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“CHILLER WINTERIZATION”

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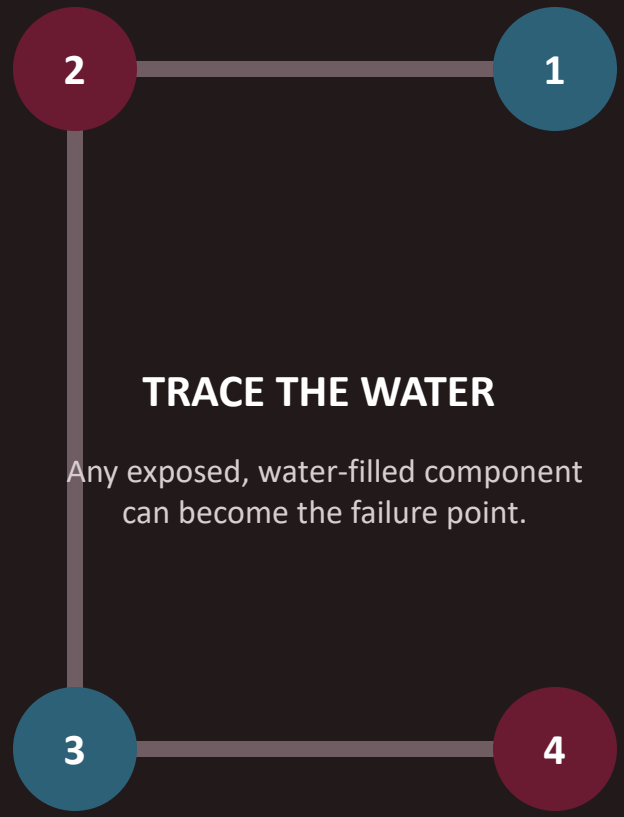
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LUNCH & LEARN

CHILLER WINTERIZATION

Protecting chiller plants during freezing conditions

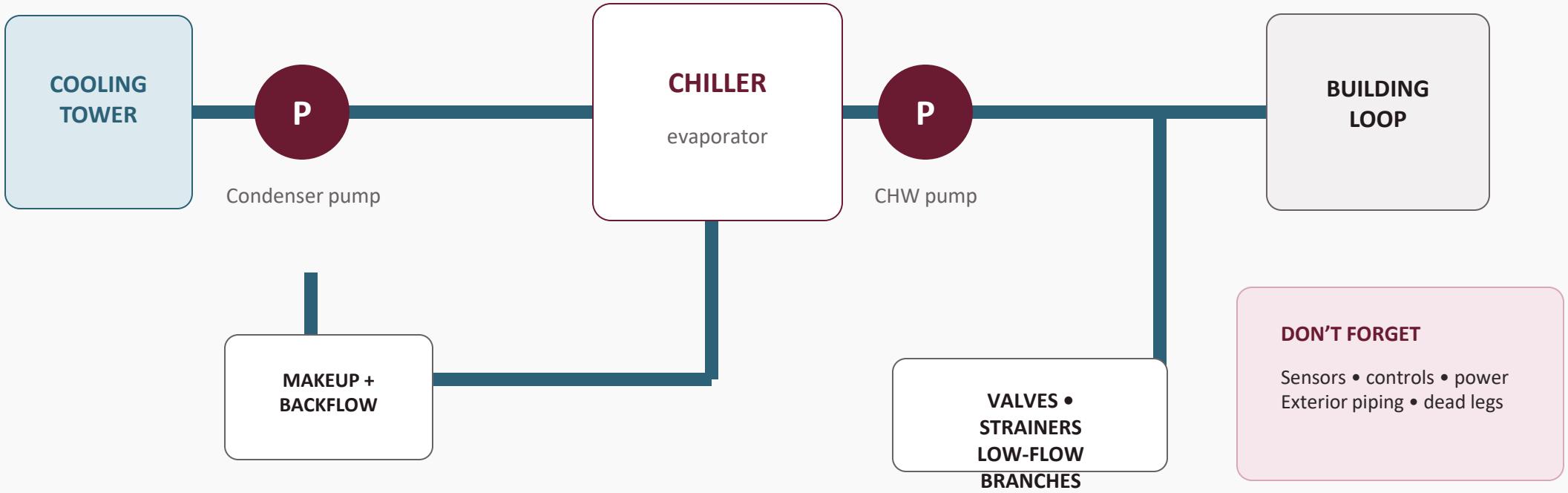
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Freeze risk follows the water path

TRACE THE WATER

Every exposed or stagnant water volume is a potential failure point.



A pump command is not proof of freeze protection



LOW OAT	ENABLE	COMMAND	PROVE	ALARM	RECOVER
Sensor + engineered threshold	Freeze mode + deadband	Pump ON + valves open	Status + flow + DP	No flow / no proof	Hold protection until the recovery threshold is met

WHAT THE BAS SHOULD KNOW

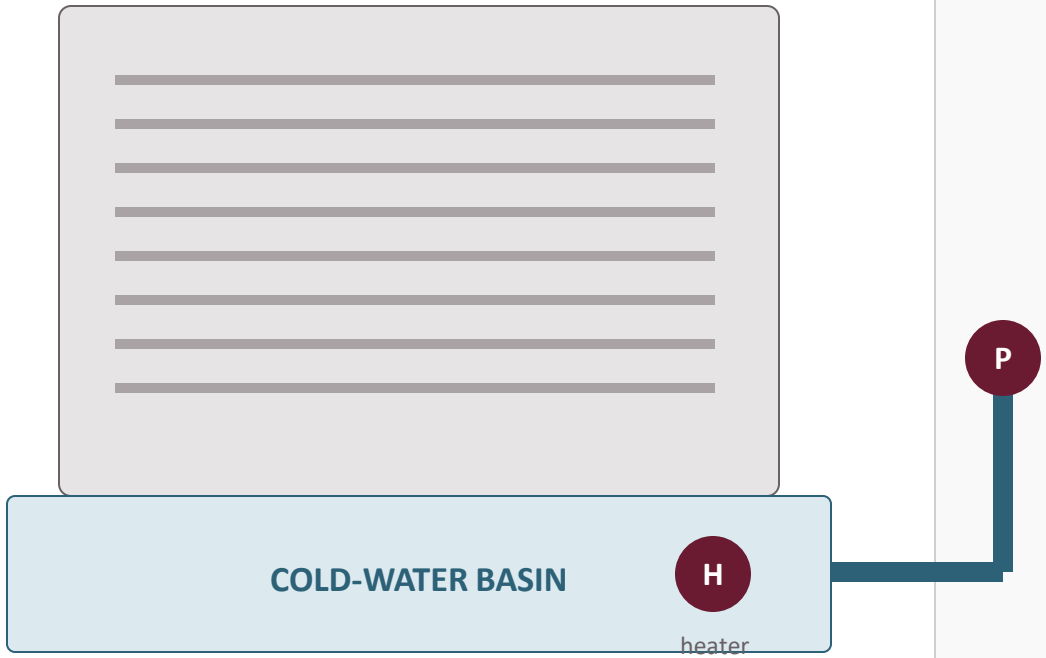
- Outside-air temperature and sensor health
- Required valve position
- Pump command and actual status
- Flow switch or differential-pressure proof
- Failure alarm and recovery deadband

ENGINEER THE THRESHOLD

There is no universal low-OAT setpoint.

Base enable and recovery values on equipment exposure, fluid, manufacturer requirements, project design, and local risk.

A basin heater protects the basin—not the connected piping



Exposed condenser-water piping

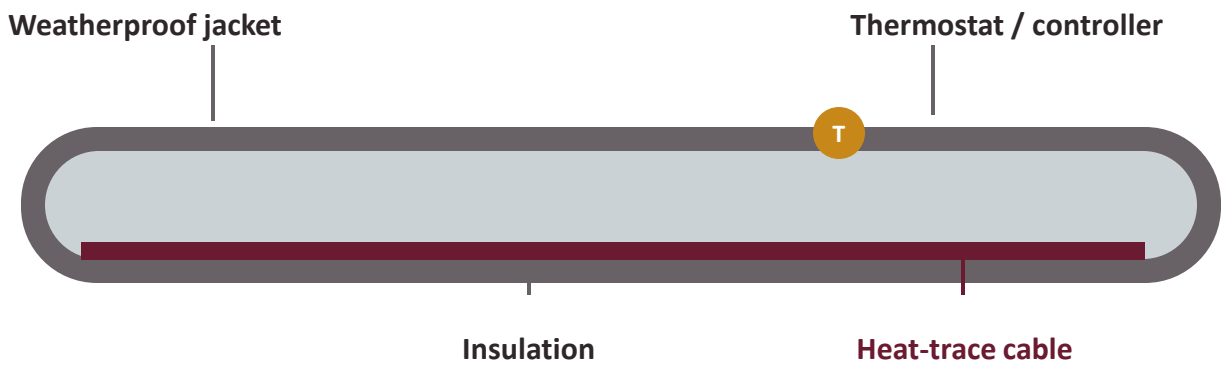
WINTER OPERATING PRIORITIES

1. **BASIN**
   Control water temperature; prove level before heater energizes.
2. **HEATER**
   Verify controls, amperage, contactor, and low-water cutoff.
3. **FANS**
   Sequence to control leaving water temperature and limit icing.
4. **FLOW**
   Maintain appropriate circulation and heat load when operating.
5. **PIPING**
   Heat trace, insulate, or drain exposed sections as designed.

Shutdown strategy: protect every retained water volume—or drain it.

Insulation slows heat loss; heat trace supplies heat

EXPOSED MAKEUP-WATER ASSEMBLY



Pre-winter test

Energize the circuit, verify controller response, test protection devices, and inspect every inch of insulation and jacketing.

PROTECT THE WHOLE ASSEMBLY

- Pipe and low-flow branches
- Backflow preventers
- Valves, fittings, strainers
- Controller and sensor
- Ground-fault protection
- Circuit power / current monitoring
- Insulation and weather jacket

Select and maintain propylene glycol for the actual risk

TWO DIFFERENT DESIGN TARGETS

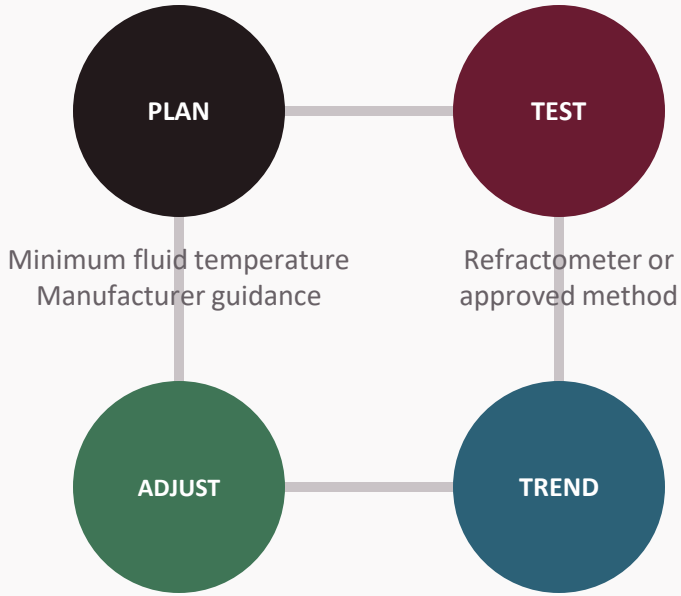
FREEZE PROTECTION

Keeps the solution fluid enough to circulate at the design minimum fluid temperature.

BURST PROTECTION

Allows ice/slush formation while protecting inactive piping from damaging expansion—when the system has adequate expansion volume.

MAINTENANCE LOOP



Use inhibited, HVAC-grade propylene glycol—and control makeup-water dilution.

Propylene glycol is not thermally equivalent to water

PROPERTY	WHEN PG INCREASES
Specific heat	DECREASES
Viscosity	INCREASES
Heat-transfer effectiveness	DECREASES
Pressure drop	INCREASES
Required pump head	CAN INCREASE

THE PENALTY CASCADES THROUGH THE SYSTEM

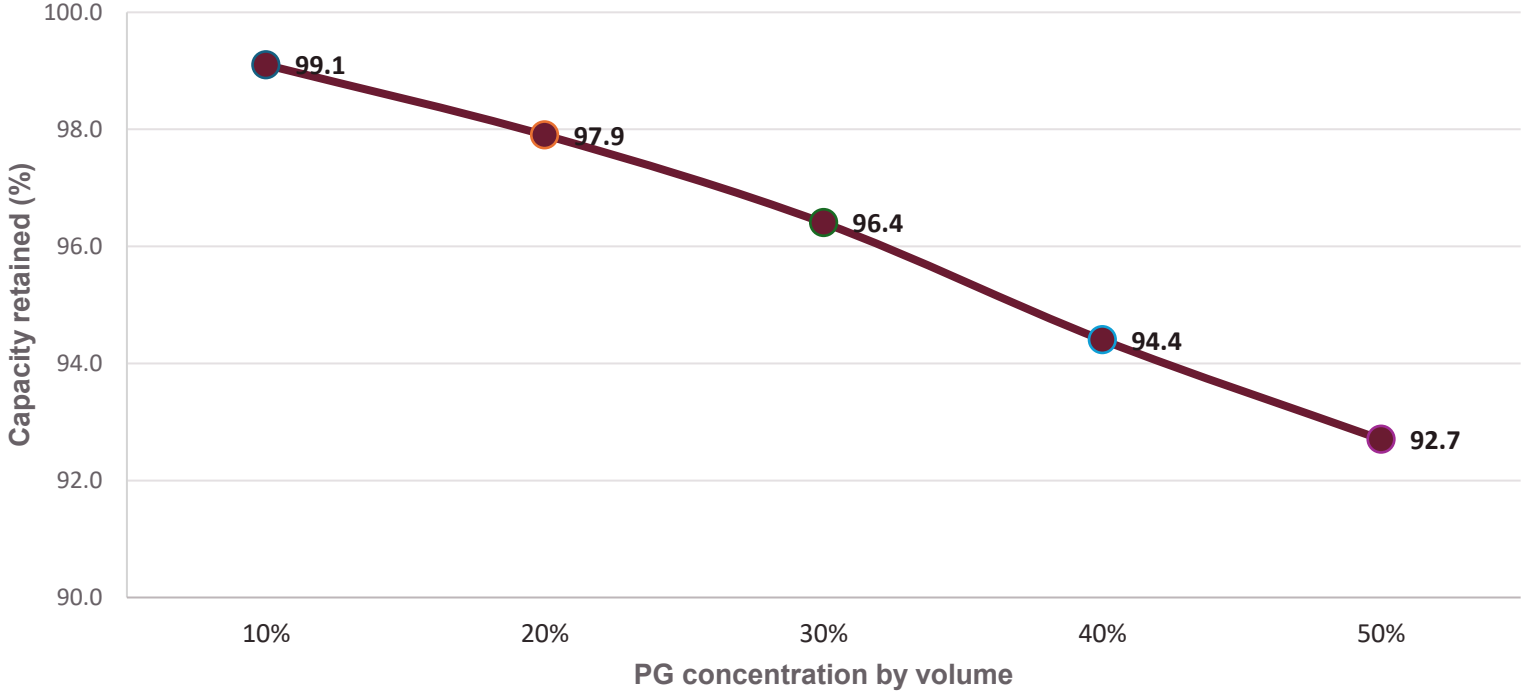
1. **CHILLER**
   capacity derate
2. **FLUID**
   less heat carried per gallon
3. **HEAT EXCHANGERS**
   lower effectiveness
4. **PUMPS + PIPING**
   more flow / higher ΔP

Direct chiller derate ≠ total system penalty

Selection software must evaluate the actual machine and loop.

Daikin example: direct chiller capacity declines gradually

PROPYLENE GLYCOL CONCENTRATION VS. CAPACITY RETAINED



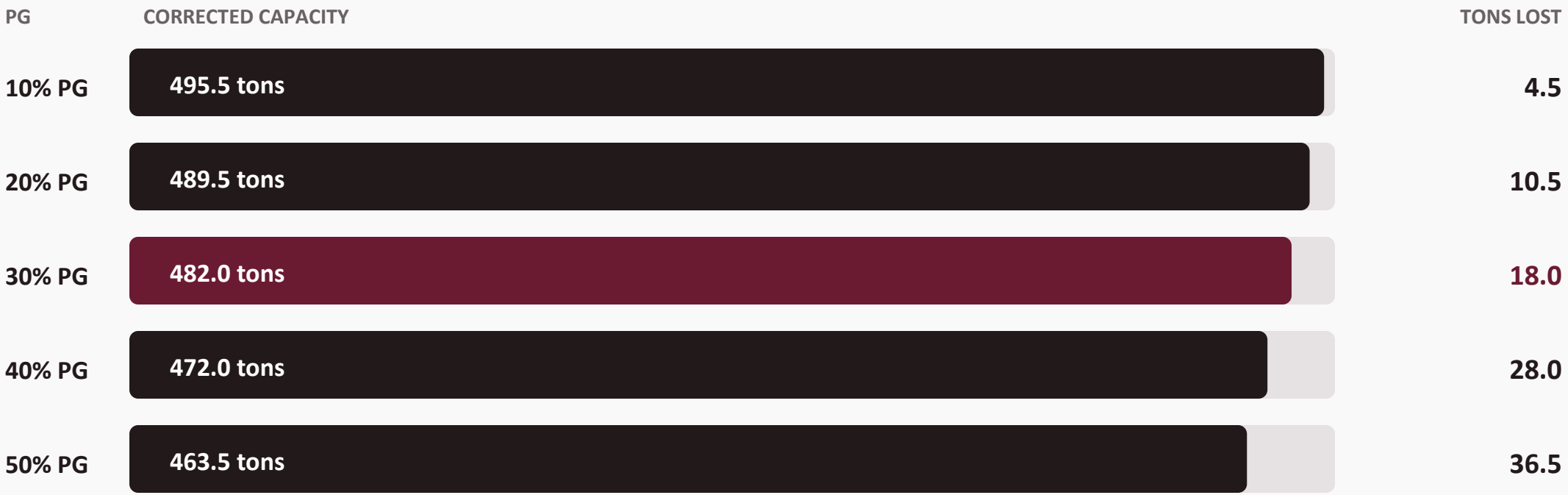
CAPACITY LOSS	
10% PG	0.9%
20% PG	2.1%
30% PG	3.6%
40% PG	5.6%
50% PG	7.3%

Manufacturer-specific example. Actual results depend on model, temperatures, flow, concentration, and operating conditions.

Source: Daikin Applied Catalog WGS-1, Table 3

Illustrative 500-ton chiller: the direct loss is measurable

ILLUSTRATIVE EXAMPLE — 500 WATER-RATED TONS



30% propylene glycol does not automatically mean a 10–15% chiller-tonnage loss.

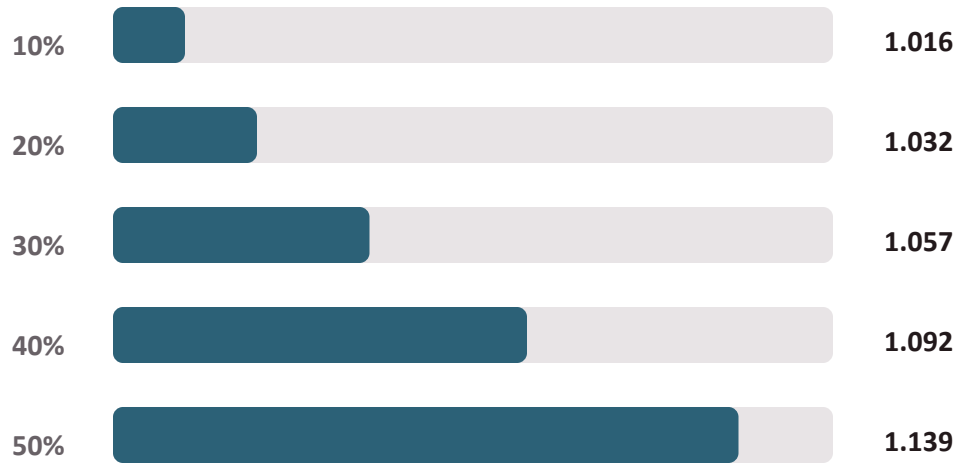
Calculation: 500 tons × Daikin capacity-retained factor. Source: Daikin Applied Catalog WGS-1, Table 3.

Flow and pressure drop can outweigh the tonnage derate

DAIKIN WGS-1 PROPYLENE-GLYCOL ADJUSTMENT FACTORS

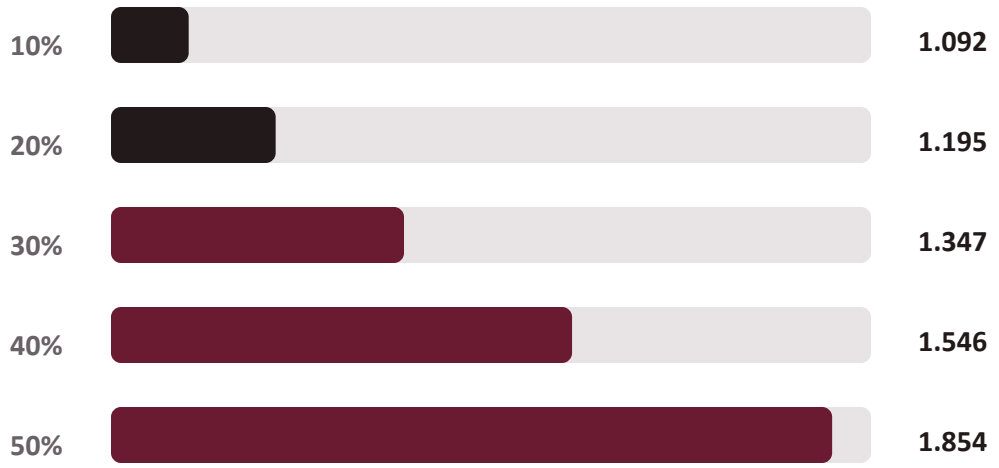
FLOW FACTOR

Relative required flow



EVAPORATOR ΔP FACTOR

Relative pressure drop



At 50% PG, this example shows 1.139× flow and 1.854× evaporator pressure drop—not a 7.3% story alone.

Source: Daikin Applied Catalog WGS-1, Table 3

Freeze protection must operate as a closed-loop sequence

DETECT → COMMAND → PROVE → PROTECT → ALARM → RECOVER

DETECT
Low OAT / low fluid temp

COMMAND
Pump ON / valves open

PROVE
Status / flow / DP

LOCAL PROTECTION
Heat trace / basin heat / safeties

ALARM
Pump / flow / temp / heater fault

RECOVER
Hold until recovery; return to normal

FIELD TEST

Simulate the trigger and watch every state change.

- Confirm local/remote modes
- Force a proof failure
- Verify the right alarm
- Check recovery deadband
- Document results

Commission winter protection before the first freeze

BAS / CONTROLS

- ☑ **Verify OAT sensor**
- ☑ Simulate enable
- ☑ Command pump + valves
- ☑ Prove flow / DP
- ☑ Test alarms
- ☑ Verify deadband

COOLING TOWER

- ☑ **Test basin heaters**
- ☑ Verify amperage
- ☑ Test controller
- ☑ Prove basin level safety
- ☑ Inspect exposed piping
- ☑ Verify fan sequence

HEAT TRACE

- ☑ **Verify circuit power**
- ☑ Test controller
- ☑ Test protection devices
- ☑ Inspect insulation
- ☑ Inspect weather jacket
- ☑ Protect backflow / valves

PROPYLENE GLYCOL

- ☑ **Measure concentration**
- ☑ Confirm protection temp
- ☑ Review fluid condition
- ☑ Investigate makeup use
- ☑ Check leaks
- ☑ Verify selection + pump head

Record actual readings—not just ‘checked OK.’

Freeze failures hide between command and proof

PROTECTION INTENT	HIDDEN FAILURE	CONSEQUENCE
Pump command	Pump trips or is in HAND/OFF	No circulation; local freezing
Open isolation valve	Actuator failed / valve shut	Pump runs with blocked path
Basin heater	Piping remains exposed	Basin survives; pipe freezes
Heat trace	Breaker / ground fault trips	Stagnant makeup line freezes
Pipe insulation	Jacket leaks; insulation is wet	Heat loss rises sharply
PG protection	Makeup water dilutes concentration	Protection temperature drifts
Correct PG concentration	Pump / chiller not reselected	Low flow or capacity shortfall
Active protection	Utility power is lost	Pump, heaters, controls unavailable

Design for failure: prove the outcome, alarm the exception, and plan for loss of power.

WINTERIZATION IS A SYSTEM STRATEGY

Q&A

Any unprotected water-filled component can become the failure point.

1. **Trace the water.**
2. Circulate—and prove circulation.
3. Basin heaters protect the basin, not the entire tower system.
4. Insulation alone is not freeze protection.
5. Heat trace must be powered, controlled, monitored, and insulated.
6. Select and test the actual PG concentration.
7. Account for capacity, flow, viscosity, and pressure drop.
8. Use manufacturer-specific correction data.
9. **Test the winter sequence before the first freeze.**

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