Mono Throughput Model

Fill-and-Finish Labor, Postless vs. Capped Cartridges | Version 1.0 | July 2026 | Companion document to the Mono Filling & Capping SOP

SUMMARY

Mono is filled through a self-sealing septum on a fully assembled cartridge; there is no post-fill capping step. This removes 3.5-11.5 seconds of operator labor per unit (cap placement/press plus cap-specific inspection) which models to a **1.9-3.9x per-operator throughput advantage** over capped-cartridge lines, or roughly **0.6-2.0 FTE per million units annually**. All figures are modeled estimates from industry-typical cycle times, not measured production data.

Headline Figures (modeled)

Line Configuration	Units/Op-Hour	Mono Advantage	Op-Hours Saved /1M units/yr	FTE*
Capped - manual hand-cap	~185	3.9x	~4,000	2.0
Capped - jig / arbor press	~250	2.9x	~2,600	1.3
Capped - semi-automated capper	~385	1.9x	~1,200	0.6
Mono - septum fill, no capping	~720	-	-	-

*FTE = 2,000 paid hours/year.

Model Construction - Labor Content Per Unit (seconds)

Process Step	Manual Cap	Jig Press	Semi-Auto Cap	Mono
Fill (semi-auto indexing filler: load / index / unload)	4.0	4.0	4.0	4.0
Cap placement + press	10.0	6.0	2.5	-
Post-cap inspection / torque check	1.5	1.5	1.0	-
Total	**15.5**	**11.5**	**7.5**	4.0

Assumptions

80% operator efficiency (2,880 productive seconds per paid hour); semi-automatic indexing filler baseline; 1 g distillate format; single-operator station accounting (labor content per unit, not multi-operator line-rate capacity); Mono closure zero-touch per the Filling & Capping SOP; reference volume 1,000,000 units/year.

Sensitivity to Filling Method

Fill labor is identical on both line types, so absolute hours saved are independent of filler choice; the relative labor reduction versus a manual-capped line ranges from -53% (manual fill gun) to -74% (semi-automatic indexing filler) to -92% (fully automatic filler). With a manual fill gun (~10 s/unit), Mono models to ~200 UPH and the advantage compresses to ~1.5-2x; with a fully automatic filler, per-tending-operator throughput can exceed 1,200 UPH and the advantage widens.

Scope and Limitations

This model covers direct fill-and-finish labor only. Excluded: capping-defect elimination (leaks, misalignment, press damage), avoided capping equipment capital, cure-rack space planning (24 h+ upright cure per SOP, a hold not operator labor), and line-debottlenecking effects. Actual throughput depends on cartridge geometry, filler equipment, oil viscosity and temperature, tray design, and workforce experience. A stopwatch time study on your own line will produce different, and more reliable, numbers.