Hydraulic Accumulator
nominal volume 13 cm³ – 750 cm³
max. operating pressure 250 bar - 500 bar

Nominal volume	[cm³]	75	75	750	750	75	13
Max. operating pressure	[bar]	250	250	250	250	500	500
Gas-preload pressure*	[bar]	40	100	40	100	100	100
Accumulated volume at max. static pressure and 22°C operating pressure	[cm³]	60	45	625	450	59	10
Min. operating pressure	[bar]	45	110	45	110	110	110
Recom. range of operating pressure	[bar]	50-150	120-250	50-150	120-250	125-500	125-500
Weight	[kg]	0.7	0.7	3.7	3.7	2.2	0.24
Part-no.		**9601-300**	**9601-500**	**9604-301**	**9604-501**	**9605-600**	**9606-102**

* different gas-preload pressures on request

Accessories

Union for pipe Ø 8 mm	**9208-805**	**9208-805**			**9208-040**
O-ring	**3001-322**	**3001-322**			
Threaded red. adapt. screw-in thread G 1/4			**3613-015**	**3613-015**	
Hexagon nut M 33 x 1.5 DIN 936			**3300-010**	**3300-010**	

Application

In power workholding hydraulic accumulators are used as energy storage for compensation of internal leakage and for the reduction of temperature influence on uncoupled clamping systems.

1. Energy storage

Between working cycles or if the demanded flow rate is less than the pump flow rate, energy can be stored and be released immediately if required.
In certain operating cases, e.g. with coupling processes of automatic couplings oil volume will be free or reduced during the coupling movement. According to the oil quantity in the fixture the internal hydraulic pressure would drop by a certain rate due to the uncoupling process. This pressure loss is reduced by the energy storage of the accumulator as to its size. Such an element should also be mounted on hydraulic clamping fixtures which are pressurised statically for energy storage. Thereby the hydraulic clamping system remains elastic and can compensate, e.g. for workpiece movement.

2. Reduction of temperature influence

Another important case is the reduction of temperature influence to static clamping fixtures. The pressure changes by approx. 10 bar per degree temperature change without accumulator. This influence can be reduced by means of an accumulator. Amount of reduction depends upon the accumulator's size.

3. Compensation for internal leakage

Internal leakage can be found with special hydraulic components, e. g. spool valves or rotary valve couplings. With power units operating in a cut-off mode to clamp/unclamp fixtures the switching frequency could not be tolerated without hydraulic accumulator. A reasonably sized accumulator stores energy, which compensates for the leakage, if necessary.

Important note

Hydraulic accumulators are not suitable for external leakage e.g. to compensate for an external leakage caused by a defective fitting. External leakage should be removed immediately.

Type	Diaphragm
Filling gas	Nitrogen
Pressure fluid	Hydraulic oil as per DIN 51524
Adm. operating temperature	–10° up to +80°C
Position of installation	any

Safety provisions

These hydraulic accumulators have to comply with the German accident prevention regulations (Unfallverhütungsvorschrift „Druckbehälter" (VGB 17) des Hauptverbandes der gewerblichen Berufsgenossenschaften), however, as per paragraph 5 group II, are not subject to inspection. Hydraulic installations with hydraulic accumulators have to be provided with the following control and safety devices.

1. Pressure gauge

For pressure control of the accumulator a pressure gauge is required, indicating the existing operating pressure at all times.

2. Safety valve

A safety valve is to protect the accumulator from exceeding the max. operating pressure. This can happen in case of unauthorised adjustment of the pressure relief valve at the power unit, in case of heating up or if the hydraulic cylinders have to absorb additional forces.

The safety valve has to be selected and set such that exceeding the highest admissible operating pressure by more than 10% is prevented. Thereby it has to be in a position to carry off the total output flow of the power unit.

In principle, a pressure relief valve whose setting can be protected against unauthorised adjustment (increase), is sufficient. Generally, so-called TÜV-valves are used.

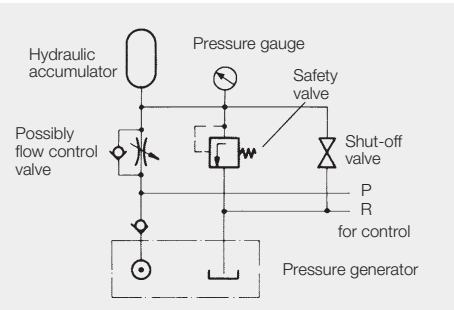
3. Relief valve

Accumulators have to be discharged during repair work etc.
This is made by a shut-off valve. This shut-off valve should be easily visible, and should have an identifiable open-shut position.

4. Flow control

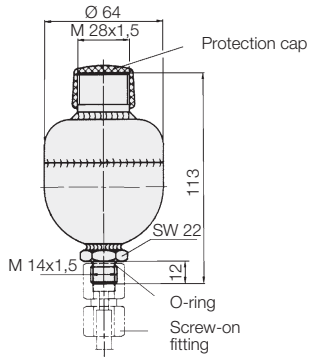
If there is danger that the accumulator is suddenly discharged during valve switching, or if the operating pressure temporarily falls below the gas preload, a flow control valve should be built in the pressure line.

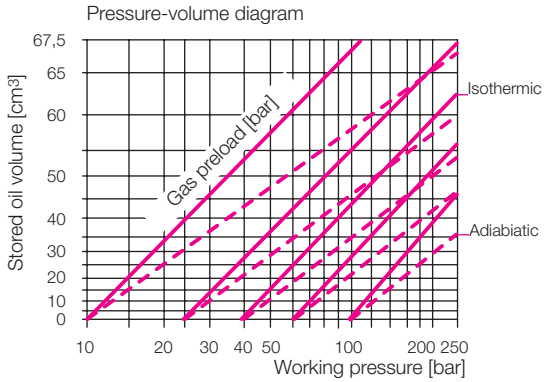
Hydraulic circuit diagram for an accumulator with safety provisions



For dimensions and pressure-volume characteristics see page 2

Part-no. 9601-300/500





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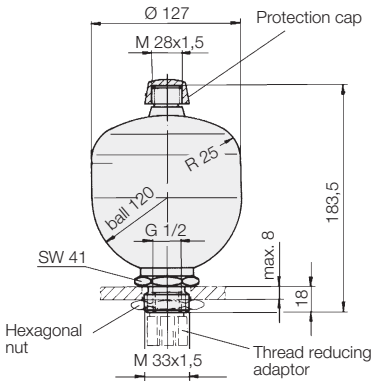

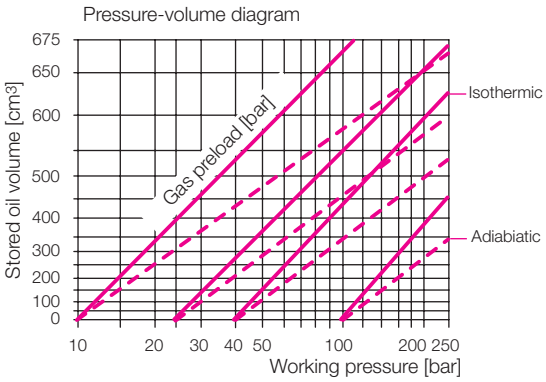

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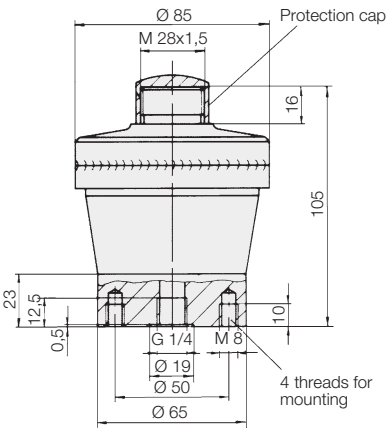

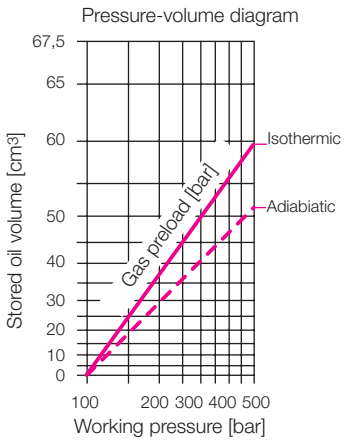

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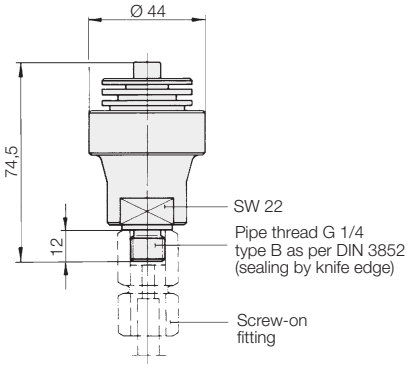

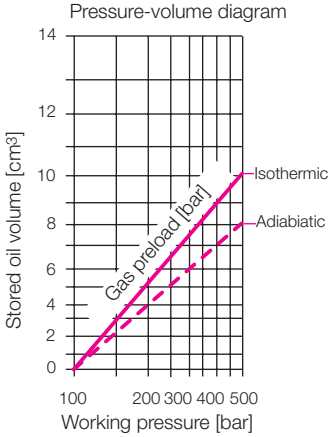

Criteria for selection

When choosing suitable hydraulic accumulators, certain criteria should met to ensure optimal functioning and a long life.

1. Max. operating pressure $p_{max.}$

The max. operating pressure indicated in the table must by no means be exceeded. This applies especially if a temperature influence is to be expected. The following thumb rule which can be applied here: 30°C corresponds to approx. 10% change in pressure. In applications the operating pressure should not exceed 80% of the max. accumulator operating pressure.

2. Correct selection of the gas preload p_o

The gas preload defines the nitrogen gas pressure in the gas bubble, if the accumulator is not pressurised with hydraulic fluid.

In order to put an accumulator into working mode the minimum operating pressure of the hydraulic fixture should be about 10% over the gas preload pressure. Only after the hydraulic pressure has exceeded the gas preload pressure the accumulator can take up hydraulic oil.

The max. operating pressure and the gas preload pressure in an application should not be in larger ratio than 5:1. If this pressure ratio is exceeded, the absorption ability of the accumulator becomes proportionally weaker and the life of the membrane becomes shorter.

3. Oil volume

The oil volume which is taken up by the accumulator should be adapted to the application.

a) To balance leakage oil, e.g. for rotary valve couplings, the accumulator volume should minimally increase the switching time to 5 seconds.

b) For temperature compensation it is advisable to use an accumulator with a nominal volume of min. 75 cm³ if the total volume is more than 100 cm³.

4. Operating mode

There exists the adiabatic and isothermic operating modes.

Adiabiatic: The accumulating or discharging process is effected so quickly, that there is no temperature balance. The nitrogen is warmed up according to the thermodynamic equation, without giving this warmth into the surroundings due to the short accumulating process.

Isothermic: The accumulating and discharging process is effected so slowly that there is no change in temperature at the gas side.

It can be assumed that in hydraulic workholding application there is the isothermic operating mode. The nitrogen is compressed under adiabatic conditions, but the pressure is decreased afterwards by giving warmth to the surrounding and by reducing the volume as a result within the gas bubble. If there is more than 10% pressure decrease the power unit switches again and brings the oil to the required operating pressure. Afterwards the accumulator is filled with an oil volume, which corresponds to the isothermic operating mode.

If the pressure generator is to be separated from the clamping fixture, the separation should only be effected after the power unit has stopped switching (usually after approx. 15 sec).

Example: Accumulator 9601-500
max. operating pressure = 200 bar
gas preload pressure p_o = 40 bar
accumulated oil volume according to diagram
in isothermic operating mode = 59 cm³