Closed System Labs Inc.

Ensuring longevity with chemistry.

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Cooling Towers

HVAC LABORATORY REPORT

Safe Zones	Opacity/Color	pH	Conductivity	Hardness	Chloride	Iron	Molybdate	Phosphonate	Quat	Silica	Corrosion	Prescribed Action
CT	clear/colorless	8-9	<7000	<800	<750	<3	3-5	3-5	5-10	<150	A	
MU	clear/colorless	x	x	x	x					x		Run tower at 10 cycles, as dictated by silica.

Big Bay HS [CT: 500 ton • 60% load • Apr-Oct • Softened Make-Up]

CT	May 10	clear/colorless	8.6	3650	45	80	1	5	4	8	35	A	OK; no action necessary.
CT	Jun 10	clear/colorless	8.7	4600	60	95	1	3	2	12	50	A	Increase Phosphonate feed 50%.
CT	Jul 10	clear/colorless	8.6	6220	90	120	1	4	4	10	70	A	OK; no action necessary.

MU	May 10	clear/colorless	7.5	825	10	40	-	-	-	-	15	-	Run tower at 10 cycles, as dictated by silica.
MU	Jun 10	clear/colorless	7.4	780	85	40	-	-	-	-	14	-	Check softener; output is only moderately soft.
MU	Jul 10	clear/colorless	7.6	750	15	40	-	-	-	-	11	-	OK; no action necessary.

LEGEND Protective | Borderline | Destructive

Add: Number of unit doses to be fed into system.
Chloride: Measure of chloride in ppm; values in the safe zone reduce damage to galvanized metal.
Conductivity: Measure of dissolved inorganic salts in μmhos/cm; values in the safe zone reduce corrosion.
Corrosion: Grade assigned to corrosion rate; A = < 0.1 mpy, B = < 0.2 mpy, C = < 0.3 mpy, D = < 0.4 mpy, F = > 0.5 mpy.
Hardness: Measure of total hardness in ppm as calcium carbonate; values in the safe zone reduce scaling.
Iron: Measure of iron ions in ppm; values in the safe zone indicate iron components are protected.
Molybdate: Measure of molybdate as Mo^{+6} in ppm; values in the safe zone inhibit corrosion.
Opacity/Color: Indication of corrosion products, organic matter and particulates present.
pH: Measure of acidic or basic conditions; values in the safe zone reduce corrosion.
Phosphonate: Measure of hydroxyethylidene diphosphonate in ppm; values in the safe zone inhibit scaling and iron-deposition.
Quat: Measure of quaternary ammonium chloride in ppm; values in the safe zone inhibit fouling.
Silica: Measure of silica in ppm; values in the safe zone reduce scaling.
System: CT (Cooling Tower), MU (Make-Up).

Hydronic Loops

HVAC LABORATORY REPORT

Safe Zones	Opacity/Color	pH	Conductivity	Hardness	Sulfite	Phosphate	Sarcosinate	Freeze Point	Corrosion	Prescribed Action
CW/HW	clear/colored	9-10	<1500	<50	30-50	10-20	20-30	~winter lows	A	

Big Bay HS [CW: 1000 gal • Apr-Oct • Unsoftened Make-Up • Propylene]

CW	Apr 10	clear/pink	8.0	580	35	0	0	0	+2 (35%)	C	Add: 1 Phosphate + 1 Sarcosinate + 1 Sulfite.
CW	Jul 10	clear/pink	9.2	810	50	60	25	100	+8 (31%)	B	Higher freeze point indicates fluid was lost. OK; no action necessary.
CW	Oct 10	clear/pink	9.1	775	10	20	10	50	+8 (31%)	A	Add: 1 Phosphate + 1 Sulfite; circulate well before seasonal shut-down.

LEGEND Protective | Borderline | Destructive

Add: Number of unit doses to be fed into system.
Conductivity: Measure of dissolved inorganic salts in μmhos/cm; values in the safe zone reduce corrosion.
Copper: Measure of copper ions in ppb; values in the safe zone indicate copper pipe is protected.
Corrosion: Grade assigned to corrosion rate; A = < 0.1 mpy, B = < 0.2 mpy, C = < 0.3 mpy, D = < 0.4 mpy, F = > 0.5 mpy.
Freeze Point: Measure of °F temperature at which a fluid freezes; values 5° below local winter lows prevent freezing.
Hardness: Measure of total hardness in ppm as calcium carbonate; values in the safe zone reduce scaling.
Iron: Measure of iron ions in ppb; values in the safe zone indicate iron and steel pipe are protected.
Nitrite: Measure of sodium nitrite in ppm; values in the safe zone inhibit corrosion.
Opacity/Color: Indication of corrosion products, organic matter and particulates present.
pH: Measure of acidic or basic conditions; values in the safe zone reduce corrosion.
Phosphate: Measure of orthophosphate in ppm; values in the safe zone inhibit scaling and corrosion.
Sarcosinate: Measure of sodium lauroyl sarcosinate in ppm; values in the safe zone inhibit corrosion.
Sulfite: Measure of sodium sulfite in ppm; values in the safe zone inhibit corrosion.
Sulfate: Measure of sulfate in ppm; values in the safe zone reduce interference with corrosion inhibitors.
System: CW (Chilled Water), HP (Heat Pump), HW (Heated Water), MU (Make-Up).

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Steam Loops

HVAC LABORATORY REPORT

Safe Zones	Opacity/Color	pH	Conductivity	Hardness	Sulfite	Phosphate	Alkalinity	Chloride	Silica	Corrosion	Prescribed Action
SB	clear/colorless	10-12	<7000	<500	30-50	30-50	<700/>250		<150	A	
					Iron	Copper				% Return	
CR	clear/colorless	8-9	<50		<100	<50				100	
FW	clear/colorless	8-9	x	<0.1	<100	<50		<10			
MU	clear/colorless	x	x	<50			x	x	x		

Bay Area HS [SB: 1000 gal • 150 hp • Oct-Apr • Unsoftened Make-Up]

SB	Oct 10	cloudy/tan	10.1	500	85	0	0	270/0	-	7	B Copper/Iron 300/350	Add: 1 Phosphate + 1 Sulfite. Alkalinity will increase with time.
SB	Nov 10	clear/yellow	10.8	3230	80	20	35	530/250	-	35	A Copper/Iron 50/ND	Add Sulfite as needed to maintain >30 ppm.
SB	Dec 10	clear/colorless	11.5	4750	75	60	20	690/430	-	50	A Copper/Iron ND/ND	Add: 1 Phosphate + 1 Silicone.
CR	Oct 10	clear/colorless	7.8	45	-	10	10	-	-	-	75	pH will rise as boiler purges carbon dioxide from start-up.
CR	Nov 10	clear/colorless	8.1	75	-	10	ND	-	-	-	75	OK; no action necessary.
CR	Dec 10	clear/colorless	8.7	30	-	ND	ND	-	-	-	95	OK; no action necessary.
FW	Oct 10	clear/colorless	9.1	60	30	ND	ND	-	10	-	-	Hardness should drop as boiler load increases.
FW	Nov 10	clear/colorless	8.9	100	<0.1	ND	ND	-	10	-	-	OK; no action necessary.
FW	Dec 10	clear/colorless	8.8	32	<0.1	ND	ND	-	20	-	-	OK; no action necessary.
MU	Oct 10	clear/colorless	7.8	230	120	-	-	210/NA	20	5	-	OK; no action necessary.
MU	Nov 10	clear/colorless	7.8	235	85	-	-	230/NA	30	4	-	OK; no action necessary.
MU	Dec 10	clear/colorless	7.6	210	140	-	-	200/NA	30	3	-	OK; no action necessary.

LEGEND	Protective	Borderline	Destructive

Add: Number of unit doses to be fed into system.
Alkalinity: Measure of total and hydroxyl alkalinity in ppm as calcium carbonate; values in the safe zone reduce boiler carry-over and corrosion.
Chloride: Measure of chloride in ppm; values in the safe zone reduce damage to the boiler's oxide layer.
Conductivity: Measure of dissolved inorganic salts in μmhos/cm; values in the safe zone reduce corrosion.
Copper: Measure of copper ions in ppb; values in the safe zone indicate copper pipe is protected.
Corrosion: Grade assigned to corrosion rate; A = < 0.1 mpy, B = < 0.2 mpy, C = < 0.3 mpy, D = < 0.4 mpy, F = > 0.5 mpy.
Hardness: Measure of total hardness in ppm as calcium carbonate; values in the safe zone reduce scaling.
Iron: Measure of iron ions in ppb; values in the safe zone indicate iron and steel pipe are protected.
Opacity/Color: Indication of corrosion products, organic matter and particulates present.
pH: Measure of acidic or basic conditions; values in the safe zone reduce corrosion.
Phosphate: Measure of orthophosphate in ppm; values in the safe zone inhibit scaling.
Phosphonate: Measure of hydroxyethylidene diphosphonate in ppm; values in the safe zone inhibit scaling and iron-deposition.
% Return: Percent of feed water that is condensate.
Silica: Measure of silica in ppm; values in the safe zone reduce scaling.
Sulfite: Measure of sodium sulfite in ppm; values in the safe zone inhibit corrosion.
System: SB (Steam Boiler), CR (Condensate Return), FW (Feed Water), MU (Make-Up).