

The Complete Cheat Sheet

Every number an operator holds, on two pages

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SAMUEL'S RULE

Always zoom out and have a macro view of the situation when troubleshooting a pool problem.

1 · THE EIGHT READINGS

the targets - the code floors are in block 8

Free chlorine	3 ppm	daily on a commercial pool
Combined chlorine	under 0.2 ppm	daily commercial, weekly at home
pH	7.4 – 7.6	daily on a commercial pool
Total alkalinity	80 – 120 ppm	weekly
Calcium hardness	200 – 400 ppm	monthly
Cyanuric acid	25 ppm	weekly
Dissolved solids	under 1,500 over fill	monthly
Temperature	record it	every test

2 · THE ORDER OF CORRECTION

never vary it

1. Alkalinity	80 – 120 ppm	nothing above it holds without it
2. pH	7.4 – 7.6	it often walks into range on its own
3. Hardness	200 – 400 ppm	one way only, so go slowly
4. Index	-0.3 to +0.3	confirm the whole set together

3 · DOSING

ounces per 10,000 gal per ppm

OUNCES = (GALLONS ÷ 10,000) × PPM CHANGE × FACTOR

Cal-hypo 65%	2.05	Sodium bicarbonate	2.23
Cal-hypo 73%	1.82	Calcium chloride 77%	1.92
Trichlor 90%	1.48	Calcium chloride 94%	1.57
Dichlor 56%	2.38	Stabilizer 100%	1.33
Lithium hypo 35%	3.80	Liquid 12.5%	10.2 fl oz

Any product not listed: divide 1.33 by the strength on the label. pH gets a rule of thumb, not a formula. Appendix B of the book has every dose pre-figured by pool size.

4 · SATURATION INDEX

run it weekly

pH + TEMP + HARDNESS + ALKALINITY – 12.1

The middle three are factors from Appendix C. Target -0.3 to +0.3. Negative water takes calcium out of plaster, grout, and heat exchangers. Positive drops it as scale. Use 12.2 above 1,000 ppm dissolved solids, and correct with alkalinity and hardness, never with pH.

5 · NEVER

no exceptions

- Never open a container without goggles and gloves on.
- Never add water to chemicals. Chemicals go into water, slowly.
- Never mix two chlorine products, or reuse a feeder for a different one.
- Never store acid and chlorine together, or one above the other.
- Never add a full dose. Half, one turnover, retest, then the rest.
- Never top up a pool from a water softener.

Turnover	volume ÷ flow. One turnover filters 63%, three reach 95%
Velocity, ft/s	$0.41 \times \text{gpm} \div d^2$, with d the inside diameter in inches
Suction limit	6 ft/s, so max gpm = $14.7 \times d^2$. Past it the pump cavitates
Return limit	8 ft/s, so max gpm = $19.6 \times d^2$. Past it the pipe erodes
Filtration rate	gpm ÷ square feet of media area
Rate by medium	sand and regen 15, DE 2, cartridge 0.375 gpm per sq ft
Backwash	at 8 to 10 psi over the clean baseline, until the glass clears
Biggest sand tank	the pump's top-speed flow ÷ 15. Larger cannot be cleaned
Two gauges	high pressure, low vacuum: after the impeller. Reverse: before it. Both low: air. Both high: too fast

7 · HEAT

chapters 28 to 31

Sizing	BTU = surface area × degrees of rise × 12, or 14 to 16 exposed
Maximum lift	output ÷ (area × 12), in degrees above ambient
Evaporation	one inch off the surface costs 5,448 BTU per square foot
A cover	saves 50% to 70%, and nothing folded up on the deck
Stop and call	soot, a yellow flame, an exhaust smell, two lockouts in a week

8 · COMMERCIAL FLOORS

the model's numbers · your health department writes yours

Chlorine minimum	1 ppm plain, 2 ppm with stabilizer in it, 3 ppm in a spa
Chlorine maximum	10 ppm in the model code. The label says 4 with bathers in
pH range	7.2 to 7.8. Combined chlorine is an action level above 0.4
Cyanuric acid	100 ppm outdoors in the model code, none in a new spa or therapy pool
Temperature	104°F maximum, on a thermometer and not the display
Bather load	25 sq ft each under 3 ft, 30 from 3 to 6, 22 to 10 ft, 16 deeper
Treatment demand	5.34 gpm per bather, so capacity in people is flow ÷ 5.34
Spa drain interval	gallons ÷ 3 ÷ daily bathers, in days

9 · CONTAMINATION

chapter 38

Formed stool, vomit	2 ppm, pH 7.5 or below, 77°F or warmer, 30 min, 60 if stabilized
Diarrhea	20 ppm at pH 7.5 or below, hold 12.75 hours, log hourly
The two numbers	Giardia needs CT 45. Cryptosporidium needs 15,300
Stabilizer	1 to 15 ppm stretches the hold. Above 15, pH 6.5 at 40 ppm for 30 hours
Either way	net it, never vacuum it. Backwash to waste. Replace DE and cartridge media

Follow your own jurisdiction's protocol wherever it differs from this. Many health departments publish one and require it specifically.