

Industrial Cooling Systems

Cooling Towers, Chillers, Heat Exchangers
Flow Meters and Controls



Direct Reading Flowmeters
For Liquids and Gases

Introduction - Cooling System Basics

Today plants face escalating utility cost and tightening EPA control requirement. RCM Industries, Inc. provides direct reading differential pressure flow meters that provide precise flow measurement to manage, maintain and reduce operating cost. The purpose of a cooling system is to transfer heat from the cooling water generated from various industrial equipment and production processes.

Cooling systems are composed of a heat exchanger and cooling unit (chiller). The heat exchanger allows cooling water to remove heat from production processes and plant equipment. The cooling unit removes the heat gained from contact with cooling water with hot equipment and fluids in the heat exchanger. The heat is removed by transferring the heat to air through evaporation to the atmosphere thru towers or as a self contained closed loop system.

Cooling systems are used in many industrial applications:

- Petrochemical
- Pharmaceutical
- Manufacturing
- Power Generation
- Laser Welding
- Refineries – Ethanol / Biodiesel / Gasoline
- Food and Beverage
- Automotive
- Semiconductor
- Satellite Systems
- Jetway Preconditioned Air System

Evaporation Rate

A general rule is for each 10°F circulated water needs to be cooled, 1% of the cooling water is evaporated in the cooling tower. The following equation provides an estimate of the evaporation rate for various circulated cooling water temperature reduction.

Evaporation Rate = Recirculated Flow Rate x (Warm Water Temp. – Desired Cool Water Temp.) x (1% Evaporation per 10°F Temp. Reduction)

Example: If a cooling tower circulates water at a rate of 1,000 gpm and the cooling tower needs to cool the warmed water exiting the heat exchanger from 90°F to 80°F use the following formula to determine the evaporation rate:

Evaporation Rate = 1,000 gpm x (90°F - 80°F) x 0.01/10°F = 10 gpm

Blow-Down Water

The water that drains from the cooling equipment is called the “blow-down” water. This water has a higher mineral content than potable water algae, bacteria or pathogen may also be present. This makes potable water or treated water using additives to maintain proper pH levels more favorable. Reusing untreated blow down water is not suitable for irrigation of any kind due to high levels of TDS (Total Dissolved Solids).

Make Up Water - Filtration and Treatment

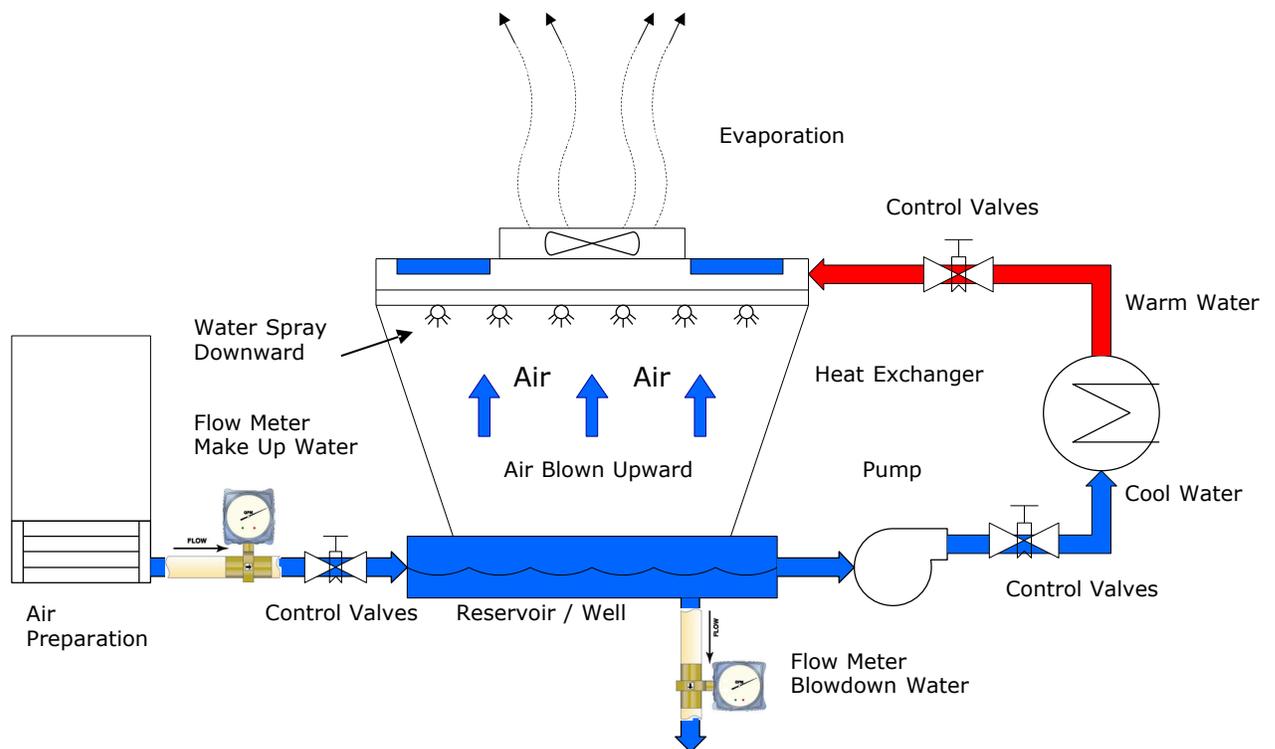
Most industrial cooling towers use river water or well water as their source for fresh cooling water called make up water. Make up water is recirculated back to the heat exchanger replacing cooling water lost through evaporation, blowdown and other losses.

Adding raw make up water before filtration or treatment can complicate the efficiency and add cost in maintaining the entire cooling system. Any water source has various levels of dissolved or suspended solids that are left behind causing the remaining cooling water to become concentrated. This concentration of solids decreases the efficiency of the cooling system while increasing the chance for a catastrophic failure and damage to critical equipment and production processes.

Scaling and Biofouling can also deprive the cooling system from operating properly. Water treatment can reduce the amount of biological growth in the cooling system.

Chlorine is the most widely used chemical for controlling biofouling in a cooling system. Chlorine does have its disadvantages in that it reacts with water to form hydrochloric acid and hypochlorous acid causing environmental issues. Chlorine dioxide is a better alternative when treating the water. Chlorine dioxide does not react with water nor does its chemical form or biocidal activity change with changes in pH. Combining corrosion and scaling inhibitors can also improve the water quality and avoid premature fouling.

Basic Cooling Tower Schematic



Point of Use and Modular Chillers

Industrial chillers typically come as complete packaged closed-loop systems, including the chiller unit, condenser, and pump station with recirculating pump, expansion valve, flow meter with low-flow alarm, internal cold water tank, and temperature control. The modular design of many chillers provides reliable and economical temperature control.

The process fluid being cooled is contained in a "closed" circuit and is not directly exposed to the atmosphere or the recirculated external water. The process fluid that flows through the closed circuit can be water, a glycol mixture or a refrigerant.

Industrial chillers are used for controlled cooling of products, mechanisms and factory machinery in a wide range of industries.



Chillers provide advanced thermal management solutions in various processes. Above are two Jetway air handling units used to provide cool air flow during pre-flight and loading of the aircraft which dramatically reduces fuel and operating cost.

Our Flo-Gage™ with optional reed switches or transmitter are added to provide an alarm or 4-20mA output when flow rates fall below normal operating conditions then supplied for control room reporting.

General Purpose:

Electrical Rating:

Ambient Temp.: 120°F (50°C)

Setability: $\pm 5\%$ F.S.

Hysteresis: $\pm 13\%$ F.S.

Contact Rating:

10 Watts

175 Vdc max.

125 Vac max.

Current: 350 mA max. Switching

Hazardous Location Approvals:

CSA / NRTL/c:

AEx ia IIC: Class I, Division I, Groups A, B, C, and D

Class II, Division I, Groups E, F, and G

KEMA: Ex ia IIC: Zone 0, II 1G T4 $0^\circ \leq T_a \leq 50^\circ\text{C}$ ATEX EC Type Examination



Reed switches are an economical solution for equipment protection and automation for critical processes in a variety of industrial and commercial applications. LED's provide viewing at a glance and easy field calibration, LED operating voltage 24Vdc, 20mA. Each switch is independently adjustable from 30% to 90% of full scale. The switches can be configured to your factory set points.

Monitoring the cooling system from a remote location can be obtain with the RCM digital display flow meter with optional Modbus communication RS232 / 485 / TTL and backlighting further enhance this models capability.



Process control depends on accurate and reliable flow measurement devices strategically placed in key areas along with a careful understanding of the process needs and requirements.

Our 7000 series bronze flow meter incorporates an interchangeable orifice which allows the user greater flexibility when to nominal flow rate is not known. In these application a 100% dial is used the flow rate is determined by the orifice used. Each body offer a range of flow rate for that given pipe size.

RCM Industries, Inc. provides flow meters to major chiller manufacturers these flow meters come equipped with a stainless steel connection (NPT) 1/4"-3" or brass solder connection in 1" 1 1/2" and 2", and broad range of flow rates to choose from they can be equipped with transmitters with 4-20mA output or dry contact reed switches to monitor flow rate conditions directly or to a remote control room. The chillers (see photo) incorporate 4 RCM flow meters with the reed switch option to monitor low conditions. These switches are factory set to the customer specifications making installation quick and easy.



VAF (Valve and Filter Corp.) Cooling Tower Filtration System



Conclusion

Designing the optimum cooling system requires a thorough evaluation of the cooling water equipment and cooling system operation primarily the water velocity and water temperature. Low water velocity (flow) causes deposits to form and high temperatures affects water quality requiring treatment to maintain proper pH levels, and minimize biological growth.

Many industrial applications utilize both cooling towers and closed loop portable chillers for point of use cooling, flow meters provide proper management of the flow rate of the cooling water optimizing the systems integrity and efficiency and improve manufacturing process yields.

With the high cost of fuel, construction, operating and energy, large users of cooling water are forced to maximize thermal and mechanical efficiency. An unrestricted cooling water flow requires careful control of deposit, corrosion, scaling, and biofouling saving thousand of dollars in maintenance and energy cost. Implementing a well maintained management system will provide long term cost saving while saving our environment in excess waste.

RCM Industries, Inc. is subject to a comprehensive quality audit from a Notified Body representative once every year meeting ISO 9000 requirements along with quarterly inspections by a CSA representative validating the manufacturing process to meet 94/9/EC directive requirements for hazardous locations. We pride ourselves in providing top quality workmanship in every product we manufacture.

Contact the factory our knowledgeable staff is always willing to help in all your flow measurement needs.