Mechanical Design Considerations

For Freeze-Prone Climates & Seasonally Operated Cooling Systems

All forms of water treatment are most effective during times of circulation and operation. Idling can lead to the settling of suspended particulate, the formation of uneven pH gradients, and can support the proliferation of microbiological "biofilms". The net effect of one or more of these processes is the formation of corrosion cells and in the case of biofilms, can result in Microbiological Induced Corrosion (MIC) - a source of pinhole corrosion and potential mechanical failure.

Draining piping isn't an acceptable alternative, except in areas prone to freezing, as compared to leaving it wet. Residual moisture exposed to carbon-dioxide from atmospheric tend to form a weak carbonic acid which removes the protective films and patina that both chemical-treatment and non-chemical devices (NCD) form during the operating season.

Protecting air-exposed pipe is a subject outside the scope of this bulletin but from a design perspective, consider the following goals:

- Minimize the length of pipe that the operator will have to drain;
- Reduce the quantity of chemicals required to protect exposed piping.

Maximizing System Protection During Idle Periods

If idling is the enemy, then circulation or treated water is most beneficial principle of providing protection against corrosion and biological proliferation. Protection is offered with NCD technology by periodically circulating water through the treatment device, which distributes the "treated" water through the system, and supports velocity-based dispersion of settleable solids. Velocity disrupts the potential formation of corrosion cells in the form of tubercles which are often observed in low-flow water mains. The effects of stagnation, which produces low oxygenation and limits oxygen concentration, is negated or at least greatly minimized.

The keys to mechanical design keys include: implementing bypasses which permit circulation at design velocity when permitted; programming controls that permit treated water to enter isolated vessels, and; adding both a manual makeup water connection and vents to remove any potentially entrained air. Lastly, additional benefit can be gained by adding a side-stream filter on a pump bypass permitting the unit to capture suspended particulate that are a potential food source for bacteria or deposits.

The aforementioned filtration unit can double as a chemical bypass feeder that assists the water treatment service technician in adjustments to the bulk water chemistry when required.

Consult the attached drawings for a general system representation.

FAVORABLE CHEMISTRY

The action of NCD technologies creates favorable, corrosion resistant environment during system operation including but not limited to developing a durable inhibitor following the attainment of calcium-saturation. When operator-based system cleaning or flushing activities reduces the corrosion control potential of the bulk water, a technician may add environmentally-friendly treatment products or other traditional chemistry that imparts corrosion impendence, particle dispersion, or biocides.

Periodic Circulation

As a rule of thumb, Azure recommends circulating at design velocity for at least one-hour per day, or three-hours every three-days. Heat-exchangers and pumps should be periodically opened or rotated into service at least weekly to prevent the stagnation. Exceeding the minimum suggested periods imparts more favorable water conditions while decreased velocity may hinder benefits.

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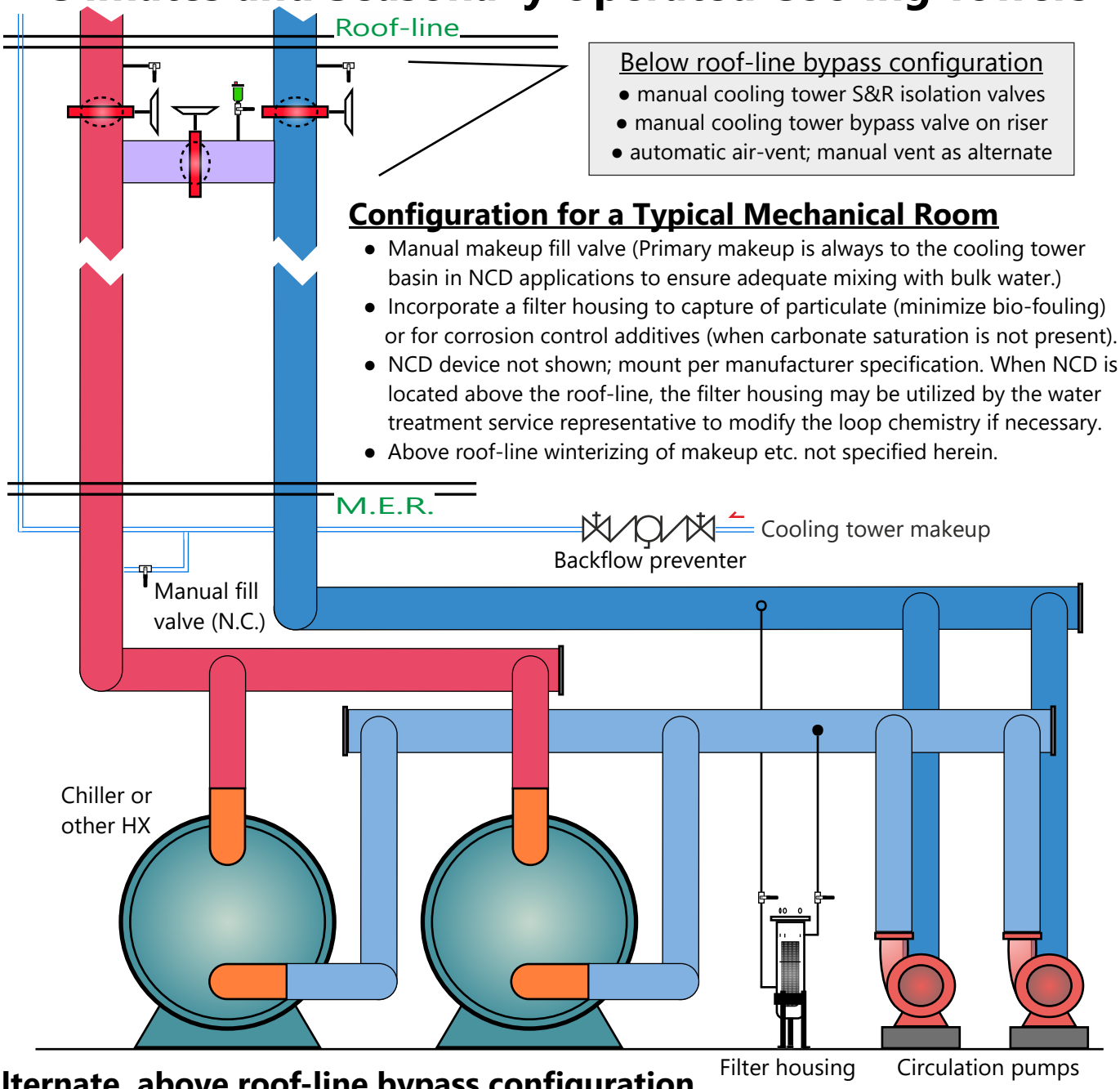
Mechanical Design Considerations for Freeze-prone Climates and Seasonally Operated Cooling Towers



Below roof-line bypass configuration

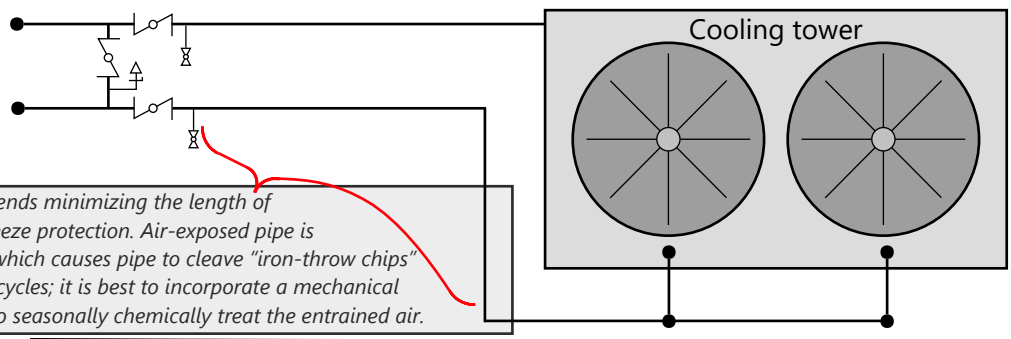
- manual cooling tower S&R isolation valves
- manual cooling tower bypass valve on riser
- automatic air-vent; manual vent as alternate

Configuration for a Typical Mechanical Room

- Manual makeup fill valve (Primary makeup is always to the cooling tower basin in NCD applications to ensure adequate mixing with bulk water.)
- Incorporate a filter housing to capture of particulate (minimize bio-fouling) or for corrosion control additives (when carbonate saturation is not present).
- NCD device not shown; mount per manufacturer specification. When NCD is located above the roof-line, the filter housing may be utilized by the water treatment service representative to modify the loop chemistry if necessary.
- Above roof-line winterizing of makeup etc. not specified herein.

Alternate, above roof-line bypass configuration

Manual butterfly valves shown on S&R pipe and bypass. Add drain valves to tower S&R and automatic air vent.



Design suggestion: Azure recommends minimizing the length of S/R pipe potentially drained for freeze protection. Air-exposed pipe is vulnerable to a form of corrosion which causes pipe to cleave "iron-throw chips" after multiple filling and draining cycles; it is best to incorporate a mechanical design that prevents the attempt to seasonally chemically treat the entrained air.

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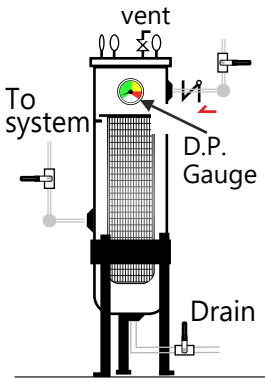
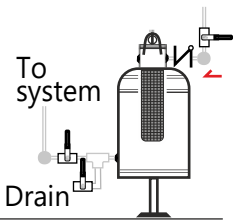


Filtration Options for Off-Season Circulation

The water quality in cooling loops circulated through a bypass (not under operating loads), can be maintained with a bag or media filter. Use the following housing & filter schedule as a guide.
Filter elements should be removed when load resumes.



Bag Filter Housing, High-Pressure Eye-Bolt Style

Bypass Feeder with Filter

Tower Tonnage	Approx. Gallons	Connection Size	Filter unit
< 250	< 2500	¾"	5-gallon Carbon steel bypass feeder with filter insert typical for a closed loop application
< 400	< 4000	¾ - 1"	#1 Stainless steel bag housing (or other inert material)
401 - 1000	4,000 - 10,000	1 - 1-½"	#2 Stainless steel bag housing (or other inert material)
> 1000	> 10,000	1-½ - 2"	One (1) single #2 housing with pleated filter or Dual #2 Stainless Steel bag filter (Pipe in parallel, not in series.)
Filter Bags	Polyester or poly/ felt 40 - 50-micron initially; reduce to 5 - 10-micron after first seasonal filter change.		
Cartridges	Polyester. 50-micron initially; reduce to 5 - 10-micron after first seasonal filter change.		

Recommended installation & accessories:

- Plumb all units with valves at the feeder or filter vessel for servicing including a drain valve (hard piped to sanitary drain preferred). Pipe unit across the pump S&R to initiate the greatest potential pressure drop; do not pipe across a pressure drop induced by a heat exchanger.
- Include a swing check valve to prevent accidental reverse flow.
- On #1 or larger filter vessels, include a single indicator gauge to indicate filter element cleanliness (consider reed-switch and B.A.S. Termination) or alternately inlet & outlet pressure gauges.
- Include a vent on #1 and larger filter housings. Many manufacturers supply a dedicated port for this purpose; typically 1/4" NPT.

General unit specifications:

- Rate all units to the intended application pressure (and temperature).

Bypass feeders: Carbon steel (or stainless), 5 - 7.5-gallon capacity, stainless steel filter basket. 3/4" inlet and outlet connections; add pipe-tee and drain valve when a dedicated drain port is not installed. Add stand or legs when not integral to unit. Azure recommends *General Water Systems* (with *Safety Bar* closure) FB-5-SB-CS-Z (5-gallon capacity), P-12 pedestal mount, SB-SS basket.

Filter housings: 316 S.S. (314 S.S. acceptable when bulk water chloride salt is maintained at 400 ppm or less) or inert other material, band clamp closure is acceptable up to 80 psi; eye-bolt lid closure > 80 psi, 316 S.S. filter basket. Add accessory legs when not integral to unit. Bush inlet and outlet connections to the table's suggested size. Typical of, or suggested equal to: *Pentair* E Series (bag), Watts PWHSJUM90 (cartridge).

Differential pressure gauge: *Differential Plus* DPP975, (option -RS for reed switch), RMB mounting base (as required), 0 - 15 psid range (typical) or equal. Mounting will vary with the housing selected.

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