METHODS & VERIFICATION

Internal calculator Worked test results

24 worked numerical results passed

Every internal tool has a worked example below. The calculations were compared with independent arithmetic, supplied workbook values, or published source factors. Checks also cover invalid inputs, unit round trips, menu order and continued numerical output beyond reference limits.

Additional regression checks

4,017 usable motor-table cells; 23 WRS workbook gas/cycle-rate rows; 78 catalog models; 50 real-catalog candidates at 1 US gal/h and 500 psi. Curve capacity, pressure bounds and FXA/FXS ordering were checked. Counts describe the bundled data tested, not approval of a specific installation.

Three separate versions

Engineering: all in one calculator plus flow curve generator.
Intranet: all in one calculator only, without curve editing or a customer signup form.
Customer website: standard pump selection and its existing login/details form, unchanged by this internal update.

Updated internal behavior

Air/gas consumption uses only the corrected WRS workbook method. Motor sizing no longer asks for actual head pressure rating. The torque formula continues to calculate horsepower and torque. Reference rod-load and gearbox notes remain visible alongside results; there are no Engineered Solutions prompts or redirects. Source-table lookups still require an available valid cell. The tool does not invent missing chart data.

Reading these results

PASS means the implementation matches the stated equation or source for the tested inputs. It does not establish equipment suitability for every fluid or operating condition. The report supersedes the earlier internal guide where it described a mandatory head-rating field or Engineered Solutions behavior.

WORKED CALCULATIONS / PASS

Volume flow

Inputs: 1 US gal/min

Expected and actual: 227.124707 L/h / PASS

1 US gal = 3.785411784 L; multiply by 60 min/h. NIST SP 811.

Mass flow

Inputs: 100 lb/h

Expected and actual: 45.359237 kg/h / PASS

1 lb = 0.45359237 kg. NIST SP 811.

Mass to volume

Inputs: 100 kg/h; density 800 kg/m3

Expected and actual: 125 L/h / PASS

Volume = mass / density; m3 converted to L.

Volume to mass

Inputs: 125 L/h; density 800 kg/m3

Expected and actual: 100 kg/h / PASS

Mass = volume x density.

Pressure conversion

Inputs: 1 bar

Expected and actual: 14.5037738 psi / PASS

100000 Pa / 6894.757293168 Pa per psi. Reference basis unchanged.

WORKED CALCULATIONS / PASS

Temperature conversion

Inputs: 20 deg C

Expected and actual: 68 deg F / PASS

F = C x 9/5 + 32.

Temperature conversion

Inputs: 20 deg C

Expected and actual: 293.15 K / PASS

K = C + 273.15.

SLA motor sizing

Inputs: 7:1; 1-inch plunger; 1000 psi; 1 head; 1750 RPM; 0% margin

Expected and actual: 1.8326309 HP / PASS

Supplied SLA Motor HP Calculator.xlsx: CP SLA Hp Calcs, B6/B13/B16/B21. Rod load = area x pressure; torque includes cam, gearing and efficiency.

SLA motor sizing

Inputs: Same motor inputs

Expected and actual: 1.36659286 kW / PASS

Workbook B22 = HP x 0.7457.

SLA motor sizing

Inputs: Same motor inputs

Expected and actual: 2 HP / PASS

App motor-size list rounds calculated power upward. No head-rating input or engineering redirect.

WORKED CALCULATIONS / PASS

Motor chart lookup

Inputs: Workbook: 15:1, 1750 RPM, SLA-P12, 1900 PSIG

Expected and actual: 1 HP / PASS

SLA power workbook, sheet 2000 lbf HP Charts 1 or 2 Head, cell H29. Lookup retains source bounds; missing cells are not fabricated.

WRS workbook SCFM

Inputs: 1250 · 0.5 in; 30 US gal/h; 100 PSIA; 0% allowance

Expected and actual: 22.7347884 SCFM / PASS

Sheet1!B16:J16, P16:Q16. Independently extracted saved workbook result; pressure treated explicitly as absolute.

Stroke length

Inputs: 10 L/h; 12.7 mm plunger; 60 cycles/min; 95% efficiency

Expected and actual: 23.0821666 mm / PASS

Inverse displacement: Q x 1e6 / (60 x SPM x area x efficiency).

Plunger displacement

Inputs: 10 mm plunger; 10 mm stroke; 100 cycles/min; 2 heads; 100% efficiency

Expected and actual: 9.42477796 L/h / PASS

Area x stroke x cycles/min x head count x 60 x efficiency.

Calibration

Inputs: 100 mL in 60 s; current setting 50%; target 9 L/h

Expected and actual: 6 L/h / PASS

mL/s x 3.6 = L/h.

WORKED CALCULATIONS / PASS

Calibration

Inputs: Same calibration inputs

Expected and actual: 75 % / PASS

Current setting x target flow / measured flow.

Rod force

Inputs: 0.75-inch outer diameter; no inner rod; 3400 psi

Expected and actual: 1502.07399 lbf / PASS

Net circular area x pressure. Matches supplied workbook E37.

Pipe losses

Inputs: 10 L/h; 25 mm bore; 20 m length; 1 cP; 1000 kg/m3; K=0

Expected and actual: 5.79465464e-05 bar / PASS

Independent laminar Hagen-Poiseuille check: delta P = 128 mu L Q / (pi D^4).

NPSH

Inputs: 1 bar absolute surface; zero vapor pressure; 1000 kg/m3; elevation 2 m; losses 0.5 + 1 m; NPSHr 3 m

Expected and actual: 10.6971621 m / PASS

(Psurface-Pvapor)/(rho g) + elevation - friction - acceleration losses.

Chemical dosing

Inputs: 100 m3/h water; 5 mg/L dose; 10% active; solution density 1.1 kg/L

Expected and actual: 4.54545455 L/h / PASS

0.5 kg/h active / 0.1 mass fraction / 1.1 kg/L.

WORKED CALCULATIONS / PASS

Hydraulic power

Inputs: 3600 L/h; differential pressure 100 bar; pump 80%; motor 90%

Expected and actual: 10 kW / PASS

Q x delta P; shaft 12.5 kW; electrical input 13.888889 kW.

Hydraulic power

Inputs: Same hydraulic inputs

Expected and actual: 13.8888889 kW / PASS

Hydraulic / pump efficiency / motor efficiency.

Pressure & head

Inputs: 1 bar differential; density 1000 kg/m3

Expected and actual: 10.1971621 m / PASS

Head = delta P / (rho x 9.80665).

Pump curve interpolation

Inputs: Reference test curve: 10 GPH at 0 psi, 6 GPH at 1000 psi; duty 500 psi

Expected and actual: 8 US gal/h / PASS

Linear interpolation gives 8 GPH. This is a synthetic calculation test, not a real pump recommendation.

SOURCE LOCATORS & LIMITS

Where the data comes from

Motor torque calculation

SLA Motor HP Calculator.xlsx, sheet CP SLA Hp Calcs: B6 rod load; B13 application torque; B16 motor torque; B21 HP; B22 kW; F3:G5 rod limits; J24:K26 gearbox recommendations. Uses 0.5-inch cam offset and the supplied equal-load head-count multiplier. Added margin and next listed motor size are app behavior.

Motor power tables

SLA Motor Power Charts RevA 20200302BG Unlocked[85].xlsm, selected sheet and cell are shown in the app. The worked case uses H29 on 2000 lbf HP Charts 1 or 2 Head. FXA, SLA plunger and LeakLess PDF tables retain their own configuration and revision limits. An unavailable lookup is reported as unavailable; use the SLA formula only for an applicable SLA drive.

WRS gas estimate

Gas Consumption - Estimated - Corrected WRS.xlsx: selected row reference appears in the app. Column Q is selected displacement and P is air volume. SPM = GPH x 231 / (60 x displacement); SCFM = PSIA / 14.7 x SPM x air volume. Workbook pressure basis is ambiguous; the application explicitly selects gauge or absolute. Its standard temperature is not stated.

Conversions

NIST SP 811 Appendix B.8: https://www.nist.gov/pml/special-publication-811/nist-guide-si-appendix-b-conversion-factors/nist-guide-si-appendix-b8. Mass/volume conversion additionally needs actual fluid density at the matching conditions. Pressure conversion retains gauge/absolute basis. Temperature conversion uses absolute readings, not differences.

Pump selection and other tools

Bundled CheckPoint catalog and curves are used without extrapolation. A no-match result retains entered requirements and invites adjustment, with no engineering redirect. Pipe loss uses Darcy-Weisbach: 64/Re in laminar flow, Colebrook for turbulence; transition-region friction is withheld. Displacement and stroke assume a single-acting circular plunger. Calibration is proportional and should be checked against measured delivery.