC-C 422-423



EFC-C 432-433



EFC-C Model	CFM	Fan Motor HP[1]	Spray Water GPM[2]	Pump Motor HP[2]	Remote Sump Water In	Remote Sump Sump Drain	Remote Sump Gal.[3] Req'd	Dimensions (Inches) Height H	Dimensions (Inches) Length L	Dimensions (Inches) Width W	Dimensions (Inches) Ctrs B	Tube Coil Weights Unit[4] Shipg	Tube Coil Weights Unit[5] Oprtng	Tube Coil Weights Hvst Sect.	HTR kW
222-1	29,400	15	180	1	3-MPT	4-FPT	135	92.250	117	102.5	22.875	5,710	7,620	4,430	4.5
222-2	29,400	15	180	1	3-MPT	4-FPT	135	99.625	117	102.5	30.250	6,320	8,410	5,040	4.5
222-3	29,400	15	180	1	3-MPT	4-FPT	135	106.875	117	102.5	37.500	7,260	9,660	5,980	4.5
222-4	29,400	15	180	1	3-MPT	4-FPT	135	113.625	117	102.5	44.250	7,810	10,270	6,530	4.5
223-1	40,700	20	240	1.5	3-MPT	5-FPT	190	92.250	117	125.5	22.875	6,890	9,530	5,610	6.0
223-2	40,500	20	240	1.5	3-MPT	5-FPT	190	99.625	117	125.5	30.250	7,740	10,640	6,460	6.0
223-3	40,200	20	240	1.5	3-MPT	5-FPT	190	106.875	117	125.5	37.500	8,950	12,280	7,670	6.0
223-4	40,050	20	240	1.5	3-MPT	5-FPT	190	113.625	117	125.5	44.250	10,000	13,770	8,720	6.0
232-2	44,400	20	270	2	3-MPT	4-FPT	215	99.625	177	102.5	30.250	9,550	12,490	7,380	7.5
232-3	44,000	20	270	2	3-MPT	4-FPT	215	106.875	177	102.5	37.500	10,820	14,050	8,650	7.5
232-4	43,400	20	270	2	3-MPT	4-FPT	215	113.625	177	102.5	44.250	11,960	15,470	9,790	7.5
233-1	61,500	30	370	3	3-MPT	6-FPT	295	92.250	177	125.5	22.875	10,140	14,170	7,970	9.0
233-2	61,100	30	370	3	3-MPT	6-FPT	295	99.625	177	125.5	30.250	11,430	15,860	9,260	9.0
233-3	60,900	30	370	3	3-MPT	6-FPT	295	106.875	177	125.5	37.500	13,170	18,260	11,000	9.0
233-4	60,500	30	370	3	3-MPT	6-FPT	295	113.625	177	125.5	44.250	14,740	20,100	12,570	9.0
422-1	58,800	(2)15	360	(2)1	(2)3-MPT	(2)4-FPT	270	92.250	117	102.5	22.875	11,420	15,230	(2)4,430	(2)4.5
422-2	58,800	(2)15	360	(2)1	(2)3-MPT	(2)4-FPT	270	99.625	117	102.5	30.250	12,640	16,830	(2)5,040	(2)4.5
422-3	58,800	(2)15	360	(2)1	(2)3-MPT	(2)4-FPT	270	106.875	117	102.5	37.500	14,520	19,320	(2)5,980	(2)4.5
422-4	58,800	(2)15	360	(2)1	(2)3-MPT	(2)4-FPT	270	113.625	117	102.5	44.250	15,610	20,530	(2)6,530	(2)4.5
423-1	81,400	(2)20	480	(2)1.5	(2)3-MPT	(2)5-FPT	380	99.625	117	125.5	22.875	13,790	19,070	(2)5,620	(2)6.0
423-2	81,000	(2)20	480	(2)1.5	(2)3-MPT	(2)5-FPT	380	99.625	117	125.5	30.250	15,490	21,290	(2)6,470	(2)6.0
423-3	80,000	(2)20	480	(2)1.5	(2)3-MPT	(2)5-FPT	380	106.875	117	125.5	37.500	17,910	24,570	(2)7,680	(2)6.0
423-4	80,100	(2)20	480	(2)1.5	(2)3-MPT	(2)5-FPT	380	113.625	117	125.5	44.250	19,990	27,530	(2)8,720	(2)6.0
432-2	44,400	(2)20	540	(2)2	(2)3-MPT	(2)4-FPT	430	99.625	177	102.5	30.250	19,100	24,980	(2)7,380	(2)7.5
432-3	44,000	(2)20	540	(2)2	(2)3-MPT	(2)4-FPT	430	106.875	177	102.5	37.500	21,660	28,110	(2)8,660	(2)7.5
432-4	43,400	(2)20	540	(2)2	(2)3-MPT	(2)4-FPT	430	113.625	177	102.5	44.250	23,920	30,940	(2)9,790	(2)7.5
433-1	123,000	(2)30	740	(2)3	(2)3-MPT	(2)6-FPT	590	92.250	177	125.5	22.875	20,290	28,350	(2)7,970	(2)9.0
433-2	122,200	(2)30	740	(2)3	(2)3-MPT	(2)6-FPT	590	99.625	177	125.5	30.250	22,850	31,700	(2)9,250	(2)9.0
433-3	121,800	(2)30	740	(2)3	(2)3-MPT	(2)6-FPT	590	106.875	177	125.5	37.500	26,340	36,520	(2)11,000	(2)9.0
433-4	121,000	(2)30	740	(2)3	(2)3-MPT	(2)6-FPT	590	113.625	177	125.5	44.250	29,490	41,000	(2)12,570	(2)9.0

Do not use for construction–product drawings available on request.
NOTE: See footnotes on page 6.

EFC-C OPTIONAL EQUIPMENT

DISCHARGE HOOD WITH POSITIVE CLOSURE DAMPERS

To reduce chimney effect heat losses from the cooler when idle, a discharge hood with positive closure dampers can be furnished. For installations where low cooler height is required, a low silhouette discharge hood with positive closure dampers is available. The low-silhouette damper assembly is designed for low air pressure drop and does not require an oversized fan motor.

A tapered discharge hood can be furnished, with positive-closure dampers, for installations where the height and velocity of the fluid cooler air discharge must be increased.

The dampers are operated by a two-position actuator and linkage. Actuator and linkage are factory installed. All wiring and actuator controls must be furnished by others. A 120 volt power supply is required. Damper actuator should be interlocked with the temperature control system so the dampers are open when the fans are running and closed when the fans are off.

Tapered discharge hood with dampers increases the static pressure on the fan and require the fan motor to be increased to the next larger size. **NOTE: Option adds 3 - 4 ft to unit height.**

AIR INLET DUCT ADAPTER

Air inlet duct adapter is required when the intake air is ducted to the unit fan section. The air inlet duct adapter is available on all EFC-C Fluid Coolers. When air inlet duct adapters are utilized, all bearing lube lines are extended to facilitate maintenance from outside of the duct.

ELECTRIC PAN WATER LEVEL CONTROL

For installations where very close control of the pan water is required, an electric water level system can be provided that consists of a weather-protected electric float switch mounted on the pan section and weather-protected solenoid valve mounted on the water makeup connection. The float switch and solenoid valve are factory wired to a NEMA 4 junction box.

PAN HEATER(S)

To prevent freeze-up of water in the pan when the unit is idle, electric immersion heater(s) can be furnished and installed in the pan.

The electric immersion heater is a stainless steel sheath type that is controlled by a thermostat that senses the pan water temperature and a low water cutout switch that prevents operation of the heater if the water level in the pan is insufficient. The heater will maintain the pan water at 40°F when the ambient is -10°F with a 45 mph wind, and the unit is not operating.

COIL-CASING INSULATION

To reduce heat loss from the cooler, insulation can be furnished and installed on the casing of the cooler.

The insulation consists of a one inch layer of Armaflex that is glued to the casing and is covered by a protective paint coating. For maximum reduction of heat loss from the idle cooler, the insulation should be used in conjunction with positive-closure discharge dampers. All Factory discharge hoods may be furnished with insulation to minimize losses.

VIBRATION ISOLATORS

Where building codes require vibration isolation, spring-type vibration isolators can be furnished to properly isolate the equipment from the mounting structure.

HOT DIP GALVANIZED AFTER FABRICATION

For the most effective method of corrosion protection all casing material for the pan section, fan section, and coil section can be provided using *Hot Dip Galvanized After Fabrication* components.

CAPACITY CONTROL

To maintain system leaving water temperatures during low ambient temperatures or in systems with widely fluctuating loads, several types of capacity control systems are offered:

MODULATING DAMPERS

On the EFC centrifugal fluid coolers, modulating dampers can be mounted in the discharge throat of each fan. These dampers consist of galvanized steel blades mounted on a common steel shaft and are controlled by a modulating damper actuator that is mounted on the fan casing with the appropriate interconnecting linkage. A temperature-sensing controller is furnished for mounting in the leaving fluid line to the unit.

The damper actuator is designed to close the dampers if the unit is turned off or power is lost, and also contains an end switch that can be used to turn off the fan motor when the dampers close.

TWO-SPEED FAN MOTORS

On all EFC fluid coolers, two-speed fan motors are available and one step of capacity reduction by reducing the fan speed. These motors are available with either single or dual windings.

PONY MOTOR DRIVE PACKAGE

A complete line of Pony Motor Drive Packages is available for use on all model EFC-C Evaporative Fluid Coolers. The Pony Motor fan system utilizes two single-speed fan motors and drive assemblies on either end of the fan shaft. The Pony Motor is sized for approximately 1/3 of the design HP. The motors operate independently and provide control similar to that achieved with a two-speed/two-winding fan motor with the additional benefit of standby capacity.

SOUND ATTENUATION

EFC centrifugal fluid coolers will meet most sound level criteria without acoustical treatment. For extremely noise-sensitive installations, EFC-C units can be provided with factory-assembled sound attenuators for field mounting.

Contact your local Johnson Controls sales representative or the factory for complete details. **NOTE: Option adds 6 - 8 ft to unit height.**

COIL CONNECTIONS

Our evaporative fluid coolers can be supplied with MPT, Victaulic groove, flanged, or copper sweat coil connections when required.

Contact your local Johnson Controls sales representative or the factory for complete details.

CONTROL PANEL

To minimize design engineering and field wiring, single-point electrical connections are offered with all the necessary components in a control panel. Panels include: main disconnect(s), individual fusing of all major components, motor starters with 3-phase overload protection, 120 volt single-phase control voltage transformer, Hand-Off-Auto switch for both manual and automatic startups, terminal strip with custom wiring for stage controllers, and a NEMA-4 enclosure.

Contact your local sales representative or the factory for your specific design applications.

EFC-C SERIES RIGGING AND FOUNDATION LAYOUT

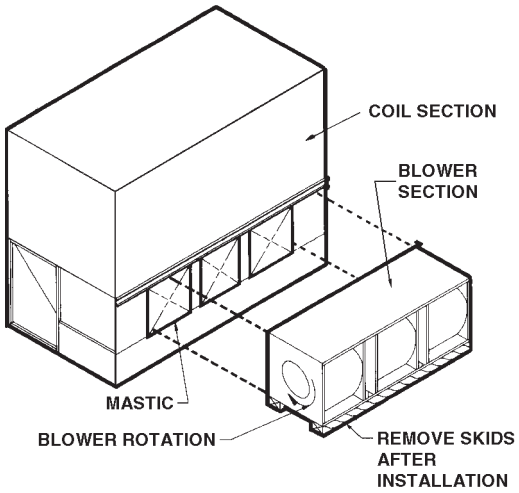
ASSEMBLY INSTRUCTIONS:

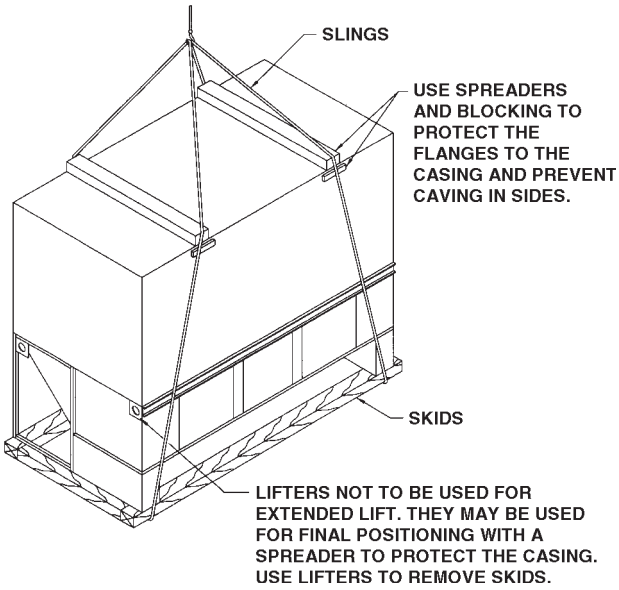
Step 1
Take mastic from parts box and place mastic on coil section as shown.

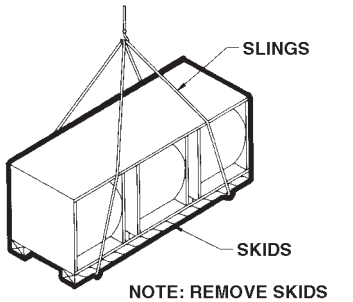
Step 2
Lower blower section to unit body so that the support on the blower section rests on the flanged edge of the top mounting panel on the unit body. Move the blower section to the coil section until all mounting flanges are touching.

Step 3
On each blower, install bolts with a flat washer under both the bolt and nut.

Step 4
TIGHTEN ALL BOLTS CONNECTING BLOWER SECTION TO UNIT BODY BEFORE REMOVING RIGGING.



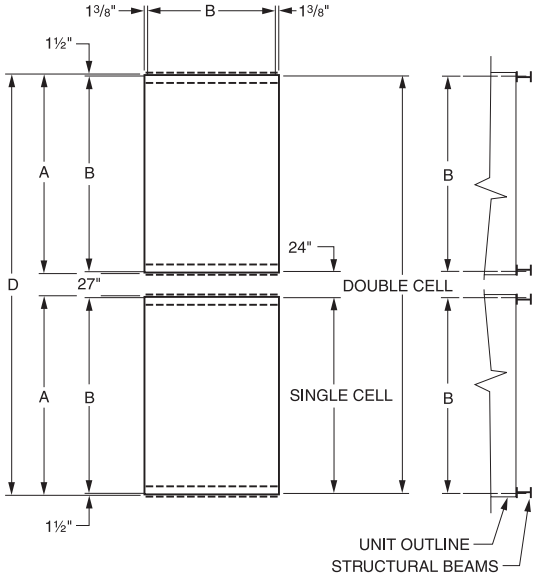




EFC-C - CENTRIFUGAL PLATFORM LAYOUT

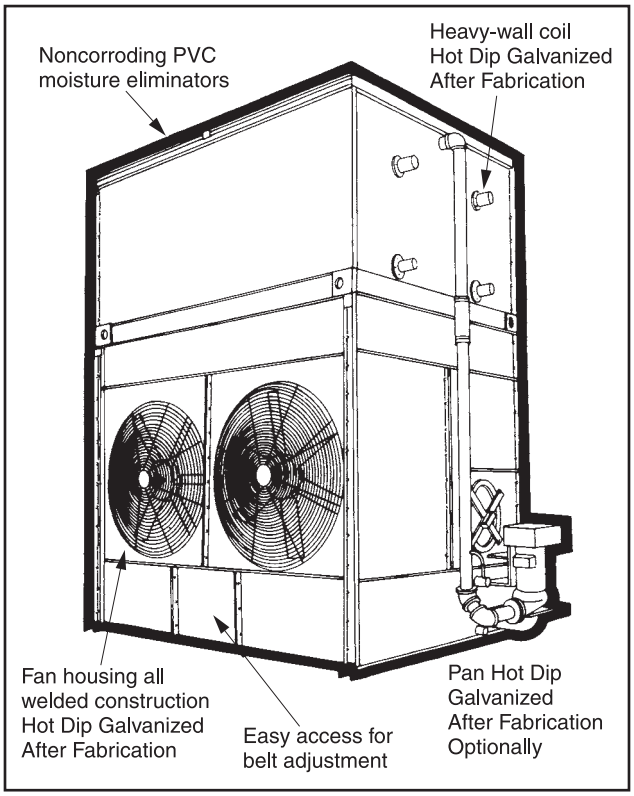
Model #s	A	B	C	D
EFC-C 112-0 through EFC-C 112-4	57	54	27.25	—
EFC-C 113-1 through EFC-C 113-4	57	54	38.75	—
EFC-C 122-1 through EFC-C 122-4	117	114	27.25	—
EFC-C 123-1 through EFC-C 123-4	117	117	38.75	—
EFC-C 222-1 through EFC-C 222-4	117	114	57.25	—
EFC-C 223-1 through EFC-C 223-4	117	114	80.25	—
EFC-C 232-2 through EFC-C 232-4	177	174	57.25	—
EFC-C 233-1 through EFC-C 233-4	177	174	80.25	—
EFC-C 422-1 through EFC-C 422-4	117	114	57.25	258
EFC-C 423-1 through EFC-C 423-4	117	114	80.25	258
EFC-C 432-2 through EFC-C 432-4	177	174	57.25	378
EFC-C 433-1 through EFC-C 433-4	177	174	80.25	378

NOTE: Beams and/or piers should be sized in accordance with standard engineering practices. Beam deflection should not exceed 1/360 of span, not to exceed 1/2 inch.



EFC-P

EFC-P SERIES PROPELLER FAN FLUID COOLERS



The vane-axial series of evaporative fluid coolers utilize two-stage axial-flow fans mounted in a close fitting fan cylinder. Discharge guide vanes at the outlet of the first stage fan minimize pre-rotation of the air into the second stage fan and further maximize fan efficiency. Vane axial evaporative fluid coolers operate with low fan horsepower-providing the required cooling capacity with as low as 50% of the fan horsepower of comparable sized centrifugal fan units. The multistage fan design also has the additional benefit of operating at rotative and fan tip speeds slower than most conventional single stage axial fans, providing acceptable sound levels for most industrial applications.

Vane-axial evaporative fluid coolers are ideal for unrestricted, open installations which do not require external static pressure capability, extremely low sound levels or leaving fluid temperature control more accurate than that provided by fan cycling. They satisfy the requirements of most fluid cooling applications with low energy consumption.

FAN SECTION

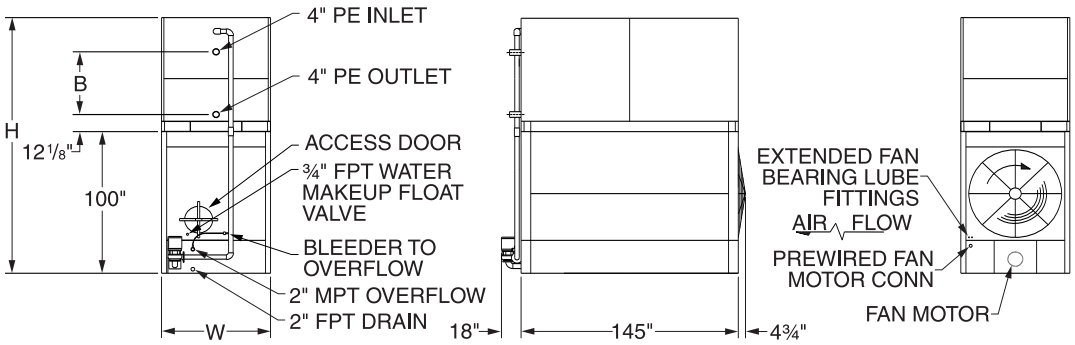
All vane-axial evaporative fluid coolers use two-stage, heavy-duty cast aluminum vane axial fans mounted in a fan orifice tube with air guides mounted between the first- and second-stage fans to straighten the air between the fans, improving fan performance. The fans are designed to run at low rpm to reduce wear and noise.

Fan shafts are supported by heavy duty, self-aligning ball bearings with locking collar. Bearings are conservatively sized for long life. Bearing lubrication is accomplished with lube lines extended to the outside casing. Fan housing, including orifice panel, tube, and vanes, are all welded together to form a superior assembly that is of heavy-gauge steel.

A convex-shaped, heavy-duty *Hot Dip Galvanized After Fabrication* fan guard protects the fans during operation. The guards can be easily removed for access to fans, shafts and bearings. V-belt drives are designed for a minimum 150% of the fan motor nameplate horsepower. Motors are mounted on a heavy-duty base designed for easy accessibility for belt adjustment. The solid orifice panels and lower casings protect the motor(s) from the weather. Fan motors are prewired to the outside of the casing.

EFC-P SERIES ENGINEERING DATA

END VIEW **S90 – S270**



EFC-P Model	CFM	Fan Motor HP[1]	Spray Water GPM[2]	Pump Motor HP[2]	Remote Sump Water In	Remote Sump Sump Drain	Remote Sump Gal.[3] Req'd	Dimensions (Inches) Height H	Dimensions (Inches) Length L	Dimensions (Inches) Width W	Dimensions (Inches) Ctrs B	Tube Coil Weights Unit[4] Shipg	Tube Coil Weights Unit[5] Oprtng	Tube Coil Weights Hvst Sect.	HTR kW
S90	17,620	1.5	200	1.5	3-MPT	6-PE	120	159.12	145	61.75	22.87	5,220	9,136	3,170	7.5
S100	21,680	3	200	1.5	3-MPT	6-PE	120	159.12	145	61.75	22.87	5,230	9,146	3,170	7.5
S110	25,460	5	200	1.5	3-MPT	6-PE	120	159.12	145	61.75	22.87	5,245	9,161	3,170	7.5
S115	21,180	3	200	1.5	3-MPT	6-PE	120	166.25	145	61.75	30.25	5,490	9,624	3,430	7.5
S120	28,400	7.5	200	1.5	3-MPT	6-PE	120	159.12	145	61.75	22.87	5,270	9,186	3,170	7.5
S125	20,780	3	200	1.5	3-MPT	6-PE	120	173.50	145	61.75	37.50	6,580	10,932	4,520	7.5
S130	25,030	5	200	1.5	3-MPT	6-PE	120	166.25	145	61.75	30.25	5,505	9,639	3,430	7.5
S135	23,650	3	240	2	3-MPT	6-PE	120	166.25	145	61.75	30.25	6,610	10,999	4,550	7.5
S140	28,880	7.5	200	1.5	3-MPT	6-PE	120	166.25	145	61.75	30.25	5,530	9,664	3,430	7.5
S145	24,560	5	200	1.5	3-MPT	6-PE	120	173.50	145	61.75	37.50	6,595	10,947	4,520	7.5
S150	27,950	5	240	2	3-MPT	6-PE	120	166.25	145	61.75	30.25	6,625	11,014	4,550	7.5
S155	23,690	5	200	1.5	3-MPT	6-PE	120	180.25	145	61.75	44.25	7,375	11,939	5,300	7.5
S160	28,350	7.5	200	1.5	3-MPT	6-PE	120	173.50	145	61.75	37.50	6,620	10,972	4,520	7.5
S165	32,250	7.5	240	2	3-MPT	6-PE	120	166.25	145	61.75	30.25	6,650	11,039	4,550	7.5
S170	27,330	7.5	200	1.5	3-MPT	6-PE	120	180.25	145	61.75	44.25	7,760	12,110	5,660	7.5
S175	34,380	10	240	2	3-MPT	6-PE	120	166.25	145	61.75	30.25	6,670	11,059	4,550	7.5
S180	33,350	5	300	3	4-MPT	8-PE	150	166.25	145	72.75	30.25	7,975	13,293	5,800	9.0
S185	31,700	7.5	240	2	3-MPT	6-PE	120	173.50	145	61.75	37.50	7,680	12,334	5,480	7.5
S190	30,120	7.5	240	2	3-MPT	6-PE	120	180.25	145	61.75	44.25	8,560	13,476	6,360	7.5
S195	37,510	7.5	300	3	4-MPT	8-PE	150	166.25	145	72.75	30.25	8,000	13,318	5,800	9.0
S200	34,870	10	240	2	3-MPT	6-PE	120	173.50	145	61.75	37.50	7,700	12,354	5,480	7.5
S205	33,130	10	240	2	3-MPT	6-PE	120	180.25	145	61.75	44.25	8,580	13,496	6,360	7.5
S210	41,670	10	300	3	4-MPT	8-PE	150	166.25	145	72.75	30.25	8,020	13,338	5,800	9.0
S220	36,170	7.5	300	3	4-MPT	8-PE	150	173.50	145	72.75	37.50	8,850	14,493	6,650	9.0
S230	40,180	10	300	3	4-MPT	8-PE	150	173.50	145	72.75	37.50	8,870	14,513	6,650	9.0
S240	42,900	15	300	3	4-MPT	8-PE	150	173.50	145	72.75	37.50	8,880	14,523	6,650	9.0
S250	39,480	10	300	3	4-MPT	8-PE	150	180.25	145	72.75	44.25	9,930	15,900	7,710	9.0
S270	43,480	15	300	3	4-MPT	8-PE	150	180.25	145	72.75	44.25	9,940	15,910	7,890	9.0

1. Fan motor HP is for free air delivery with 0" external static pressure.
2. Remote units are supplied less water-circulating pump(s), float valve(s), and related piping.
3. Values account for water in unit and piping–remote sump must also be sized for volume in field-erected spray distribution supply and drain pipes.
4. Shipping weights include water-circulating pumps.
5. Operating weights include water-circulating pump, water in the coils, and normal water operating level in the sump.

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Do not use for construction–product drawings available on request.

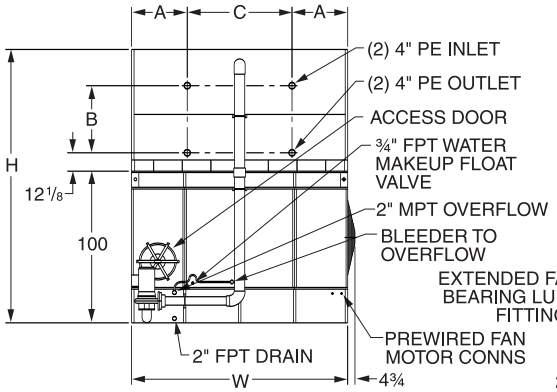
ATTACHMENT 4

EFC/IDFC EVAPORATIVE FLUID COOLERS
ENGINEERING DATA

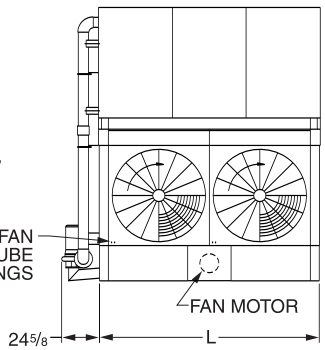
Johnson Controls

EFC-P

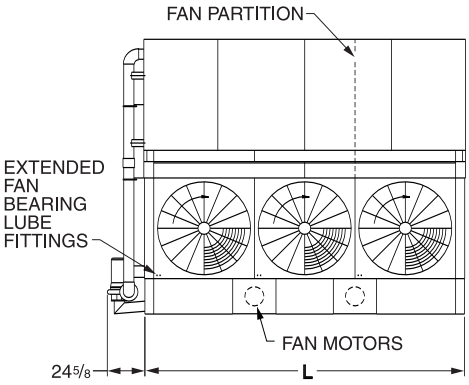
END VIEW



M155 – M280



M285 – M430



EFC-P Model	CFM	Fan Motor HP(1)	Spray Water GPM(2)	Pump Motor HP(2)	Remote Sump Water In	Remote Sump Sump Drain	Remote Sump Gal.(3) Req'd	Dimensions (Inches) Height H	Dimensions (Inches) Length L	Dimensions (Inches) Width W	Dimensions (Inches) Ctrs B	Tube Coil Weights Unit(4) Shipg	Tube Coil Weights Unit(5) Oprtng	Tube Coil Weights Hvst Sect.	HTR kW
M155	32,060	3	325	3	4-MPT	8-PE	190	159.12	121.875	96.25	22.87	7,900	12,874	5,100	9.0
M170	37,380	5	325	3	4-MPT	8-PE	190	159.12	121.875	96.25	22.87	8,000	12,974	5,100	9.0
M185	31,460	3	325	3	4-MPT	8-PE	190	166.25	121.875	96.25	30.25	8,930	14,270	6,130	9.0
M190	42,780	7.5	325	3	4-MPT	8-PE	190	159.12	121.875	96.25	22.87	8,050	13,024	5,100	9.0
M195	47,080	10	325	3	4-MPT	8-PE	190	159.12	121.875	96.25	22.87	8,150	13,124	5,100	9.0
M200	30,540	3	325	3	4-MPT	8-PE	190	173.50	121.875	96.25	37.50	10,210	15,916	7,410	9.0
M205	36,690	5	325	3	4-MPT	8-PE	190	166.25	121.875	96.25	30.25	9,030	14,370	6,130	9.0
M210	29,580	3	325	3	4-MPT	8-PE	190	180.25	121.875	96.25	44.25	11,400	17,472	8,600	9.0
M220	41,920	7.5	325	3	4-MPT	8-PE	190	166.25	121.875	96.25	30.25	9,080	14,420	6,130	9.0
M225	35,620	5	325	3	4-MPT	8-PE	190	173.50	121.875	96.25	37.50	10,310	16,016	7,410	9.0
M235	34,500	5	325	3	4-MPT	8-PE	190	180.25	121.875	96.25	44.25	11,500	17,572	8,600	9.0
M240	47,220	10	325	3	4-MPT	8-PE	190	166.25	121.875	96.25	30.25	9,180	14,520	6,130	9.0
M245	40,700	7.5	325	3	4-MPT	8-PE	190	173.50	121.875	96.25	37.50	10,360	16,066	7,410	9.0
M260	39,410	7.5	325	3	4-MPT	8-PE	190	180.25	121.875	96.25	44.25	11,550	17,622	8,600	9.0
M270	45,850	10	325	3	4-MPT	8-PE	190	173.50	121.875	96.25	37.50	10,460	16,166	7,410	9.0
M280	44,400	10	325	3	4-MPT	8-PE	190	180.25	121.875	96.25	44.25	11,650	17,722	8,600	9.0
M285	48,200	3 & 1.5	450	5	4-MPT	8-PE	280	166.25	177	96.25	30.25	13,080	20,918	8,780	12.0
M305	46,800	3 & 1.5	450	5	4-MPT	8-PE	280	173.50	177	96.25	37.50	15,030	23,400	10,730	12.0
M310	56,210	5 & 3	450	5	4-MPT	8-PE	280	166.25	177	96.25	30.25	13,180	21,018	8,780	12.0
M320	45,320	3 & 1.5	450	5	4-MPT	8-PE	280	180.25	177	96.25	44.25	16,830	25,731	12,530	12.0
M335	54,580	5 & 3	450	5	4-MPT	8-PE	280	173.50	177	96.25	37.50	15,130	23,500	10,730	12.0
M340	64,530	7.5 & 5	450	5	4-MPT	8-PE	280	166.25	177	96.25	30.25	13,230	21,068	8,780	12.0
M355	52,850	5 & 3	450	5	4-MPT	8-PE	280	180.25	177	96.25	44.25	16,930	25,831	12,530	12.0
M360	69,640	10 & 5	450	5	4-MPT	8-PE	280	166.25	177	96.25	30.25	13,330	21,168	8,780	12.0
M370	62,360	7.5 & 5	450	5	4-MPT	8-PE	280	173.50	177	96.25	37.50	15,180	23,550	10,730	12.0
M395	60,390	7.5 & 5	450	5	4-MPT	8-PE	280	180.25	177	96.25	44.25	16,980	25,881	12,530	12.0
M405	70,240	10 & 5	450	5	4-MPT	8-PE	280	173.50	177	96.25	37.50	15,280	23,650	10,730	12.0
M430	68,020	10 & 5	450	5	4-MPT	8-PE	280	180.25	177	96.25	44.25	17,080	25,981	12,530	12.0
M810-2*	140,480	(2)10&(2)5	900	(2)5	(2)4-MPT	(2)8-PE	560	173.50	378	96.25	37.50	30,540	47,279	(2)10,720	(2)12.0
M860-2*	136,040	(2)10&(2)5	900	(2)5	(2)4-MPT	(2)8-PE	560	180.25	378	96.25	44.25	34,170	51,972	(2)12,535	(2)12.0

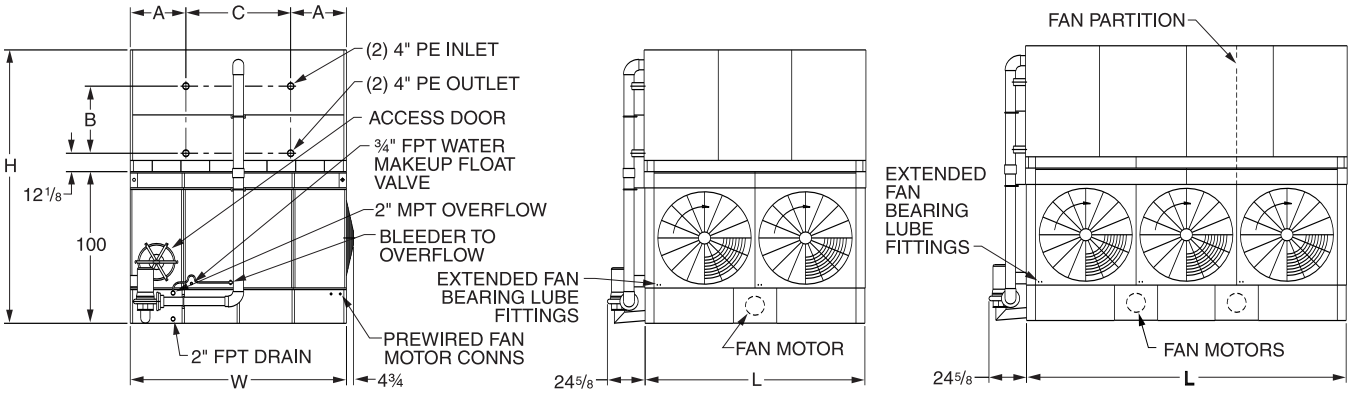
1. Fan motor HP is for free air delivery with 0" external static pressure.
2. Remote units are supplied less water-circulating pump(s), float valve(s), and related piping.
3. Values account for water in unit and piping–remote sump must also be sized for volume in field-erected spray distribution supply and drain pipes.
4. Shipping weights include water-circulating pumps.
5. Operating weights include water-circulating pump, water in the coils, and normal water operating level in the sump.

All data in this catalog is subject to change without notice. The standard right hand arrangement as shown has air inlet side on the right when facing coil connection end. Left hand arrangement can be furnished upon request.

Do not use for construction–product drawings available on request.

* Dual-cell units are not shown in cut sheet drawings above. Single-cell base model numbers are one half of the dual-cell model number.

END VIEW **ML235 – ML345** **ML350 – ML520**



EFC-P Model	CFM	Fan Motor HP[1]	Spray Water GPM[2]	Pump Motor HP[2]	Remote Sump Water In	Remote Sump Sump Drain	Remote Sump Gal.[3] Req'd	Dimensions (Inches) Height H	Dimensions (Inches) Length L	Dimensions (Inches) Width W	Dimensions (Inches) Ctrs B	Tube Coil Weights Unit[4] Shipg	Tube Coil Weights Unit[5] Oprtng	Tube Coil Weights Hvst Sect.	HTR kW
ML235	41,950	5	400	3	4-MPT	8-PE	230	166.25	145	96.25	30.25	10,330	16,757	7,230	12.0
ML260	40,490	5	400	3	4-MPT	8-PE	230	173.50	145	96.25	37.50	11,910	18,772	8,810	12.0
ML265	48,670	7.5	400	3	4-MPT	8-PE	230	166.25	145	96.25	30.25	10,430	16,857	7,230	12.0
ML270	39,270	5	400	3	4-MPT	8-PE	230	180.25	145	96.25	44.25	13,390	20,687	10,290	12.0
ML280	53,050	10	400	3	4-MPT	8-PE	230	166.25	145	96.25	30.25	10,480	16,907	7,230	12.0
ML290	46,970	7.5	400	3	4-MPT	8-PE	230	173.50	145	96.25	37.50	12,010	18,872	8,810	12.0
ML295	57,430	15	400	3	4-MPT	8-PE	230	166.25	145	96.25	30.25	10,580	17,007	7,230	12.0
ML300	45,550	7.5	400	3	4-MPT	8-PE	230	180.25	145	96.25	44.25	13,490	20,787	10,290	12.0
ML305	51,200	10	400	3	4-MPT	8-PE	230	173.50	145	96.25	37.50	12,060	18,922	8,810	12.0
ML320	49,750	10	400	3	4-MPT	8-PE	230	180.25	145	96.25	44.25	13,540	20,837	10,290	12.0
ML330	57,580	15	400	3	4-MPT	8-PE	230	173.50	145	96.25	37.50	12,160	19,022	8,810	12.0
ML345	55,850	15	400	3	4-MPT	8-PE	230	180.25	145	96.25	44.25	13,640	20,937	10,290	12.0
ML350	61,670	5 & 3	575	5	4-MPT	8-PE	340	166.25	211	96.25	30.25	15,390	24,841	10,490	15.0
ML380	59,620	5 & 3	575	5	4-MPT	8-PE	340	173.50	211	96.25	37.50	17,690	27,775	12,790	15.0
ML385	71,540	7.5 & 5	575	5	4-MPT	8-PE	340	166.25	211	96.25	30.25	15,490	24,941	10,490	15.0
ML395	57,820	5 & 3	575	5	4-MPT	8-PE	340	180.25	211	96.25	44.25	19,840	30,558	14,940	15.0
ML410	77,980	10 & 5	575	5	4-MPT	8-PE	340	166.25	211	96.25	30.25	15,540	24,991	10,490	15.0
ML425	69,160	7.5 & 5	575	5	4-MPT	8-PE	340	173.50	211	96.25	37.50	17,790	27,875	12,790	15.0
ML430	84,420	15 & 7.5	575	5	4-MPT	8-PE	340	166.25	211	96.25	30.25	15,640	25,091	10,490	15.0
ML445	67,080	7.5 & 5	575	5	4-MPT	8-PE	340	180.25	211	96.25	44.25	19,940	30,658	14,940	15.0
ML450	75,400	10 & 5	575	5	4-MPT	8-PE	340	173.50	211	96.25	37.50	17,840	27,925	12,790	15.0
ML475	73,110	10 & 5	575	5	4-MPT	8-PE	340	180.25	211	96.25	44.25	19,990	30,708	14,940	15.0
ML490	84,790	15 & 7.5	575	5	4-MPT	8-PE	340	173.50	211	96.25	37.50	17,940	28,025	12,790	15.0
ML520	82,230	15 & 7.5	575	5	4-MPT	8-PE	340	180.25	211	96.25	44.25	20,090	30,808	14,940	15.0
ML820-2*	155,960	(2)10&(2)5	1150	(2)5	(2)4-MPT	(2)8-PE	680	166.25	446	96.25	30.25	31,090	49,992	(2)10,495	(2)15.0
ML850-2*	138,320	(2)7.5&(2)5	1150	(2)5	(2)4-MPT	(2)8-PE	680	173.50	446	96.25	37.50	35,580	55,749	(2)12,790	(2)15.0
ML860-2*	168,840	(2)15&(2)7.5	1150	(2)5	(2)4-MPT	(2)8-PE	680	166.25	446	96.25	30.25	31,290	50,192	(2)10,495	(2)15.0
ML890-2*	134,160	(2)7.5&(2)5	1150	(2)5	(2)4-MPT	(2)8-PE	680	180.25	446	96.25	44.25	39,860	61,296	(2)14,930	(2)15.0
ML900-2*	150,800	(2)10&(2)5	1150	(2)5	(2)4-MPT	(2)8-PE	680	173.50	446	96.25	37.50	35,680	55,849	(2)12,790	(2)15.0
ML950-2*	146,220	(2)10&(2)5	1150	(2)5	(2)4-MPT	(2)8-PE	680	180.25	446	96.25	44.25	39,960	61,396	(2)14,930	(2)15.0
ML980-2*	169,580	(2)15&(2)7.5	1150	(2)5	(2)4-MPT	(2)8-PE	680	173.50	446	96.25	37.50	35,880	56,049	(2)12,790	(2)15.0
ML1040-2*	164,460	(2)15&(2)7.5	1150	(2)5	(2)4-MPT	(2)8-PE	680	180.25	446	96.25	44.25	40,160	61,596	(2)14,930	(2)15.0

1. Fan motor HP is for free air delivery with 0" external static pressure.
2. Remote units are supplied less water-circulating pump(s), float valve(s), and related piping.
3. Values are amount for water in unit and piping–remote sump must also be sized for volume in field-erected spray distribution supply and drain pipes.
4. Shipping weights include water-circulating pumps.
5. Operating weights include water-circulating pump, water in the coils, and normal water operating level in the sump.

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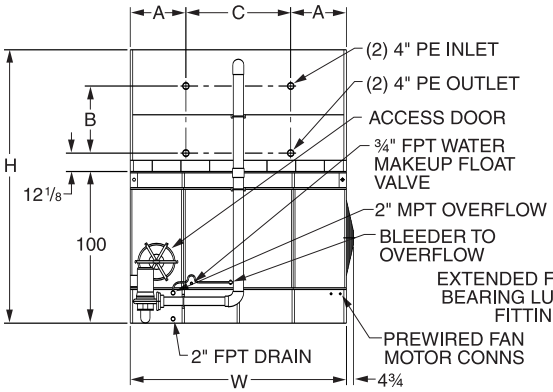
ATTACHMENT 4

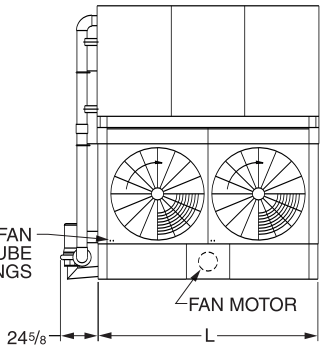
EFC/IDFC EVAPORATIVE FLUID COOLERS
ENGINEERING DATA

Johnson Controls

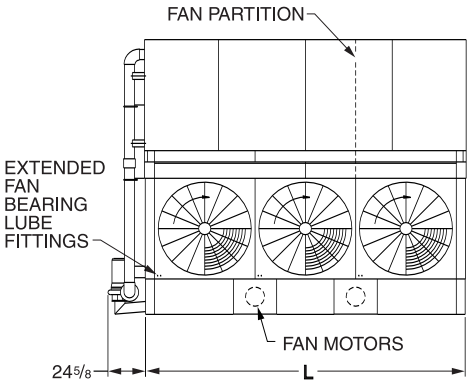
END VIEW



L290 – L450



L435 – L700



EFC-P Model	CFM	Fan Motor HP(1)	Spray Water GPM(2)	Pump Motor HP(2)	Remote Sump Water In	Remote Sump Sump Drain	Remote Sump Gal.(3) Req'd	Dimensions (Inches) Height H	Dimensions (Inches) Length L	Dimensions (Inches) Width W	Dimensions (Inches) Ctrs B	Tube Coil Weights Unit(4) Shipg	Tube Coil Weights Unit(5) Oprtng	Tube Coil Weights Hvst Sect.	HTR kW
L290	52,200	7.5	400	3	4-MPT	8-PE	325	166.25	145	116.25	30.25	12,715	20,842	8,840	12.0
L300	57,500	10	400	3	4-MPT	8-PE	325	166.25	145	116.25	30.25	12,740	20,867	8,840	12.0
L315	50,600	7.5	400	3	4-MPT	8-PE	325	173.50	145	116.25	37.50	14,655	23,313	10,780	12.0
L330	49,000	7.5	400	3	4-MPT	8-PE	325	180.25	145	116.25	44.25	16,475	25,664	12,600	12.0
L335	65,800	15	400	3	4-MPT	8-PE	325	166.25	145	116.25	30.25	12,790	20,917	8,840	12.0
L345	55,700	10	400	3	4-MPT	8-PE	325	173.50	145	116.25	37.50	14,680	23,338	10,780	12.0
L350	70,000	20	400	3	4-MPT	8-PE	325	166.25	145	116.25	30.25	12,840	20,967	8,840	12.0
L355	54,000	10	400	3	4-MPT	8-PE	325	180.25	145	116.25	44.25	16,500	25,689	12,600	12.0
L375	63,700	15	400	3	4-MPT	8-PE	325	173.50	145	116.25	37.50	14,730	23,388	10,780	12.0
L390	69,000	20	400	3	4-MPT	8-PE	325	173.50	145	116.25	37.50	14,780	23,438	10,780	12.0
L405	61,500	15	400	3	4-MPT	8-PE	325	180.25	145	116.25	44.25	16,550	25,739	12,600	12.0
L415	68,000	20	400	3	4-MPT	8-PE	325	180.25	145	116.25	44.25	16,600	25,789	12,600	12.0
L435	78,300	7.5 & 5	600	5	4-MPT	8-PE	500	166.25	211	116.25	30.25	18,440	30,445	12,790	18.0
L450	74,800	30	600	5	4-MPT	8-PE	500	180.25	145	116.25	42.00	16,700	23,077	12,600	12.0
L460	86,200	10 & 5	600	5	4-MPT	8-PE	500	166.25	211	116.25	30.25	18,490	30,495	12,790	18.0
L475	75,800	7.5 & 5	600	5	4-MPT	8-PE	500	173.50	211	116.25	37.50	21,280	34,059	15,630	18.0
L505	98,700	15 & 7.5	600	5	4-MPT	8-PE	500	166.25	211	116.25	30.25	18,540	30,545	12,790	18.0
L510	83,400	10 & 5	600	5	4-MPT	8-PE	500	173.50	211	116.25	37.50	21,330	34,109	15,630	18.0
L520	101,800	20 & 10	600	5	4-MPT	8-PE	500	166.25	211	116.25	30.25	18,590	30,595	12,790	18.0
L565	95,400	15 & 7.5	600	5	4-MPT	8-PE	500	173.50	211	116.25	37.50	21,380	34,159	15,630	18.0
L575	101,100	20 & 10	600	5	4-MPT	8-PE	500	173.50	211	116.25	37.50	21,430	34,209	15,630	18.0
L590	92,160	15 & 7.5	600	5	4-MPT	8-PE	500	180.25	211	116.25	44.25	24,000	37,552	18,300	18.0
L635	101,950	20 & 10	600	5	4-MPT	8-PE	500	180.25	211	116.25	44.25	24,100	37,652	18,300	18.0
L700	112,500	30 & 15	850	7.5	4-MPT	8-PE	500	180.25	211	116.25	42.00	24,200	33,697	18,300	18.0
L810-2*	123,000	(2)15	800	(2)3	(2)4-MPT	(2)8-PE	650	180.25	314	116.25	44.25	33,090	51,468	(2)12,595	(2)12.0
L830-2*	136,000	(2)20	800	(2)3	(2)4-MPT	(2)8-PE	650	180.25	314	116.25	44.25	33,190	51,568	(2)12,595	(2)12.0
L870-2*	156,600	(2)7.5&(2)5	1200	(2)5	(2)4-MPT	(2)8-PE	1000	166.25	446	116.25	30.25	36,880	60,891	(2)12,790	(2)18.0
L900-2*	149,600	(2)30	1,200	(2)5	(2)4-MPT	(2)8-PE	650	180.25	314	116.25	42.00	33,400	46,154	(2)12,600	(2)12.0
L920-2*	172,400	(2)10&(2)5	1200	(2)5	(2)4-MPT	(2)8-PE	1000	166.25	446	116.25	30.25	36,980	60,991	(2)12,790	(2)18.0
L950-2*	151,600	(2)7.5&(2)5	1200	(2)5	(2)4-MPT	(2)8-PE	1000	173.50	446	116.25	37.50	42,570	68,128	(2)15,635	(2)18.0
L1010-2*	197,400	(2)15&(2)7.5	1200	(2)5	(2)4-MPT	(2)8-PE	1000	166.25	446	116.25	30.25	37,080	61,091	(2)12,790	(2)18.0
L1020-2*	166,800	(2)10&(2)5	1200	(2)5	(2)4-MPT	(2)8-PE	1000	173.50	446	116.25	37.50	42,670	68,228	(2)15,635	(2)18.0
L1040-2*	203,600	(2)20&(2)10	1200	(2)5	(2)4-MPT	(2)8-PE	1000	166.25	446	116.25	30.25	37,180	61,191	(2)12,790	(2)18.0
L1130-2*	190,800	(2)15&(2)7.5	1200	(2)5	(2)4-MPT	(2)8-PE	1000	173.50	446	116.25	37.50	42,770	68,328	(2)15,635	(2)18.0
L1150-2*	202,200	(2)20&(2)10	1200	(2)5	(2)4-MPT	(2)8-PE	1000	173.50	446	116.25	37.50	42,870	68,428	(2)15,635	(2)18.0
L1180-2*	184,320	(2)15&(2)7.5	1200	(2)5	(2)4-MPT	(2)8-PE	1000	180.25	446	116.25	44.25	47,990	75,095	(2)18,295	(2)18.0
L1270-2*	203,900	(2)20&(2)10	1200	(2)5	(2)4-MPT	(2)8-PE	1000	180.25	446	116.25	44.25	48,190	75,295	(2)18,295	(2)18.0
L1400-2*	225,000	(2)30&(2)15	1,900	(2)7.5	(2)4-MPT	(2)8-PE	1000	180.25	446	116.25	42.00	48,400	67,394	(2)18,300	(2)18.0

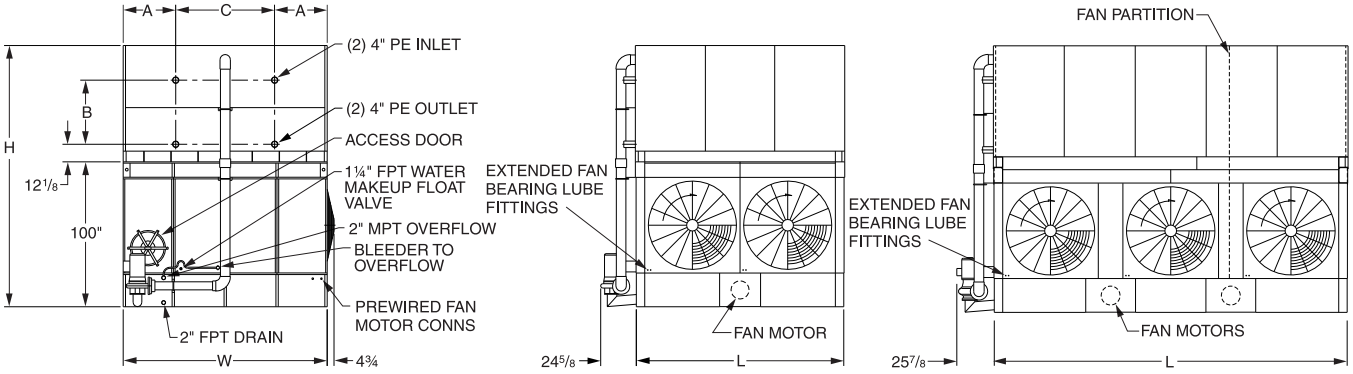
1. Fan motor HP is for free air delivery with 0" external static pressure.
2. Remote units are supplied less water-circulating pump(s), float valve(s), and related piping.
3. Values are amount for water in unit and piping–remote sump must also be sized for volume in field-erected spray distribution supply and drain pipes.
4. Shipping weights include water-circulating pumps.
5. Operating weights include water-circulating pump, water in the coils, and normal water operating level in the sump.

All data in this catalog is subject to change without notice. The standard right hand arrangement as shown has air inlet side on the right when facing coil connection end. Left hand arrangement can be furnished upon request.

Do not use for construction–product drawings available on request.

* Dual-cell units are not shown in cut sheet drawings above. Single-cell base model numbers are one half of the dual-cell model number.

END VIEW **XL355 – XL530** **XL535 – XL970**



EFC-P Model	CFM	Fan Motor HP[1]	Spray Water GPM[2]	Pump Motor HP[2]	Remote Sump Water In	Remote Sump Sump Drain	Remote Sump Gal.[3] Req'd	Dimensions (Inches) Height H	Dimensions (Inches) Length L	Dimensions (Inches) Width W	Dimensions (Inches) Ctrs B	Tube Coil Weights Unit[4] Shipg	Tube Coil Weights Unit[5] Oprtng	Tube Coil Weights Hvst Sect.	HTR kW
XL355	63,600	10	600	5	6-FLG	10-PE	350	166.25	145	141.25	30.25	15,300	25,524	10,500	(2)7.5
XL390	73,100	15	600	5	6-FLG	10-PE	350	166.25	145	141.25	30.25	15,350	25,574	10,500	(2)7.5
XL395	63,100	10	600	5	6-FLG	10-PE	350	173.50	145	141.25	37.50	17,670	28,549	12,870	(2)7.5
XL415	79,700	20	600	5	6-FLG	10-PE	350	166.25	145	141.25	30.25	15,400	25,624	10,500	(2)7.5
XL425	62,500	10	600	5	6-FLG	10-PE	350	180.25	145	141.25	44.25	19,890	31,423	15,090	(2)7.5
XL435	72,200	15	600	5	6-FLG	10-PE	350	173.50	145	141.25	37.50	17,720	28,599	12,870	(2)7.5
XL440	86,300	25	600	5	6-FLG	10-PE	350	166.25	145	141.25	30.25	15,500	25,724	10,500	(2)7.5
XL470	78,900	20	600	5	6-FLG	10-PE	350	173.50	145	141.25	37.50	17,770	28,649	12,870	(2)7.5
XL475	71,300	15	600	5	6-FLG	10-PE	350	180.25	145	141.25	44.25	19,940	31,473	15,090	(2)7.5
XL495	85,500	25	600	5	6-FLG	10-PE	350	173.50	145	141.25	37.50	17,870	28,749	12,870	(2)7.5
XL505	78,200	20	600	5	6-FLG	10-PE	350	180.25	145	141.25	44.25	19,990	31,523	15,090	(2)7.5
XL530	84,700	25	600	5	6-FLG	10-PE	350	180.25	145	141.25	44.25	20,090	31,623	15,090	(2)7.5
XL535	96,200	10 & 5	900	7.5	6-FLG	10-PE	520	166.25	211	141.25	30.25	21,390	36,456	14,740	(2)12.0
XL590	111,000	15 & 7.5	900	7.5	6-FLG	10-PE	520	166.25	211	141.25	30.25	21,490	36,556	14,740	(2)12.0
XL600	95,850	10 & 5	900	7.5	6-FLG	10-PE	520	173.50	211	141.25	37.50	24,930	40,948	18,280	(2)12.0
XL630	123,000	20 & 10	900	7.5	6-FLG	10-PE	520	166.25	211	141.25	30.25	21,540	36,606	14,740	(2)12.0
XL640	95,800	10 & 5	900	7.5	6-FLG	10-PE	520	180.25	211	141.25	44.25	27,940	44,911	21,590	(2)12.0
XL660	132,000	25 & 15	900	7.5	6-FLG	10-PE	520	166.25	211	141.25	30.25	21,690	36,756	14,740	(2)12.0
XL665	110,600	15 & 7.5	900	7.5	6-FLG	10-PE	520	173.50	211	141.25	37.50	25,030	41,048	18,280	(2)12.0
XL710	121,450	20 & 10	900	7.5	6-FLG	10-PE	520	173.50	211	141.25	37.50	25,080	41,098	18,280	(2)12.0
XL715	110,500	15 & 7.5	900	7.5	6-FLG	10-PE	520	180.25	211	141.25	44.25	28,340	45,311	21,590	(2)12.0
XL745	130,400	25 & 15	900	7.5	6-FLG	10-PE	520	173.50	211	141.25	37.50	25,230	41,248	18,280	(2)12.0
XL765	121,100	20 & 10	900	7.5	6-FLG	10-PE	520	180.25	211	141.25	44.25	28,390	45,361	21,590	(2)12.0
XL785	132,100	20 & 10	1050	7.5	6-FLG	12-PE	680	184.00	245	141.25	48.25	29,260	47,789	21,360	(2)15.0
XL805	130,000	25 & 15	900	7.5	6-FLG	10-PE	520	180.25	211	141.25	44.25	28,540	45,511	21,590	(2)12.0
XL830	131,850	25 & 15	1050	7.5	6-FLG	12-PE	680	184.00	245	141.25	48.25	29,430	47,959	21,360	(2)15.0
XL845	142,400	20 & 10	1050	7.5	6-FLG	12-PE	680	191.75	245	141.25	56.00	32,910	52,533	25,010	(2)15.0
XL870	152,000	30 & 15	1050	7.5	6-FLG	12-PE	680	184.00	245	141.25	48.25	30,390	48,926	21,360	(2)15.0
XL895	142,200	25 & 15	1050	7.5	6-FLG	12-PE	680	191.75	245	141.25	56.00	33,080	52,703	25,010	(2)15.0
XL940	151,800	30 & 15	1050	7.5	6-FLG	12-PE	680	191.75	245	141.25	56.00	33,140	52,756	25,010	(2)15.0
XL970	159,390	30 & 15	2400	10	6-FLG	12-PE	683	191.75	245	141.25	56.00	33,340	47,218	25,010	(2)15.0

1. Fan motor HP is for free air delivery with 0" external static pressure.
2. Remote units are supplied less water-circulating pump(s), float valve(s), and related piping.
3. Values account for water in unit and piping–remote sump must also be sized for volume in field-erected spray distribution supply and drain pipes.
4. Shipping weights include water-circulating pumps.
5. Operating weights include water-circulating pump, water in the coils, and normal water operating level in the sump.

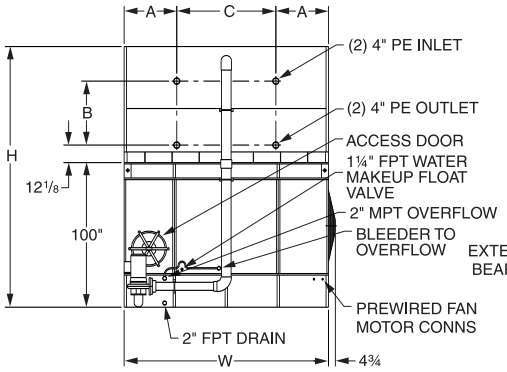
All data in this catalog is subject to change without notice. The standard right hand arrangement as shown has air inlet side on the right when facing coil connection end. Left hand arrangement can be furnished upon request.

Do not use for construction–product drawings available on request.

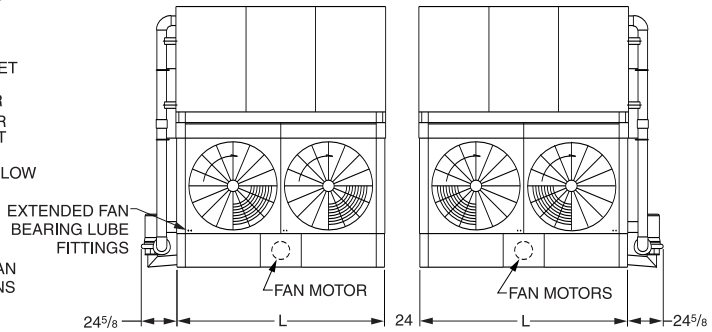
ATTACHMENT 4
EFC/IDFC EVAPORATIVE FLUID COOLERS
ENGINEERING DATA

Johnson Controls

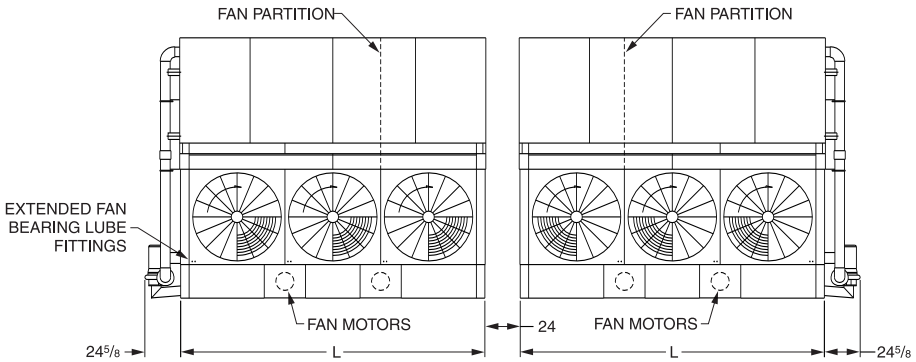
END VIEW



XL830-2 – XL1060-2



XL1070-2 – XL1940-2



EFC-P Model	CFM	Fan Motor HP(1)	Spray Water GPM(2)	Pump Motor HP(2)	Remote Sump Water In	Remote Sump Sump Drain	Remote Sump Gal.(3) Req'd	Dimensions (Inches) Height H	Dimensions (Inches) Length L	Dimensions (Inches) Width W	Dimensions (Inches) Ctrs B	Tube Coil Weights Unit(4) Shipg	Tube Coil Weights Unit(5) Oprtng	Tube Coil Weights Hvst Sect.	HTR kW
XL830-2	159,400	(2)20	1200	(2)5	(2)6-FLG	(2)10-PE	750	166.25	145	141.25	30.25	30,800	51,248	(2)10,500	(4)7.5
XL850-2	125,000	(2)10	1200	(2)5	(2)6-FLG	(2)10-PE	750	180.25	145	141.25	44.25	39,770	62,837	(2)15,085	(4)7.5
XL870-2	144,400	(2)15	1200	(2)5	(2)6-FLG	(2)10-PE	750	173.50	145	141.25	37.50	35,440	57,197	(2)12,870	(4)7.5
XL880-2	172,600	(2)25	1200	(2)5	(2)6-FLG	(2)10-PE	750	166.25	145	141.25	30.25	31,000	51,448	(2)10,500	(4)7.5
XL940-2	157,800	(2)20	1200	(2)5	(2)6-FLG	(2)10-PE	750	173.50	145	141.25	37.50	35,540	57,297	(2)12,870	(4)7.5
XL950-2	142,600	(2)15	1200	(2)5	(2)6-FLG	(2)10-PE	750	180.25	145	141.25	44.25	39,870	62,937	(2)15,085	(4)7.5
XL990-2	171,000	(2)25	1200	(2)5	(2)6-FLG	(2)10-PE	750	173.50	145	141.25	37.50	35,740	57,497	(2)12,870	(4)7.5
XL1010-2	156,400	(2)20	1200	(2)5	(2)6-FLG	(2)10-PE	750	180.25	145	141.25	44.25	39,970	63,037	(2)15,085	(4)7.5
XL1060-2	169,400	(2)25	1200	(2)5	(2)6-FLG	(2)10-PE	750	180.25	145	141.25	44.25	40,170	63,237	(2)15,085	(4)7.5
XL1070-2	192,400	(2)10&(2)5	1800	(2)7.5	(2)6-FLG	(2)10-PE	1040	166.25	211	141.25	30.25	42,780	72,911	(2)14,740	(4)12.0
XL1180-2	222,000	(2)15&(2)7.5	1800	(2)7.5	(2)6-FLG	(2)10-PE	1040	166.25	211	141.25	30.25	42,980	73,111	(2)14,740	(4)12.0
XL1200-2	191,700	(2)10&(2)5	1800	(2)7.5	(2)6-FLG	(2)10-PE	1040	173.50	211	141.25	37.50	49,860	81,896	(2)18,280	(4)12.0
XL1260-2	246,000	(2)20&(2)10	1800	(2)7.5	(2)6-FLG	(2)10-PE	1040	166.25	211	141.25	30.25	43,080	73,211	(2)14,740	(4)12.0
XL1280-2	191,600	(2)10&(2)5	1800	(2)7.5	(2)6-FLG	(2)10-PE	1040	180.25	211	141.25	44.25	55,900	89,841	(2)21,600	(4)12.0
XL1320-2	264,000	(2)25&(2)15	1800	(2)7.5	(2)6-FLG	(2)10-PE	1040	166.25	211	141.25	30.25	43,380	73,511	(2)14,740	(4)12.0
XL1330-2	221,200	(2)15&(2)7.5	1800	(2)7.5	(2)6-FLG	(2)10-PE	1040	173.50	211	141.25	37.50	50,060	82,096	(2)18,280	(4)12.0
XL1420-2	242,900	(2)20&(2)10	1800	(2)7.5	(2)6-FLG	(2)10-PE	1040	173.50	211	141.25	37.50	50,160	82,196	(2)18,280	(4)12.0
XL1430-2	221,000	(2)15&(2)7.5	1800	(2)7.5	(2)6-FLG	(2)10-PE	1040	180.25	211	141.25	44.25	56,700	90,641	(2)21,600	(4)12.0
XL1490-2	260,800	(2)25&(2)15	1800	(2)7.5	(2)6-FLG	(2)10-PE	1040	173.50	211	141.25	37.50	50,460	82,496	(2)18,280	(4)12.0
XL1530-2	242,200	(2)20&(2)10	1800	(2)7.5	(2)6-FLG	(2)10-PE	1040	180.25	211	141.25	44.25	56,800	90,741	(2)21,600	(4)12.0
XL1570-2	264,200	(2)20&(2)10	2100	(2)7.5	(2)6-FLG	(2)12-PE	1360	184.00	245	141.25	48.25	58,530	95,402	(2)21,365	(4)15.0
XL1610-2	260,000	(2)25&(2)15	1800	(2)7.5	(2)6-FLG	(2)10-PE	1040	180.25	211	141.25	44.25	57,100	91,041	(2)21,600	(4)12.0
XL1660-2	263,700	(2)25&(2)15	2100	(2)7.5	(2)6-FLG	(2)12-PE	1360	184.00	245	141.25	48.25	58,870	95,929	(2)21,365	(4)15.0
XL1690-2	284,800	(2)20&(2)10	2100	(2)7.5	(2)6-FLG	(2)12-PE	1360	191.75	245	141.25	56.00	65,820	105,081	(2)25,010	(4)15.0
XL1740-2	304,000	(2)30&(2)15	2100	(2)7.5	(2)6-FLG	(2)12-PE	1360	184.00	245	141.25	48.25	60,790	97,849	(2)21,365	(4)15.0
XL1790-2	284,400	(2)25&(2)15	2100	(2)7.5	(2)6-FLG	(2)12-PE	1360	191.75	245	141.25	56.00	66,160	105,421	(2)25,010	(4)15.0
XL1880-2	303,600	(2)30&(2)15	2100	(2)7.5	(2)6-FLG	(2)12-PE	1360	191.75	245	141.25	56.00	66,280	105,541	(2)25,010	(4)15.0
XL 1940-2	318,780	(2)30&(2)15	2400	(2)10	(2)6-FLG	(2)12-PE	1366	191.75	245	141.25	56.00	66,680	94,466	(2)25,010	(4)15.0

Do not use for construction–product drawings available on request. NOTE: See footnotes on page 15.

EFC-P OPTIONAL EQUIPMENT

DISCHARGE HOOD WITH POSITIVE CLOSURE DAMPERS

To reduce chimney effect heat losses from the cooler when idle, a discharge hood with positive closure dampers can be furnished. For installations where low cooler height is required, a low silhouette discharge hood with positive closure dampers is available. The low-silhouette damper assembly is designed for low air pressure drop and does not require an oversized fan motor.

A tapered discharge hood, with positive-closure dampers, can also furnished for installations where the height and velocity of the fluid cooler air discharge must be increased.

The dampers are operated by a two-position actuator and linkage. Actuator and linkage are factory installed. All wiring and actuator controls must be furnished by others. A 120 volt power supply is required. Damper actuator should be interlocked with the temperature control system so the dampers are open when the fans are running and closed when the fans are off.

Tapered discharge hood with dampers increases the static pressure on the fan and require the fan motor to be increased to the next larger size. **NOTE: Option adds 4 - 6 ft to unit height.**

ELECTRIC PAN WATER LEVEL CONTROL

For installations where very close control of the pan water is required, an electric water level system can be provided that consists of a weather-protected electric float switch mounted on the pan section and weather-protected solenoid valve mounted on the water makeup connection. The float switch and solenoid valve are factory wired to a NEMA 4 junction box.

PAN HEATER(S)

To prevent freeze-up of water in the pan when the unit is idle, an electric immersion heater(s) can be furnished and installed in the pan.

The electric immersion heater is a stainless steel sheath type that is controlled by a thermostat that senses the pan water temperature and a low water cutout switch that prevents operation of the heater if the water level in the pan is insufficient. The heater will maintain the pan water at 40°F when the ambient is -10°F with a 45 mph wind, and the unit is not operating.

COIL-CASING INSULATION

To reduce heat loss from the cooler, insulation can be furnished and installed on the casing of the cooler.

The insulation consists of a one inch layer of Armaflex that is glued to the casing and is covered by a protective paint coating. For maximum reduction of heat loss from the idle cooler, the insulation should be used in conjunction with positive-closure discharge dampers. All Factory discharge hoods may be furnished with insulation to minimize losses.

VIBRATION ISOLATORS

Where building codes require vibration isolation, spring-type vibration isolators can be furnished to properly isolate the equipment from the mounting structure.

HOT DIP GALVANIZED AFTER FABRICATION

For the most effective method of corrosion protection, all casing material for the pan section, fan section, and coil section can be provided using *Hot Dip Galvanized After Fabrication* components.

CAPACITY CONTROL

To maintain system leaving water temperatures during low ambient temperatures or in systems with widely fluctuating loads, several types of capacity control systems are offered:

TWO-SPEED FAN MOTORS

On all EFC fluid coolers, two-speed fan motors are available and one step of capacity reduction by reducing the fan speed. These motors are available with either single or dual windings.

FAN PARTITIONS

On EFC-P vane axial fan fluid coolers with two or more fan motors, partitions can be installed between fans to allow cycling some motor/fan combinations, allowing sequential staging of the fans. These partitions prevent idle fans from turning backwards and water from being blown out the idle fans.

COIL CONNECTIONS

Our evaporative fluid coolers can be supplied with MPT, Victaulic groove, flanged, or copper sweat coil connections when required. Contact your local Johnson Controls sales representative or the Factory for complete details.

MULTICIRCUITED COIL

Cooling coils can be divided into multiple circuits to satisfy most cooling system requirements. This arrangement might be considered for a split heat pump system requiring a common fluid cooler.

LOW-NOISE FANS

In a noise sensitive area, low-noise-level fans can be provided on the EFC-P vane axial units.

CATWALKS AND HANDRAILS

Optionally available catwalks and handrails offer convenient access to water eliminators and spray trees.

As configured at the Factory and provided for field assembly, these items are ruggedly designed with OSHA requirements in mind. They mount to the fluid cooler structure without requiring any casing penetrations.

CONTROL PANEL

To minimize design engineering and field wiring, we offer single-point electrical connections with all the necessary components in a control panel. Panels include: main disconnect(s), individual fusing of all major components, motor starters with 3-phase overload protection, 120 volt single-phase control voltage transformer, Hand-Off-Auto switch for both manual and automatic startups, terminal strip with custom wiring for stage controllers, and a NEMA-4 enclosure. Contact your local Johnson Controls representative or the Factory for your specific design applications.

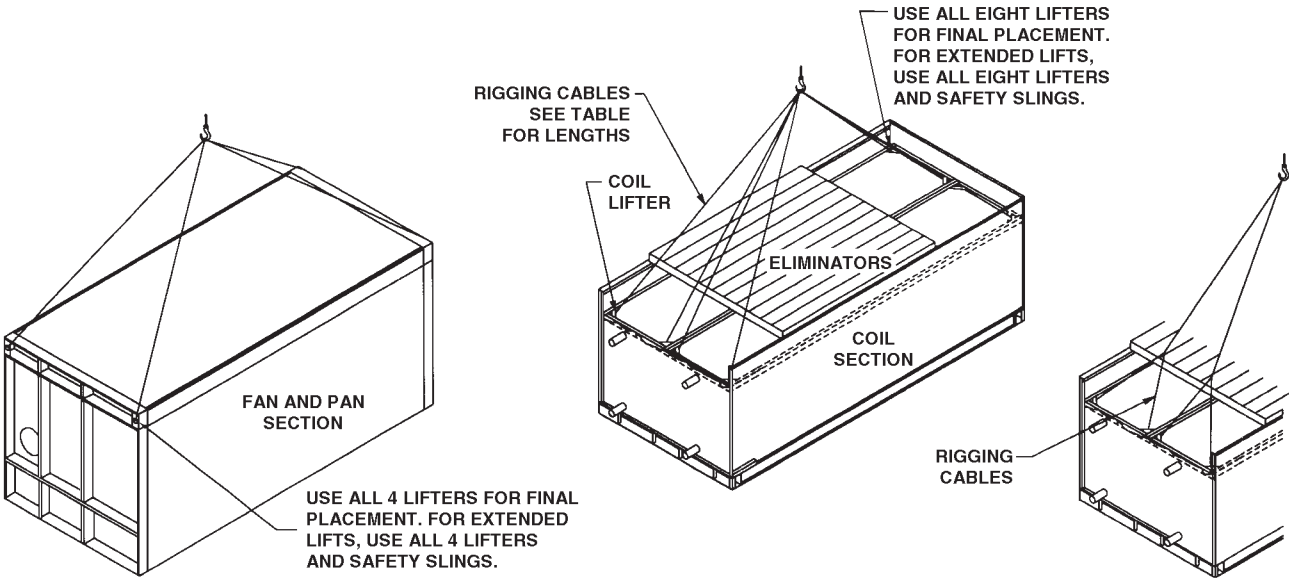
EFC-P SERIES RIGGING AND FOUNDATION LAYOUT

ASSEMBLY INSTRUCTIONS:

Step 1
Take mastic from parts box and place mastic on fan/pan section as shown. Remove paper strip before lowering coil section.

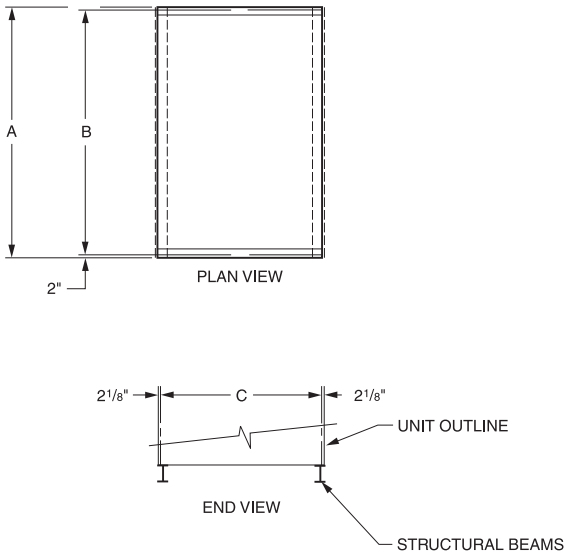
Step 2
Lower coil section to pan/fan section. Use drift pins in four alignment holes to guide coil section in final placement.

Step 3
On all four sides, install fasteners in holes provided.



EFC-P - VANE AXIAL PLATFORM LAYOUT

Model #s	A	B	C
S 90 through S 175 S 185, S 190, S 200, S 205	145	141	61.75
S 180, S 195, and S 210 through S 270	145	141	68.5
M 155 through M 280 M 285 through M 430	121.87 177	117.87 173	92 92
ML 235 through ML 345 ML 350 through ML 520	145 211	141 207	92 92
L 290 through L 450 L 435 through L 700	145 211	141 207	112 112
XL 355 through XL 530 XL 535 through XL 805	145 211	141 207	137 137
XL 830 through XL 970	245	241	137



NOTE: Beams and/or piers should be sized in accordance with standard engineering practices. Beam deflection should not exceed 1/360 of span, not to exceed 1/2 inch.

IDFC SERIES
INDUCED DRAFT FLUID COOLER

Johnson Controls continues to set the standard for evaporative fluid cooler quality with the most rugged, most reliable induced draft fluid coolers available, our IDFC fluid coolers.

Differentiating the Imeco IDFC series from lesser induced fluid coolers are the following important standard design features:

- Every IDFC fluid cooler coil assembly is **pressure tested** under water before and after galvanizing at **450 psig,** a 28% higher test level than competitive fluid coolers. This yields a **design operating pressure of 300 psig**.
- Every IDFC induced draft evaporative fluid cooler comes with an unparalleled **five year motor and drive warranty.**
- Industrially designed, flange-mounted, fan shaft roller bearings have a **minimum L10 bearing life of 133, 500 hours,** 78% greater than the competition's.

If the concept of an induced draft fluid cooler appeals to you, don't settle for a lesser quality offering.

Choose the fluid cooler with the best corrosion protection, the most vigorous safety testing, the highest pressure rating, the best and longest warranty, and the fluid cooler with the components designed for longest, most problem free life. The choice is Imeco IDFC series, induced draft, evaporative fluid cooler.

IDFC SERIES STANDARD FEATURES

FLUID COOLER COIL

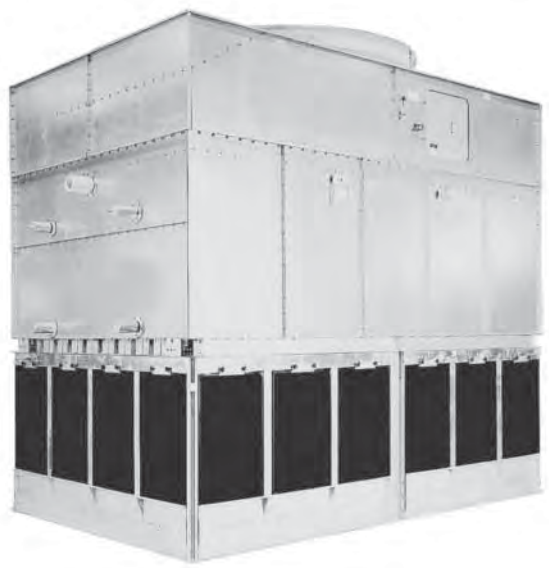
The IDFC series fluid cooler utilizes heavy-wall coils with eddy-current-tested steel tubing to ensure long life. Coil circuits are staggered in the direction of airflow to ensure maximum air turbulence and water coverage across the coil for optimum heat transfer performance.

All IDFC series fluid cooler **coils are submersion tested with 450 psi air pressure.** This results in a **design working pressure of 300 psi**. This unparalleled pressure testing and correspondingly high pressure rating provides additional protection for the problem-free operation of your evaporative fluid cooler.

IDFC series fluid cooler coils are hot dip galvanized after fabrication.

PUMP AND SPRAY PIPING

The spray water circulating pump is a close-coupled centrifugal unit with a ductile iron housing, closed impeller, mechanical seal, and is driven by a TEFC motor with a 1.15 service factor. The pump is mounted vertically under an all-weather hood to permit self draining and is completely piped, using schedule 40 PVC pipe, to the spray system inlet connection. The piping includes a bleed line with adjustable valve located between the pump discharge and overflow connection to meter the necessary water bleed-off.



IDFC

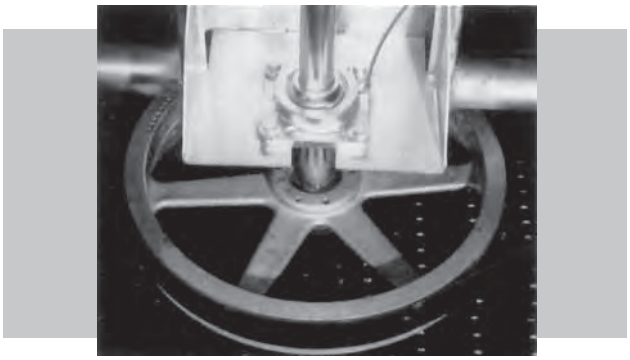
FANS, GUARDS, BEARINGS, MOTORS, AND DRIVES

IDFC series fluid coolers feature 96″ or 120″ diameter axial fans with close-fitting cowls and venturi inlets. Fan design has been optimized to provide performance that is most efficiently matched to the fluid cooler airflow requirements.

The fan shaft bearings are double-row, flange-mounted, self-aligning, tapered roller bearings, with lubrication lines extended for ease of service. Its heavy-duty "roller", as opposed to "ball", design features **a minimum L10 life of 133, 500 hours, 78% greater than the competition.**

On our IDFC series fluid coolers, we use premium quality, totally enclosed motors designed with a 1.15 service factor. The combination of these motors, our reliable, time tested fan technology, and heavy-duty roller bearing design allows us to offer an **unprecedented five-year warranty on the IDFC series motor and drive (fan, fan shaft, sheaves, and fan shaft bearings).**

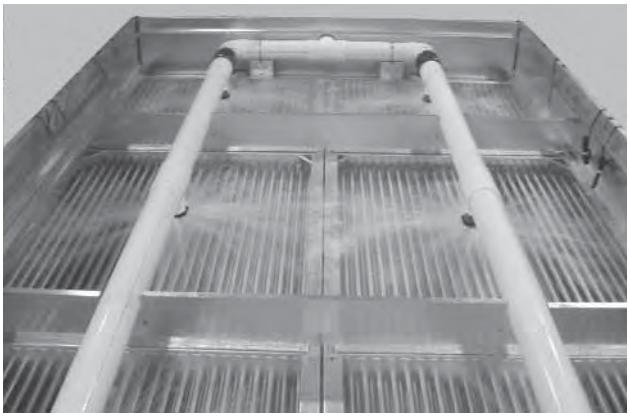
Further, the IDFC fluid cooler heavy-duty fan guard is *Hot Dip Galvanized After Fabrication* for the ultimate in corrosion protection and durability.



IDFC

SPRAY ASSEMBLY

The IDFC noncorroding PVC spray pipes provide complete and even water coverage from low pressure, large orifice, clog-resistant nozzles. This efficient spray system provides complete and continuous water coverage to maximize lifetime fluid cooler capacity, reducing scale formation under all operating conditions.



MOISTURE ELIMINATORS

The IDFC multiple break design eliminator provides very efficient removal of water droplets and mist from the air stream. These small, highly efficient eliminators can easily be removed for coil and spray assembly inspection.

The eliminators are constructed of noncorroding PVC for maximum protection against even the most corrosive atmospheres.

Optional, heavier duty moisture eliminators are available to increase eliminator life and withstand frequent handling without damage. Heavy-duty, bolted, PVC eliminators provide a lightweight, but durable alternative. The eliminator blade thickness is increased by a factor of 40. Eliminators are also available in steel, mounted in a heavy-gauge steel framework, *Hot Dip Galvanized After Fabrication*.

COIL CASING

IDFC coil casings are constructed of heavy-gauge galvanized steel. All casing panels are flanged and positively closed with nut and bolt hardware. Internal structural members provide added integrity. A large, inward-opening, access door provides serviceability to fan drive equipment, moisture eliminators, and spray tree assembly. As an option, the entire casing is available *Hot Dip Galvanized After Fabrication* to provide the highest level of corrosion protection.

FACTORY TESTING

All IDFC units are fabricated, assembled, and tested at the factory to ensure consistent high quality construction and performance before shipment. This ensures trouble-free installation and lasting service.

HIGH QUALITY FLUID COOLER COMPONENTS

- HEAVY-WALL STEEL COILS ARE *Hot Dip Galvanized After Fabrication*
- PITCHED COIL FOR COMPLETE DRAINAGE
- STAGGERED TUBE COIL FOR MAXIMUM HEAT TRANSFER
- LARGE, SLOW SPEED FAN
- EASY BELT ADJUSTMENT
- SOLID BRASS FLOAT VALVE WITH PLASTIC FLOAT
- OVERSIZED STRAINER
- FULL COVERAGE, LARGE ORIFICE, CLOG-REDUCING NOZZLE FOR CONTINUOUS SPRAY COVERAGE
- CONVENIENT EXTENDED LUBRICATION POINTS FOR SIMPLIFIED SERVICE

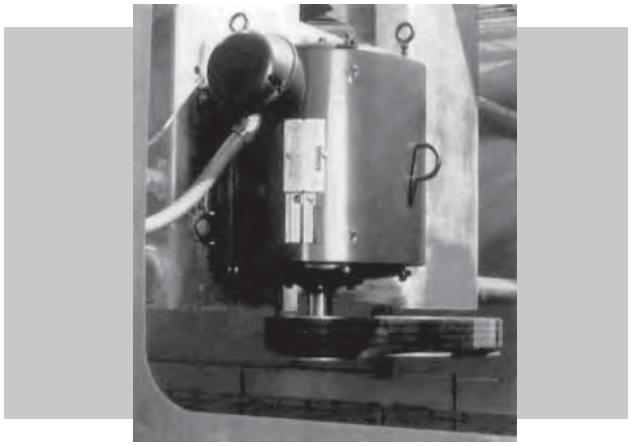
OTHER COMPONENTS, OUR DETAILED COMMITMENT TO QUALITY

From our stainless steel sump suction strainers to our rigid, corrosion-free PVC air inlet louvers and eliminators, to our industry best, clog-reducing nozzles, Imeco's commitment to quality is evident in every component we use.

Further, we measure and test the quality and performance of your completely assembled evaporative fluid cooler in our factory. Unlike other manufacturers, we run test the fan, fan drive, and water distribution system of your IDFC series evaporative fluid cooler.

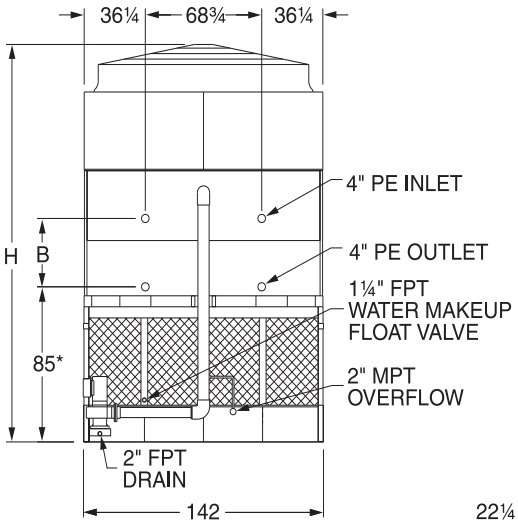
Your evaporative fluid cooler installation is expected to last. The fluid cooler produces a visible reflection on the quality of the installation and the condition of the facility for many years after it is put into operation. With this in mind, we've designed the IDFC series to offer you maximum reliability and durability.

Best built, most rigorously tested, designed to provide long term reliability and value... the Imeco IDFC Series Induced Draft fluid cooler .... your standard for evaporative fluid cooler quality.



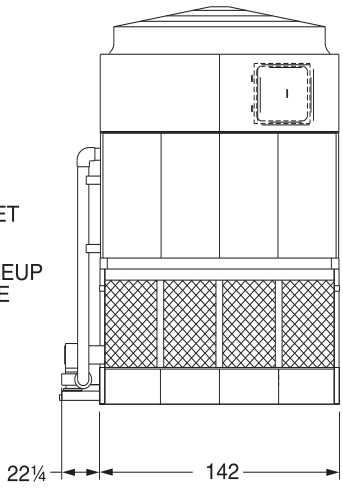
IDFC SERIES ENGINEERING DATA

END VIEW

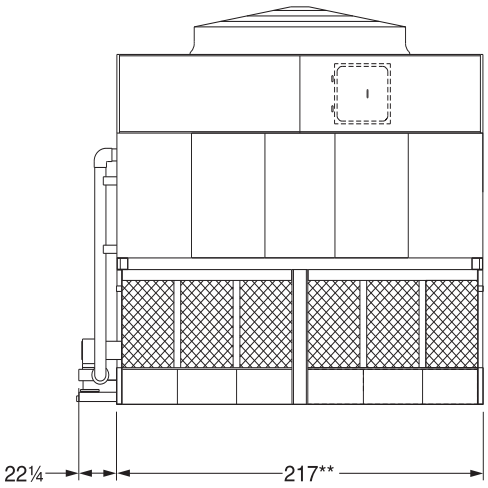


* 97 for 870 – 990

IDFC 420 – 540



IDFC 575 – 990



** 245 for 870 – 990

IDFC Model	CFM	Fan Motor HP (1)	Spray Water GPM (2)	Pump Motor HP (2)	Remote Sump			Dimensions		Tube Coil Weights			HTR kW
					Water In	Sump Drain	Gal.(3) Req'd	Height H	Ctrs B	Unit (4) Ship'g	Unit (5) Operat'g	Heaviest Section	
420	81,300	15	715	5	6" PE	10" PE	600	212	30.25	16,099	22,511	11,957	(2) 6.0
435	84,900	20	715	5	6" PE	10" PE	600	212	30.25	16,199	22,611	12,057	(2) 6.0
450	88,600	25	715	5	6" PE	10" PE	600	212	30.25	16,299	22,711	12,157	(2) 6.0
490	84,600	20	715	5	6" PE	10" PE	600	219	37.50	18,196	24,829	14,054	(2) 6.0
505	87,300	25	715	5	6" PE	10" PE	600	219	37.50	18,296	24,929	14,154	(2) 6.0
520	82,100	25	715	5	6" PE	10" PE	600	225	44.25	20,262	27,117	16,192	(2) 6.0
540	87,300	30	715	5	6" PE	10" PE	600	225	44.25	20,362	27,217	19,292	(2) 6.0
575	105,300	15	1,050	7.5	6" PE	10" PE	900	212	30.25	24,173	33,800	17,953	(2) 9.0
615	115,800	20	1,050	7.5	6" PE	10" PE	900	212	30.25	24,273	33,900	18,053	(2) 9.0
645	124,800	25	1,050	7.5	6" PE	10" PE	900	212	30.25	24,375	34,000	18,153	(2) 9.0
670	132,600	30	1,050	7.5	6" PE	10" PE	900	212	30.25	24,473	34,100	18,253	(2) 9.0
700	117,000	20	1,050	7.5	6" PE	10" PE	900	219	37.50	27,322	37,281	21,102	(2) 9.0
735	125,800	25	1,050	7.5	6" PE	10" PE	900	219	37.50	27,422	37,381	21,202	(2) 9.0
765	133,800	30	1,050	7.5	6" PE	10" PE	900	219	37.50	27,522	37,481	21,302	(2) 9.0
800	127,400	30	1,050	7.5	6" PE	10" PE	900	225	44.25	30,423	40,716	24,313	(2) 9.0
835	133,800	40	1,050	7.5	6" PE	10" PE	900	225	44.25	30,523	40,816	24,413	(2) 9.0
870	153,000	40	1,050	7.5	6" PE	10" PE	900	229	48.25	32,222	44,065	24,183	(2) 12.0
895	141,700	30	1,050	7.5	6" PE	10" PE	900	237	56.00	35,123	47,300	27,833	(2) 12.0
940	153,000	40	1,050	7.5	6" PE	10" PE	900	237	56.00	35,243	47,420	27,953	(2) 12.0
955	164,140	50	1,050	7.5	6" PE	10" PE	900	237	56.00	35,343	47,520	28,013	(2) 12.0
990	164,140	50	1,100	10	6" PE	10" PE	900	237	56.00	35,343	47,520	28,013	(2) 12.0

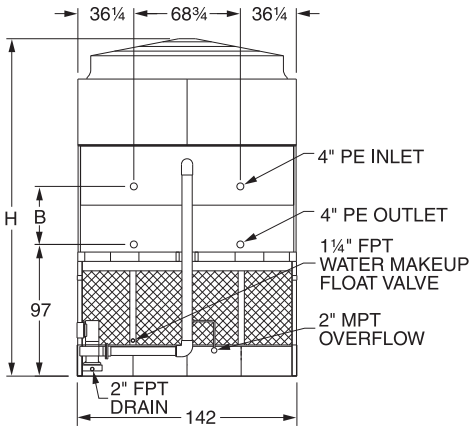
1. Fan motor HP is for free air delivery with 0" external static pressure.
2. Remote units are supplied less water-circulating pump(s), float valve(s), and related piping.
3. Values account for water in unit and piping–remote sump must also be sized for volume in field-erected spray distribution supply and drain pipes.
4. Shipping weights include water-circulating pumps.
5. Operating weights include water-circulating pump, water in the coils, and normal water operating level in the sump.

All data in this catalog is subject to change without notice.

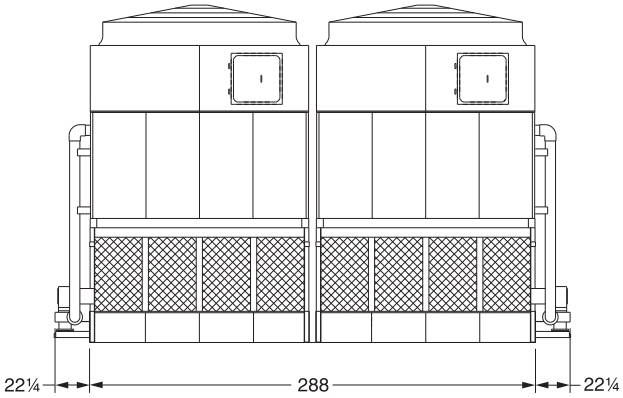
Do not use for construction–product drawings available on request.

ATTACHMENT 4
EFC/IDFC EVAPORATIVE FLUID COOLERS
ENGINEERING DATA

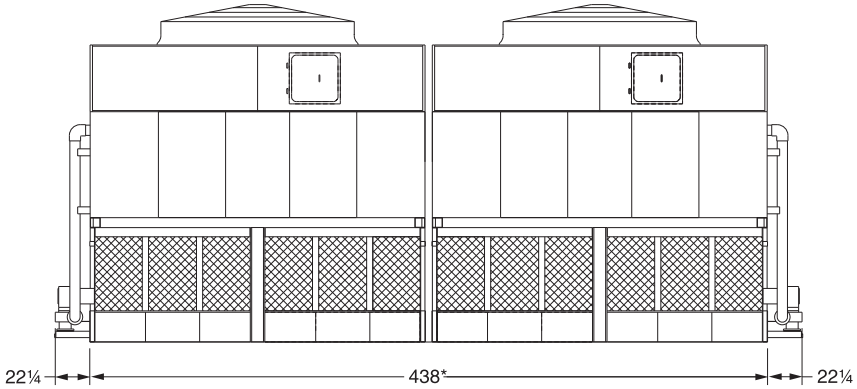
END VIEW



IDFC 840-2E – 1080-2E



IDFC 1150-2E – 1980-2E



* 494 for 1740-2E – 1980-2E

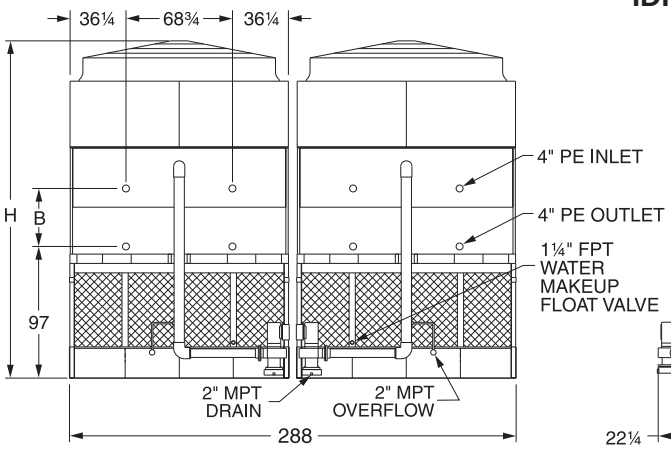
IDFC Model	CFM	Fan Motor HP (1)	Spray Water GPM (2)	Pump Motor HP (2)	Remote Sump Water In	Remote Sump Sump Drain	Remote Sump Gal.(3) Req'd	Dimensions Height H	Dimensions Ctrs B	Tube Coil Weights Unit (4) Ship'g	Tube Coil Weights Unit (5) Operat'g	Tube Coil Weights Heaviest Section	HTR kW
840-2E	162,600	(2)15	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	224	30.25	32,198	45,022	(2)11,957	(2) 6.0
870-2E	169,800	(2)20	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	224	30.25	32,398	45,222	(2)12,057	(2) 6.0
900-2E	177,200	(2)25	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	224	30.25	32,598	45,422	(2)12,157	(2) 6.0
980-2E	169,200	(2)20	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	231	37.50	36,392	49,658	(2)14,054	(2) 6.0
1010-2E	174,600	(2)25	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	231	37.50	36,592	49,858	(2)14,154	(2) 6.0
1040-2E	164,200	(2)25	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	237	44.25	40,524	54,234	(2)16,192	(2) 6.0
1080-2E	174,600	(2)30	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	237	44.25	40,724	54,434	(2)19,292	(2) 6.0
1150-2E	210,600	(2)15	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	224	30.25	48,346	67,600	(2)17,953	(2) 9.0
1230-2E	231,600	(2)20	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	224	30.25	48,546	67,800	(2)18,053	(2) 9.0
1290-2E	249,600	(2)25	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	224	30.25	48,750	68,000	(2)18,153	(2) 9.0
1340-2E	265,200	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	224	30.25	48,946	68,200	(2)18,253	(2) 9.0
1400-2E	234,000	(2)20	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	231	37.50	54,644	74,562	(2)21,102	(2) 9.0
1470-2E	251,600	(2)25	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	231	37.50	54,844	74,762	(2)21,202	(2) 9.0
1530-2E	267,600	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	231	37.50	55,044	74,962	(2)21,302	(2) 9.0
1600-2E	254,800	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	237	44.25	60,846	81,432	(2)24,313	(2) 9.0
1670-2E	267,600	(2)40	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	237	44.25	61,046	81,632	(2)24,413	(2) 9.0
1740-2E	306,000	(2)40	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	242	48.25	64,444	88,130	(2)24,183	(2) 12.0
1790-2E	283,400	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	249	56.00	70,246	94,600	(2)27,833	(2) 12.0
1880-2E	306,000	(2)40	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	249	56.00	70,486	94,840	(2)27,953	(2) 12.0
1910-2E	328,280	(2)50	2,100	(2)7.5	(2)6" PE	(2)10" P	1,800	249	56.00	70,665	95,019	(2)28,013	(4) 12.0
1980-2E	328,280	(2)50	2,200	(2)10	(2)6" PE	(2)10" P	1,800	249	56.00	70,686	95,040	(2)28,013	(4) 12.0

1. Fan motor HP is for free air delivery with 0" external static pressure.
2. Remote units are supplied less water-circulating pump(s), float valve(s), and related piping.
3. Values account for water in unit and piping–remote sump must also be sized for volume in field-erected spray distribution supply and drain pipes.
4. Shipping weights include water-circulating pumps.
5. Operating weights include water-circulating pump, water in the coils, and normal water operating level in the sump.

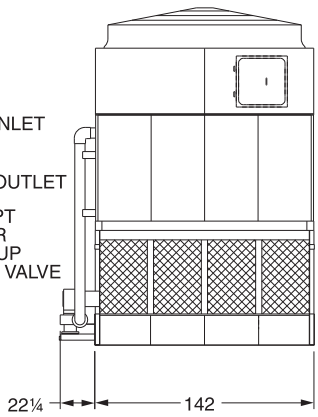
All data in this catalog is subject to change without notice.

Do not use for construction–product drawings available on request.

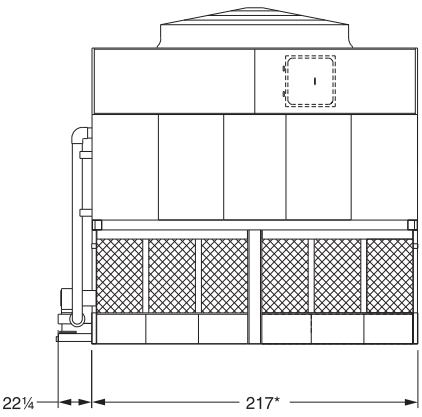
END VIEW



IDFC 840-2S – 1080-2S



IDFC 1120-2S – 1920-2S



* 245 for 1690-2S – 1920-2S

IDFC Model	CFM	Fan Motor HP (1)	Spray Water GPM (2)	Pump Motor HP (2)	Remote Sump Water In	Remote Sump Sump Drain	Remote Sump Gal.(3) Req'd	Dimensions Height H	Dimensions Ctrs B	Tube Coil Weights Unit (4) Ship'g	Tube Coil Weights Unit (5) Operat'g	Tube Coil Weights Heaviest Section	HTR kW
840-2S	162,600	(2)15	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	224	30.25	32,198	45,022	(2)11,957	(2) 6.0
870-2S	169,800	(2)20	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	224	30.25	32,398	45,222	(2)12,057	(2) 6.0
900-2S	177,200	(2)25	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	224	30.25	32,598	45,422	(2)12,157	(2) 6.0
980-2S	169,200	(2)20	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	231	37.50	36,392	49,658	(2)14,054	(2) 6.0
1010-2S	174,600	(2)25	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	231	37.50	36,592	49,858	(2)14,154	(2) 6.0
1040-2S	164,200	(2)25	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	237	44.25	40,524	54,234	(2)16,192	(2) 6.0
1080-2S	174,600	(2)30	1,430	(2)5	(2)6" PE	(2)10" PE	1,200	237	44.25	40,724	54,434	(2)19,292	(2) 6.0
1120-2S	200,070	(2)15	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	224	30.25	48,346	67,600	(2)17,953	(2) 9.0
1200-2S	220,020	(2)20	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	224	30.25	48,546	67,800	(2)18,053	(2) 9.0
1260-2S	237,120	(2)25	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	224	30.25	48,750	68,000	(2)18,153	(2) 9.0
1300-2S	251,940	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	224	30.25	48,946	68,200	(2)18,253	(2) 9.0
1360-2S	222,300	(2)20	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	231	37.50	54,644	74,562	(2)21,102	(2) 9.0
1430-2S	239,020	(2)25	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	231	37.50	54,844	74,762	(2)21,202	(2) 9.0
1490-2S	254,220	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	231	37.50	55,044	74,962	(2)21,302	(2) 9.0
1560-2S	242,060	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	237	44.25	60,846	81,432	(2)24,313	(2) 9.0
1620-2S	254,220	(2)40	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	237	44.25	61,046	81,632	(2)24,413	(2) 9.0
1690-2S	281,520	(2)40	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	242	48.25	64,444	88,130	(2)24,183	(2) 12.0
1740-2S	260,730	(2)30	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	249	56.00	70,246	94,600	(2)27,833	(2) 12.0
1810-2S	281,520	(2)40	2,100	(2)7.5	(2)6" PE	(2)10" PE	1,800	249	56.00	70,486	94,840	(2)27,953	(2) 12.0
1840-2S	302,020	(2)50	2,100	(2)7.5	(2)6" PE	(2)10" P	1,800	249	56.00	70,665	95,019	(2)28,013	(4) 12.0
1920-2S	302,020	(2)50	2,200	(2)10	(2)6" PE	(2)10" P	1,800	249	56.00	70,686	95,040	(2)28,013	(4) 12.0

1. Fan motor HP is for free air delivery with 0" external static pressure.
2. Remote units are supplied less water-circulating pump(s), float valve(s), and related piping.
3. Values account for water in unit and piping–remote sump must also be sized for volume in field-erected spray distribution supply and drain pipes.
4. Shipping weights include water-circulating pumps.
5. Operating weights include water-circulating pump, water in the coils, and normal water operating level in the sump.

All data in this catalog is subject to change without notice.

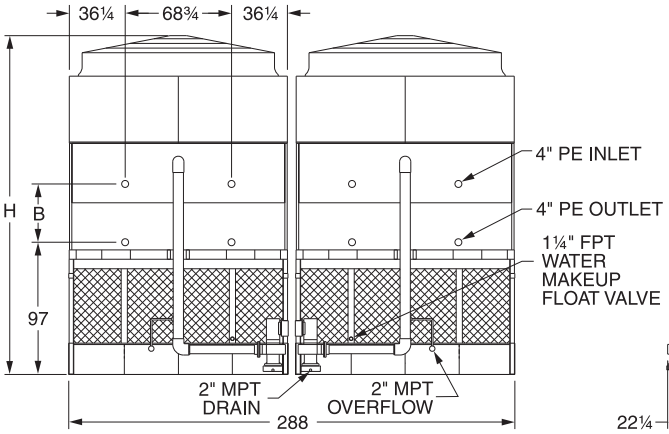
Do not use for construction–product drawings available on request.

ATTACHMENT 4

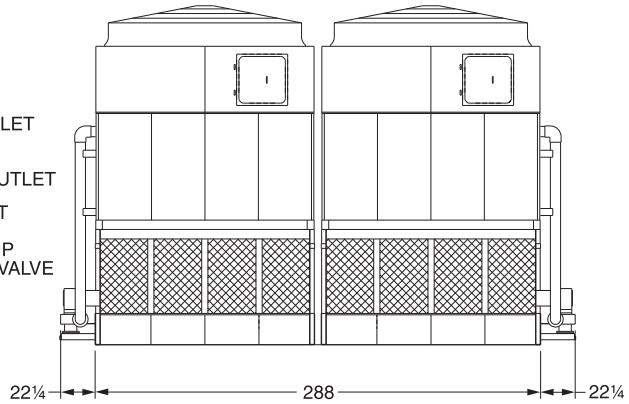
EFC/IDFC EVAPORATIVE FLUID COOLERS
ENGINEERING DATA

Johnson Controls

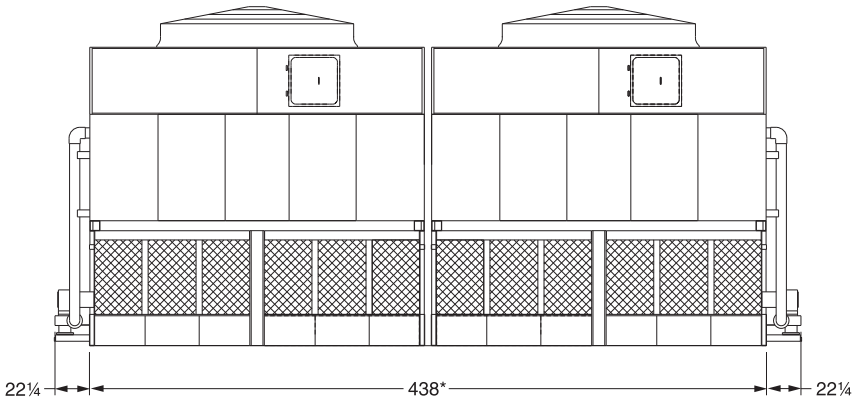
END VIEW



IDFC 1620-4Q – 2080-4Q



IDFC 2190-4Q – 3740-4Q



* 494 for 3270-4Q – 3740-4Q

IDFC Model	CFM	Fan Motor HP (1)	Spray Water GPM (2)	Pump Motor HP (2)	Remote Sump Water In	Remote Sump Sump Drain	Remote Sump Gal.(3) Req'd	Dimensions Height H	Dimensions Ctrs B	Tube Coil Weights Unit (4) Ship'g	Tube Coil Weights Unit (5) Operat'g	Tube Coil Weights Heaviest Section	HTR kW
1620-4Q	305,690	(4)15	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	224	30.25	64,396	90,044	(4)11,957	(4) 6.0
1670-4Q	319,230	(4)20	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	224	30.25	64,796	90,444	(4)12,057	(4) 6.0
1730-4Q	333,140	(4)25	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	224	30.25	65,196	90,844	(4)12,157	(4) 6.0
1880-4Q	318,100	(4)20	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	231	37.50	72,784	99,316	(4)14,054	(4) 6.0
1940-4Q	328,250	(4)25	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	231	37.50	73,184	99,716	(4)14,154	(4) 6.0
2000-4Q	308,700	(4)25	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	237	44.25	81,048	108,468	(4)16,192	(4) 6.0
2080-4Q	328,250	(4)30	2,860	(4)5	(4)6" PE	(4)10" PE	2,400	237	44.25	81,448	108,868	(4)19,292	(4) 6.0
2190-4Q	395,930	(4)15	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	224	30.25	96,692	135,200	(4)17,953	(4) 9.0
2340-4Q	435,410	(4)20	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	224	30.25	97,092	135,600	(4)18,053	(4) 9.0
2450-4Q	469,250	(4)25	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	224	30.25	97,500	136,000	(4)18,153	(4) 9.0
2550-4Q	498,580	(4)30	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	224	30.25	97,892	136,400	(4)18,253	(4) 9.0
2660-4Q	439,920	(4)20	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	231	37.50	109,288	149,124	(4)21,102	(4) 9.0
2790-4Q	473,010	(4)25	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	231	37.50	109,688	149,524	(4)21,202	(4) 9.0
2910-4Q	503,090	(4)30	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	231	37.50	110,088	149,924	(4)21,302	(4) 9.0
3040-4Q	479,030	(4)30	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	237	44.25	121,692	162,864	(4)24,313	(4) 9.0
3170-4Q	503,090	(4)40	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	237	44.25	122,092	163,264	(4)24,413	(4) 9.0
3270-4Q	575,280	(4)40	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	242	48.25	128,888	176,260	(4)24,183	(4) 12.0
3370-4Q	532,800	(4)30	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	249	56.00	140,492	189,200	(4)27,833	(4) 12.0
3540-4Q	575,280	(4)40	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	249	56.00	140,972	189,680	(4)27,953	(4) 12.0
3610-4Q	620,500	(4)50	4,200	(4)7.5	(4)6" PE	(4)10" PE	3,600	249	56.00	141,330	190,038	(4)28,013	(8) 12.0
3740-4Q	620,500	(4)50	4,400	(4)10	(4)6" PE	(4)10" PE	3,600	249	56.00	141,372	190,080	(4)28,013	(8) 12.0

1. Fan motor HP is for free air delivery with 0" external static pressure.
2. Remote units are supplied less water-circulating pump(s), float valve(s), and related piping.
3. Values account for water in unit and piping–remote sump must also be sized for volume in field-erected spray distribution supply and drain pipes.
4. Shipping weights include water-circulating pumps.
5. Operating weights include water-circulating pump, water in the coils, and normal water operating level in the sump.

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IDFC OPTIONAL EQUIPMENT

HOT DIP GALVANIZED AFTER FABRICATION
Johnson Controls stands alone in offering the premium corrosion protection of *Hot Dip Galvanized After Fabrication*. As an option, all casing components and fan sections can be galvanized after fabrication. This provides maximum corrosion protection for all components.

FAN LEVEL HANDRAIL
A handrail, designed to surround the top of the unit, can be provided as a safety measure when it is necessary to access the fan or the motor from atop the IDFC series fluid cooler.

JIB BOOM ASSIST FOR OVERHEAD MOTOR ACCESS
The induced draft design of the IDFC requires that the motor be located at the top of the unit. Given the motor size and weight, a jib boom assist is offered to swing the motor from its mounted position up and out over the fluid cooler installations. A single jib boom can be provided, attached, and removed to service all of the fluid coolers.

CAPACITY CONTROL ALTERNATIVES (TWO-SPEED MOTORS AND VARIABLE FREQUENCY DRIVES)
For energy savings and capacity control, we offer alternatives to the conventional single-stage cycling of the IDFC motors.

Through the application of an optional two-speed motor, we can provide 100% full rated capacity (fan on - high speed), 60% capacity (fan on - low speed), or 10% capacity (fan off) in a controlled sequence of operation, based on load conditions.

Alternatively, through the application of our optional variable frequency drives and optional heavy-duty VFD motors, fluid cooler fan operation can be controlled through an infinite number of steps of motor capacity.

MULTICIRCUITED COILS
Fluid cooler coils can be divided into multiple circuits to satisfy most system requirements.

ELECTRIC WATER LEVEL CONTROL
Where close control of the integral basin water level is required, we can provide an electric water level control system consisting of a weather-protected electric float switch and a weather-protected solenoid valve factory wired to a NEMA 4 junction box.

PAN WATER HEATERS
Stainless steel, sheath-type electric immersion heaters can be provided to supply sufficient heat to the integral basin to prevent freeze-up of basin water. Thermostatically controlled, the heater includes a low-water-level cutout switch that prevents heater operation with insufficient water in the basin.

SOLID-STATE VIBRATION CUTOUT SWITCH
One NEMA 4 solid-state vibration cutout switch for each fan motor of unit. Switch is designed to operate on 120-1-60 voltage. Each switch is furnished with one trip for alarm or shutdown. Vibration cutout switch(es) is shipped loose with unit(s) and requires field installation on unit(s).

MECHANICAL VIBRATION CUTOUT SWITCH
One NEMA 4 weatherproof mechanical vibration cutout switch for each fan motor of unit. Vibration cutout switch is shipped loose with unit(s) and requires field installation on unit(s).

SERVICE PLATFORM
A platform may be cantilevered from the unit providing service access to the spray headers and mist eliminators.

VIBRATION ISOLATORS
Where building codes require vibration isolation, spring-type vibration isolators, with or without rails, can be furnished to properly isolate the equipment from the mounting structure.

COIL CONNECTIONS
Evaporative fluid coolers can be supplied with MPT, Victaulic groove, flanged, or copper sweat coil connections when required.

Contact your local sales representative or the factory for complete details.

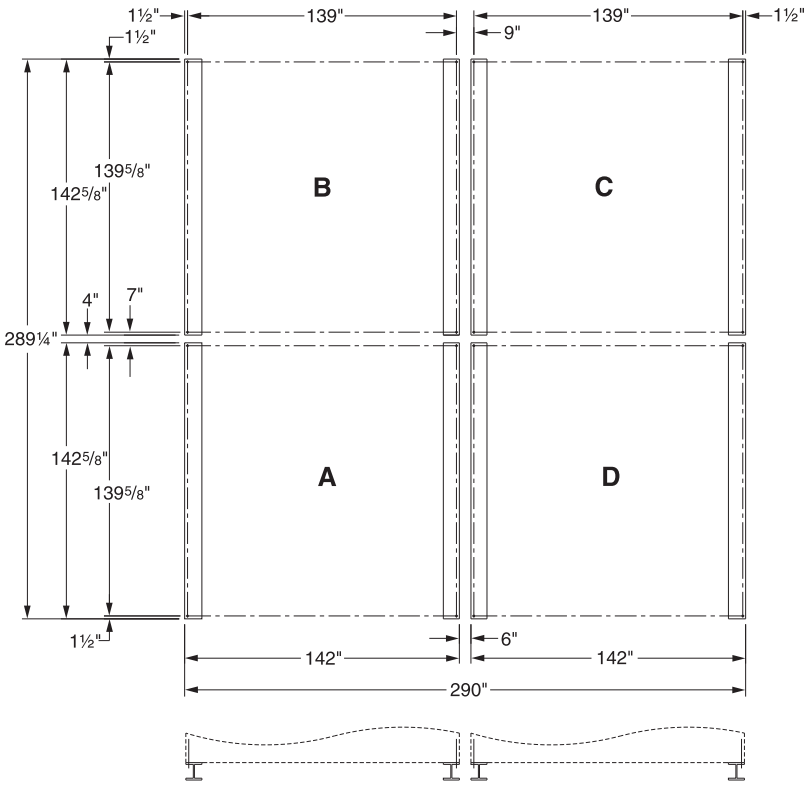
CONTROL PANEL
To minimize design engineering and field wiring, single-point electrical connections are offered with all the necessary components in a control panel. Panels include: main disconnect(s), individual fusing of all major components, motor starters with 3-phase overload protection, 120 volt single-phase control voltage transformer, Hand-Off-Auto switch for both manual and automatic startups, terminal strip with custom wiring for stage controllers, and a NEMA-4 enclosure.

Contact your local sales representative or the factory for your specific design applications.

ATTACHMENT 4

EFC/IDFC EVAPORATIVE FLUID COOLERS
DIMENSIONS

IDFC PLATFORM LAYOUT

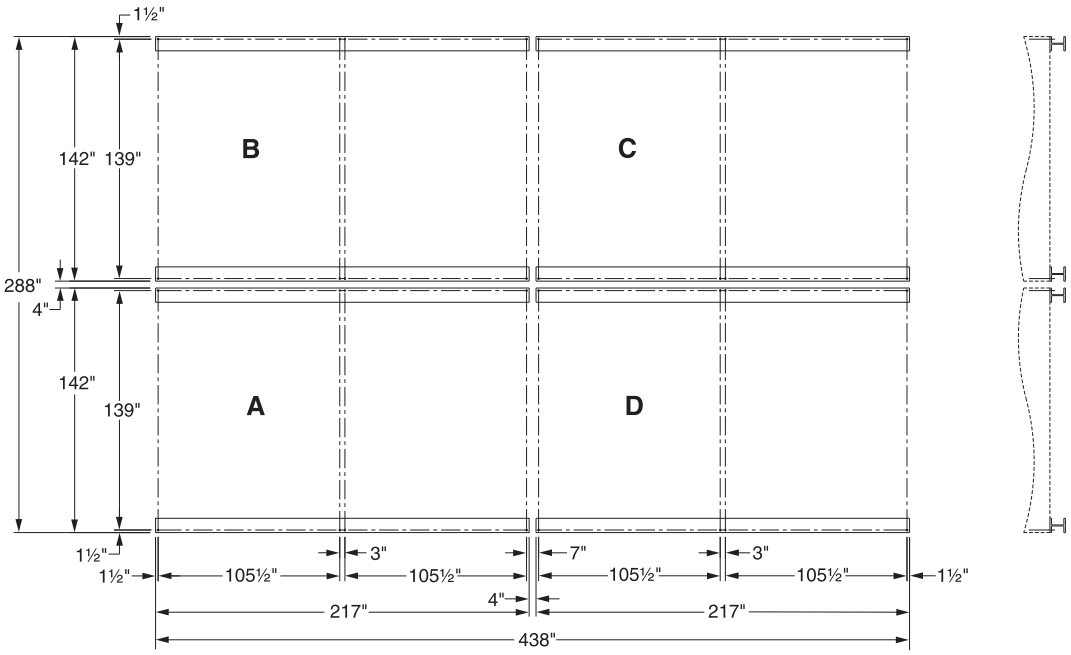


IDFC 420 – 540; 840-2E – 1080-2E; 840-2S – 1080-2S; 1620-4Q – 2080-4Q

MODEL	APPLICABLE CELLS	OVERALL	
		LENGTH	WIDTH
420 – 540	**A**	142-5/8"	142"
840-2S – 1080-2S	**A D**	142-5/8"	290"
840-2E – 1080-2E	**A B**	289-1/4"	142"
1620-4Q – 2080-4Q	**A B C D**	289-1/4"	290"

Do not use for construction purposes - detailed drawings available on request.
Dimensions are in inches.

IDFC PLATFORM LAYOUT



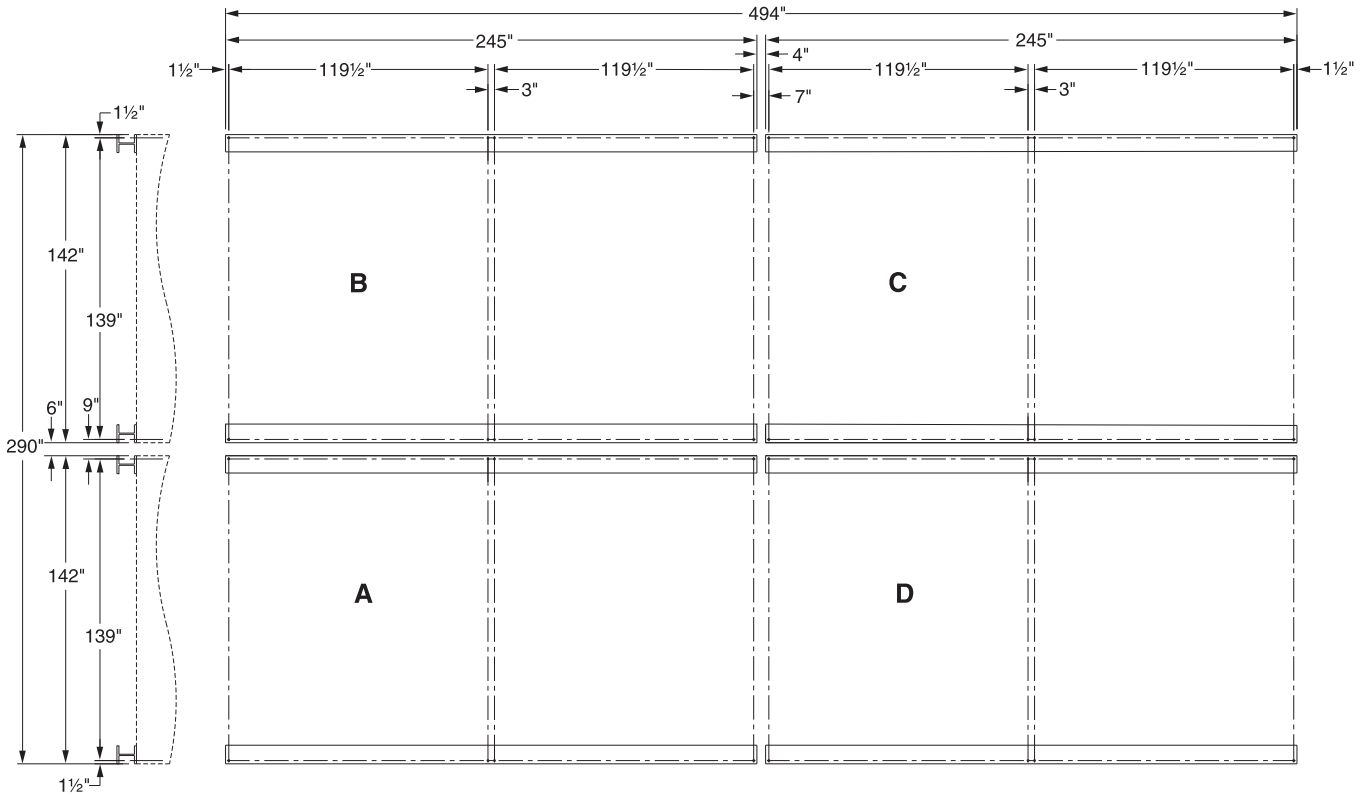
IDFC 575 – 835; 1150-2E – 1670-2E; 1120-2S – 1620-2S; 2190-4Q – 3170-4Q

MODEL	APPLICABLE CELLS	OVERALL	
		LENGTH	WIDTH
575 – 835	**A**	217"	142"
1120-2S – 1620-2S	**A B**	217"	288"
1150-2E – 1670-2E	**A D**	438"	142"
2190-4Q – 3170-4Q	**A B C D**	438"	288"

Do not use for construction purposes - detailed drawings available on request.
Dimensions are in inches.

ATTACHMENT 4
EFC/IDFC EVAPORATIVE FLUID COOLERS
DIMENSIONS

IDFC PLATFORM LAYOUT



IDFC 870 – 990; 1740-2E – 1980-2E; 1690-2S – 1920-2S; 3270-4Q – 3740-4Q

MODEL	APPLICABLE CELLS	OVERALL	
		LENGTH	WIDTH
870 – 990	**A**	245"	142"
1690-2S – 1920-2S	**A B**	245"	290"
1740-2E – 1980-2E	**A D**	494"	142"
3270-4Q – 3740-4Q	**A B C D**	494"	290"

Do not use for construction purposes - detailed drawings available on request.
Dimensions are in inches.

Form Form 440.10-SED1 (MAY08)
Supersedes: E140-700 SED (DEC01)
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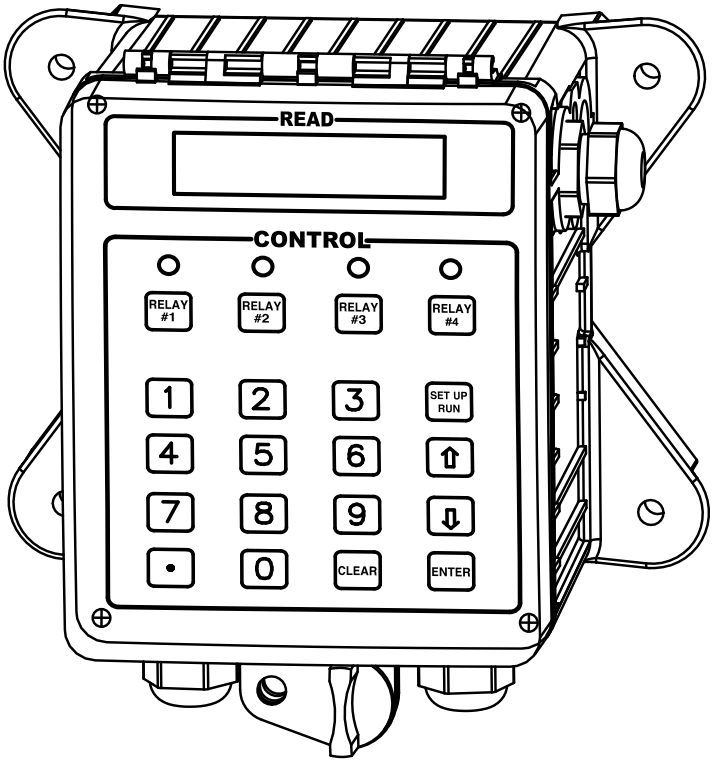
Dixon, IL 61021
Phone: 815-2898-3859 • FAX: 815-288-1665
www.johnsoncontrols.com

ATTACHMENT 4

Advantage Controls — *Manual*

MicroTron
Tower Controller

Installation
Maintenance
Repair
Manual



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email: support@advantagecontrols.com

5/09

ATTACHMENT 4

MicroTron Tower Controller
Instruction & Maintenance Manual
Table of Contents

Instructions herein apply to all MicroTron tower controllers. Additional options described in this manual may or may not be present on your unit. Refer to Model Numbering on Page 3.

ATTACHMENT 4

I. Introduction

MicroTron controllers are microprocessor based menu driven units for control of recirculating and other water applications. All settings are entered into the controller through a simple front panel keypad which includes relay test keys.

Model Numbering

MicroTron controllers have several base functions and optional features available. Your unit may be supplied with one or more of the options that are described in this manual. To determine what features apply to your unit, check the model number label located on the controller enclosure.

Base Functions

All model numbers can be broken down as follows and will start with an **M** or **L**.

M	MicroTron with a VFD display
L	MicroTron with an LCD display
C	Conductivity Control
C-0	Conductivity Monitor only
C-2	Adds make-up conductivity function
F	Single programmable feed timer
F-2	Dual feed timers
F-3	Triple feed timers
F-4	Quadruple feed timers
F-5	Five feed timers
B	Single 28 day timer
B-2	Dual 28 day timers
B-3	Triple 28 day timers
B-4	Quadruple 28 day timers
P	pH control
P-0	pH monitor only
P-2	pH control with dual set points
R	ORP control

Optional Features

This list represents our most popular options.

A	Conduit connections
A-6	On/Off power switch
A-7	Lower enclosure
C-1	0-5V non-isolated output
C-4	Single 4-20mA non-isolated output
C-6	Single isolated 4-20mA output
D	220 V service (conduit only)
E	Mounted flow switch assembly
M	Alarm relay options
M-1S	Sonic alarm buzzer with silence switch
N	Non standard conductivity scales
Q	Alternate electrodes
R	Molex connector on conductivity electrode
V	Digital input for bleed-off water meter
W	Power relay 1.5 HP max, 25 amps
X	Tank low level alarms
Y	Bleed flow alarm (requires flow switch)
Z-6	One water meter input for each chemical feed timer
Z-11	Lockout chem feed with low conductivity alarm
9	Paddle wheel flowmeter input

Note: The list of functions and options represents past and current offerings.
Some of these may no longer be available on new units, but are listed for reference.

II. Description

Control Functions

Each of the control functions is based on an analog input from a probe and will include user settable relay control settings along with a High and Low Alarm setting and Limit Timer. Each control function will include a control relay output. When the reading reaches the Set Point the control relay is activated until the reading changes by the Differential amount.

1. **Conductivity** - The conductivity function of the controller is designed to monitor and control Total Dissolved Solids (TDS) in a recirculating system like a cooling tower in terms of electrical conductivity measured in MicroSiemens/cm. This control function is also referred to as bleed. Units with conductivity and the make-up conductivity function can control the TDS of the tower system to a cycles of concentration by calculating the difference between the incoming make-up water's conductivity and the system's conductivity

2. **pH** - The pH function monitors and controls pH on a scale of 0-14 pH units.

3. **ORP** - The ORP function monitors and controls ORP on a scale of +/- 999 mV.

Chemical Feed Timers

Selectable Chemical feed timers (base function F) are designed to automate the addition of various chemicals by activating a relay output. Multiple timers can be supplied depending upon the model number and each timer will include a relay output. All timers can be programmed to be one of the following types.

1. **Pulse Time** - This timer accepts dry contact pulses from a make-up water meter (supplied separately). It can accumulate 1-99 pulses to activate the timer to run from 0-99 minutes in minutes and seconds.

2. **Feed with Bleed** - This timer activates the relay output simultaneously with the bleed. The timer can limit the amount of time the relay output will be on during the bleed cycle, thereby preventing chemical overfeed.

3. **Feed after Bleed** - This timer activates the relay output based on a user defined percentage of the bleed off time. The relay is activated after a bleed cycle and runs for the set percentage of that bleed cycle. A limit time can also be set for the maximum amount of time the timer can run for one cycle.

4. **Percentage** - The relay is on for a percentage of a continuously repeating cycle time. The percentage timer can be set from 1 to 99% and the cycle time can be set from 1 second to 99 minutes and 59 seconds.

28-Day Feed Timers

28-day feed timers, typically used for biocide feed are based on a 28 day cycle with two independent programmable feed cycles allowing for feed on selectable days and weeks. The biocide timers also include prebleed and bleed lockout settings. Multiple timers can be supplied depending upon the model number and each timer will include a relay output.

III. Installation

Electrical Wiring

The standard MicroTron Tower controller has an internal regulated power supply that will operate in the range of approximately 100 to 240 VAC on the incoming wiring. Output relay(s) are protected with a replaceable fuse. Each relay's output voltage will equal incoming line voltage.

Prewired units are supplied with a 16 AWG cable with 3-wire grounded USA 115 volt plug for incoming power and 18 AWG 3-wire grounded U.S.A. 120 volt receptacle cords for all control relay outputs.

Conduit units are supplied with connectors located in the lower section of the controller. Remove the screws of the lower panel for access and to view wiring diagram.

NOTE: Liquid tight fittings and labeled signal lead cables are provided for all signal (low voltage) connections, such as water meter, low drum level, flow switch and 4-20mA outputs.

⚠ **WARNINGS:**

1. The controller should be connected to its own isolated circuit breaker, and for best results, the ground should be a true earth ground, not shared. Wiring must be done according to all applicable local codes.

2. Power (line voltage) must be disconnected while making any connections. If power is supplied to the unit, line voltage will be present on the relay cards.

3. Low voltage signal wires (probes, flow switch, water meter, etc.) should never be run in conduit with high voltage wires.

NOTE: Liquid tight fittings and some labeled signal leads are provided for all signal (low voltage) connections for both pre-wired and conduit units.

Mounting Instructions

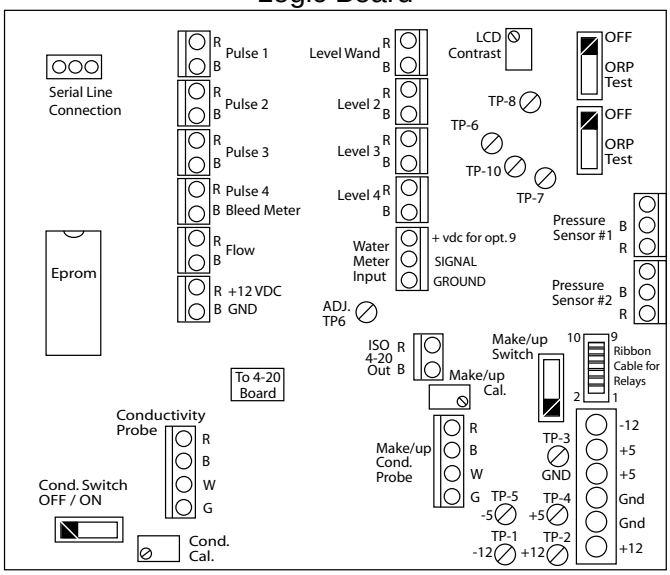
Select a mounting location that provides the operator easy access to the unit and a clear view of the controls through the cover of the controller. The location should be convenient to grounded electrical connections, the required sample line plumbing, and installed on a stable vertical surface.

⚠ **WARNINGS:**

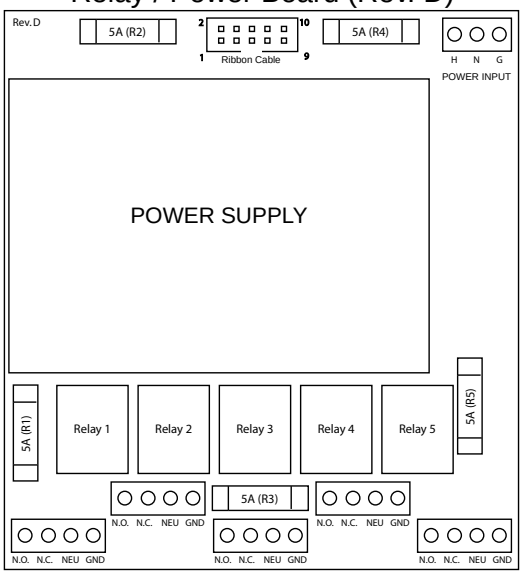
Avoid locations that expose the controller to direct sunlight, vapors, vibration, liquid spills or extreme temperatures; less than 0°F (-17.8°C) or greater than 120°F (50°C). EMI(electromagnetic interference) from radio transmissions and electric motors can also cause damage or interference and should be avoided.

ATTACHMENT 4
Conduit Layout for LCD Display

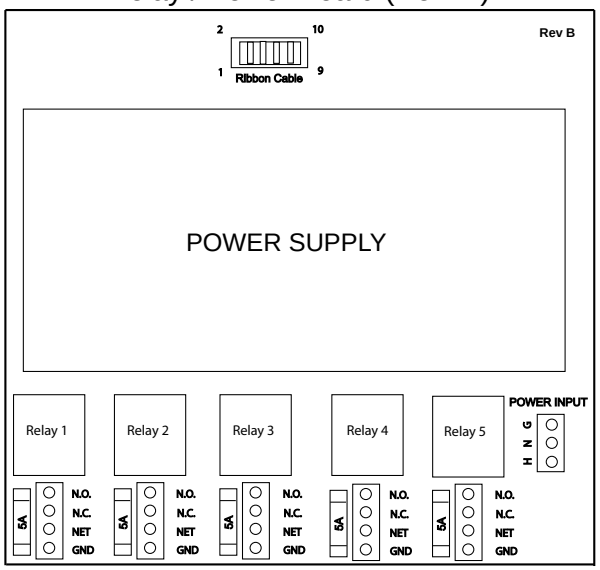
Logic Board



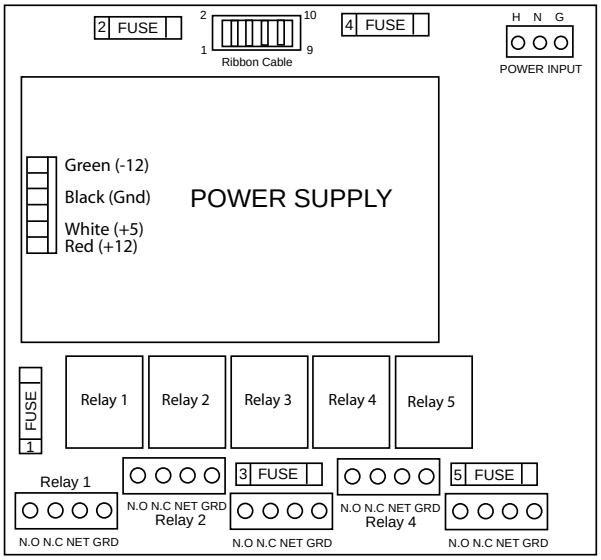
Relay / Power Board (Rev. D)



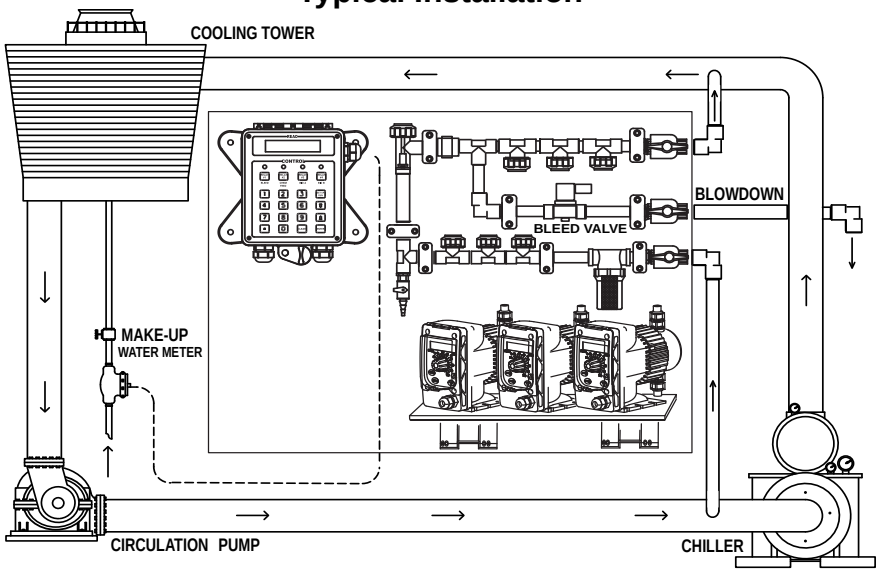
Relay / Power Board (Rev. B)



Relay / Power Board (Rev. C)



Typical Installation



ATTACHMENT 4

Electrode Installation

MicroTron tower controllers may come configured for various recirculating water systems. Listed below are instructions for typical cooling tower installations. Your specific installation requirements may differ but should conform to these instructions as much as possible for proper operation.

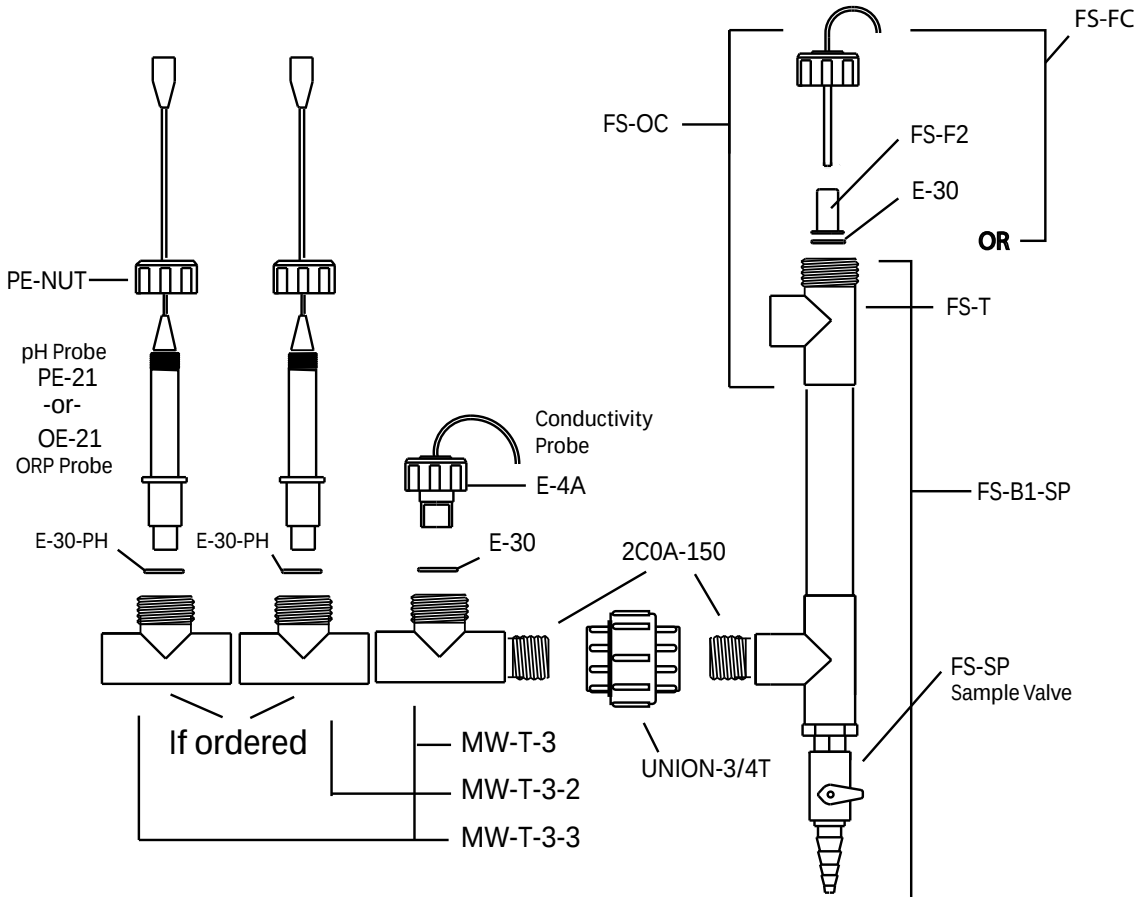
The standard probe(s) and/or flow assembly for cooling tower installations is constructed of schedule 80 PVC and supplied with ¾" slip fittings for installing into a sample line. To insure proper operation the sample line must have a flow rate of 3-10 gpm. Inlet pressure must be higher than outlet pressure in order for water to flow past the electrode(s) at the required rate. The probes are temperature compensated for increased accuracy.

NOTES:

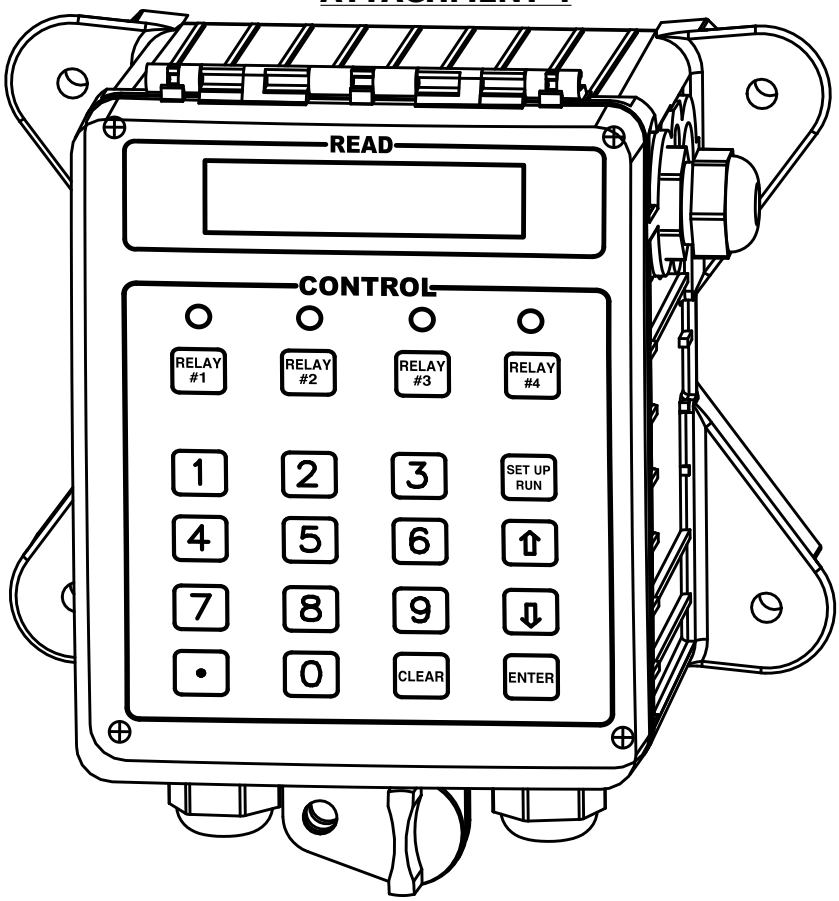
1. **Install an isolation valve on either side of the flow assembly so electrodes can be easily isolated for removal and cleaning.**
2. **A line strainer is recommended upstream from the probes to protect against fouling and damage.**
3. **Mount pH electrodes vertically.**
4. **Units with a flow switch require the needed flow rate to operate the relay outputs.**
5. **Tap points for sample line should not be at the top or bottom of the supply piping to reduce air or debris introduction to sample line.**

WARNINGS:

1. **Electrodes are O-ring sealed, which if damaged will cause a leak.**
2. **Do not allow pH sensor tips to dry out, damage will occur.**
3. **Do not exceed a water temperature range of 32°F to 140°F.**
4. **Do not exceed a maximum pressure of 150 psi.**



ATTACHMENT 4



IV. Front Panel Description

READ: 1x16 (1/4") Alpha Numeric Display.

CONTROL: Relay 1, Relay 2, Relay 3, Relay 4 - HOA switches for control relays.

SET UP RUN **SET UP/RUN key** - System initializes into RUN mode. Press this switch to toggle the controller from SET UP mode to RUN mode.

UP/DOWN arrows - Used to change the display from one line to the next. All menus are circular, so when all items in a menu have been displayed, the display will return to the originally displayed item.

ENTER **ENTER key** - Used to access a menu and to log a changed value into the program.

CLEAR **CLEAR key** - Used to clear numerical values from items being changed in the SET UP mode.

• **DECIMAL key** - Used at certain places to change a function or displayed items. For example, when temperature is being displayed, pressing the DECIMAL key will change the reading from Fahrenheit to Celsius or visa versa.

1 **NUMERICAL keys** - Used to enter new values in the SET UP mode.

V. System Operation Overview

MicroTron controllers have two modes of operation, RUN and SET UP. Both the RUN and SET UP menus are circular. Pressing the DOWN key in either menu will display the next line of information on the display. After the last item in a menu has been displayed, pressing the DOWN key will return the display to the top line of that menu.

RUN MODE - This mode is for normal operation. The control relays will only be automatically activated in this mode. In the RUN mode the display will read system values. If an alarm is present the display flashes with the alarm status.

The RUN menu will display values such as conductivity, pH, day, time, date and other values depending upon the features present on the unit. The unit will automatically return to the RUN mode if no keys are pressed for three minutes.

SET UP MODE - This mode is used to make adjustments to settings and readings on the controller. To access the SET UP mode from the RUN screen, press the SETUP/RUN key. Use the up or down arrow to scroll through the various SET UP menus. When you want to enter a specific SET UP menu, press the ENTER key. Once you have entered a SET UP sub menu you will be able to step through that menu's options with the down arrow key.

Relays may be forced on while in the SET UP mode. Press the desired relay test key to force it on. Press it a second time to turn it off. Once the unit returns to the RUN mode, relays will activate automatically.

The relay 4 test key will activate relay 4 on the first press, then will activate relay 5 on the second and will turn both 4 and 5 off on the third**.**

A. Description of SET UP Menu Screens

The SET UP menu is the main menu circle of set up sub-menus used to customize your unit to the particular parameters needed for your installation. Listed on the following pages is a description and menu map of each SET UP menu.

NOTES:

1. Your unit may not have all of the SET UP menus listed depending upon your model number.
2. After you press ENTER or CLEAR to change a numerical value in the SET UP menu, use the number keys to define the new value. Press ENTER again to enter the new value.
3. When entering new numeric values, all available digits (characters) must be entered. The number of available digits depends upon the scale of operation. Position of cursor indicates number of digits to be entered.

   For example, when entering a run time value for a timer in the minute and seconds scale (10:30 would equal 10 minutes and thirty seconds). You would need to key in a number of 0030 to make it 0 (zero) minutes and 30 seconds.

ATTACHMENT 4

1. CALIBRATION

All MicroTron controllers are factory calibrated for temperature, conductivity, pH and/or ORP (if present). These values should be verified for accuracy, and adjusted as per the instructions listed below and to the side.

Calibrating the temperature reading, press SET UP/ RUN button. The “CALIBRATION” screen will appear. Press ENTER and the screen will read “CALIBRATE F”. Press ENTER to log in the new reading. To display the reading in degrees Celsius, press the decimal key.

High Temp Alarm Set - If this is exceeded the Alarm will activate, set to 0 to disable.

Calibrating the Conductivity with the probe in a known solution, select “CALIBRATE uS” from the “CALIBRATION” menu. Press CLEAR, then key in the corrected conductivity value. Press ENTER to log in that reading.

Calibrating the pH with the probe in solution on line. Select “CALIBRATE PH” from the “CALIBRATION” menu. Press CLEAR, then key in the corrected pH value. Press ENTER to log in that reading.

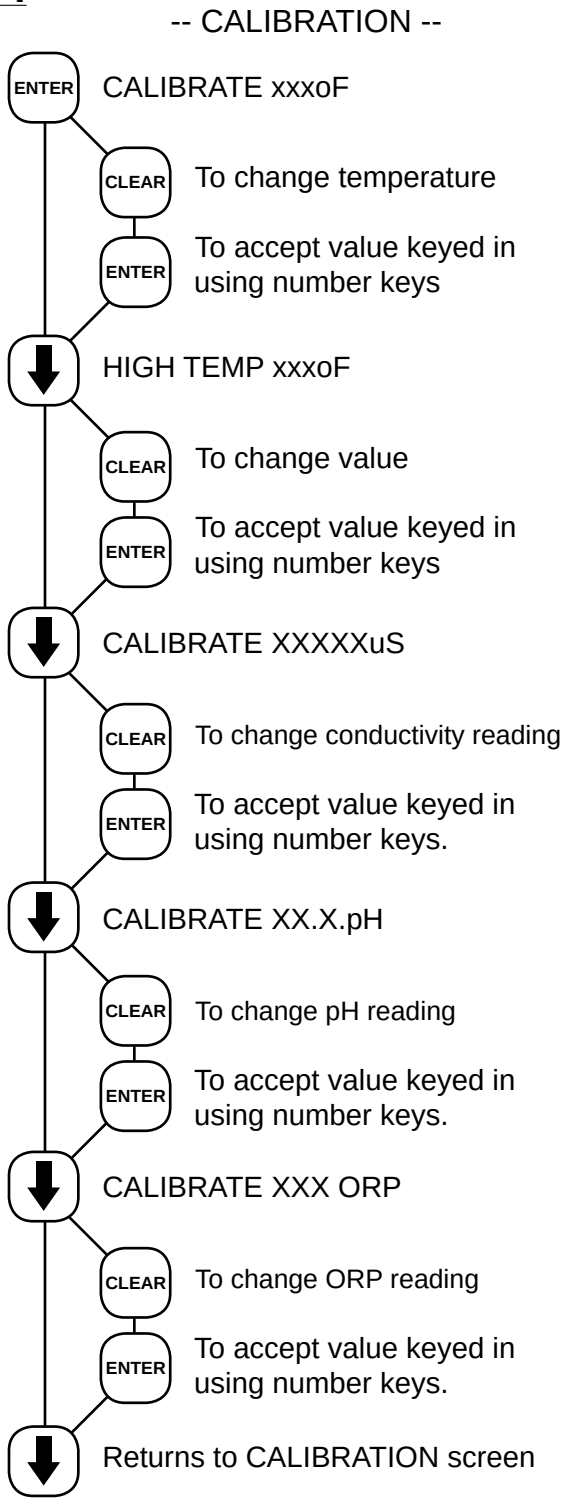
Calibrating the ORP with the probe in solution on line. Select “CALIBRATE ORP” from the “CALIBRATION” menu. Press CLEAR, then key in the corrected ORP value. Press ENTER to log in that reading.

The limits on this factor are from 50% to 200% and any entry which would lead to a factor outside this range will cause it to default back to the previous value.

NOTES:

1. **After entering a new numerical value hit the ENTER key to accept value and advance.**

2. **For severe calibration problems, see Reset Zero and Recentering pH on page 22 & 23.**



ATTACHMENT 4

2. BLEED SET

This menu is used to set bleed control parameters including set point, differential, high and low alarms plus a feed limit timer.

BleedTrip - A reading above this value will activate the blowdown relay until the reading falls by the amount of the differential below the trip point.

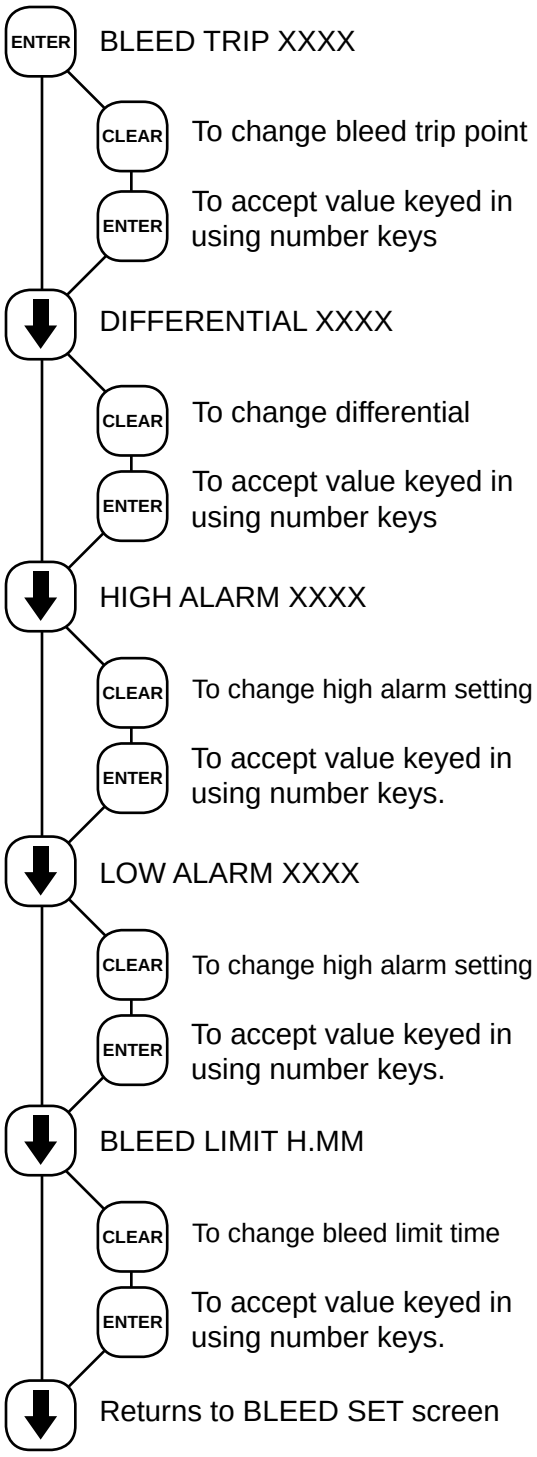
Differential - With a rising trip point the bleed relay comes on if conductivity exceeds the trip point and goes off when it falls below the trip point minus the differential value.

The differential may be made negative by using the DECIMAL key during edit. If negative, the Trip Point changes from rising to falling.

High Alarm Setting - Setting for a high conductivity alarm condition.

Low Alarm Setting - Setting for a low conductivity alarm condition.

Bleed Limit Timer - The bleed limit timer is set in hours and minutes. If the unit bleeds longer than the limit timer is set for an alarm is given. Maximum value is 9 hours and 59 minutes. A setting of zero disables the timer.



ATTACHMENT 4

3. PH FEED SET

This menu is used to set pH control parameters including set point, differential, high and low alarms plus a feed limit timer. (This menu choice will be present only if you have the pH control option, see model numbering on page 3.)

pH Trip - The pH reading value that will activate the pH relay.

pH Diff - Normally a rising trip point, the pH relay comes on if pH exceeds the trip point and goes off when it falls below the trip point minus the differential.

The differential may be made negative by pressing the DECIMAL key when changing differential setting. When the differential is negative, the Trip Point changes from rising to falling.

High Alarm Setting - Setting for a high pH alarm condition.

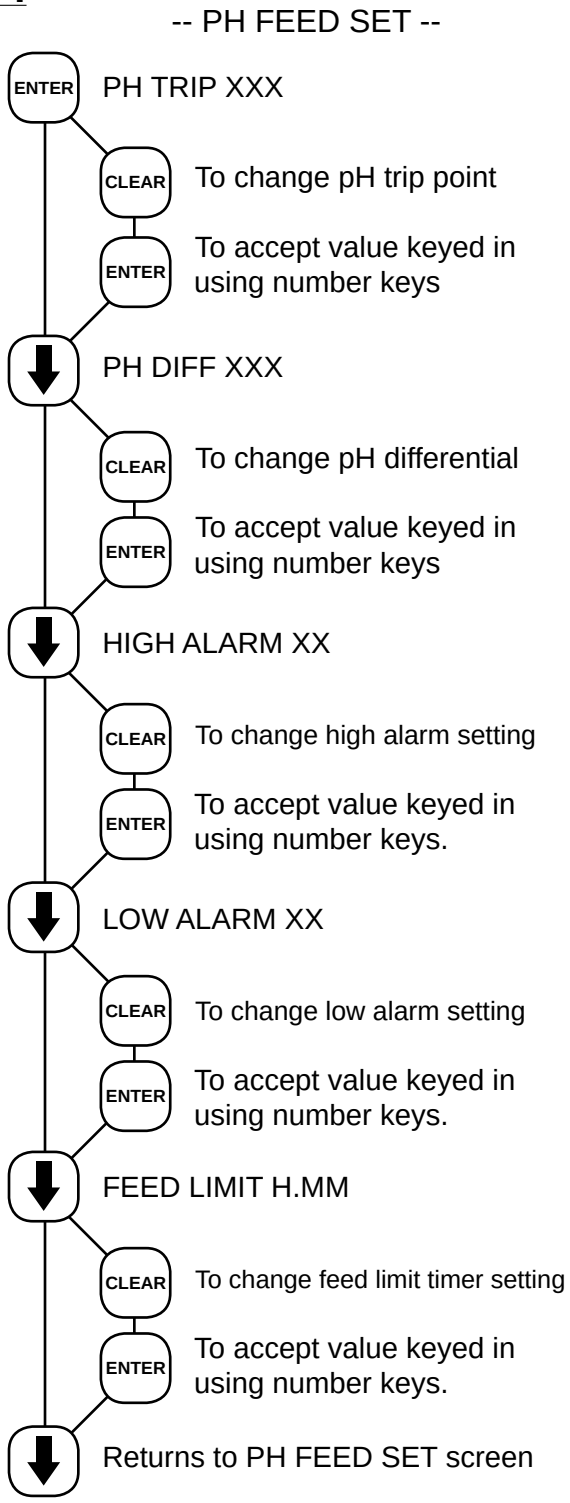
Low Alarm Setting - Setting for a low pH alarm condition.

pH Limit Timer - The pH limit timer is set in hours and minutes. If the unit calls for feed longer than the limit timer is set for, an alarm is given and the pH feed is stopped. Maximum value is 9 hours and 59 minutes. A setting of zero disables the timer.

After entering a new numerical value hit the ENTER key to accept value and advance.

NOTES:

If a unit has dual pH trip points, there will be a group of settings for "PH A" followed by the settings for "PH B".



ATTACHMENT 4

4. ORP FEED SET

This menu is used to set ORP control parameters including set point, differential, high and low alarms plus a feed limit timer. (This menu choice will be present only if you have the ORP control option, see model numbering on page 3.)

ORP Trip - The ORP reading value that will activate the ORP relay

ORP Diff - Normally a falling trip point, the ORP relay comes on if ORP falls below the trip point and goes off when it rises above the trip point plus the differential.

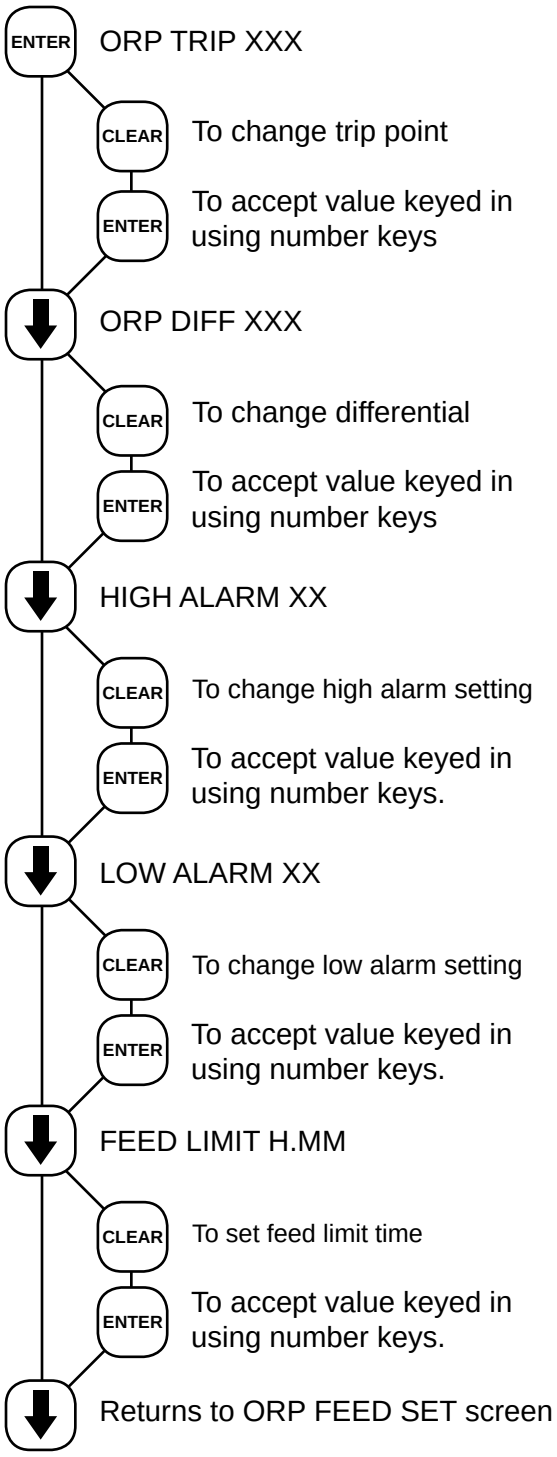
The differential may be made positive by pressing the DECIMAL key when changing differential setting. When the differential is positive, the Trip Point changes from falling to rising.

High Alarm Setting - Setting for a high ORP alarm condition.

Low Alarm Setting - Setting for a low ORP alarm condition.

ORP Limit Timer - The ORP limit timer is set in hours and minutes. If the unit calls for feed longer than the limit timer is set for, an alarm is given and the ORP feed is stopped. Maximum value is 9 hours and 59 minutes. A setting of zero disables the timer.

After entering a new numerical value hit the ENTER key to accept value and advance.



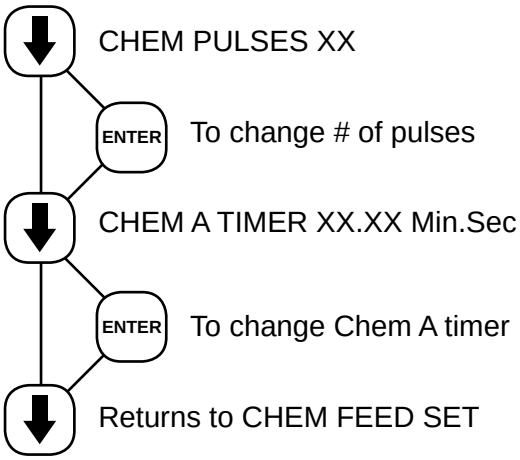
ATTACHMENT 4

5. CHEM FEED SET

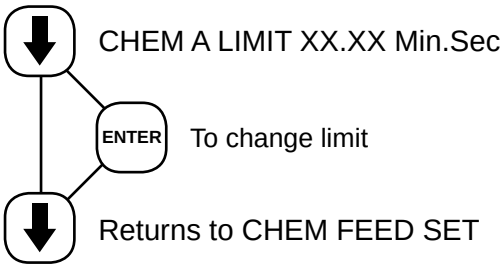
Units with selectable feed timer(s) will have this SET UP menu for selecting the chemical feed method and setting the feed time. A selectable feed timer can be programmed to be one of the following:

1. **PULSE TIME** - A timer activated by dry contacts from a contacting head water meter and includes an accumulator for counting the number of pulse (contacts) before starting the timer.
2. **WITH BLEED** - A feed limit timer that runs during a bleed cycle. The chemical feed will run for as long as the bleed occurs or until the limit time is reached.
3. **POST BLEED** - This timer counts how long a bleed cycle lasts then runs the chemical feed after the cycle is over for a user defined percentage of the bleed time. A limit timer prevents over feeding.
4. **PERCENTAGE** - A continuously repeating timer where the cycle timer can be programmed along with the percentage of ON time for the cycle.

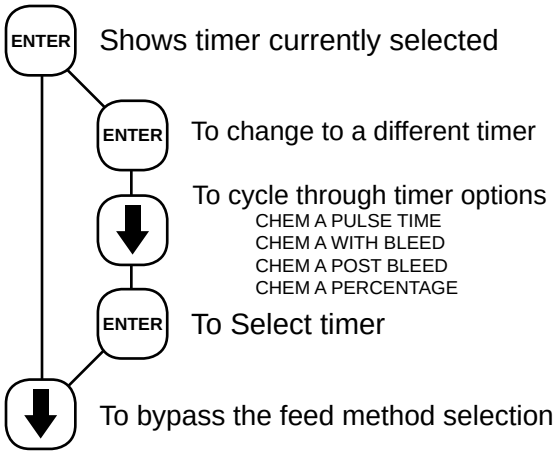
-- CHEM A PULSE TIME --



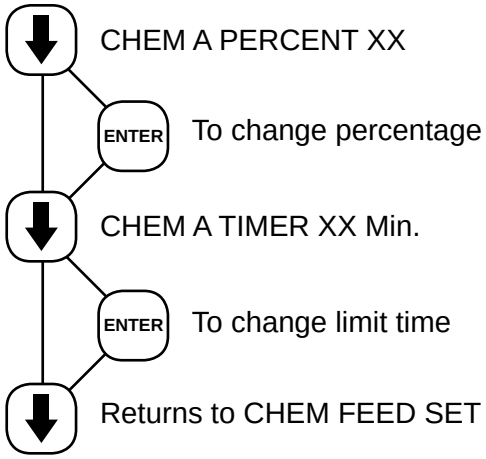
-- CHEM A WITH BLEED --



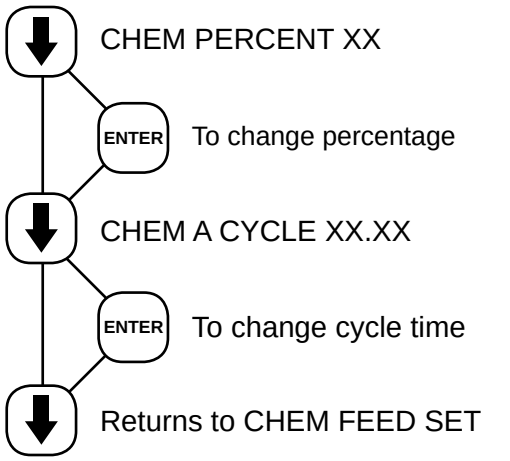
-- CHEM FEED SET --



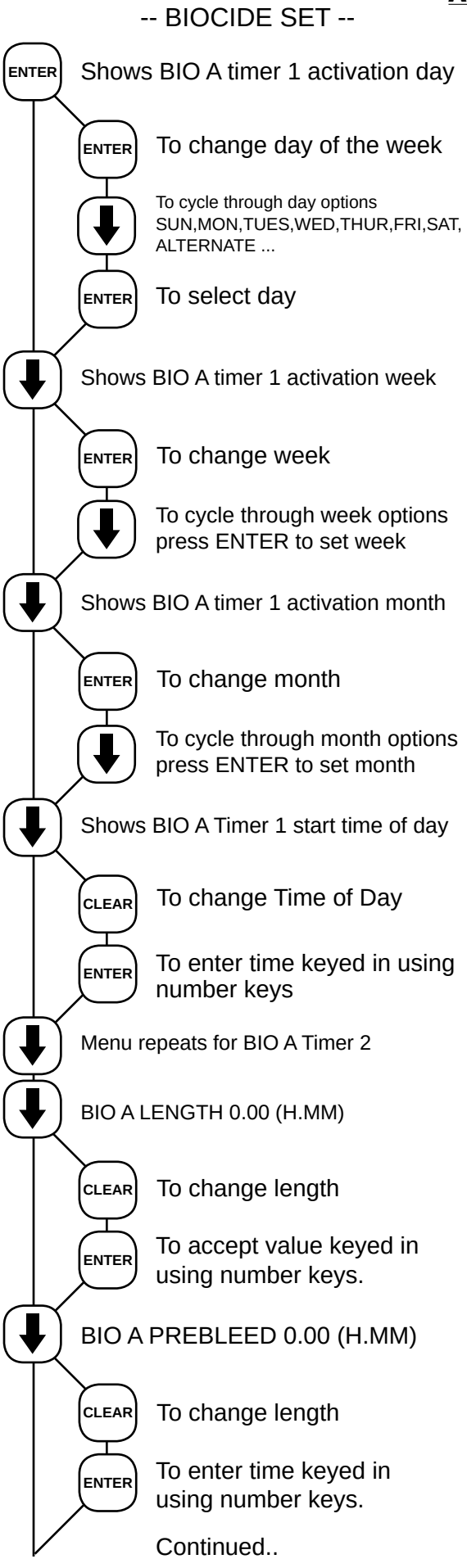
-- CHEM A POST BLEED --



-- CHEM A PERCENTAGE --



ATTACHMENT 4



6. BIOCIDE SET

Units with a biocide timer will have this SET UP menu for setting biocide feed times. Biocide Set Menu consists of two weekdays, week and start times, one feed length time and an overall prebleed and lockout setting for each biocide.

BIO __ (A1,A2,B1,B2...) WEEKDAY - Select from Sunday through Saturday, or TuesThrSat, MonWedFri, Every Other day, Every Day or No Day. A setting of No Day disables timer.

BIO__(A1,A2,B1,B2 ...) WEEK - Select week (1-4), Even Weeks, Odd Weeks, or Every Week. A setting of No Week disables timer.

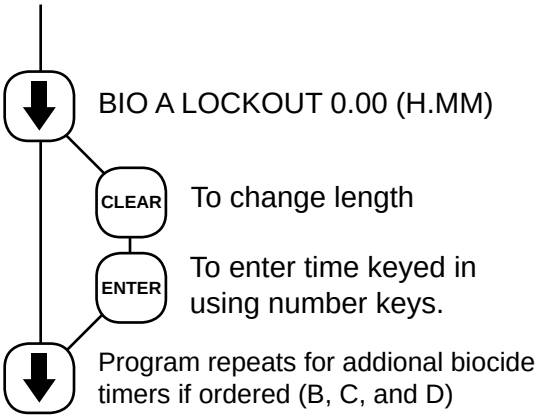
BIO__(A1,A2,B1,B2 ...) MONTH - Select month (1-12), Even Month, Odd Month, or Every Month. A setting of No Month disables timer.

BIO_(A,B,C...)TIME HH.MM - Start time based on 24 hour clock, in hours and minutes.

BIO_(A,B,C...) LENGTH H.MM - Feed time in hours and minutes can be set up to 9 hours and 59 minutes, 0 (zero) disables both start times for that biocide.

BIO_ (A,B,C...) PREBLEED H.MM - Prebleed and lockout settings are in hours and minutes, with a maximum of 9 hours and 59 minutes, 0 (zero) disables timer. When the clock reaches a start time for any of the four timers, the Prebleed is begun.

BIO_(A,B,C...) LOCKOUT H.MM - The lockout timer is a timer that starts after the biocide feed time is finished. The timer can be set for a time up to 9 hours and 59 minutes to lock out the bleed.



7. CLOCK SET

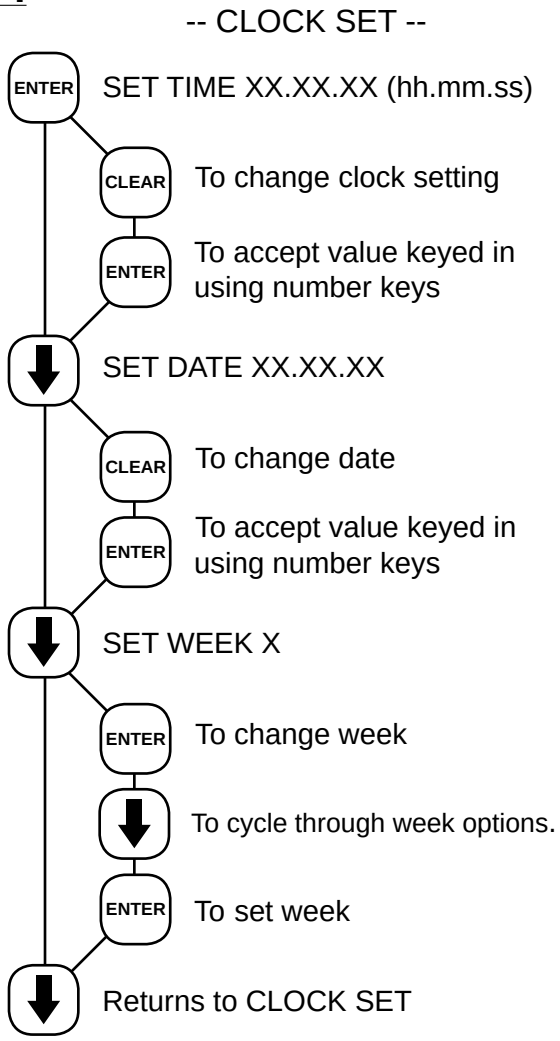
The CLOCK SET menu is for adjusting the time, date and day of the week.

After entering a new value, hit the ENTER key to accept the value and advance.

The clock time is based on a 24 hour clock. So, a time of 1 pm would be shown as 13.00.00.

NOTES:

If unit doesn't have a biocide timer, there will not be a SET WEEK selection.



ATTACHMENT 4

8. SYSTEM SET MENU

This menu is used to configure the controller to specific operational needs. All of the items in this menu may not apply depending on the controller model but will always be present.

NOTE: Do not use this menu to make calibration adjustments. Use the Calibration screen.

PASSWORD - If a value of 0000 is entered, a password is not required. If a password is entered, it must be used to operate the controller. If the first digit is zero, relays may be activated without a password.

RESET WATER METER COUNT - Does not apply unless the unit has selectable feed timer.

DRY CONTACT HEAD - Select a contacting head water meter or a hall effect paddle wheel meter. Anytime this setting is changed the GAL/PULSE value will need to be re-entered.

GAL/PULSE - If a feed timer is using a contacting head water meter this tracks make-up volume by entering the number of gallons a contact equals. Use • key to change to pulse/gal for flowmeter.

STRAIGHT/PROPORTIONAL OUTPUTS - A straight output setting means the optional 4-20 output span will be the same as the full scale. The proportional setting allows the span of the 4-20 mA output to be selected by the user based on the setpoint and differential.

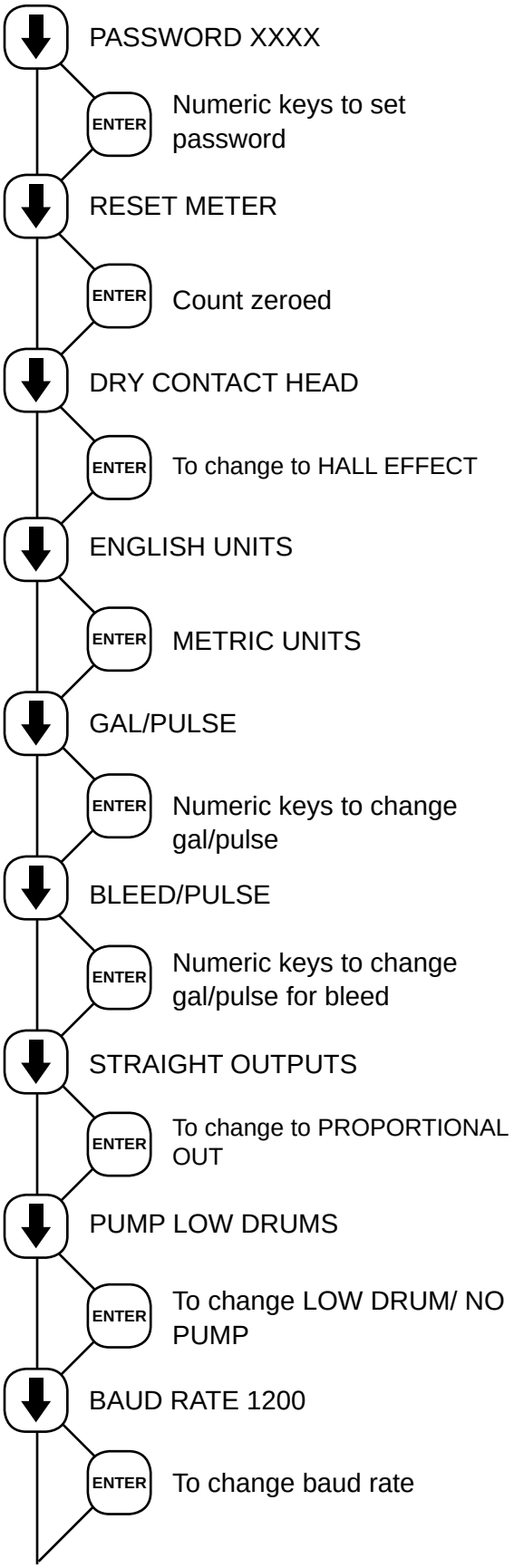
LOW DRUM NO PUMP/PUMP LOW DRUMS - If unit has low level alarms, allows the associated feed timer to be forced off when drum is low.

COMM Setup:

BAUD RATE - For units ordered with the serial line or modem option.

ALARM CALL - For units with modem.

FLOW WHEN CLOSED - For flow switches.



System Set continued on next page.

ATTACHMENT 4

SYSTEM SET (continued)

FLOW ALARM - With FLOW ALARM ON when the system loses flow, an alarm signal can be sent. FLOW ALARM OFF means that no alarm signal is sent in the event of loss of system flow.

CONCURRENT - Only applies if there are two or more feed timers. This allows all feed timers to become active simultaneously together.

SEQUENTIAL - Allows the feed timer to become active in a chronological order based on settings.

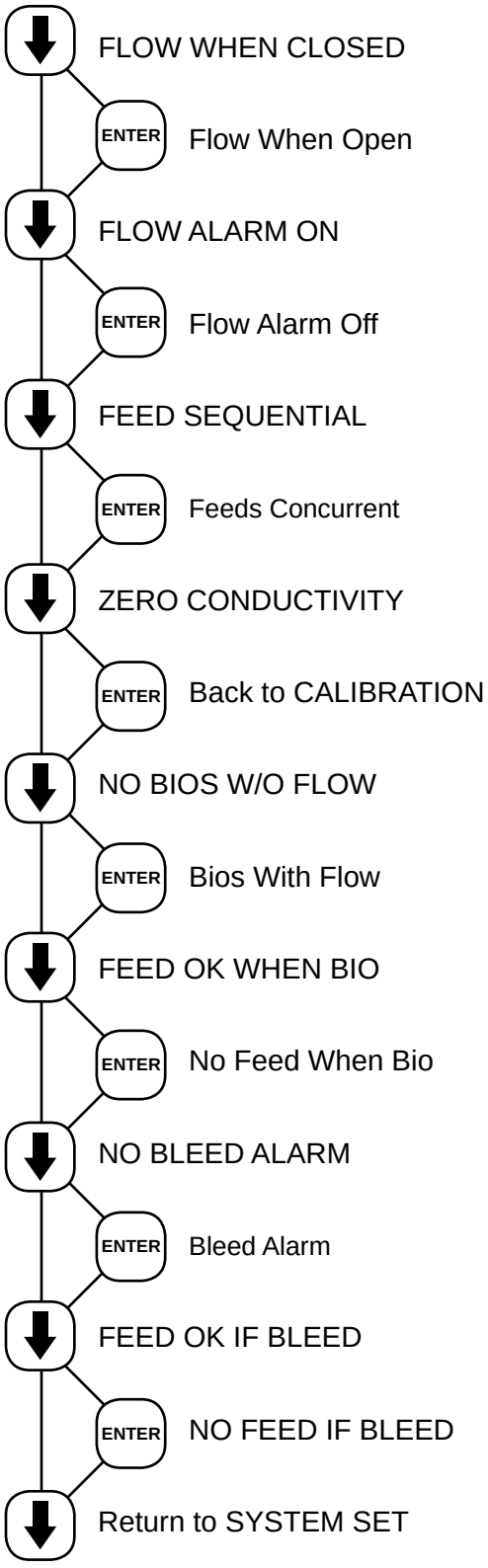
ZERO CONDUCTIVITY - This is normally not required, and is not recommended to use this function unless instructed to do so by the factory.

NO BIOS WITHOUT FLOW - Allows the biocide timer(s) to run only with a flow condition or to ignore the flow and always run even without flow.

FEED OK WHEN BIO - The chemical feed timer can be prevented from activating during a biocide timer run time.

NO BLEED ALARM - With the optional bleed flow alarm, the unit can produce an alarm if it is not sensing flow in the bleed line when bleeding.

FEED OK IF BLEED - Lets the unit feed chemical only when not bleeding or at anytime it is bleeding if called for.



ATTACHMENT 4

9. DIAGNOSTICS MENU

This menu is used to select, enter and test the following items.

MODEL NUMBER - Read only screen.

SOFTWARE VERSION NUMBER - Read only screen. Please have this number should you need to contact customer service.

Have both available for service

TEST DISPLAY - Press ENTER and all pixels will flash. Make a visual check to see that all pixels are lit.

TEST KEYPAD - Press ENTER, then press each individual key to test its function. NOTE: Pressing the SET UP/RUN key returns display to the main menu. Pressing ENTER again returns to TEST KEYPAD.

RESET CALIBRATE - Resets ALL calibration data to factory default calibration.

LEVELS INACTIVE - Press ENTER to select between having level alarms active or inactive.

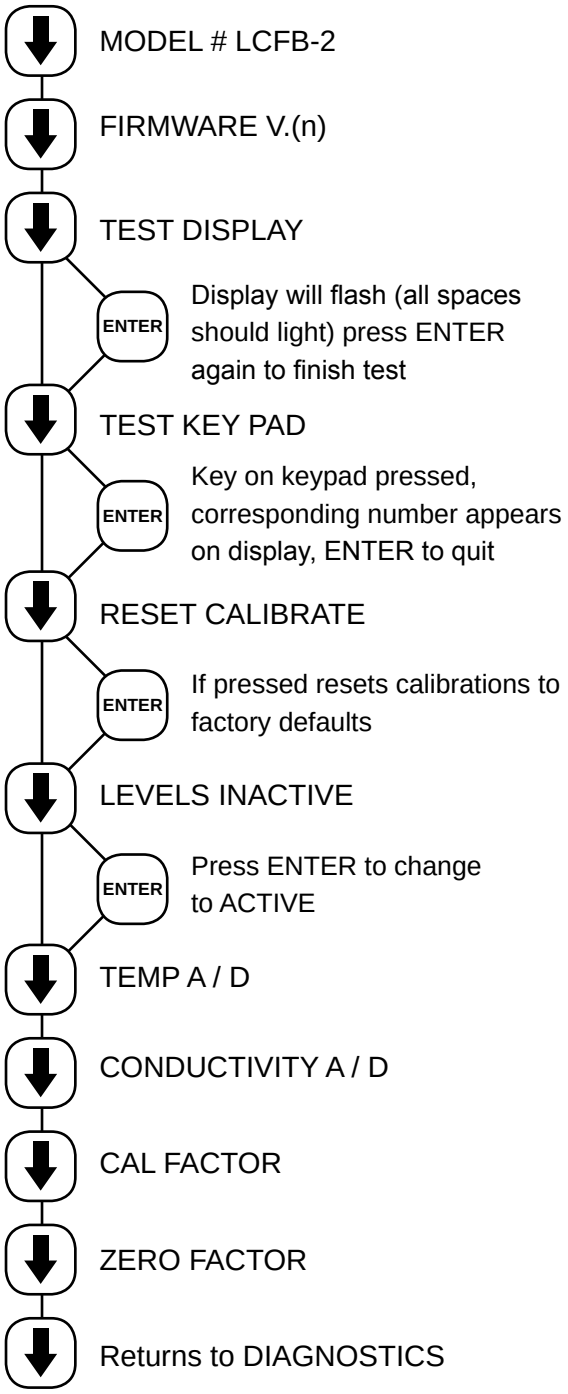
TEMP A/D - Shows the raw analog to digital value for the temperature reading.

COND A/D - Shows the raw analog to digital value for the conductivity reading.

CAL FACTOR - Shows internal calibration varible. (slope of conductivity line) Default = 1000

ZERO FACTOR - Similar to calibration factor. (zero point of conductivity line) Default = 0

These 4 screens aid in troubleshooting, please have this information available if you require service concerning conductivity readings.



B. Run Menu

During normal operations the controller will be in the RUN mode where current values are displayed. If left in the SET UP mode the display will revert to the RUN mode screen if no keys are touched for 3 minutes. If an alarm is present it will be flashed on the screen in the RUN mode.

While in the RUN mode if you hit the down arrow the following items may be shown:

COND	Current conductivity value.
PH	Current pH value.
ORP	Current ORP value.
TEMP	Current water temperature.
DAY-TIME	Current day of the week and time.
DATE	Current date.
BLEED TIME	If bleeding, how long it has been bleeding off.
CHEM (A)	If a chemical feed relay is on, how long it has been on.
GALLONS	If a water meter is being use, total number of gallons made up.
WATER METER	If a water meter is being used, number of contacts
BLEED METER	If a bleed-off water meter is being used, total number of gallon. If bleed/pulse = 0 bleed pulses is displayed otherwise bleed gallons

VI. Maintenance

The only required maintenance for normal uninterrupted operation of your MicroTron controller is cleaning of the electrode(s).

After initial start up, it is a good idea to clean the electrode(s) frequently until a schedule based on need has een developed. Since each application is unique, it is difficult to estimate the required frequency of cleaning. o determine the required cleaning frequency, record the reading on the controller before the electrode is removed for cleaning. After cleaning, record the new reading. If a change is observed in the two readings, the electrode was dirty. The more significant the change, the dirtier the electrode. If no change occurs, cleaning can be done less often.

Conductivity Electrode Cleaning Procedure

1. Record the current conductivity reading.
2. Turn off water flow from tower to the electrode loop, bleed pressure from the line, and remove electrode.
3. Use a clean cloth and a mild cleaning solution to clean the flat surface of the electrode.
4. If deposits such as scale are attached to the electrode surface, use a more aggressive cleaning approach. There are several ways to do this, the preferred method is the one that is easiest for the user.
   a. Use a mild acid solution to dissolve deposits.
   b. Scrape probe surface perpendicular to the electrodes. Using sand paper (200 grit or finer) sand the electrode on a flat surface to remove stubborn deposits.
5. Reinstall the electrode in the system. When reading stabilizes, calibrate the unit to a reliable test reading.

pH & ORP Electrode Cleaning Procedure

Prior to servicing, the electrode must be removed from the system.

1. Remove the pH/ORP electrode from the system by turning counter-clockwise until fully released.
2. Spray with water and/or detergent, using a soft brush to dislodge any particulate matter. (Cold water applied to a hot probe may cause damage.).
3. Visually inspect the electrode for signs of damage.
4. Calibrate the electrode.
5. Replace the PTFE tape and re-mount into the system, avoid twisting on the cable.

The pH glass is susceptible to coating by many substances. The speed of response, normally 95% of the reading in less than 10 seconds, is dramatically degraded when the pH glass is coated.

Slow response or non-reproducible measurements are signs that the electrode has become coated, clogged or dead. pH probes should be replaced annually under good conditions.

ATTACHMENT 4

VII. Troubleshooting

The Advantage Microtron controller is designed for many years of trouble free operation. Should a problem occur, refer to the following chart to help identify the problem.

SYMPTOM	POSSIBLE CAUSE	SOLUTION
False reading	Bad or dirty electrode Out of calibration	Clean as needed Calibrate unit, see Page 10
Will not calibrate	Dirty electrode Faulty electrode Faulty wiring to electrode Out of calibration	Clean electrode Replace controller or electrode as needed. Calibrate unit see Page 10 Check diagnostics menu - Pg 19
No system power	Power source Cable from power supply board to relays or fuse	Check power source Secure cable
No output power	Check relay fuse Check ribbon cable from login board to relays	Replace as needed Secure ribbon cable & orientation
Not receiving water meter contacts	Connection between unit and water meter	Check cable between water meter and unit

If problem persists, contact our customer service department with the model number and serial number of unit for free factory technical assistance at 800-743-7431.

Reset Zero Conductivity

It may be necessary to reset the zero value of the conductivity scale if the calibration is not responsive.

1. Remove the probe from the line and make sure it is clean and dry. Leave it out, or disconnect black and red wire at probe.
2. Make note of current blowdown settings (trip, diff, Hi/lo Alarms and Limit) as they will be reset by this procedure. Also, make note of cal factor and zero factor from diagnostics.
3. Push SET UP/RUN key and arrow to DIAGNOSTICS.
4. Push ENTER and arrow down to RESET CALIBRATE.
5. Make sure probe is clean and dry before going on.
6. Push ENTER and arrow up to SYSTEM SET.
7. Push ENTER and arrow down to ZERO CONDUCTIVITY.
8. Push the decimal key • and your current conductivity scale will appear. Continue to hit the decimal key until the conductivity scale loops through the various scale settings and comes back to your scale, then push ENTER twice.
9. Reenter you blowdown settings under the BLEED SET menu.
10. Reinstall the probe in the line and check conductivity against the actual reading.
11. Calibrate as needed using the CALIBRATION menu.

Recentering the pH

Prior to servicing, the electrode must be removed from the system.

1. Remove the pH electrode from the line and clean the sensor tip with a clean, non-abrasive cloth.
2. Place the electrode in a buffer solution with a known and accurate pH of 7. Solution must be grounded by placing temp comp ground probe in solution also.
3. Scroll through the set up menu until you reach the “SYSTEM SET” screen.
4. Press ENTER and use the DOWN arrow to find the “CENTER PH” option. Press ENTER while the electrode is in the buffer solution.
5. Replace the pH electrode in the line and make any necessary adjustments to the pH reading using the normal pH calibration procedure.
6. Press the SET UP/RUN key to resume normal operation

VIII. Advantage Controls’ Product Warranty

Advantage Controls warrants control systems of its manufacture to be free of defects in material or workmanship. Liability under this policy extends for 24 months from date of installation. Liability is limited to repair or replacement of any failed equipment or part proven defective in material or workmanship upon manufacturer’s examination. Removal and installation costs are not included under this warranty. Manufacturer’s liability shall never exceed the selling price of equipment or part in question.

Advantage disclaims all liability for damage caused by its products by improper installation, maintenance, use or attempts to operate products beyond their intended functionality, intentionally or otherwise, or any unauthorized repair. Advantage is not responsible for damages, injuries or expense incurred through the use of its products.

The above warranty is in lieu of other warranties, either expressed or implied. No agent of ours is authorized to provide any warranty other than the above.

30 Day Billing Memo Policy

Advantage Controls maintains a unique factory exchange program to ensure uninterrupted service with minimum downtime. If your in warranty controller malfunctions, call 1-800-743-7431, and provide our technician with Model and Serial Number information. If we are unable to diagnose and solve your problem over the phone, a fully warranted replacement unit will be shipped, usually within 48 hours, on a 30 Day Billing Memo.

This service requires a purchase order and the replacement unit will be billed at current list price for that model less any applicable resale discount. Upon return of your old unit, credit will be issued to your account if the unit is in warranty. If the unit is out of warranty or the damage not covered, a partial credit will be applied based upon a prorated replacement price schedule dependent on the age of the unit. Any exchange covers only the controller or pump. **Electrodes, liquid ends and other external accessories are not included**.

FCC Warning

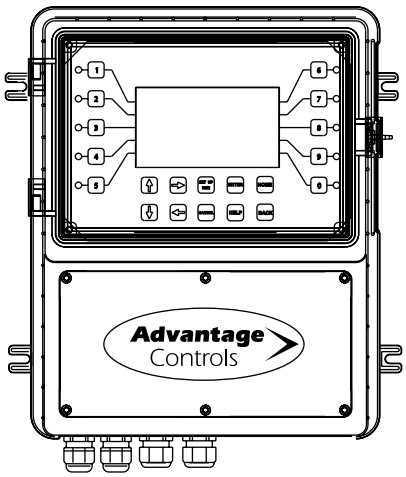
This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer’s instruction, may cause interference to radio communications. It has been type tested and found to comply with the limits for a class A computing device pursuant to subpart J of part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial or industrial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will be required to take whatever measures necessary to correct the interference.

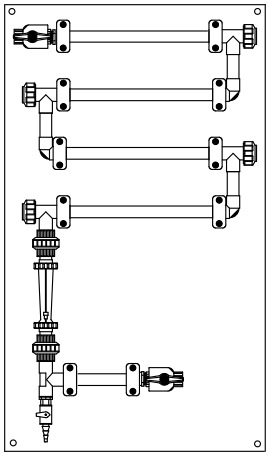
ATTACHMENT 4

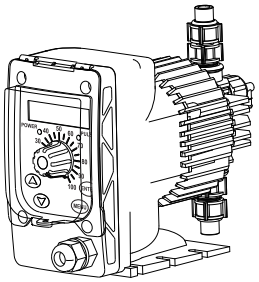
Get the Advantage in Water Treatment Equipment

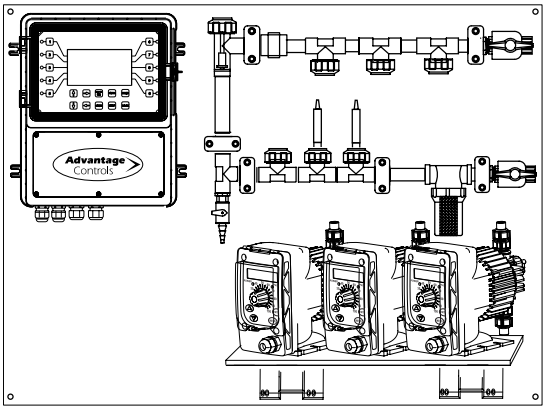
Advantage Controls can give you the *Advantage* in products, knowledge and support on all of your water treatment equipment needs.

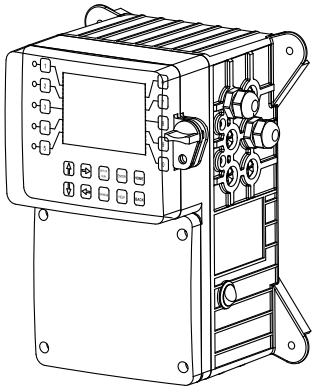
- Cooling Tower Controllers
- Boiler Blow Down Controllers
- Blow Down Valve Packages
- Solenoid Valves
- Water Meters
- Chemical Metering Pumps
- Corrosion Coupon Racks
- Chemical Solution Tanks
- Solid Feed Systems
- Feed Timers
- Filter Equipment
- Glycol Feed Systems
- Pre Fabricated Systems











Appendix G

Material Safety Data Sheets

for

Cooling Tower Chemicals

Date of Acceptance by Campus	Product Name	General Use	Manufacturer	MSDS Provided
September 1, 2017	Formula 1152	Corrosion Control	Albemarle Corporation	Yes
September 1, 2017	Aqucar GA 15	Biocide	Dow Chemical	Yes
September 1, 2017	Stabrom 909	Biocide	B&L Control Service	Yes

ATTACHMENT 4

Product Data

STABROM® 909 BIOCIDE
COOLING WATER MICROBIOCIDE

DESCRIPTION AND USE

STABROM 909 BIOCIDE is a unique stabilized liquid bromine-based microbiocide for use in once-through industrial cooling water systems, open recirculating cooling tower and evaporative condenser water systems, decorative fountains, industrial air scrubbers, pulp and paper mill systems and wastewater systems. The product can be applied as a stand-alone biocide program, but is typically applied in combination with a biodispersant or intermittent feed of a non-oxidizing microbiocide. The *"stabilizing"* effect of STABROM 909 BIOCIDE enables this product to provide superior control of biofilm (and removal of existing biofilm) compared to conventional halogen products.

CHEMICAL FEEDING AND CONTROL

STABROM 909 BIOCIDE is fed much like feeding bleach. A pump with an auto-degassing wet end is recommended to ensure reliable pumping, especially where environment conditions are variable. The suggested initial feedrate dose is 4.55 oz. to 9.1 oz of product per 1000 gallons of system volume if fed continuous **or** 2.9 oz to 5.8 oz per 1000 gallons of system volume if slug fed intermittently. The recommended residual control to start is ≈2 ppm total bromine as Br if fed continuous **or** 4-6 ppm total bromine as Br if slug fed intermittently. The final maintenance feedrate will vary depending upon system operating conditions and can be specified by the technical representative servicing the facility. This neat product is compatible with various plastic materials including HDPE, PP, EPDM, PTFE, Tygon, Hypalon, vinyl tubing, PVC & Viton. At recommended use concentration, this product is compatible with the commonly used materials of construction in cooling towers.

Site specific experience based on microbiological and fouling indicators should be used to optimize the dosage and residual target. Conventional total halogen tests can be used to measure residual. Note, multiply the test results as Cl_2 by 2.25 to convert to residual as Br. There are various microbiological and fouling monitoring methods. Specific feedrate and monitoring methods must be specified by the technical service representative.

TYPICAL PROPERTIES

Appearance	Clear yellow to clear orange liquid
Odor	Mild Odor
Boiling Point	214 – 216 °F
Specific gravity	1.29 - 1.37
pH (undiluted)	>12.40
Freeze Point	<32 °F

SAFETY AND HANDLING

Do not take STABROM 909 BIOCIDE internally. If ingested, drink water and get immediate medical attention. Contact with eyes will cause burns and possible irreversible damage. If eyes are contacted, immediately flush with clean water for 15 minutes and get medical attention. Direct contact with the skin will cause burns. For skin contact, flush with water while removing contaminated clothing and get immediate medical attention. For additional information, see the Material Safety Data Sheet provided with this product.

PACKAGING

STABROM 909 BIOCIDE is packaged in 55, 30, 15 and 5 gallon plastic containers and one-way 275 gallon totes.

ATTACHMENT 4

ALBEMARLE®

SAFETY DATA SHEET

STABROM® 909 Biocide

Preparation Date : 14-Feb-2012 **Revision Date:** 24-Apr-2015 **Revision Number:** 1.01

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product Identifier

Product Name STABROM® 909 Biocide

Other means of identification

Chemical Family Stabilized bromine biocide, aqueous solution

CAS-No Mixture

Recommended use of the chemical and restrictions on use

General function Water treatment chemical.

Uses advised against No information available

Details of the supplier of the safety data sheet

Company Albemarle Corporation
451 Florida Street
Baton Rouge, LA 70801

For Non-Emergency 800-535-3030

'Competent Body for SDS' HSE@Albemarle.com

Emergency telephone number

Emergency Telephone Numbers +1-225-344-7147

2. HAZARDS IDENTIFICATION

Classification

Acute toxicity - Inhalation (Dusts/Mists)	Category 4
Skin Corrosion/irritation	Category 1
Serious eye damage/eye irritation	Category 1
Acute aquatic toxicity	Category 2
Chronic aquatic toxicity	Category 2

Label elements

Emergency Overview

Danger

Hazard Statements
Harmful if inhaled
Causes severe skin burns and eye damage
Toxic to aquatic life with long lasting effects

Skin Contact	If on skin or clothing, take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
Inhalation	Move to fresh air.
Ingestion	If swallowed,. Call a physician or Poison Control Center immediately. Have person sip a glass of water if able to swallow. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Probable mucosal damage may contraindicate the use of gastric lavage.

Most important symptoms and effects, both acute and delayed

Symptoms Causes burns.

Indication of any immediate medical attention and special treatment needed

Notes to Physician Probable mucosal damage may contraindicate the use of gastric lavage.

5. FIRE-FIGHTING MEASURES

Extinguishing media

Suitable extinguishing media Not required.

Unsuitable Extinguishing Media No information available.

Specific Hazards Arising from the Chemical

Combustion/explosion hazards No information available.

Hazardous Combustion Products Bromine. Chlorine.

Explosion Data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Protective Equipment and Precautions for Firefighters

In the event of fire and/or explosion do not breathe fumes.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation.

Environmental Precautions

Environmental precautions Contain any spill with dikes or absorbents to prevent migration and entry into sewers or streams. Large spills should be collected mechanically (remove by pumping) for disposal. May require excavation of contaminated soil. Take up small spills by first diluting with water and then using a dehalogenating agent such as sodium thiosulfate solution.

Methods and material for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so.

Methods for Cleaning up Soak up with inert absorbent material (e.g. sand, silica gel, universal binder, sawdust)

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Avoid contact with skin, eyes and clothing.

Conditions for safe storage, including any incompatibilities

Vapor Density	No information available
Relative density	1.29 - 1.37 (25°C)
Solubility(ies)	
Water Solubility	Miscible.
Solubility in other solvents	No information available
Partition coefficient	No data available
Autoignition temperature	No information available
Decomposition temperature	No information available
Viscosity, kinematic	2 cSt (25°C)
Dynamic viscosity	No information available
Explosive Properties	None
Oxidizing Properties	None

10. STABILITY AND REACTIVITY

Reactivity Hazard	No data available
Stability	No information available
Hazardous Reactions	No hazardous reaction expected under normal handling.
Hazardous Polymerization	None under normal processing.
Conditions to Avoid	Protect from light. Extremes of temperature and direct sunlight. Keep away from heat. Freezing.
Materials to avoid	This product is strongly basic and an oxidizing agent. Avoid contact with alcohols, aldehydes, strong reducing agents, strong oxidizers, acids, ammonia-containing products, and common metals such as steel, aluminum, iron and copper. Use of incompatible materials can promote the exothermic decomposition of the product.
Hazardous decomposition products	Bromine. Chlorine.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Inhalation	Not an expected route of exposure.
Eye contact	Causes severe burns.
Skin Contact	Causes severe burns.
Ingestion	Not expected to be acutely toxic.

Potential Health Effects

Acute Effects

Skin Corrosion/irritation	Data obtained from tests on used product: Skin irritation. (rabbit). (4 hr): Corrosive to skin. Causes burns.
Serious eye damage/eye irritation	Corrosive. Risk of serious damage to eyes.
Respiratory irritation :	Not irritating.
Sensitization	Data obtained from tests on used product: Buehler Test. (guinea pig): Not sensitizing.

Chronic Effects

Mutagenic Effects	No information available.
Carcinogenicity	There are no known carcinogenic chemicals in this product.

Waste Disposal Method Dispose in a safe manner in accordance with local/national regulations.

Contaminated Packaging Do not reuse container.

14. TRANSPORT INFORMATION

DOT

Proper Shipping Name	Corrosive Liquids, Basic, Inorganic, N.O.S. (Halogenated Complex, Sodium Hydroxide)
Hazard Class	8
UN No.	3266
Packing Group	III
Description	UN 3266 Corrosive liquid, Basic, Inorganic, N.O.S. (Halogenated complex, Sodium hydroxide), 8, III

IMDG/IMO

IMO Class	8
Packing Group	III
UN-No	3266
IMO Labelling and Marking	8
Proper Shipping Name	Corrosive liquid, Basic, Inorganic, N.O.S. (Halogenated complex, Sodium hydroxide)
EmS	F-A, S-B
Marpol - Annex II	Not determined
Marpol - Annex III	Unregulated
Transport Description	UN 3266 Corrosive liquid, Basic, Inorganic, N.O.S. (Halogenated complex, Sodium hydroxide), 8, III

IATA/ICAO

IATA/ICAO Class	8
Packing Group	III
UN-No	3266
IATA/ICAO Labelling/Marking	8
Passenger Aircraft	Forbidden (Product is shipped in containers with vented caps)
Cargo aircraft only	Forbidden (Product is shipped in containers with vented caps)
Proper shipping name	Corrosive liquid, Basic, Inorganic, N.O.S. (Halogenated complex, Sodium hydroxide)
Transport Description	UN 3266 Corrosive liquid, Basic, Inorganic, N.O.S. (Halogenated complex, Sodium hydroxide), 8, III

15. REGULATORY INFORMATION

International Inventories	TSCA	DSL	NDSL	AICS	EINECS	ELINCS	ENCS	KECL	PICCS	IECSC	NZIoC
STABROM® 909 Biocide	-	-	-	X	-	-	-	X	X	-	X

TSCA Statement THIS MATERIAL IS EXEMPT FROM THE TOXIC SUBSTANCES CONTROL ACT (15 USC 2601-2629)

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazardous Categorization

Acute Health Hazard	Yes
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Reportable and Threshold Planning Quantities

The following components have RQs and/or TPQs under SARA and/or CERCLA

Component	CERCLA RQ, lbs	SARA 302 RQ, lbs	SARA 302 TPQ, lbs

ATTACHMENT 4

PRODUCT DATA

AQUCAR™ GA 15 WATER TREATMENT MICROBIOCIDE COOLING WATER MICROBIOCIDE

DESCRIPTION AND USE

AQUCAR™ GA 15 is a highly concentrated glutaraldehyde based microbiocide for use in air washers, recirculating water cooling towers and water systems including pasteurizer cooling water systems, retort water systems, and industrial closed, recirculating process water systems. The product is effective over a wide pH range of 6.0 - 9.5 against slime forming bacteria, sulfate reducing bacteria, and algae. The product functions to kill these microorganisms by reacting with the cell wall. Thus, it possesses many unique features when compared to other materials:

- Very effective over a broad spectrum of organisms.
- Aqueous solution is relatively safe to handle and is easily diluted and mixed when treating water.
- Unlike most non-oxidizing microbiocides, it will function to clean up a biologically fouled system.
- Functions over a wide pH range and most rapidly at pH 8.5 - 9.5. Will **NOT** react with the wide range of inhibitors and anionic dispersants used in modern cooling water treatment.
- It is non-surface active and will therefore not cause objectionable foaming in treated systems.

CHEMICAL FEEDING AND CONTROL

When a system is noticeably fouled, AQUCAR™ GA 15 should be slug dosed to establish a concentration of 50-100 ppm actives in the recirculating water (i.e. 4.1-8.2 fl. ozs AQUCAR™ GA 15 /100 gals. contained water). Once control is evident, a dosage of 20-50 ppm actives (1.7-4.1 fl. ozs AQUCAR™ GA 15 /100 gals.) twice weekly will normally maintain control unless unusual conditions develop.

TYPICAL PROPERTIES:

Appearance	Clear liquid
Odor	Sharp, pungent
Glutaraldehyde	15%
Specific gravity	1.030-1.044
pH(@25 deg.C)	3.1-4.5
Flash point	Non-flammable
Freeze point	-6.5°C(20.3°F)

SAFETY AND HANDLING

AQUCAR™ GA 15 may be toxic by ingestion. DO NOT TAKE INTERNALLY. If ingested, do not induce vomiting. Do not give anything to drink. GET IMMEDIATE MEDICAL ATTENTION. Contact with eyes causes severe irritation or burns and irreversible eye damage. If eyes are contacted, immediately flush with clear water for 30 minutes and get medical attention. VAPOR is irritating to respiratory tract. If skin is contacted, immediately wash with soap and water. Change and launder contaminated clothing before reuse. The use of goggles or face shield and rubber gloves when handling this product is recommended. For more information, consult the Material Safety Data Sheet provided with this product.

PACKAGING

AQUCAR™ GA 15 is packaged in 55, 30, and 15 gallon, non-returnable plastic drums and 5 & 6 gallon non-returnable plastic pails.

ATTACHMENT 4

SAFETY DATA SHEET

THE DOW CHEMICAL COMPANY

Product name: AQUCAR™ GA 15 Water Treatment Microbiocide

Issue Date: 20150318
Print Date: 07/15/2016

THE DOW CHEMICAL COMPANY encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. IDENTIFICATION

Product name: AQUCAR™ GA 15 Water Treatment Microbiocide

Recommended use of the chemical and restrictions on use
Identified uses: For biocidal applications. For industrial use only.

COMPANY IDENTIFICATION
THE DOW CHEMICAL COMPANY
2030 WILLARD H DOW CENTER
MIDLAND MI 48674-0000
UNITED STATES

Customer Information Number: 800-258-2436
SDSQuestion@dow.com

EMERGENCY TELEPHONE NUMBER
24-Hour Emergency Contact: CHEMTREC +1 800-424-9300
Local Emergency Contact: 800-424-9300

2. HAZARDS IDENTIFICATION

Hazard classification
This material is hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29CFR 1910.1200.
Acute toxicity - Category 4 - Oral
Acute toxicity - Category 3 - Inhalation
Skin corrosion - Category 1B
Serious eye damage - Category 1
Respiratory sensitisation - Category 1
Skin sensitisation - Category 1
Specific target organ toxicity - single exposure - Category 3

Label elements
Hazard pictograms

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical nature: aldehyde
This product is a mixture.

Component	CASRN	Concentration
Glutaraldehyde	111-30-8	15.0%
Water	7732-18-5	<= 85.0 %

4. FIRST AID MEASURES

Description of first aid measures
General advice: First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists refer to Section 8 for specific personal protective equipment.

Inhalation: Move person to fresh air. If person is not breathing, call an emergency responder or ambulance, then give artificial respiration; if by mouth to mouth use rescuer protection (pocket mask etc). Call a poison control center or doctor for treatment advice. If breathing is difficult, oxygen should be administered by qualified personnel.

Skin contact: Take off contaminated clothing. Wash skin with soap and plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice. Wash clothing before reuse. Shoes and other leather items which cannot be decontaminated should be disposed of properly. Suitable emergency safety shower facility should be immediately available.

Eye contact: Wash immediately and continuously with flowing water for at least 30 minutes. Remove contact lenses after the first 5 minutes and continue washing. Obtain prompt medical consultation, preferably from an ophthalmologist. Suitable emergency eye wash facility should be immediately available.

Ingestion: If the person is fully alert and cooperative, have the person rinse mouth with plenty of water. In cases of ingestion have the person drink 4 to 10 ounces (120-300 mL) of water. Do not induce vomiting. Do not attempt mouth rinse if the person has respiratory distress, altered mental status, or nausea and vomiting. Call a physician and/or transport to emergency facility immediately.

Most important symptoms and effects, both acute and delayed: Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), any additional important symptoms and effects are described in Section 11: Toxicology Information.

Indication of any immediate medical attention and special treatment needed
Notes to physician: Maintain adequate ventilation and oxygenation of the patient. May cause respiratory sensitization or asthma-like symptoms. Bronchodilators, expectorants and antitussives may be of help. Glutaraldehyde may transiently worsen reversible airways obstruction including asthma or reactive airways disease. Treat bronchospasm with inhaled beta2 agonist and oral or parenteral corticosteroids. Respiratory symptoms, including pulmonary edema, may be delayed. Persons receiving significant exposure should be observed 24-48 hours for signs of respiratory

Environmental precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information. Spills or discharge to natural waterways is likely to kill aquatic organisms.

Methods and materials for containment and cleaning up: Avoid making contact with spilled material, glutaraldehyde will be absorbed by most shoes. Always wear the correct protective equipment, consisting of splashproof monogoggles, or both safety glasses with side shields and a wraparound full-face shield, appropriate gloves and protective clothing. A self-contained breathing apparatus or respirator and absorbents may be necessary, depending on the size of the spill and the adequacy of ventilation. Small spills: Wear the correct protective equipment and cover the liquid with absorbent material. Collect and seal the material and the dirt that has absorbed the spilled material in polyethylene bags and place in a drum for transit to an approved disposal site. Rinse away the remaining spilled material with water to reduce odor, and discharge the rinsate into a municipal or industrial sewer. Large spills: In case of nasal and respiratory irritation, vacate the room immediately. Personnel cleaning up should be trained and equipped with a self-contained breathing apparatus, or an officially approved or certified full-face respirator equipped with an organic vapor cartridge, gloves, and clothing impervious to glutaraldehyde, including rubber boots or shoe protection. Deactivate with sodium bisulfite (2-3 parts (by weight) per part of active substance glutaraldehyde), collect the neutralized liquid and place in a drum for transit to an approved disposal site.

7. HANDLING AND STORAGE

Precautions for safe handling: Do not spray or aerosolize the undiluted form of the product. Full personal protective equipment (including skin covering and full-face SCBA respirator) is required for dilutions or mixtures of the product used in a spray application.

Keep out of reach of children. Do not get in eyes, on skin, on clothing. Do not swallow. Avoid prolonged or repeated contact with skin. Avoid breathing vapor. Keep container closed. Use with adequate ventilation. Wear goggles, protective clothing and butyl or nitrile gloves. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.

Conditions for safe storage: Do not store in: Aluminum. Carbon steel. Copper. Mild steel. Iron.

Storage stability
Shelf life: Use within 18 Month

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters
Exposure limits are listed below, if they exist.

Component	Regulation	Type of listing	Value/Notation
Glutaraldehyde	ACGIH	C	0.05 ppm
	ACGIH	C	DSEN, RSEN

Exposure controls
Engineering controls: Use engineering controls to maintain airborne level below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, use only with adequate ventilation. Local exhaust ventilation may be necessary for some operations.

Individual protection measures

Flammability (solid, gas)	Not applicable to liquids
Lower explosion limit	No test data available
Upper explosion limit	No test data available
Vapor Pressure	0.3 mmHg at 20 °C (68 °F) *OECD Test Guideline 104* Active ingredient
Relative Vapor Density (air = 1)	0.7 *Calculated.*
Relative Density (water = 1)	1.042 at 20 °C (68 °F) *OECD 109*
Water solubility	100 % at 20 °C (68 °F) *Calculated.*
Partition coefficient: n-octanol/water	no data available
Auto-ignition temperature	No test data available
Decomposition temperature	No test data available
Kinematic Viscosity	No test data available
Explosive properties	Not explosive
Oxidizing properties	No
Molecular weight	No test data available

NOTE: The physical data presented above are typical values and should not be construed as a specification.

10. STABILITY AND REACTIVITY

Reactivity: no data available

Chemical stability: Thermally stable at typical use temperatures.

Possibility of hazardous reactions: Polymerization will not occur.

Conditions to avoid: Active ingredient decomposes at elevated temperatures.

Incompatible materials: Avoid contact with: Amines. Ammonia. Strong acids. Strong bases. Strong oxidizers. Avoid contact with metals such as: Aluminum. Carbon steel. Copper. Iron. Mild steel.

Hazardous decomposition products: Decomposition products depend upon temperature, air supply and the presence of other materials.

11. TOXICOLOGICAL INFORMATION

Toxicological information on this product or its components appear in this section when such data is available.

Acute toxicity

Acute oral toxicity

Teratogenicity
For glutaraldehyde: Has been toxic to the fetus in laboratory animals at doses toxic to the mother. Did not cause birth defects in laboratory animals.

Reproductive toxicity
For glutaraldehyde: In animal studies, did not interfere with reproduction.

Mutagenicity
For glutaraldehyde: In vitro genetic toxicity studies were negative in some cases and positive in other cases. Animal genetic toxicity studies were predominantly negative.

Aspiration Hazard
Aspiration into the lungs may occur during ingestion or vomiting, causing tissue damage or lung injury.

COMPONENTS INFLUENCING TOXICOLOGY:

Glutaraldehyde

Acute inhalation toxicity
LC50, Rat, female, 4 Hour, dust/mist, 0.28 mg/l

LC50, Rat, male, 4 Hour, dust/mist, 0.35 mg/l

12. ECOLOGICAL INFORMATION

Ecotoxicological information on this product or its components appear in this section when such data is available.

Toxicity

Glutaraldehyde

Acute toxicity to fish
Material is highly toxic to aquatic organisms on an acute basis (LC50/EC50 between 0.1 and 1 mg/L in the most sensitive species tested).
LC50, Cyprinodon variegatus (sheepshead minnow), 96 Hour, 32 mg/l

Acute toxicity to aquatic invertebrates
LC50, copepod Acartia tonsa, semi-static test, 48 Hour, 3 mg/l

Acute toxicity to algae/aquatic plants
ErC50, Desmodesmus subspicatus (Scenedesmus subspicatus), 72 Hour, 0.6 mg/l
NOEC, Desmodesmus subspicatus (Scenedesmus subspicatus), 72 Hour, Growth rate inhibition, 0.025 mg/l

Toxicity to bacteria
EC50, activated sludge, > 50 mg/l, OECD 209 Test

Chronic toxicity to aquatic invertebrates
NOEC, water flea Daphnia magna, flow-through test, 21 d, number of offspring, 0.12 mg/l

Toxicity to Above Ground Organisms
Material is moderately toxic to birds on an acute basis (LD50 between 51 and 500 mg/kg).

INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Incinerator or other thermal destruction device.

14. TRANSPORT INFORMATION

DOT

Proper shipping name	Corrosive liquid, acidic, organic, n.o.s.(Glutaraldehyde)
UN number	UN 3265
Class	8
Packing group	III

Classification for SEA transport (IMO-IMDG):

Proper shipping name	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.(Glutaraldehyde)
UN number	UN 3265
Class	8
Packing group	III
Marine pollutant	No
Transport in bulk according to Annex I or II of MARPOL 73/78 and the IBC or IGC Code	Consult IMO regulations before transporting ocean bulk

Classification for AIR transport (IATA/ICAO):

Proper shipping name	Corrosive liquid, acidic, organic, n.o.s.(Glutaraldehyde)
UN number	UN 3265
Class	8
Packing group	III

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

OSHA Hazard Communication Standard
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312
Acute Health Hazard

Legend

ACGIH	USA. ACGIH Threshold Limit Values (TLV)
C	Ceiling limit
DSEN, RSEN	Skin and respiratory sensitizer

Information Source and References
This SDS is prepared by Product Regulatory Services and Hazard Communications Groups from information supplied by internal references within our company.

THE DOW CHEMICAL COMPANY urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS

DANGER

KEEP OUT OF REACH OF CHILDREN

Corrosive. Causes irreversible eye damage. Causes skin irritation. Harmful if inhaled. Harmful if swallowed. Harmful if absorbed through skin. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Causes asthmatic signs and symptoms in hyper-reactive individuals.

Do not get in eyes, on skin, on clothing.
Avoid breathing vapor. Do not swallow.
Wear goggles, protective clothing, and butyl or nitrile gloves.
Wash thoroughly with soap and water after handling.
Remove contaminated clothing and wash before reuse.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA.

STORAGE AND HANDLING

AQUCAR GA 15 Water Treatment Microbiocide is incompatible with many commonly used materials of construction such as steel, galvanized iron, aluminum, tin, and zinc. AQUCAR GA 15 Water Treatment Microbiocide can be stored and handled in baked phenolic-lined steel, polyethylene, stainless steel, or reinforced epoxy-plastic equipment. This product freezes at about 20.3° F (-6.5° C). Therefore, unless the storage tank is inside or underground, heating and insulation may be required. If heating is needed, exposure to high temperatures should be avoided. For short storage times (up to about 1 month), temperatures of up to 100° F (37.8° C) can be tolerated but the preferred maximum storage temperature is about 80° F (26.7° C).

A stainless steel centrifugal pump is suggested for transfer service. Spiral-wound stainless steel with TEFLON® Polymer is suitable for gaskets and packing.

Handle in a well-ventilated area. If vapors are irritating to the nose or eyes, special ventilation or respiratory protection (MSHA/NIOSH approved air purifying respirator equipped with an organic vapor cartridge) may be required.

STORAGE AND DISPOSAL

PESTICIDE DISPOSAL: Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited. Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or your Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL

Nonrefillable container. Do not reuse or refill this container. Triple or pressure rinse container (or equivalent) promptly after emptying. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or other procedures approved by state and local authorities.

BEFORE HANDLING OR USING THIS PRODUCT, SEE YOUR EMPLOYER AND READ CURRENT MATERIAL SAFETY DATA SHEET.

AQUCAR™ GA 15 Wat

A highly effective Microbiocide for use in controlling Bacteria including Slime Forming Bacteria Systems Including those that contain Reverse Osmosis Membranes and Service Water and Auxi Pigments and Filler Slurries for Paper and Paperboard, Water Based Coatings for Paper and Pap Gas Storage Fields and Equipment; such as Steam-Injection Water Holding Tanks, Flood Water, Industrial Recirculating Water Handling Systems.

Active Ingredient:	
Glutaraldehyde	15%
Inert Ingredient(s):	85%
Total	100%

KEEP OUT OF REACH OF CHILDREN
DANGER

FIRST AID	
IF SWALLOWED:	• Call a poison control center or a doctor immediately for treatment advice. • DO NOT INDUCE VOMITING. • Do not give anything to drink.
IF IN EYES:	• Wash immediately and continuously with flowing water for at least 30 minutes. • Remove contact lenses after the first 5 minutes and continue washing. Obtain prompt medical consultation, preferably from an ophthalmologist. • Call a poison control center or a doctor immediately for treatment advice.
IF ON SKIN OR CLOTHING:	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15–20 minutes. • Call a poison control center or a doctor for treatment advice.
IF INHALED:	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, and then give artificial respiration, preferably mouth-to-mouth if possible. • Call a poison control center or a doctor for further treatment advice.
NOTE TO PHYSICIAN: Aspiration may cause lung damage. Probable mucosal damage may contraindicate the use of gastric lavage.	
Have the MSDS and, if available, the product container or label with you when calling a poison control center or a doctor, or going for treatment.	
IN CASE OF AN EMERGENCY endangering life or property involving this product, call collect (989)636-4400.	

SEE SIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS.

E.P.A. Registration No. 464-693
E.P.A. Est. 56485-PA-001

Produced for:

DOW®

The Dow Chemical Company
Midland, Michigan 48674 U.S.A.
(989)636-4400

Made in U.S.A.

NET CONTENTS: 6 gallons **NET WEIGHT: 50 LBS.**

LOT NO:

ATTACHMENT 4

er Treatment Microbiocide

and Sulfate-Reducing Bacteria, Fungi (Yeast and Molds) and Algae in Air washers and Industrial Scrubbing Systems, Recirculating Cooling and Process Water liary Systems, Heat Transfer Systems, Wastewater Systems Including Wastewater Sludge and Holding Tanks, Paper Mills and Paper Mill Process Water Systems, erboard and in Oil Well Drilling, Oil Field Processing Applications, Oil Field Water Systems, Oil and Gas Production and Transmission Pipelines and Systems, and Fracturing Fluids, Injection Water, Holding Pond Water, Disposal-Well Water, Water Holding Tanks, Fuel Storage Tanks and related Refinery and Oil Field Closed,

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

AIR WASHERS AND INDUSTRIAL SCRUBBING SYSTEMS/RECIRCULATING COOLING AND PROCESS WATER SYSTEMS

This product may be used only in industrial air washers and air washer systems which have mist-eliminating components.

AQUCAR GA 15 Water Treatment Microbiocide should be added at the application rates described below to a water treatment system at a convenient point of uniform mixing such as the basin area. Addition may be made intermittently (SLUG DOSE) or continuously. Badly fouled systems can be shock treated with AQUCAR GA 15 Water Treatment Microbiocide. Under these conditions, blowdown should be discontinued for up to 24 hours.

AQUCAR GA 15 Water Treatment Microbiocide can be used in industrial process water systems that contain ultra filtration units and non-medical reverse osmosis membranes (where approved for compatibility by the membrane manufacturer) and associated distribution systems.

INTERMITTENT (SLUG DOSE) METHOD

Initial Dose: When the system is noticeably fouled, apply 4.1 to 8.2 fluid ounces of AQUCAR GA 15 Water Treatment Microbiocide per 100 gallons of water in the system. Repeat until control is achieved.

Subsequent Dose: When microbial control is evident, add 1.6 to 4.1 fluid ounces of AQUCAR GA 15 Water Treatment Microbiocide per 100 gallons of water in the system weekly, or as needed to maintain control.

Badly fouled systems must be cleaned before treatment is begun.

CONTINUOUS FEED METHOD

Initial Dose: When the system is noticeably fouled, apply 4.1 to 8.2 fluid ounces of AQUCAR GA 15 Water Treatment Microbiocide per 100 gallons of water in the system.

Subsequent Dose: Maintain this treatment level by starting a continuous feed of 0.8 to 4.1 fluid ounces of AQUCAR GA 15 Water Treatment Microbiocide per 100 gallons of water in the system per day.

Badly fouled systems must be cleaned before treatment is begun.

SERVICE WATER AND AUXILIARY SYSTEMS

AQUCAR GA 15 Water Treatment Microbiocide should be used at the same application rates, and in the same manner as described above. It should be added to the system at a point that will allow for uniform mixing throughout the system.

HEAT TRANSFER SYSTEMS

(Evaporative Condensers, Dairy Sweetwater Systems, Hydrostatic Sterilizers And Retorts, And Pasteurizers And Warmers)

AQUCAR GA 15 Water Treatment Microbiocide should be used at the same application rates, and in the same manner as described above. It should be added to the system at a point of uniform mixing such as a basin area, sump area, or other reservoir or collecting area from which the treated water will be circulated uniformly throughout the system.

INDUSTRIAL WASTEWATER SYSTEMS

(Wastewater Systems, Wastewater Sludge And Wastewater Holding Tanks)

AQUCAR GA 15 Water Treatment Microbiocide should be added to a wastewater system or sludge at a convenient point of uniform mixing such as the digester. Add 1.4 to 7.2 gallons (1500 to 7,500 ppm AQUCAR GA 15 Water Treatment Microbiocide) per 1,000 gallons of wastewater or sludge.

PAPER MILLS AND PAPER MILL PROCESS WATER SYSTEMS

AQUCAR GA 15 Water Treatment Microbiocide should be added to the paper making system at a point of uniform mixing such as the beaters, broke chest pump, save-all tank, or white-water tank.

Initial Dose: When the system is noticeably contaminated, add 1.7 to 9.9 lbs of AQUCAR GA 15 Water Treatment Microbiocide per ton of pulp or paper (dry basis) as a slug dose. Repeat until control is achieved. Heavily fouled systems should be boiled out prior to initial treatment.

Subsequent Dose: When microbial control is evident, add 1.0 to 6.6 lbs of AQUCAR GA 15 Water Treatment Microbiocide per ton of pulp or paper (dry basis) as a slug dose as necessary to maintain control.

PIGMENTS AND FILLER SLURRIES FOR PAPER AND PAPERBOARD

(For use in food and non-food contact pigments and filler slurries)

Use from 0.33 to 2.0 lbs. of AQUCAR GA 15 Water Treatment Microbiocide per 1,000 lbs. of dry powder to produce a concentration from 333 to 2,000 ppm as product (based on slurry solids) in the mixed slurry.

WATER BASED COATINGS FOR PAPER AND PAPERBOARD

NOTE: For use in non-food contact coatings only.

Use from 0.33 to 2.0 lbs. of AQUCAR GA 15 Water Treatment Microbiocide per 1,000 lbs. of dry powder to produce a concentration from 333 to 2,000 ppm as product (based on slurry solids) in the mixed slurry.

WATER FLOODS

AQUCAR GA 15 Water Treatment Microbiocide should be added to a water flood system at a point of uniform mixing.

Initial Treatment: When the system is noticeably contaminated, add 330 to 16,670 ppm AQUCAR GA 15 Water Treatment Microbiocide to the system (0.3 to 16.0 gallons AQUCAR GA 15 Water Treatment Microbiocide per 1,000 gallons flood water). Repeat until control is achieved.

Subsequent Dose: When microbial control is evident, add 67 to 16,670 ppm AQUCAR GA 15 Water Treatment Microbiocide (0.06 to 16.0 gallons AQUCAR GA 15 Water Treatment Microbiocide per 1,000 gallons flood water) to the system weekly, or as needed to maintain control.

FRAC FLUIDS

Product not registered for this use in the State of California.

AQUCAR GA 15 Water Treatment Microbiocide reduces bacterial contamination and degradation of fracturing fluids and gels used in oil and gas well stimulations. Add AQUCAR GA 15 Water Treatment Microbiocide to the frac water storage tanks or directly into the well head injection pipeline as the water is being pumped down-hole.

Dose Range: AQUCAR GA 15 Water Treatment Microbiocide should be added at a rate of 333 to 16,667 (3.2 – 160 gallons per 10,000 gallons) depending on the degree of bacterial fouling in the source water.

DRILLING, COMPLETION, AND WORKOVER FLUIDS

AQUCAR GA 15 Water Treatment Microbiocide should be added to a drilling fluid system at a point of uniform mixing such as the circulating mud tank.

Initial treatment: Add 170 to 3,330 ppm AQUCAR GA 15 Water Treatment Microbiocide (0.7 to 13.4 gallons AQUCAR GA 15 Water Treatment Microbiocide per 100 barrels of fluid) to a freshly prepared fluid depending on the severity of contamination.

Maintenance dosage: Maintain a concentration of 170 to 3,330 ppm AQUCAR GA 15 Water Treatment Microbiocide by adding 0.7 to 13.4 gallons of AQUCAR GA 15 Water Treatment Microbiocide per 100 barrels of additional fluid, or as needed, depending on the severity of contamination.

PACKER FLUIDS

AQUCAR GA 15 Water Treatment Microbiocide should be added to a packer fluid at a point of uniform mixing such as a circulating holding tank. Add 170 to 2,000 ppm AQUCAR GA 15 Water Treatment Microbiocide (0.7 to 8.1 gallons AQUCAR GA 15 Water Treatment Microbiocide per 100 barrels of fluid) to a freshly prepared fluid depending on the severity of contamination. Seal the treated packer fluid in the well between the casing and production tube.

OIL PRODUCTION AND TRANSMISSION PIPELINES AND SYSTEMS

AQUCAR GA 15 Water Treatment Microbiocide should be added to an oil production or transmission line via direct injection. The application should be conducted to ensure maximum distribution of AQUCAR GA 15 Water Treatment Microbiocide throughout the entire internal pipeline surface by adding a sufficient amount of biocide to detect/measure a residual concentration at the back end of the pipeline system. Criteria for success of the treatment will be a reduction in bacterial counts and/or reduced corrosion rates. To facilitate application, it may be desirable to dilute the AQUCAR GA 15 Water Treatment Microbiocide with an appropriate solvent immediately before use. The concentration in the solvent should not fall below an active concentration range of 500 to 5,000 ppm based on the volume of water in the pipeline. Injections to the system should be weekly, or as needed to maintain control.

GAS PRODUCTION AND TRANSMISSION PIPELINES AND SYSTEMS

AQUCAR GA 15 Water Treatment Microbiocide should be added to a gas production or transmission pipeline via direct injection. The application should be conducted to ensure maximum distribution of AQUCAR GA 15 Water Treatment Microbiocide throughout the entire internal pipeline surface by adding a sufficient amount of biocide to detect/measure a residual concentration at the back end of the pipeline system. Criteria for success of the treatment will be a reduction in bacterial counts and/or reduced corrosion rates. To facilitate application, it may be desirable to dilute the AQUCAR GA 15 Water Treatment Microbiocide with an appropriate solvent immediately before use. The concentration in the solvent should not fall below an active concentration range of 500 to 5,000 ppm based on the volume of water in the pipeline. Injections to the system should be weekly, or as needed to maintain control.

GAS STORAGE WELLS AND SYSTEMS

Individual injection wells should be treated with a sufficient quantity of AQUCAR GA 15 Water Treatment Microbiocide to produce a concentration of 1,670 to 16,670 ppm AQUCAR GA 15 Water Treatment Microbiocide when diluted by the water present in the formation. Injection should take place before gas is injected (during the summer). Injections should be repeated yearly, or as needed to maintain control.

Individual drips should be treated with a sufficient quantity of AQUCAR GA 15 Water Treatment Microbiocide to produce a concentration of 670 to 6,670 ppm AQUCAR GA 15 Water Treatment Microbiocide when diluted by the water present in the drip. Injections should be repeated yearly, or as needed to maintain control.

HYDROTESTING

Water used to hydrotest pipelines or vessels should contain 330 to 13,330 ppm AQUCAR GA 15 Water Treatment Microbiocide (0.3 to 12.8 gallons AQUCAR GA 15 Water Treatment Microbiocide per 1,000 gallons water), depending on water quality and length of time the equipment will remain idle.

PIPELINE PIGGING AND SCRAPING OPERATIONS

Add AQUCAR GA 15 Water Treatment Microbiocide to a slug of water immediately following the scraper (ideally this water volume can be kept to a minimum and contained between the scraper and a trailing pig). Sufficient AQUCAR GA 15 Water Treatment Microbiocide should be added to produce a concentration of 0.3 to 3.3% (0.3 to 3.2 gallons AQUCAR GA 15 Water Treatment Microbiocide per 100 gallons water), depending on the length of the pipeline and the severity of biofouling.

LIMITED WARRANTY AND DISCLAIMER

Seller warrants that the product conforms to its chemical description as contained on this label and is reasonably fit for the purposes stated on this label when used in accordance with directions under normal conditions of use. THE WARRANTIES MADE IN THIS PARAGRAPH ARE SELLER'S SOLE WARRANTIES WITH RESPECT TO THE PRODUCT AND ARE MADE EXPRESSLY IN LIEU OF AND EXCLUDE ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE AND ALL OTHER EXPRESS OR IMPLIED REPRESENTATIONS AND WARRANTIES.

NOTICE

Do Not Ship or Store with Food, Feeds, Drugs, or Clothing

117774-4/29/2011-RA2012

ATTACHMENT 4

ATTACHMENT 4

Safety Data Sheet

FORMULA 1152

1. IDENTIFICATION

Product Name: FORMULA 1152 **Revised:** 5/11/15
Chemical Name: Not Applicable
Description: Clear, light amber liquid with characteristic odor
Recommended Use: Cooling Water Treatment
Restrictions on Use: For industrial use only. Not for use in treating drinking water or some food processing cooling systems.

COMPANY IDENTIFICATION

B & L CONTROL SERVICE, INC.
1448 SARATOGA ROAD
BALLSTON SPA, NY 12020

PHONE NUMBER: (518) 273-0500

EMERGENCY PHONE NUMBERS

CHEMTREC (800) 424-9300
Outside USA: CHEMTREC COLLECT (703) 527-3887

2. HAZARD(S) IDENTIFICATION

GHS Classification:

Serious eye damage/irritation - Category 1
Skin corrosion/irritation - Category 1C
Specific target organ toxicity, single exposure - Category 1
Specific target organ toxicity, single exposure - Category 1

Signal Word: Danger

Symbol(s):

Hazard Statements:

Causes severe skin burns and eye damage.
Causes damage to digestive system if swallowed
Causes damage to respiratory system if inhaled

Precautionary Statements:

Prevention

Do not breathe dusts or mists. Do not get in eyes, on skin, or on clothing. Wash hands, forearms, gloves and contaminated surfaces thoroughly after handling. Do not eat, drink or smoke when using this product. Wear protective gloves/eye protection/face protection.

Response

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CONTROL CENTER or doctor for treatment advice.
IF ON SKIN (or hair): Take off immediately all contaminated clothing and wash it before reuse. Rinse skin with water/shower. Specific treatment (see First Aid on SDS or on this label).
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CONTROL CENTER or doctor for treatment advice.
IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Immediately call a POISON CONTROL CENTER or doctor for treatment advice.

Storage

Store locked up.

Disposal

Specific Hazards Arising from the Chemical: Product is corrosive to eyes, skin, and respiratory system. Closed containers may rupture (due to buildup of pressure) when exposed to extreme heat. If evaporated to dryness, some product residuals may burn. Contact with some metals may generate explosive hydrogen gas. Thermal decomposition may release oxides of carbon and nitrogen.

Special Protective Equipment and Precautions for Fire-Fighters: Wear self-contained breathing apparatus and full turn-out gear. Approach fire from upwind direction. If possible, move containers away from fire. Cool fire exposed containers with water spray. If containers rupture or leak, product may evolve irritating or toxic gas under extreme heat. Contain runoff.

6. ACCIDENTAL RELEASE MEASURES

Spill Containment and Clean-up Instructions:
Wear suitable protective equipment found in section 8. Small spills may be flushed with copious quantities of water, preferably to a sanitary sewer or waste treatment facility. Larger spills may be absorbed in sawdust or other absorbent and sweepings disposed of in an approved landfill. The area may then be flushed with copious quantities of water. Floor may be slippery; use care to avoid falling. Avoid release of this product into the environment to prevent contamination of soil, sewers, natural waterways and/or groundwater. See Section 12 for Ecological Information.

7. HANDLING AND STORAGE

Handling and Storage:
Store in a cool, dry, well ventilated area, between 10°C and 49°C. Keep containers tightly closed when not in use and follow all recommended safety precautions when handling the material. Keep out of sun and away from heat or open flame. Keep away from incompatible materials. See Section 10 for incompatible materials.

8. EXPOSURE CONTROL / PERSONAL PROTECTION

Engineering Controls: General ventilation expected to be satisfactory

PERSONAL PROTECTION EQUIPMENT

Respiratory: Not normally required unless product is openly handled in confined areas where high concentrations of vapor could occur. Where misting may occur, wear an OSHA/NIOSH approved (or equivalent) half-mask, dust/mist air purifying respirator. Air-purifying respirators should be equipped with organic vapor cartridges.

Eyes and Face: Chemical resistant goggles or face shield.

Hands and Skin: Chemical resistant rubber, neoprene latex or PVC

Other Protective Equipment: Eyewash station in area of use. Wear long sleeve shirt, long pants, and boots.

EXPOSURE GUIDELINES

Exposure Limits:

COMPONENT	TLV
MOLYBDATE SALT	5 mg/m³(Mo)
POTASSIUM HYDROXIDE	2mg/m³/15M

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor: Clear, light amber liquid with characteristic odor
Odor Threshold: N.D. **Vapor Pressure:** N.A.

*Calculated based on GHS acute aquatic toxicity formula.

Product Fate Data: None established for this product.

Biodegradation Data: None established for this product.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose of in accordance with local, regional, national and international regulations. Contact the Hazardous Waste representative at the nearest EPA Regional Office for guidance. Container Disposal: Triple rinse container (or equivalent) promptly after emptying and offer for reconditioning if appropriate. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal.

14. TRANSPORT INFORMATION

US DEPARTMENT OF TRANSPORTATION (DOT) INFORMATION

UN/NA ID Number: UN3266
Proper Shipping Name: CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S. (CONTAINS POTASSIUM HYDROXIDE)
Hazard Class: 8
Packing Group: PGIII

VESSEL TRANSPORT (IMO/IMDG)

UN/NA ID Number: UN3266
Proper Shipping Name: CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S. (CONTAINS POTASSIUM HYDROXIDE)
Hazard Class: 8
Packing Group: PGIII
Marine Pollutant: No

15. REGULATORY INFORMATION

US FEDERAL REGULATIONS

TSCA: All ingredients listed or exempt from listing.
CERCLA and/or SARA RQ:
Reportable Quantity: POTASSIUM HYDROXIDE (CAS#1310-58-3) - 1000lbs. (455 kg)
SARA Section 302 Hazard Class: No ingredients listed in this section.
SARA Section 311/312 Chemicals:
Acute Health Hazard: Yes
Chronic Health Hazard: No
Fire Hazard: No
Sudden Release of Pressure Hazard: No
Reactive Hazard: No
SARA Section 313 Chemicals: No ingredients listed in this section.

STATE REGULATIONS

This product does not contain any ingredients known to the State of California to cause cancer.

16. OTHER INFORMATION

HAZARD RATING SUMMARY

Hazard Rating System:	**NFPA**
Health:	2
Flammability:	0
Reactivity:	1
Special:	

CODE TRANSLATION
0 = Minimal Hazard
1 = Slight Hazard
2 = Moderate Hazard
3 = Severe Hazard
4 = Extreme Hazard

Appendix H

DOH Notification Log

Regulation Reference Section: 4.10 Electronic registration and reporting.

All cooling towers required registration by September 17, 2015. In addition, any new cooling towers or changes in Ownership require registration with the NYS Department of Health. The following registration information is required;

- date of last routine culture sample collection, sample results, and date of any required remedial action;
- date of any legionella sample collection, sample results, and date of any required remedial action;
- date of last cleaning and disinfection;
- dates of start and end of any shutdown for more than five days;
- date of last certification and date when it was due;
- date of last inspection and date when it was due;
- date of discontinued use; and
- such other information as shall be determined by the department.

Regulation Reference Section: 4.8 Discontinued use.

The owner of a cooling tower shall notify the NYS State Department of Health within 30 days after removing or permanently discontinuing use of a cooling tower. Such notice shall include a statement that such cooling tower has been disinfected and drained in accordance with the same procedures as set forth in the shutdown plan, as specified in the maintenance program and plan.

Date	Initials	Summary
8/31/15		Initial CT registration