

2.1.1 DEFINITIONS

Po = nitrogen pre-charge pressure (relative to the atmospheric pressure, namely the "relative pressure"). Measure to be performed when the accumulator is completely oil-free and at a temperature of $20 \pm 2^\circ\text{C}$.

P1 = minimum working pressure of the hydraulic circuit (relative to the atmospheric pressure, namely the "relative pressure"). The minimum pressure must be higher than the pre-charge pressure.

P2 = maximum working pressure of the hydraulic circuit (relative to the atmospheric pressure, namely the "relative pressure").

P3 = calibration pressure of the safety valve (relative to the atmospheric pressure, namely the "relative pressure"). The pressure calibration of the safety valve must be greater than P2 at least of the hysteresis of the safety valve but equal or lower than the PS value.

PS = maximum working pressure of the accumulator (relative to the atmospheric pressure, namely the "relative pressure").

PT = testing pressure of the accumulator (relative to the atmospheric pressure, namely the "relative pressure"). Usually $PT = PS \times 1.43$.

ΔP = is the difference between the maximum and minimum working pressure ($P2 - P1$).

Po/P2 = compression ratio.

Vo = volume of gas under Po pressure

V = volume of fluid when the accumulator is completely full.

VoA = gas volume of the accumulator in case of a transfer bladder or piston accumulator.

V1 = volume of gas under P1 pressure.

V2 = volume of gas under P2 pressure.

V3 = volume of gas under P3 pressure.

ΔV = useful volume. It indicates the difference in volume of the working fluid between V1 and V2. Volume made by the accumulator during the working phase.

TSmin = minimum working temperature.

TSmax = maximum working temperature.

T20 = reference temperature at 20°C .

ts = discharge time of ΔV of the fluid.

tr = recharge time of ΔV of the fluid.

tc = plant cycle time. On a cyclical machine, it's the time between the start of a discharge of ΔV and the start of the next discharge.

N = number of cycles in a time unit.

η = polytropic exponent.

Q = flow rate by volume.

2.1.2 UNIT OF MEASUREMENT

Pressure - Force/Surface

Pascal	Pa	1 Pa = 1 N/m ² 1 kPa = 0.01 bar = 0.1 N/cm ² = 0.10 mH ₂ O = 7.5 mmHg = 0.0099 atm = 0.145 psi = 0.02088 lbf/ft ² = 0.334 ftH ₂ O
bar	bar	1 bar = 100'000 Pa = 100 kPa = 0.1MPa = 1.0197 kg/cm ² = 10.198 mH ₂ O = 750 mmHg = 0.987 atm = 14.5 psi = 33.455 ftH ₂ O
millibar	mbar	1 mbar = 100 Pa = 0.010 mH ₂ O = 0.750 mmHg = 0.00102 kg/cm ² = 0.0145 psi = 2.088 lbf/ft ² = 0.033 ftH ₂ O
millimetres of mercury	mmHg	1 mmHg = 133.322 Pa = 0.133 kPa = 0.00133 bar = 0.0136 mH ₂ O = 0.00131 atm = 0.00136 kg/cm ² = 0.01934 psi = 2.78 lbf/ft ² = 0.045 ftH ₂ O
technical atmosphere = kgf/cm²	at Kg/cm²	1 at = 1 kg/cm ² = 735.56 mmHg = 10 mH ₂ O = 98066.50 Pa = 98.067 kPa = 0.981 bar = 0.968 atm = 14.22 psi = 2048.16 lbf/ft ² = 32.81 ftH ₂ O
metric atmosphere	atm	1 atm = 101'325 Pa = 760 mmHg = 1.033 at = 10.33 mH ₂ O = 1.01 bar = 14.696 psi = 2116.22 lbf/ft ² = 33.9 ftH ₂ O
water column metres	m_{H2O}	1 mH ₂ O = 9806 Pa = 0.09806 bar = 73.55 mmHg = 0.9806 N/cm ² = 0.09678 atm = 0.0999 at = 1.4224 psi = 204.8 lbf/ft ² = 3.28 ftH ₂ O
foot of water	ft_{H2O}	1 ftH ₂ O = 2988.87 Pa = 0.0299 kPa = 0.3048 mH ₂ O = 22.419 mmHg = 0.0295 atm = 0.03048 kg/cm ² = 0.4335 psi = 62.42 lbf/ft ²

pounds per square inch	psi	1 psi = 6.894.76 Pa = 6.894 kPa = 0.069 bar = 0.703 mH ₂ O = 51.715 mmHg = 0.689 N/cm ² = 0.068 atm = 0.0703 kg/cm ² = 144 lbf/ft ² = 2.31 ftH ₂ O
pounds per square foot	lbf/ft ²	1 lbf/ft ² = 2'988.87 Pa = 2.99 kPa = 0.0299 bar = 0.3048 mH ₂ O = 22.418 mmHg = 0.299 N/cm ² = 0.0295 atm = 0.0305 at = 0.433 psi = 62.424 lbf/ft ²

Volume

cubic meter	m ³	1 m ³ = 1'000 dm ³ = 35.3146 ft ³ = 61'023.744 in ³ = 1.308 yd ³ = 264.20 galUS = 219.97 galUK
cubic decimetre; litre	dm ³	1 dm ³ = 1 l = 0.001 m ³ = 61.024 in ³ = 0.0353 ft ³ = 0.00131 yd ³ = 0.26417 galUS = 0.21997 galUK
cubic centimetre	cm ³ , cc	1 cm ³ = 0.001 dm ³ = 0.001 l = 0.061 in ³ = 0.000264 galUS = 0.00022 galUK
cubic inch	in ³	1 in ³ = 0.0000164 m ³ = 0.0164 dm ³ = 0.0005787 ft ³ = 0.0043 galUS = 0.0036 galUK
cubic foot	ft ³	1 ft ³ = 0.02832 m ³ = 28.32 dm ³ = 1'728 in ³ = 0.037 yd ³ = 7.48 galUS = 6.23 galUK
cubic yard	yd ³	1 yd ³ = 0.764 m ³ = 764.55 dm ³ = 46.656 in ³ = 27 ft ³ = 201.97 galUS = 168.18 galUK
gallon US	galUS	1 galUS = 0.00378 m ³ = 3.785 dm ³ = 231 in ³ = 0.134 ft ³ = 0.0049 yd ³ = 0.833 galUK
gallon UK	galUK	1 galUK = 0.00455 m ³ = 4.546 dm ³ = 277.42 in ³ = 0.16 ft ³ = 0.0059 yd ³ = 1.2 galUS

Temperature

kelvin	K	K = °C + 273.15 K = 1.8 · °R K = [5/9 · °F] + (459.67/1.8)
degree Centigrade	°C	°C = (°F - 32) · 5/9 °C = K - 273.15 °C = (5/9) · °F - (32/1.8)
degree Fahrenheit	°F	°F = 9/5 · °C + 32 °F = °R - 459.67 °F = (9/5) · K - 459.67
degree Rankine	°R	°R = (5/9) K °R = 491.67 + (9/5) · °C °R = 459.67 + °F

Time

seconds	s	s = 0.01666667 min s = 0.00027778 h s = 0.00001157 days
minutes	min.	min = 60 s min = 0.01666667 h min = 0.00071428 days
hours	h	h = 60 min h = 0.04166667 days h = 3600 s
days	days	day = 86400 s day = 1440 min day = 24 h

Flow rate by volume

cubic meters per second	m ³ /s	1 m ³ /s = 60 m ³ /min = 3'600 m ³ /hour = 1'000 l/s = 60'000 l/min = 6'102'374.42 in ³ /s = 2'118.88 ft ³ /min = 15'850.32 gpm = 13'198.13 l gpm
cubic meters per minute	m ³ /min	1 m ³ /min = 0.0167 m ³ /s = 60 m ³ /h = 16.67 l/s = 1'000 l/min = 35.31 ft ³ /min = 264.17 gpm = 219.97 l gpm
cubic meters per hour	m ³ /h	1 m ³ /h = 0.000278 m ³ /s = 0.0167 m ³ /min = 0.28 l/s = 16.67 l/min = 1017.06 in ³ /s = 0.588 ft ³ /min = 4.40 gpm = 3.66 l gpm
litres per second	l/s	1 l/s = 0.001 m ³ /s = 0.06 m ³ /min = 3.6 m ³ /h = 60 l/min = 3661.42 in ³ /min = 2.12 ft ³ /min = 15.85 gpm = 13.198 l gpm
litres per minute	l/min	1 l/min = 0.001 m ³ /min = 0.06 m ³ /h = 0.0167 l/s = 61.024 in ³ /min = 0.035 ft ³ /min = 0.264 gpm = 0.22 l gpm
cubic inch per minute	in ³ /min	1 in ³ /min = 0.00027 l/s = 0.016 l/min = 0.00058 ft ³ /min = 0.0043 gpm = 0.0036 l gpm
cubic foot per minute	ft ³ /min	1 ft ³ /min = 0.00047 m ³ /s = 0.028 m ³ /min = 1.7 m ³ /h = 0.472 l/s = 28.32 l/min = 1'728 in ³ /min = 7.48 gpm = 6.23 l gpm
gallon per minute	gpm	1 gpm = 0.0038 m ³ /min = 0.227 m ³ /h = 0.063 l/s = 3.785 l/min = 231 in ³ /min = 0.134 ft ³ /min = 0.833 l gpm
imperial gallon per minute	l gpm	1 l gpm = 0.000076 m ³ /s = 0.00454 m ³ /min = 0.273 m ³ /h = 0.076 l/s = 4.55 l/min = 277.42 in ³ /min = 0.16 ft ³ /min = 1.2 gpm