Maintenence free welded membrane accumulators/dampeners

TECHNICAL SPECIFICATIONS

Maximum pressure		100 - 140 - 210 - 250 – 280 - 300 - 350 bars
Nominal capacity		0,05 - 0,16 - 0,35 - 0,5 - 0,75 - 1 - 1,4 - 2 - 3 - 3,5 - 4 litres
Materials	Body	painted carbon steel RAL 9004 (opaque) (resistance to salt spray 250 hours)
		on request: resistance to salt spray 500 hours
		on request: AISI 316L
	Membrane	NBR (Perbunan)
		ECO (Epichlorohydrin)
		NBR -40 °C
		Others on request
	Precharge valve	M28x1,5
		Electrowelded plug with factory fixed precharge
		5/8"UNF valve (on request)
Operating temperature with membrane		NBR: -15 ÷ +80°C
		ECO: -30 ÷ +120 °C
		NBR -40: -40 ÷ +70 °C
Precharge at 20 °C		Pressure value on request (± 5% with minimum ± 3 bar) with Nitrogen: N ≥ 99.9% volume, O_2 ≤ 50 Vpm and H_2O ≤ 30 Vpm

TECHNICAL DATA

Type	Rated volume [lt]	Effective volume [lt]	Max pressure* (in carbon steel) [bar]	Max dynamic Delta P $P_2 - P_1$ [bar]	Max compress. ratio $P_2:P_0$	Max flow ** [l/min]	Ped category (for liquids in Group 2)	Weight [kg]
WA 0,05	0,05	0,07	210	120	6:1	10	Art.3 Par.3	0,5
WA 0,16	0,16	0,17	210 250	120	6:1	10	Art.3 Par.3	0,9
WA 0,35	0,35	0,35	100	100	6:1	40	Art.3 Par.3	1
		0,41	210 250	140				1,8
WA 0,5	0,5	0,58	100 140	140	8:1	40	Art.3 Par.3	1,6
		0,59	210 300					2,4 2,8
WA 0,75	0,75	0,77	100 140	120	6:1	40	Art.3 Par.3	2,0
		0,77	210	150	4:1			3,2
		0,81	250		8:1			3,4
		0,72	280		4:1			3,2
		0,75	350		6:1			5,2
WA 1	1	1,00	210	140	4:1	40	Art.3 Par.3	4,0
		1,10	250	150	8:1			4,8
		0,95	280	140	4:1			4,5
WA 1,4	1,4	1,42	100 140	80	6:1	80	Cat:II	3,6
		1,49	250	140	6:1			5,5
		1,38	350	150	6:1			8,5
WA 2	2	2,00	140	60	4:1	80	Cat:II	6
		2,05	250	140				6,6
WA 3	3	3,15	210	140	4:1	120	Cat:II	8,1
		3,15	250					10,8
		2,85	350	180			Cat:III	14,6
WA 3,5	3,5	3,55	210	140	4:1	120	Cat:II	8,9
		3,55	250					12,1
		3,50	350				Cat:III	16,6
WA 4	4	4,00	210	140	4:1	120	Cat:II	9,9
		4,00	250					13,4

* Maximum pressure calculated according to EN 14359 (for the pressure values in agreement with other standards, please contact SAIP)

** Flow rate measured using mineral oil with a viscosity of 36 cSt at 50 °C and ΔP = 5 bar

*** Maximum differential pressure permissible (pressure difference between the maximum operating pressure P_2 and the minimum operating pressure P_1) in order to have an infinite life cycle (greater than 2.000.000 cycles).

Construction: **carbon steel body**
Capacity: **0,05÷4 litres**
Pressure: **up to 350 bar**

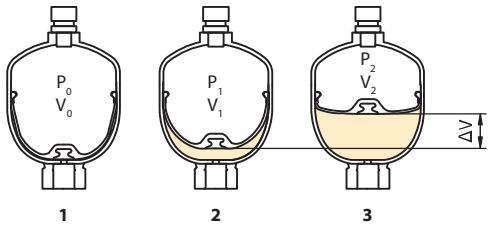
COMPATIBILITY OF MEMBRANES / TEMPERATURE / FLUID			
1	Nitrile rubber NBR	-15 ÷ +80 °C	Suitable for aliphatic hydrocarbons (propane, butane, gasoline, oils, mineral greases, diesel fuel, fuel oil, kerosene), mineral greases and oils, fluids HFA - HFB - HFC, many diluted acids, saline solutions, water, glycol water.
1C	Nitrile rubber for low temperatures NBR	-40 ÷ +70 °C	Fluids compatibility as for standard nitrile + various types of freon. (Has lower content of acrylonitrile than the standard and is therefore more suitable for work at low temperatures, but the chemical resistance to the different liquids is slightly lower).
8	Epichlorohydrin ECO	-30 ÷ +120 °C	Suitable for mineral oils and greases, aliphatic hydrocarbons (propane, butane and gasoline), silicone oils and greases, water at room temperature, low gas permeability, good resistance to ozone, ageing and weathering.

For the use of other fluids and temperatures, please contact SAIP

SIZING

For an accumulator sizing, various factors are to be considered, associated with the type of accumulator itself, operating pressure, relevant precharge pressure, necessary volumes and operating temperatures.

Status



1) P_0 = (nitrogen precharge pressure) and V_0 = (gas effective volume) correspond to precharge conditions.
Hydraulic pressure value is lower than precharge value, i.e. the membrane expansion is maximum and there is no fluid inside the accumulator. A special button closes the hole on the liquid side to prevent membrane extrusion.

2) P_1 = (minimum operating pressure) and V_1 = (gas volume at pressure P_1) correspond to minimum pressure conditions, i.e. since the fluid pressure is slightly higher than precharge pressure, it remains inside the accumulator, to prevent that - at each cycle - the membrane and the plate collide against the accumulator internal surface.

3) P_2 = (maximum operating pressure) and V_2 = (gas volume at pressure P_2) correspond to maximum pressure conditions, i.e. membrane has reached its maximum shrinkage, resulting in maximum liquid accumulation.

ΔV = rated volume delivered/absorbed =

$$V_1 gas - V_2 gas = V_2 fluid - V_1 fluid$$

Precharge pressure

Value of precharge pressure varies depending on accumulator application:

A) Energy accumulation, emergency function, hydraulic spring, force compensator, leakage compensator, volume compensator: in these applications, precharge pressure is usually P0 = 0.9 ÷ 0.95 x P_1 (at maximum operating temperature). Compression ratio $P_2 : P_0$ is also to be met, being lower than specified in paragraph Technical data (4:1. 6:1, max 8:1)

B) Pulsation damper
P_0 = 0.7 ÷ 0.9 x P (operating pressure)
Referred to maximum operating pressure.

C) Absorber of water hammers
P_0 = 0.9 ÷ 0.95 x P (operating pressure)
Referred to maximum operating pressure.

Temperature changes

Operating temperature change can strongly affect the accumulator precharge pressure. When temperature increases, the precharge pressure increases; on the contrary, when temperature decreases, the precharge pressure decreases. To better use the accumulator, precharge pressure needs to be calculated considering temperature changes during operation.

$$P_0 (T_{20}) = P_0 (T_x) \times \frac{20 + 273}{T_x + 273}$$

$P_0 (T_x)$ = pressure at temperature measured T_x
$P_0 (T_{20})$ = nitrogen pressure P_0 at 20 °C

Sizing with isothermal transfer

Example: leakage compensation, volume compensation.
Calculation in isothermal transfer only applies when both accumulation and discharge occur in a long time (more than 10 minutes), so that an efficient heat exchange is allowed and nitrogen temperature is kept almost constant.
Accumulator volume:

$$V_0 = \frac{\Delta V}{\frac{P_0}{P_1} - \frac{P_0}{P_2}}$$

V_0 and ΔV in litres
P_0 and P_1 and P_2 in absolute bars (bar(a) = bar(g) +1)
Accumulator yield:

$$\Delta V = V_0 \times \left(\frac{P_0}{P_1} - \frac{P_0}{P_2}\right)$$

Dimensionamento con trasformazione adiabatica
Example: energy accumulation, hydraulic spring, suspensions, force compensator.
Calculation in adiabatic transfer only applies when accumulation and discharge both occur in a short time, so that no heat exchange is allowed between gas and environment. (When quickly compressed, nitrogen increases temperature, on the contrary temperature decreases when released).
Accumulator volume:

$$V_0 = \frac{\Delta V}{\left(\frac{P_0}{P_1}\right)^{\frac{1}{1,4}} - \left(\frac{P_0}{P_2}\right)^{\frac{1}{1,4}}}$$

V_0 and ΔV in litres
P_0 and P_1 and P_2 in absolute bars (bar(a) = bar(g) +1)
Accumulator yield:

$$\Delta V = V_0 \times \left[\left(\frac{P_0}{P_1}\right)^{\frac{1}{1,4}} - \left(\frac{P_0}{P_2}\right)^{\frac{1}{1,4}}\right]$$

Sizing with polytropic transfer
Example: emergency, safety.
Calculation in polytropic transformation only applies when accumulation is slow (isothermal) and discharge is quick (adiabatic).
Accumulator volume:

$$V_0 = \frac{\Delta V \times \frac{P_2}{P_0}}{\left(\frac{P_2}{P_1}\right)^{\frac{1}{1,4}} - 1}$$

V_0 and ΔV in litres
P_0 and P_1 and P_2 P2 in absolute bars (bar(a) = bar(g) +1)
Accumulator yield:

$$\Delta V = V_0 \times P_0 \times \frac{\left(\frac{P_2}{P_1}\right)^{\frac{1}{1,4}} - 1}{P_2}$$

Using the formulas above, accumulator volume can be calculated with good degree of approximation and/or the volume obtained depending on accumulator dimension specified.
For other usages and/or for a more accurate calculation, considering temperature changes, real charge and discharge times, real and not ideal gas usage, SAIP SIZAC calculation software can be used as available on site www.saip.it or contacting directly SAIP technical service.

CERTIFICATIONS

All hydraulic accumulators are pressure vessels and are subject to the national legislation and directives applicable in the country of installation.
The accumulators type WA are manufactured in accordance with the European directive PED (97/23); for capacities lower than or equal to 1 litre CE marking is not required, while for higher capacities, in addition to the CE marking, each accumulator must be accompanied by the declaration of conformity and by the operation and maintenance manual.
The Technical data table indicates the category related to the use with not dangerous fluids (group 2), as a function of the product: volume by pressure.
For use with hazardous fluids (group 1), please contact SAIP.
In compliance with the European Directive PED (97/23/CE), documentation includes the declaration of conformity and the use and maintenance manual.
Accumulators can also be supplied according to directive ATEX 94/9/CE (annex VIII) and harmonized standards EN 13463-1 concerning non electrical products to be used in potentially explosive atmosphere environments and not included in classification ATEX CE II2GcT4.

SAIP also provides for other tests and certifications for countries where CE certification is not recognized.

- ASME-"U"- Stamp for USA (National Board), Canada (CRN), South Africa, etc.
- ML (ex SQL) for China.
- Australian Pressure Vessel standard AS1210-1997 for Australia.
- GOST-R for Russia, Ukraine, Kazakhstan, etc.
- Dossier RTN - Rostechnadzorf for Ukraine, Russia, Kazakhstan, etc.
- DDP passport for Algeria, Tunisia etc.
- DOSH for Malaysia

Anyway, for other countries or applications requiring for a specific test, accumulators are manufactured in compliance with the European Directive, but supplied without CE mark and with factory test or according to the standard applied.
Other certifications, such as for naval sector, can be required upon order.