aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding

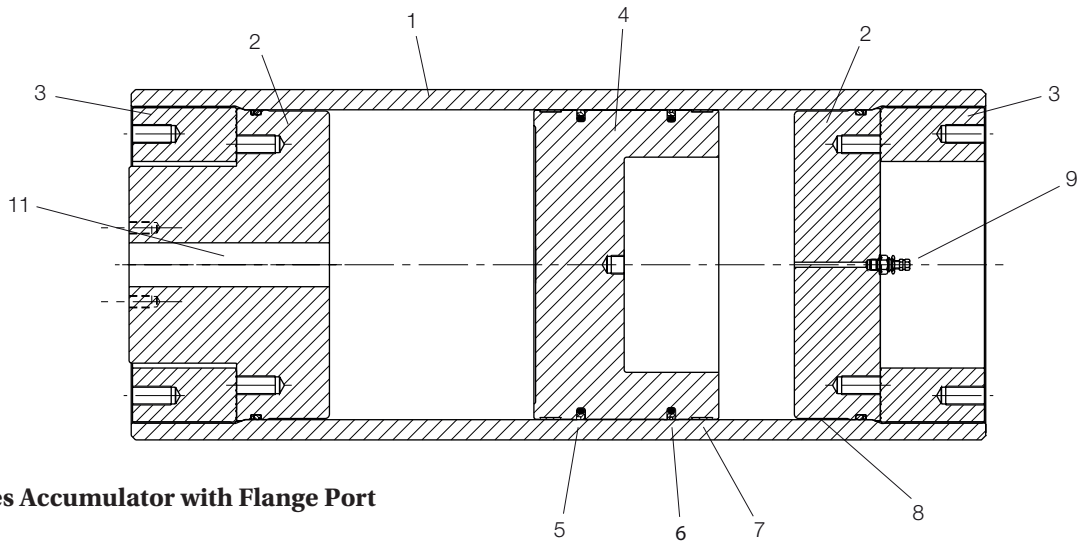
Piston Accumulators

AP Series 250 and 350 bar

Parker

ENGINEERING YOUR SUCCESS.

Benefits



360mm Bore AP Series Accumulator with Flange Port

1, 2 & 3 Shell and Caps

For maximum seal life, heat generated within the accumulator during rapid cycling must be dissipated quickly and efficiently. Compact, rugged steel shell and end caps permit rapid heat dissipation, while the bore of the accumulator is micro-finished to maximise seal life.

180mm and 250mm bore accumulators feature threaded caps to minimize downtime and simplify maintenance of the accumulator, permitting quick and easy installation of seals. 360mm bore units (illustrated) use a screwed ring (3) to retain the gas and oil caps, reducing the mass of parts handled during maintenance and providing additional protection for the gas valve.

4. Piston

Rapid response in high cycling applications is assured by Parker's lightweight piston design. The dished profile of the aluminium piston gives extra gas capacity while maintaining stability in the bore, and permits a greater usable volume of fluid.

5 & 6 Piston Sealing

Rapid cycling, with piston speeds up to 8m/s, places extreme demands on piston seals. Parker's AP Series accumulators employ seals with different performance characteristics for the oil and gas sides of the piston, selected to suit the differing operating conditions encountered.

The AP Series multi-element sealing system holds full pressure throughout long idle periods between cycles, providing dependable, full pressure storage of hydraulic energy. It ensures safe, reliable absorption of pressure peaks and helps to prevent the failure modes associated with bladder accumulator designs.

7. PTFE Bearing Rings

To reduce wear and extend service life, filled PTFE bearing rings are fitted, eliminating metal-to-metal contact between the piston and bore, and protecting the piston seals from fluidborne contaminants. Their low coefficient of friction minimizes heat build-up within the piston and shell.

8. Safety Bleed Groove

A bleed groove in the gas cap progressively releases unrelieved gas pressure in the accumulator as the gas cap is unscrewed. **Note:** to avoid the risk of damage or injury, an accumulator must always be discharged before disassembly.

9. Gas Valve

All AP Series piston accumulators are fitted as standard with a robust, mechanically opened/closed poppet-type gas valve rated at 350 bar. To avoid the risk of damage or injury, an accumulator must be discharged before disassembling but, for added safety, the gas valve vents progressively as it is unscrewed.

10. Gas Valve Protector

To prevent accidental – and potentially hazardous – damage to the gas valve, 180mm and 250mm bore AP Series accumulators are fitted with a steel gas valve protector. The gas valve on 360mm bore models (illustrated) is recessed within the shell to reduce the risk to the valve from external impact.

11. Ports

To provide the required flow rate and simplify system design, a range of port types and sizes is available. BSPP ports are fitted as standard; metric flanged ports to ISO 6162 and ISO 6164 are available as an option.

Applications

Ideal for die casting and plastic injection moulding

AP Series Piston Accumulators

Parker's AP Series accumulators are a premium specification product designed for use in high performance applications such as die casting and plastic injection moulding, where large volumes of fluid have to be displaced at high speed. Special multi-element sealing systems have been developed to combine good servo application and load holding properties with the wear characteristics required to withstand continuous use at piston speeds of up to 8m/s.

A wide range of bore/stroke combinations enables an accumulator with the required volume to be selected in a size that will optimise the use of available space, while metric mountings and a choice of port styles simplify connection. Parker offers a full range of clamps to provide secure mounting.

Main Features

Actual Bore Sizes & Maximum Flow Rates

Model	Actual Bore ø	Max. Recommended Flow Rate*
	mm	l/m
AP180	180	12,000
AP250	250	23,000
AP360	360	45,000

Bore Size, Pressures & Temperature Range

Bore Size (mm)	Max. Working Pressure (bar)	Volume (Litres)		Material Working Temperature Range °C
		Min	Max	
AP180	250/350	6	80	
AP250	250/350	30	150	-20 to +150 °C
AP360	250/350	100	300	

Materials

- Shell – high strength steel
- End caps – steel
- Pistons – lightweight aluminium alloy
- Cap end seals – NBR (standard): other compounds to suit application
- Piston bearing rings – filled PTFE
- Piston seals – filled PTFE (standard): other compounds to suit application
- Gas valve assembly – stainless steel
- Gas valve protector – steel
- Paint finish – black primer, suitable for epoxy paint finishes (standard) – other finishes on request

Custom Designs

For unique applications and hostile environments, different designs, materials and coatings can be supplied. Please contact our engineering department to discuss custom solutions to individual application requirements.

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Accumulator Cooler Division Europe
Hellaby, UK

250 and 350 Bar Pressure Ranges
AP Series industrial accumulators are available in two different pressure ratings, to suit maximum working pressures of 250 and 350 bar. The same premium quality design and technical features guarantee optimum performance and service life from every AP Series accumulator model, while differing wall thicknesses allow the designer to specify precisely the right performance envelope for the application.

Available Options
A wide variety of options are available for AP Series accumulators, including:
- Port styles and sizes
- Seal compounds
- High flow gas ports for use with remote gas storage bottles
- Water service versions
- Safety fuses
- Mounting systems
- Precharge/piston position sensors
- Certifications to suit different market requirements

Water Service
AP Series piston accumulators are available for use with water as the fluid medium. Modifications include plating of all working surfaces. Please consult the factory for details.

Operating Temperatures, Seals and Fluids
Standard and optional seal combinations for AP Series accumulators are shown below. Other seals are also available for use in exceptional conditions – please consult the factory with details of the application. The shells of Parker's AP Series accumulators are CE approved for operation at temperatures between -25°C and +150°C.

Filtration
For maximum component life, the system should be protected from contamination by effective filtration. Fluid cleanliness should be in accordance with ISO 4406. The quality of filters should be in accordance with the appropriate ISO standards.

The rating of the filter media depends on the system components and the application. The minimum required for hydraulic systems should be class 19/15 to ISO 4406, which equates to 25µ (ß10≥75) to ISO 4572.

Safety
Charging must be carried out by qualified personnel. Before taking any readings or pressurizing with nitrogen, the accumulator must be isolated from the hydraulic system and the fluid side discharged in order to depressurize it. Use only nitrogen (N_2) to pressurize the accumulator.

Danger of Explosion – Never Charge with Oxygen
The types of nitrogen permitted are: type S (99.8% pure); type R (99.99% pure); type U (99.993% pure).

Approvals

Approvals	AP180	AP250	AP360
PED 2014/68/EU	•	•	•

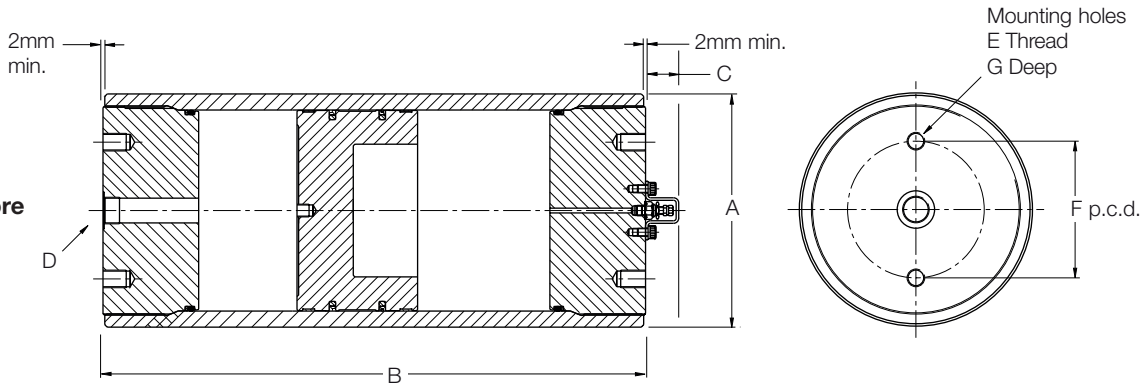
Mounting
The optimum mounting orientation is vertical however angled and horizontal mountings are permissible if the hydraulic fluid is kept clean; high levels of contaminants in the fluid can result in uneven or accelerated seal wear.

Seals, Fluids and Temperature Ranges

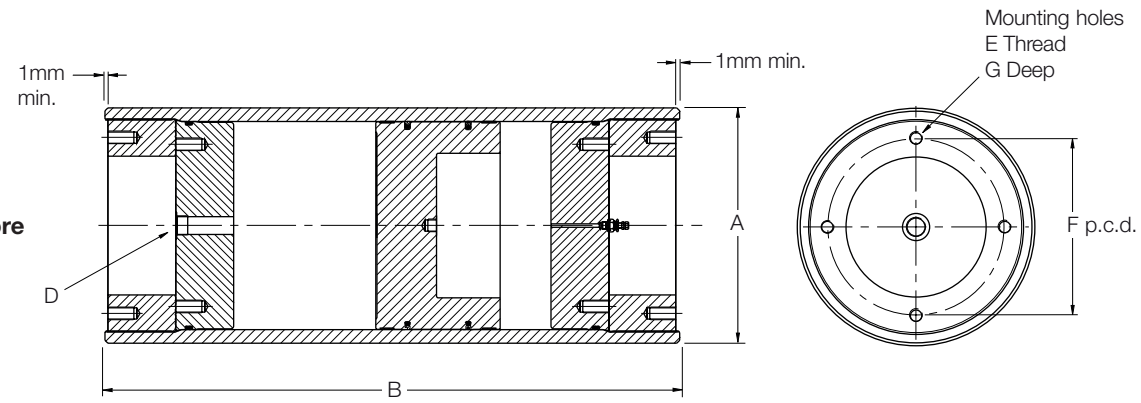
Code	Seal Type	"Min Temp"	"Max Temp"	"Fluid Type"
K	"NBR (Nitrile)"	-30°C	75°C	General purpose, petroleum-based fluids
E	"FPM (Fluorocarbon elastomer)"	-25°C	150°C	High temperature and/or synthetic fluids
D	"EPDM (Ethylene Propylene)"	-25°C	120°C	Phosphate-esters
H	"HNBR (Hydrogenated Nitrile)"	-30°C	130°C	Most oil-based and biodegradable fluids
J	"NBR "Nitrile and filled PTFE"	-30°C	75°C	Water glycol, high water content fluids
Q	"LT-NBR (Low Temperature Nitrile)"	-45°C	71°C	General purpose fluids at low temperatures

Dimensions - 250 bar & 350 bar

250 Bar and 350 Bar
AP Series
180mm and 250mm Bore
with CE Approval



250 Bar and 350 Bar
AP Series
250mm and 360mm Bore
with CE Approval



250 and 350 Bar Models, Capacities and Dimensions

Model	Code	Bore ø	Fluid Volume Litres	A mm		B mm	C mm	D BSPP	E m	F mm	G mm	Weight Kg	
				250 bar	350 bar							250 bar	350 bar
AP180	**006**	180	6	207.0	220.0	549	42	G1½	M16 x 2	140	20	83	102
	008		8			627						88	109
	010		10			706						93	117
	015		15			902						106	136
	020		20			1099						118	155
	025		25			1303						131	175
	030		30			1492						143	194
	040		40			1885						168	232
	050		50			2278						193	270
	060		60			2671						218	309
	080		80			3457						268	385
AP250	**030**	250	30	290.0	310.0	999	42	G1½	M22 x 2.5	170	30	245	317
	040		40			1203						271	359
	050		50			1407						298	401
	060		60			1610						325	442
	080		80			2018						379	526
	100		100			2426						432	609
	150		150			3445						566	817
AP360	**100**	360	100	407.0	436.0	1657[1]	N/A	G1½	M22 x 2.5	304	45	639	903
	150		150			2149[1]						742	1083
	200		200			2640[1]						845	1264
	250		250			3131[1]						948	1445
	300		300			3622[1]						1051	1626

[1] Flange mounting surface on AP360 Series extends 2mm beyond shell.

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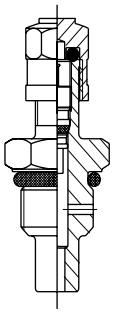
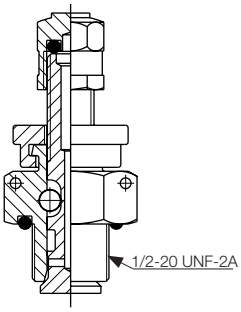
Gas Valves

The standard gas charging valve fitted to AP Series 250 and 350 bar piston accumulators is a cored-type gas valve, rated at 350 bar. A mechanically opened and closed poppet-type gas valve cartridge, also rated at 350 bar, is available as an option.



Standard Cored-Type Gas Valve



Optional Poppet-Type Gas Valve

Both types of charging valve may be used with the Charging and Gauging Kit illustrated on page 7.

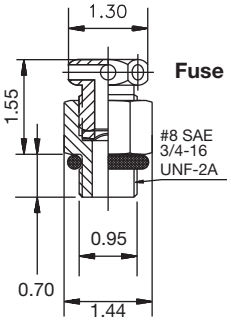
Piston Accumulator Seal Kits

Seal kits are available for all AP Series accumulator models. When ordering seal kits, please supply the complete model number from the identification plate and specify the fluid type and the temperature at which the accumulator is to be used. Installation and maintenance are described in Bulletin 1240-M1.

The seal kits listed below contain a piston with the appropriate seals ready fitted, to minimize the risk of damage during assembly. Seal kits contain items 5, 6, 7, 8, 9, 10 and 12.

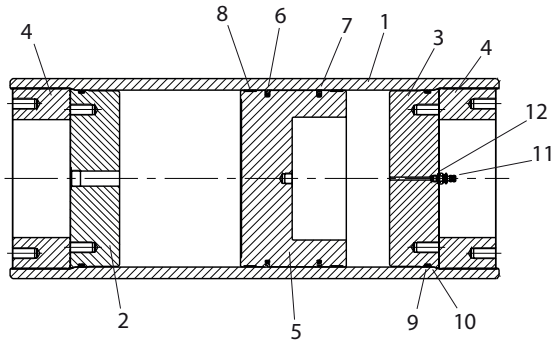
Safety Fuses (Burst Discs)

Safety fuses are available on AP Series accumulators to prevent over-pressurization of gas due to external heat or excess hydraulic pressure. They comprise a housing incorporating a disc which is calibrated to rupture at a pre-determined pressure, to be specific by the customer at the time of ordering. Please contact the factory for further information.

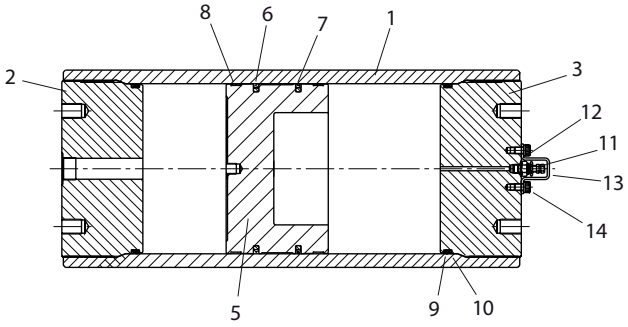


Parts List

1. Shell
2. Hydraulic cap
3. Gas cap
4. Retaining ring (AP360 only)
5. Piston
6. Piston oil seal assembly
7. Piston gas seal assembly
8. Piston bearing ring
9. Cap O-ring
10. Cap O-ring back-up washer
11. Gas valve
12. Gas valve O-ring
13. Gas valve protector (not AP360)
14. Gas valve protector screw (not AP360)



360mm Bore Piston Accumulator



180mm and 250mm Bore Piston Accumulators

Seal Kits

Seal Kit Part Numbers with piston seals assembled (remove the WP for a Seal Kit without piston seal assembled)

Model	Seal Material + Filled PTFE					
	Nitrile NBR	Fluorocarbon Elastomer FPM	Ethylene Propylene EPR	Hydrogenated Nitrile HNBR	Nitrile (HWBF) NBR	Low Temp. Nitrile NBR
AP180	PK180APKWP	PK180APEWP	PK180APDWP	PK180APHWP	PK180APJWP	PK180APQWP
AP250	PK250APKWP	PK250APEWP	PK250APDWP	PK250APHWP	PK250APJWP	PK250APQWP
AP360	PK360APKWP	PK360APEWP	PK360APDWP	PK360APHWP	PK360APJWP	PK360APQWP

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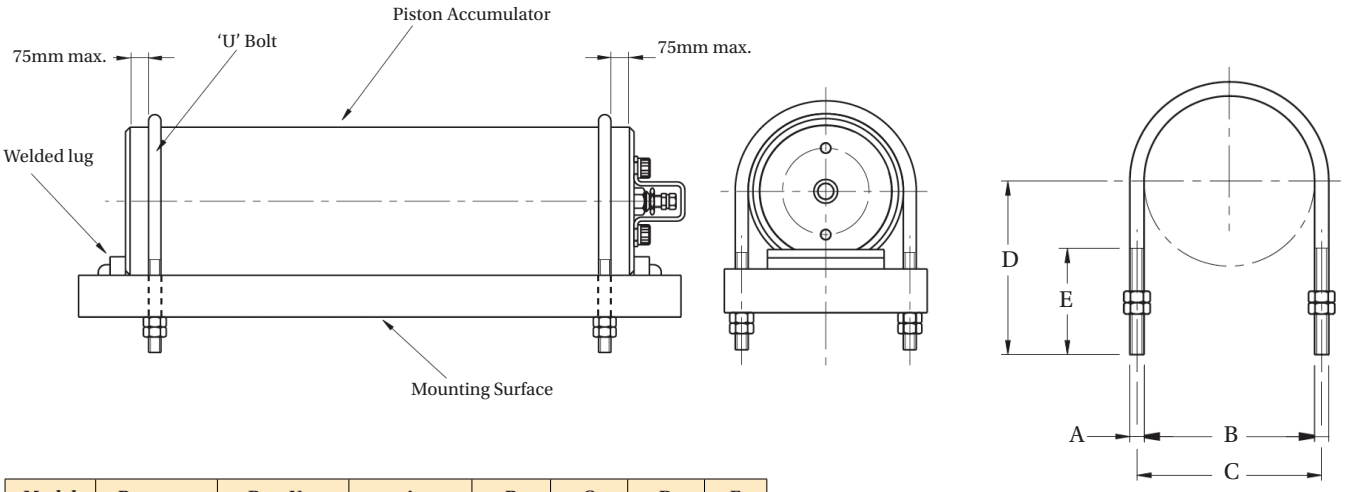
'U' Bolts for Piston Accumulators

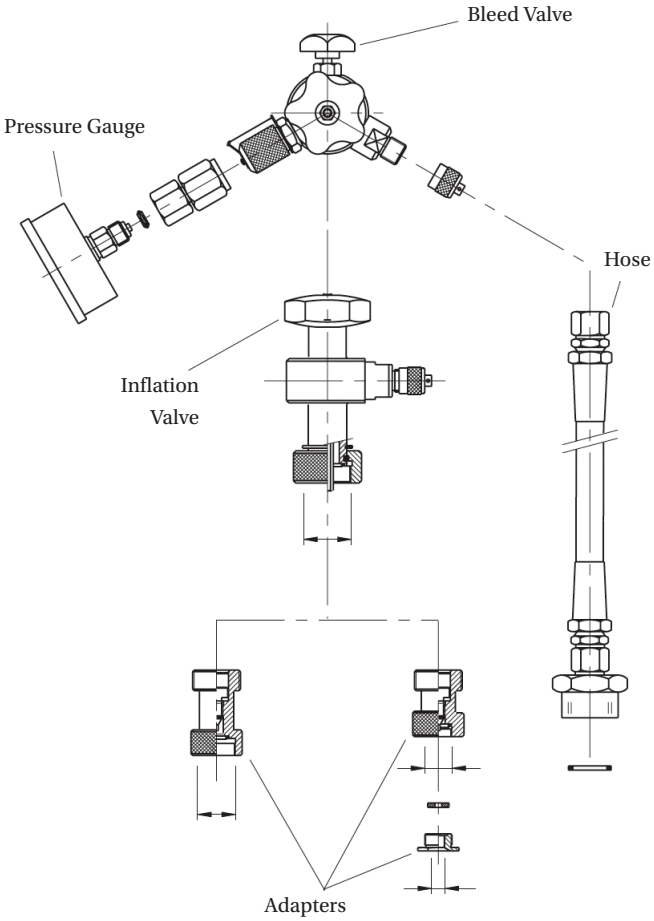


Model	Pressure Rating	Part No.	A	B mm	C mm	D mm	E mm
AP180	250	PE1093-5	M16 x 2	210	226	180	95
	350	PE1093-8		224	240	185	
AP250	250	PE1093-6	M20 x 2.5	286	306	240	115
	350	PE1093-9		312	332	256	
AP360	250	PE1093-10	M27 x 3	408	435	290	135
	350	PE1093-11		438	465	300	150

Note: 'U' bolts should never be mounted more than 75mm from the end of the accumulator to avoid deformation of the shell.

Charging and Gauging

The charging and gauging assemblies listed in the table are suitable for use with both the standard cored-type gas valve and the optional poppet type. Each kit contains a UCA assembly incorporating a gas valve, bleed valve and gas chuck, and a 3m long charging hose with standard nitrogen bottle fittings. The kit includes 25 bar and 250 bar pressure gauges, to permit easy monitoring of the gas precharge.



Territory	Gas Bottle Fitting	Part No.
UK	5/8 BSP (male)	UCA 02
France	W 21.7 x 1/14" (female)	UCA 04
Germany	W 24.32 x 1/14" (female)	UCA 01
Italy	W 21.7 x 1/14" (male)	UCA 05
US	0.960 x 1/14" (male)	UCA 03
Universal	All available fittings (includes all fittings above)	UCA UNI

All dimensions are in millimetres unless otherwise stated.

Please note:
Resistant parts cannot be supplied as spares (tubes/end caps)

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Hydraulic and Gas Ports

The BSPP ports shown are supplied as standard at the fluid ends of AP Series 250 bar accumulators, and at the gas ends of these accumulators when ordered for use with gas bottles. A range of optional threaded and flanged ports is also available, as shown below. All ports are specified by adding the relevant code to the accumulator model number.

BSPP Threaded Ports

Thread Size	From Model	Code
G1	All models	RD
G1 1/4		RE
G1 1/2 (standard)		RF
G2		RG

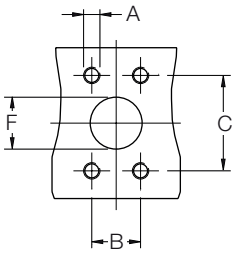
Optional Flanged Ports

Bore Ø	ISO Port Syle	DN10	DN13	DN19	DN25	DN32	DN38	DN51	DN56	DN63	DN70	DN80
180	ISO 6162		•	•	•	•	•	•				
	ISO 6164	•	•	•	•	•	•	•	•	•		
250	ISO 6162		•	•	•	•	•	•				
	ISO 6164	•	•	•	•	•	•	•	•	•	•	•
360	ISO 6162		•	•	•	•	•	•				
	ISO 6164	•	•	•	•	•	•	•	•	•	•	•

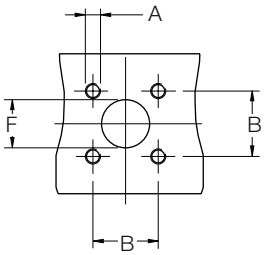
Optional Flanged Ports

AP Series Piston Accumulators are available with metric flange ports to ISO 6162/3000 psi and ISO 6164/6000 psi as shown in the tables. Inch pattern flange ports and flange ports for higher pressure operation are also available, please consult the factory for details.

ISO 6162 Flanged Port Dimensions



ISO 6164 Flanged Port Dimensions



Flange Ports to ISO 6162/3000 psi						
Flange Size	From Model	A *	B ± 0.25	C ± 0.25	F	Code
DN13	180	M8	17.5	38.1	13	MT
DN19	180	M10	22.3	47.6	19	MU
DN25	180	M10	26.2	52.4	25	MV
DN32	180	M10	30.2	58.7	32	MW
DN38	180	M12	35.7	69.9	38	MJ
DN51	180	M12	42.9	77.8	51	ML
DN64	180	M12	50.8	88.9	64	MM
DN76	180	M16	61.9	106.4	76	MN

Flange Ports to ISO 6164/6000 psi					
Flange Size	From Model	A	B ± 0.25	F +0.0 -1.5	Code
DN10	180	M6 x 1	24.7	10.0	SD
DN13	180	M8 x 1.25	29.7	13.0	SE
DN19	180	M8 x 1.25	35.4	19.0	SF
DN25	180	M10 x 1.5	43.8	25.0	SG
DN32	180	M12 x 1.75	51.6	32.0	SH
DN38	180	M16 x 2	60.1	38.0	SP
DN51	180	M16 x 2	69.3	51.0	SQ
DN56	180	M20 x 2.5	83.4	56.0	SX
DN63	180	M24 x 3	102.5	63.0	SR
DN70	250	M24 x 3	113.1	70.0	SY
DN80	250	M30 x 3.5	123.7	80.0	SZ

How to order

Series	Model	Type of Construction	Options	Capacity	Working Pressure	Design Number	Seal Type	Port Size	Gas Port	Pre-Charge
AP	**250**	**E**	**M**	**080**	**L**	**2**	**K**	**RF**	**S**	**/ 010**

AP	Series Accumulator
B	Bottle

Code	**Bore Size (nominal)**
180	180 mm bore
250	250 mm bore
360	360 mm bore

Code	**Approval Type**
E	According to PED 2014/68/EU (From 07/2016 PED 97/23/EC becomes PED 2014/68/EU)

Code	**Valve Options**
M	Poppet-type gas valve
L	Poppet-type gas valve + water service
P	Poppet-type gas valve + safety fuse
R	Poppet-type gas valve + water service + safety fuse

Code	**Capacity**	**Model**	**Code**	**Capacity**	**Model**
006	6.0	AP180 only	**050**	50	AP180 & AP250
008	8.0	AP180 only	**060**	60	AP180 & AP250
010	10	AP180 only	**080**	80	AP180 & AP250
015	15	AP180 only	**100**	100	AP250 & AP360
020	20	AP180 only	**150**	150	AP250 & AP360
025	25	AP180 only	**200**	200	AP360 only
030	30	AP180 & AP250	**250**	250	AP360 only
040	40	AP180 & AP250	**300**	300	AP360 only

Code	**Maximum Working Pressure** [3]
L	250 bar
H	350 bar

Code	**Port**
2	Metric mounting + BSPP port (standard)
###	Specials (Parker assigned number)

Please see Seals table on page 4

Please see Fluid Port tables on page 8

Gas Port
Specification (where no valve supplied)

[1] Other approvals are available to order – please consult the factory.
[2] Where a gas port is specified, no gas valve will be supplied.
[3] For other pressure ratings, please consult the factory.

Hydraulic and Gas Port Modifications

For accumulators with non-standard ports, specify special gas and/or hydraulic ports and use the appropriate port code from page 8. A typical model number for an accumulator with ISO 6149 hydraulic and gas ports would be: A - 3 - T - M - 0090 - D - 2 - K - YE/YE

Code	**Pre-Charge** (for example)
010	10 bar
020	20 bar

Accumulator Sizing Sofware
Parker Olaer has developed very sophisticated simulation software to optimize accumulator sizing recommendations. The behaviour of accumulators used in applications such as pulsation dampening, surge alleviation, thermal expansion and energy storage can be simulated. Our software can be downloaded from our website www.parker.com/ACDE .

You may also contact your local Parker Olaer office for sizing assistance.

Calculating Accumulator Size
Accurate calculation of accumulator size requires many factors to be considered – the working volume of fluid, ambient and maximum operating temperatures, the working pressure range etc. In addition, correction factors must be applied to allow for temperature compensation between the ambient and gas temperatures, and the consequent effect on precharge pressure in the accumulator. Where the working cycle is sufficiently rapid that no heat transfer takes place, the process is termed *adiabatic*. Conversely, where the process takes place at a constant temperature, it is termed *isothermal*.

Accumulator Sizing Charts
The charts shown opposite are used to estimate the size of piston accumulator required to provide a given volume of fluid discharge from the accumulator.

The curves are based on the following formula:

$$\frac{\Delta V = 0.855\ V0\ [(P_2 / P_1)^{1/n} - 1]}{(P_2 / P_1)^{1/f}}$$

Where:

ΔV = volume of fluid discharged	n = discharge coefficient
V0 = Accumulator size	P_2 = maximum system pressure
f = charge coefficient	P_1 = minimum system pressure

It is assumed that the gas precharge pressure = 0.9 P_1

Isothermal and Adiabatic Operation
In constructing the curves, the following factors have been assumed.

For isothermal operation eg: slow charge and discharge time, f and n = 1

For adiabatic operation, eg: fast charge and discharge time, f and n = 1.8

Note: The charts provide an estimate of the volume of accumulator required to store and release a given volume of fluid under specified conditions. In practice, the true charge and discharge coefficients will depend on the application, and may cause significant variations from the chart results. If in doubt, please contact our engineering department for a more detailed calculation.

Where the ratio P_2/P_1 exceeds 1.9, a fatigue analysis is necessary. Please contact our engineering department for further information.**How to Use the Sizing Chart**
These charts are used to find accumulator size Vo when the required output ΔV is known.
Example
Refer to the red lines in the charts opposite.
ΔV = 6 litres P_2 = 170 bar P_1 = 100 bar

Step 1
As the accumulator outputΔV is known, choose the appropriate pair of charts from the two sets shown opposite. For outputs up to 50 litres use charts A and B, and for outputs above 50 litres use charts C and D. In this case, as the required output is 6 litres, charts A and B should be used.

Step 2
Calculate P_2/P_1 by dividing the maximum system pressure by the minimum pressure required to make the machine function.
In this case, 170/100 = 1.7

Step 3
Using chart A, locate 1.7 on the X-axis and draw a vertical line to the top of the chart.

Step 4
Depending on the cycle time, select the appropriate curve on chart A. For fast cycle times, use the adiabatic curve; for slow cycle times, the isothermal curve should be used. In this case, use the adiabatic curve. (n and f = 1.8)

Step 5
On chart A, identify the point at which the vertical line drawn in step 3 crosses the chosen curve (in this case adiabatic) and draw a horizontal line across to the right hand end of chart B.

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Step 6
Using the lower X-axis on chart B, locate the required accumulator output (ΔV), in this case 6 litres. Draw a vertical line to the top of the chart.

Step 7
Locate the point where the vertical line drawn in step 6 crosses the horizontal line drawn in step 5. Locate the first curve to the right of this intersection.

Step 8
Follow the curve selected in step 7 up to the top X-axis (V0) and read off the required accumulator size, in this case 30 litres. Always round up to the next largest size available; for this example, therefore, a 38 litres accumulator should be selected.

Summary

Pre-charge	90% of 100 bar = 90 bar
Adiabatic / Isothermal	Adiabatic
Accumulator selected	A6ES2310L2K

Accumulator Sizing Chart ΔV = 0.1 to 50 Litres

Chart 1

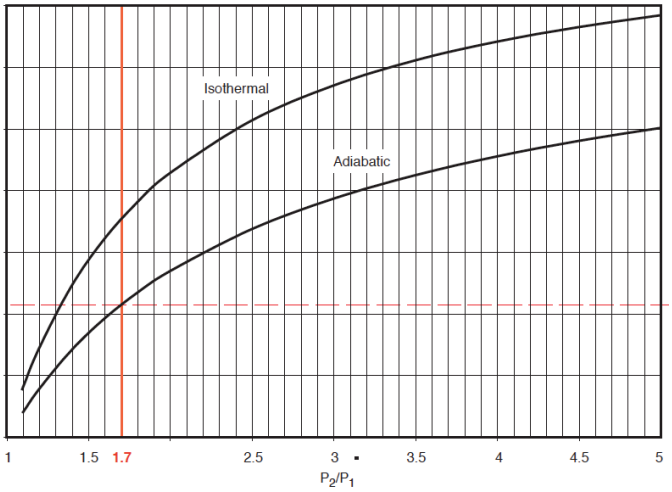


Chart 2

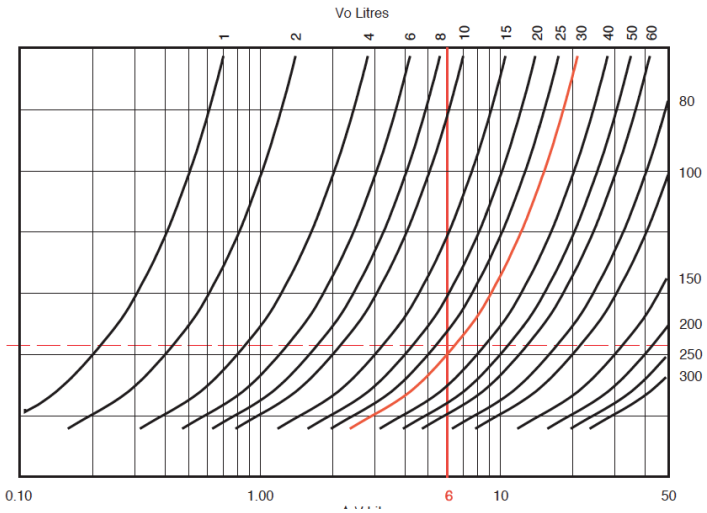


Chart 3

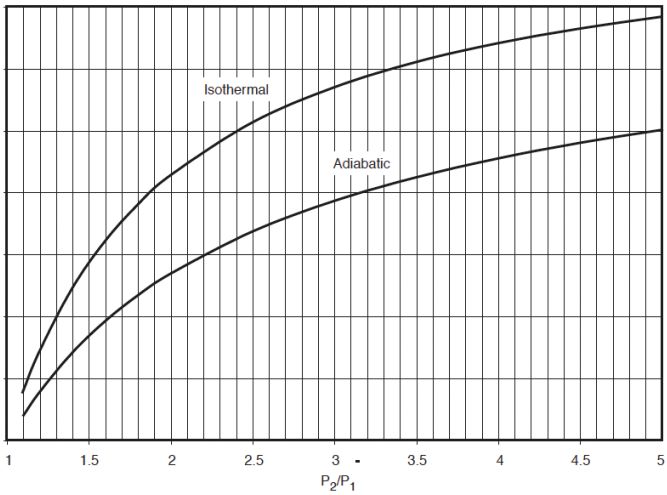
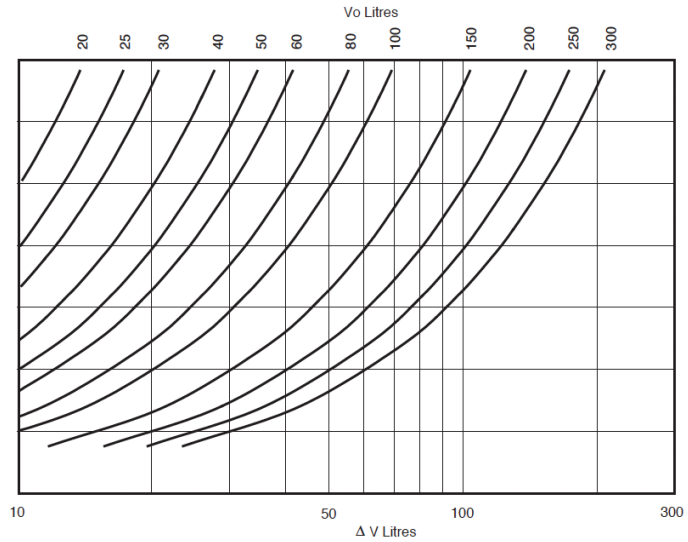


Chart 4



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