



Bulletin HY07-1240-M/UK

Maintenance Bulletin A & AP Series

Effective: March 2005



Hydraulic Piston Accumulators

Installation

All accumulators are shipped from the factory pre-charged with nitrogen, to the pressure rating stamped on the nameplate. If a pre-charge pressure is not specified by the customer, the accumulator will be shipped with 2 ± 0.5 bar of pre-charge pressure. This is to ensure that the piston is held securely at the fluid end of the accumulator during shipment, and to protect the internal surfaces of the accumulator from corrosion. **Inspect all accumulators on delivery. Do not install an accumulator if it shows evidence of transit damage. If in doubt, please consult the factory.**

Keep the hydraulic port sealed with the plastic plug supplied to prevent the entry of foreign material, until ready to make the hydraulic connections.

While vertical mounting is preferred to prevent the accumulation of solid contaminants in the shell, the accumulator can be mounted in any orientation. It should be rigidly mounted using the mounting holes provided at the hydraulic cap and/or suitable clamps. See catalogue HY07-1240, A Series Piston Accumulators and catalogue HY07-1247, AP Series Piston Accumulators for details of clamps available from Parker.

The hydraulic circuit which incorporates the accumulator should be designed so that it automatically discharges all hydraulic fluid from the accumulator when the equipment is turned off.

Accumulators must be mounted in such a way that external loading from supports, attachments, the effects of traffic, wind, and other natural loadings are eliminated or reduced as far as is reasonably practicable. Appropriate protective measures must be applied against hazards which cannot be eliminated. It is not permitted to weld supports or brackets to, or attach fittings that damage the outside surface of the accumulator shell. In addition to shut off and pressure release devices, a hydraulic system which incorporates an accumulator(s) must include a safety valve – see catalogue HY07-1241. If in doubt, details of appropriate circuits can be obtained from Parker.

Where necessary, adequate protection must be provided against corrosion or other chemical attack, taking into account the intended and any reasonable foreseeable use.

Where conditions of erosion or abrasion may arise, adequate measures must be taken to minimise their effect by incorporating suitable liners or cladding materials into the system design.

Connections

Fittings, piping, hoses, etc. must be suitable for the maximum pressure and temperature limits of the intended application.

Design and construction of the system must ensure that:

- 1 The risk of over-stressing from inadmissible free movement or excessive forces, eg: on flanges, connections, hoses, etc. is adequately controlled by suitable supports or restraints, anchoring, alignment and pre-tension.
- 2 Due consideration is given to the potential damage from turbulence.
- 3 Due consideration is given to the risk of fatigue resulting from vibration in pipes.

Operating Instructions

Only fluids in Group 2 as defined by the Pressure Equipment Directive 97/23/EC are permitted for use in A and AP Series accumulators – see Piston Accumulator Operating Instructions, bulletin HY07-1240-T. Before installation, refer to the pressure and temperature limits shown on the nameplate. For cyclic loading, consult Parker regarding the fatigue-free working pressure range or limiting of the number of cycles for finite life applications.

Maintenance

Accumulators must be regularly examined, checked for general condition, and maintained on a periodic basis. The frequency and extent of inspection required will depend on experience with the particular application. It is the responsibility of the accumulator installer to set the frequency of maintenance appropriate to the application, but a period of one year between inspections is considered to be an acceptable maximum. In the case of finite life applications, Parker recommends inspection of the accumulator when one half of the allowable load cycles has been completed or after a period of one year – whichever occurs first.

If the user is not competent to make the necessary assessment of reliability, then expert advice must be obtained. Examination shall consist of visual inspection of the physical integrity of the equipment and, where applicable, a functional test.

Maintenance routines shall be performed by authorised personnel only and shall include the verification of settings and operational testing where applicable.

Maintenance shall also include routine testing of individual devices after specified service cycles and the exchange of components before the end of the projected lifetime. Maintenance programs and work, results of examinations and any resulting remedial measures taken shall be documented and retained for 10 years or the lifetime of the installation (if shorter). Replacement of components shall be documented and retained in the same way.

Repair kits are available for all accumulator models; replacement of the piston seals is generally the only maintenance required. When ordering repair kits, state the complete model number from the nameplate and specify the type of fluid and operating temperature. Replacement of other seals on end caps and the gas valve is also recommended (for A Series kit numbers, see page 4; for AP Series kit numbers, see page 6).

Periodic checking of the pre-charge pressure, see page 8, will provide early warning of deteriorating piston seal performance. If pre-charge pressure is low, check also for gas valve and/or end cap seal leakage. Allowing for temperature difference, if any, the pre-charge pressure will rise if fluid collects in the gas side and will fall if gas leaks into the fluid side or past gas end cap seals. It is suggested that a check be made a week after installation, and thereafter once every three months or at intervals determined by the system builder.

A Series Piston Accumulators**Removal from a Hydraulic System** Ref. Figs. 1, 2 & 3

- 1 Shut the hydraulic system down, and make certain that the hydraulic pressure at the accumulator is zero. In this condition, the piston will be bottomed at the hydraulic end.
- 2 Remove the mounting screws or release the clamp(s) and remove the accumulator from the hydraulic system. Threaded holes in the hydraulic cap may be used to attach lifting equipment, or a sling may be used around the tube.

Note: If a gas bottle is attached to the accumulator, ensure that it is discharged before disconnecting the accumulator.

Disassembly of an A Series Accumulator

Note: Gas pressure should always be discharged before the disassembly of an accumulator – see pages 9 and 10.

A Series accumulators have the hydraulic and gas end caps threaded into the tube. **Always remove the gas cap first – identifiable by the gas valve or by a gas bottle connection.**

- 1 Position the accumulator horizontally and hold down with a strap wrench, or in a vice.
- 2 Where fitted, remove the gas valve protector (13) and unscrew the gas valve (10). Remove and discard the O-ring (12).
- 3 To remove the gas end cap (3), fit screws into the tapped holes in the cap then, using a long bar working against the screws, unscrew the cap from the tube.
- 4 Remove O-rings and back-up washers (8 & 9) from the gas end cap, taking care not to damage the grooves.
- 5 Repeat steps 3 and 4 for the hydraulic end cap (2).
- 6 Remove the piston (4) by pushing from the hydraulic end with a soft-faced bar. **Never try to remove the piston by applying compressed air to the opposite end.**
- 7 Remove the V-O-ring back-up washers (6) from the piston (4). Remove the V-O-ring (5) and the PTFE bearing rings (7) by lifting each ring with a smooth pointed instrument. Move the tool around the piston several times, while easing the ring off the piston.

Cleaning

Thoroughly clean and dry the metal parts, and clean the bore of the tube with clean, lint-free cloth.

Inspection

Inspect the piston for cracks, burrs around O-ring grooves, or damage. Examine the bore of the tube for scratches or scoring, using a light. Inspect the end caps for damaged threads or burrs on O-ring grooves.

Examine the thread undercuts at both ends of the tube for evidence of fatigue damage. If in doubt, consult the factory.

Reassembly Ref. Figs. 1, 2 & 3

Coat all internal parts with clean hydraulic fluid before reassembly. In order to protect the piston seals and ease assembly, the use of a loading sleeve is recommended – details of a suitable loading sleeve are available from Parker.

Piston Ref. Figs. 1 & 2

- 1 Lubricate and fit new the V-O-ring (5), back-up washers (6) and PTFE bearing rings (7) to the piston (4). The back-up washers may be fitted either way round, but ensure that the cut ends overlap correctly.
- 2 Using a loading sleeve if available, insert the piston, plain end first, into the tube from either end. Do not let the piston seals scrape on the threads. The piston must go into the bore exactly square and very slowly. (The V-O-ring will compress as it rides up the chamfer if inserted slowly, but may be damaged if forced quickly.)
- 3 Using a **clean** hammer and block, tap the piston into place until it is 50mm beyond the beginning of the honed bore. Maintain force against the piston while tapping the V-O-ring through the bore chamfer, otherwise the piston will spring back, damaging the V-O-ring. Cover the bore to prevent dirt from entering.

End Caps Ref. Figs. 1 & 3

Note: The O-ring back-up washers (9) fitted to the accumulator end caps have a flat face and a concave face to allow the ring and back-up washer to seat correctly – see figure 3.

Hydraulic End Cap

- 1 Lubricate and install a new back-up washer (9) in the groove in the hydraulic end cap (2), with its concave surface facing the inner end of the cap.
- 2 Lubricate and fit a new O-ring (8) against the concave face of the back-up washer, as shown in figure 3.
- 3 Lubricate the threads of the end cap (2) and insert into the tube, facing the plain (hydraulic) side of the piston. Care should be taken not to scrape the O-ring over the tube threads.
- 4 Tighten the end cap using a bar against screws threaded into the holes of the cap. When fully tight, the end cap will abut against the chamfer leading into the honed bore; extreme tightness is not required as sealing is achieved by the O-ring. The cap should not protrude beyond the end of the accumulator tube by more than 3mm.

Gas End Cap

- 1 Repeat the instructions 1-4 above for the hydraulic end cap. The gas end cap (3), when fitted, will face the dished side of the piston.
- 2 For accumulators with a gas valve, lubricate and fit a new O-ring (12) to the gas valve (10), thread the valve into the gas end cap and torque tighten to 27 ± 2 Nm. Refit the gas valve cap (11) and gas valve protector (13).

Installation

Remount the accumulator and connect to the hydraulic system. Pre-charge the accumulator according to the instructions on pages 8-11. Where space is restricted it may be necessary to pre-charge the accumulator before installation.

Full installation and commissioning information is given in bulletin HY07-1240-T, A & AP Piston Accumulator Operating Instructions.

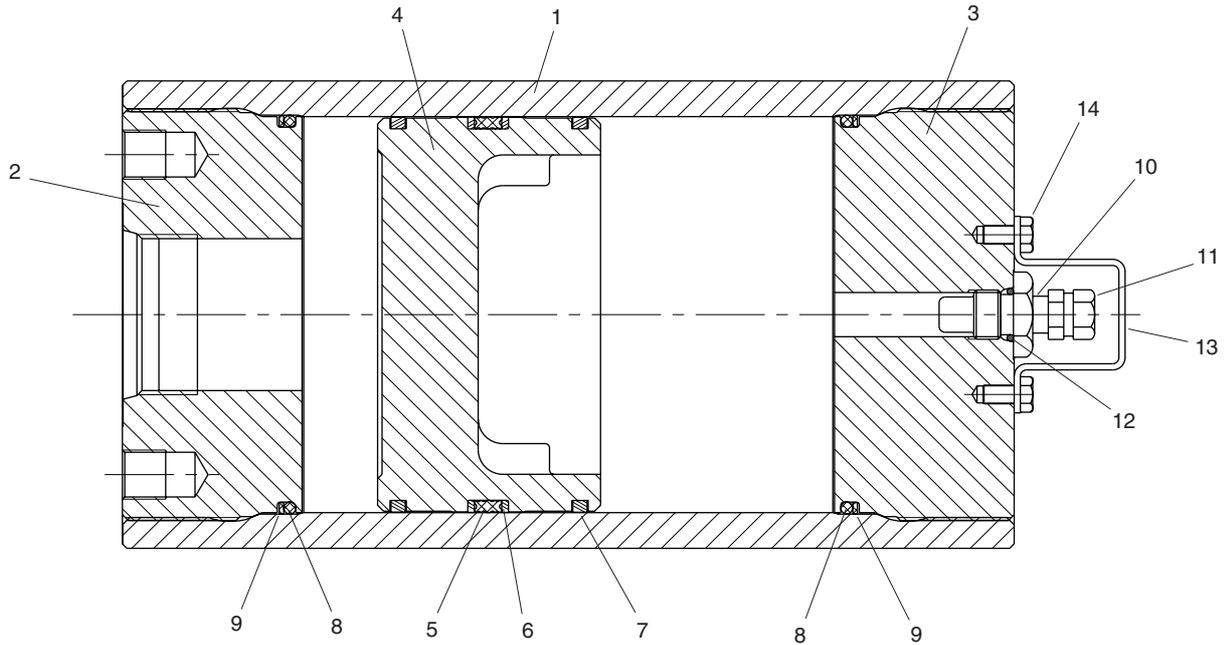


Fig. 1 A Series Accumulator – Exploded View

Item	Part Description
1	Tube
2	Hydraulic cap
3	Gas cap
4	Piston
5	V-O-ring
6	V-O-ring back-up washers
7	PTFE bearing ring (piston)
8	End cap O-ring
9	End cap O-ring back-up washer
10	Gas valve
11	Gas valve cap
12	Gas valve O-ring
13	Gas valve protector
14	Gas valve protector screw

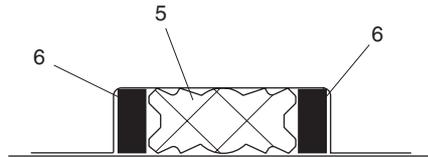


Fig. 2 Piston V-O-Ring Seal and Back-Up Washers

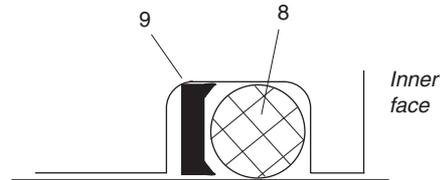


Fig. 3 End Cap O-Ring and Back-Up Washer

Seal Kit Numbers

A Series accumulator seal kits contain items 5, 6, 7, 8, 9 and 12.

Material	Seal Kit Code	Model					
		A2	A3	A4	A5	A6	A8
Nitrile (NBR) + filled PTFE (Std).	K	RK0200K000	RK0300K000	RK0400K000	RK0500K000	RK0600K000	RK0800K000
Fluorocarbon elastomer + filled PTFE	E	RK0200E000	RK0300E000	RK0400E000	RK0500E000	RK0600E000	RK0800E000
Ethylene propylene (EPR) + filled PTFE	D	RK0200D000	RK0300D000	RK0400D000	RK0500D000	RK0600D000	RK0800D000
Hydrogenated nitrile (HNBR) + filled PTFE	H	RK0200H000	RK0300H000	RK0400H000	RK0500H000	RK0600H000	RK0800H000
Low temperature Nitrile (NBR) + filled PTFE	Q	RK0200Q000	RK0300Q000	RK0400Q000	RK0500Q000	RK0600Q000	RK0800Q000

AP Series Piston Accumulators

Removal from a Hydraulic System Ref. Figs. 4 & 5

Caution: AP Series piston accumulators are extremely heavy. Ensure that adequate lifting capacity is available.

Model	Code	250 Bar Models kg	350 Bar Models kg
AP180	006	83	102
	008	88	109
	010	93	117
	015	106	136
	020	118	155
	025	131	175
	030	143	194
	040	168	232
	050	193	270
AP250	060	218	309
	080	268	385
	030	245	317
	040	271	359
	050	298	401
	060	325	442
	080	379	526
AP360	100	432	609
	150	566	817
	100	639	903
	150	742	1083
	200	845	1264
250	948	1445	
300	1051	1626	

- 1 Shut the hydraulic system down, and make certain that the hydraulic pressure at the accumulator is zero. In this condition, the piston will be bottomed at the hydraulic end.
- 2 Remove the accumulator from the hydraulic system. Threaded holes are provided in the hydraulic cap (M16 for 180mm bore, M22 for 250mm and 360mm bores) to attach lifting equipment, or a sling may be used around the tube.

Note: If a gas bottle is attached to the accumulator, ensure that it is discharged before disconnecting the accumulator.

Disassembly of an AP Series Accumulator

Note: Gas pressure should always be discharged before the disassembly of an accumulator – see page 10.

The end caps fitted to 180mm and 250mm bore AP Series accumulators may be of a threaded, one-piece design or, where manifold ports are specified, of a two-piece design at the gas end – see figure 4a. 360mm bore models use a two-piece design of hydraulic and gas end cap with recessed or flush mounting faces – see figures 5 and 5a. When removing end caps from the larger accumulators, it is recommended that the weight of the cap is supported by a hoist and sling.

Always remove the gas cap first – identifiable by the gas valve or by a gas bottle connection.

- 1 Position the accumulator horizontally and secure firmly in a vice, or with straps on v-blocks.

- 2 Remove the gas valve protector (14), where fitted, and unscrew the gas valve (11). Where the valve is recessed, a short 19mm A/F spanner, approx. 120 mm long, should be used to loosen the valve. Remove and discard the O-ring (13).
- 3 To remove the one-piece gas end cap (3) from a 180mm or 250mm bore accumulator, fit screws into the tapped holes in the cap. Using a long bar working against the screws, unscrew the cap from the tube.
- 4 To remove a two-piece gas end cap (3), fit screws into the tapped holes in the retaining ring (4) then, using a long bar working against the screws, unscrew the retaining ring from the tube. Withdraw the gas end cap from the tube using a suitable bracket and screws threaded into the tapped holes in the cap.
- 5 Remove O-rings and back-up washers (9 & 10) from the end cap, taking care not to damage the grooves.
- 6 Repeat steps 3 or 4 and 5 for the hydraulic end cap.
- 7 Remove the piston (5) by pushing from the hydraulic end with a soft-faced bar. **Never try to remove the piston by applying compressed air to the opposite end.** Support the weight of the piston with a sling as it emerges from the tube.

Cleaning

Thoroughly clean and dry the metal parts, and clean the bore of the tube with clean, lint-free cloth.

Replacement Piston Assemblies

The multi-element seal sets fitted to AP Series accumulator pistons are delicate, high-performance items which require specialist tools and workshop facilities to install successfully. To ensure satisfactory service performance and to minimize downtime, Parker supplies replacement piston and seal assemblies, and recommends that these should be fitted as part of the overhaul procedure. Kit numbers are listed on page 6.

Inspection

Examine the bore of the tube for scratches or scoring, using a light. Inspect the end caps for damaged threads or burrs on O-ring grooves.

Examine the thread undercuts at both ends of the tube for evidence of fatigue damage. If in doubt, consult the factory.

Reassembly Ref. Figs. 4-8

Coat all internal parts with clean hydraulic fluid before reassembly. In order to protect the piston seals and ease assembly, the use of a loading sleeve is recommended – details of a suitable loading sleeve are available from Parker.

Vertical Installation of the Piston into the Tube

To minimize the risk of damage to the piston and seals, it is recommended that the replacement piston assembly should be installed with the accumulator tube positioned vertically. Ensure that suitable equipment is available to permit safe working practices. Position the tube with the hydraulic end uppermost. Tapped holes (M12 for 180mm bore, M16 for 250mm and 360mm bores) are provided in the piston for the attachment of a lifting eye. The eye must be attached to the hydraulic side of the piston, ie: to the plain, not the dished, side.

Reassembly and Seal Kits

- 1 Lubricate the sides of the piston assembly liberally with clean hydraulic fluid.
- 2 Lower the piston slowly and carefully into the loading sleeve, taking the weight of the assembly with a hoist. If necessary, use a **clean** hammer and block to tap the piston into the tube until the top face of the piston is 50-100mm below the beginning of the honed bore. Take care not to introduce contamination into the bore.

Before proceeding further, it is recommended that the tube should be lowered to the horizontal position, taking care that the piston does not slide within the bore. To continue with assembly, please refer to 'End Caps' below.

Horizontal Assembly of the Piston into the Tube

For this procedure the weight of the piston must be supported with a sling, taking care not to damage the seals or to introduce contamination as the piston enters the loading sleeve.

- 1 Lubricate the piston and insert it, plain end first, into the loading sleeve positioned at the gas end of the tube.
- 2 Use a **clean** hammer and block to tap the piston into the tube until the top face of the piston is 50-100mm beyond the beginning of the honed bore. Take care not to introduce contamination into the bore.

End Caps Ref. Figs. 4, 5 & 6

Note: The O-ring back-up washers (10) fitted to the accumulator end caps have a flat face and a concave face to allow the ring and back-up washer to seat correctly.

Hydraulic End Cap

- 1 Lubricate and install a new back-up washer (10) in the groove in the hydraulic end cap, with its concave surface facing the inner end of the cap.
- 2 Lubricate and fit a new O-ring (9) against the concave face of the back-up washer, as shown in figure 6.

Piston and Seal Kit Numbers

AP Series accumulator seal kits contain items 5, 6 (a & b), 7 (a & b), 8, 9, 10 and 13.

Material	Seal Kit Code	Model		
		AP180	AP250	AP360
Nitrile (NBR) + filled PTFE (Std).	K	PK180APK	PK250APK	PK360APK
Fluorocarbon elastomer + filled PTFE	E	PK180APE	PK250APE	PK360APE
Ethylene propylene (EPR) + filled PTFE	D	PK180APD	PK250APD	PK360APD
Hydrogenated Nitrile (HNBR) + filled PTFE	H	PK180APH	PK250APH	PK360APH
Nitrile (high water based fluids) + filled PTFE	J	PK180APJ	PK250APJ	PK360APJ
Low Temperature Nitrile (NBR) + filled PTFE	Q	PK180APQ	PK250APQ	PK360APQ

Maintenance Instructions AP Series Piston Accumulators

- 3 One-piece hydraulic end cap (figures 4 and 4a): lubricate the seals and threads of the end cap (2) and insert into the tube, facing the plain (hydraulic) side of the piston. Care should be taken not to scrape the O-ring over the tube threads.

Two-piece hydraulic end cap (figures 5 and 5a): press the end cap (2) squarely into place until it meets firm resistance. Thread the retaining ring (4) into the end of the tube.

- 4 Tighten the end cap or retaining ring using a bar against screws threaded into the tapped holes. When fully tight, the end cap will abut against the chamfer leading into the honed bore; extreme tightness is not required as sealing is achieved by the O-ring. The one-piece cap should not protrude beyond the end of the accumulator tube by more than 3mm. Retaining rings, where fitted, should be recessed by at least 1mm when fully tightened.

Gas End Cap

- 1 When assembled, the gas end cap (3) must face the dished side of the piston. Repeat the hydraulic end cap instructions 1-4 above for the gas end cap.
- 2 Where a gas valve is fitted, lubricate and fit a new O-ring (13) to the valve (11), thread the valve into the gas cap and torque tighten to 27 ± 2 Nm. Refit and torque tighten the gas valve cap (12). Refit the gas valve protector (14) where applicable.

Installation

Refit the accumulator and connect it to the hydraulic system. Pre-charge the accumulator according to the instructions on pages 8-11. Where space is restricted it may be necessary to pre-charge the accumulator before installation.

Full installation and commissioning information is given in bulletin HY07-1240-T, A & AP Piston Accumulator Operating Instructions.

Item Part Description

- 1 Tube
- 2 Hydraulic cap
- 3 Gas cap
- 4 Retaining ring (two-piece cap only)
- 5 Piston
- 6 Piston oil seal assembly
- 6a Energiser ring
- 6b Step seal
- 7 Piston gas seal assembly
- 7a Energiser ring
- 7b PTFE seal
- 8 Piston bearing ring
- 9 Cap O-ring
- 10 Cap O-ring back-up washer
- 11 Gas valve
- 12 Gas Valve cap
- 13 Gas valve O-ring
- 14 Gas valve protector (AP180 & AP250 only)
- 15 Gas valve protector screw (AP180 & AP250 only)

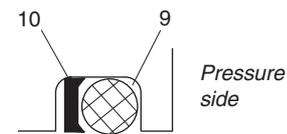


Fig. 6 End Cap O-Ring and Back-Up Washer

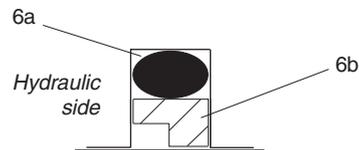


Fig. 7 AP Series Oil Seal Assembly

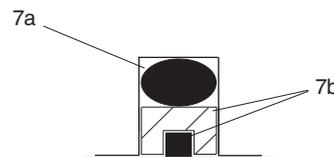


Fig. 8 AP Series Gas Seal Assembly

Fig. 4 180mm and 250mm bore AP Series with threaded hydraulic port and gas valve

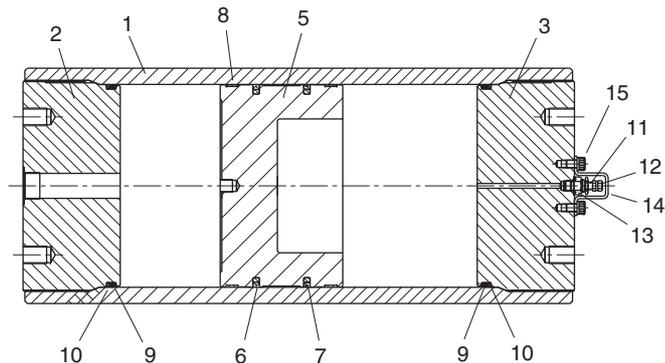


Fig. 4a 180mm and 250mm bore AP Series with manifold ports

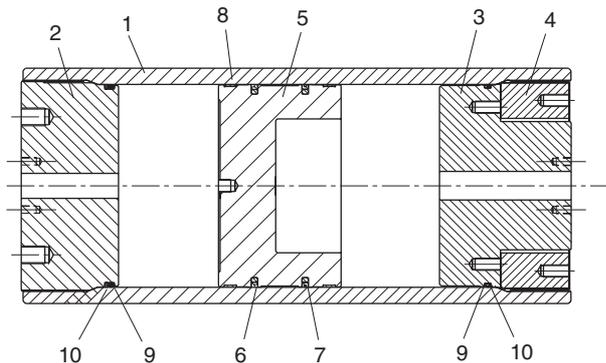


Fig. 5 360mm bore AP Series with threaded hydraulic port and gas valve

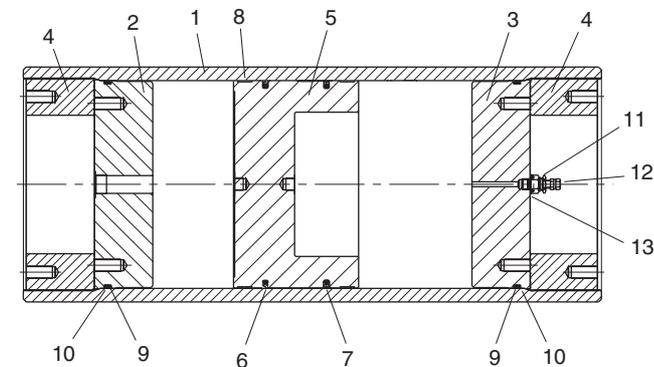
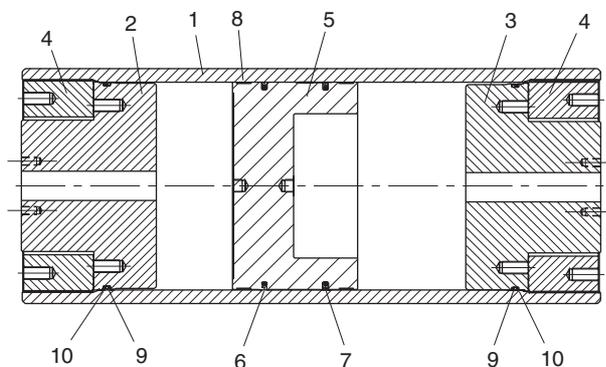


Fig. 5a 180mm and 250mm bore AP Series with manifold ports



Checking and Adjusting Precharge Pressure

The precharge pressure of an A or AP Series accumulator may be checked, and nitrogen filled or vented, using the UCA Universal Charging & Gauging kit.

The UCA assembly is screwed onto the accumulator's gas valve, allowing the precharge pressure to be checked or reduced. If the precharge pressure is to be increased, the UCA can be connected to the nitrogen source with the hose supplied. The UCA kit is supplied with two pressure gauges, reading 0-25 bar and 0-250 bar; where a different pressure range is required, a commercially-available pressure gauge may be used.

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 (N₂) 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).

If the pressure of the gas contained in the nitrogen bottle is greater than the maximum permissible operating pressure of the accumulator, a pressure regulator **must** be fitted to the nitrogen bottle.

Parker recommends that the precharge should be checked during the first week following commissioning of the system. Thereafter, it should be checked every three months, or at intervals determined by the system builder.

The Effect of Temperature on Precharge Pressure

In order to compensate for the difference in pressure at ambient and operating temperatures, it is recommended that the precharge pressure p_0 should be adjusted to reflect the operating temperature of the system, using the correction factor equations and table on page 11.

Warning – Stabilization

The process of charging or discharging an accumulator with nitrogen causes a temperature change which is transmitted to the surrounding air as the temperature of the accumulator stabilizes. To allow for the effects of temperature transfer, the accumulator should be allowed to stand for a minimum of 15 minutes before a final reading of the precharge pressure is taken.

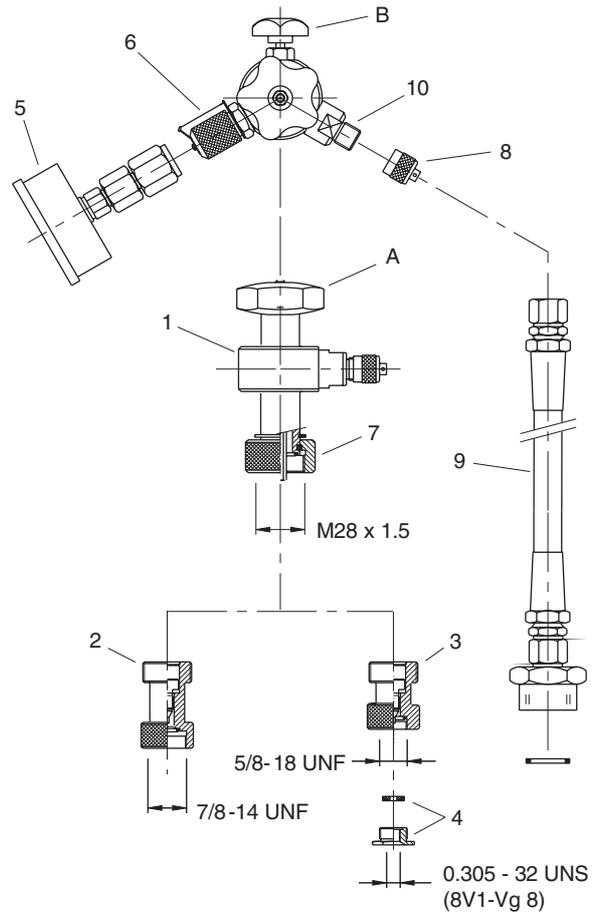


Figure 9 Universal Charging and Gauging Kit assembly

Controls

- A Inflation valve
- B Bleed valve

Key

- 1 UCA
- 2 Adapter (long)
- 3 Adapter (short)
- 4 Adapter (insert) with fibre washer
- 5 Pressure gauge
- 6 Knurled protective cap – gauge port
- 7 Knurled collar – gas port
- 8 Knurled protective cap – filling port
- 9 Filling hose (G1/4 fitting, 60° cone) with O-ring
- 10 Filling port valve

A Series Accumulators with Schrader-type Valve Figures 9 & 10

- 1 Remove the gas valve protector (11) and cap (12) from the accumulator, to gain access to the gas valve (13).
- 2 Select the appropriate pressure gauge (5) for the pressure to be checked, remove the protective cap (6) and attach the gauge to the UCA (1).
- 3 Make sure that the bleed valve (B) is fully closed and that the inflation valve (A) is in the fully **raised** position by turning the handwheel in an anti-clockwise direction.

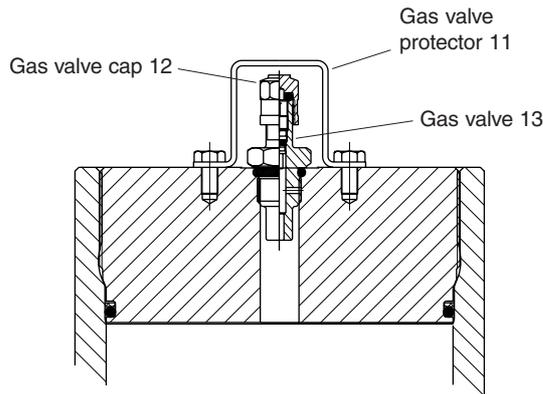


Figure 10 Piston accumulator with Schrader-type gas valve

- 4 Assemble the short adapter and adapter insert (3 and 4), screw onto the gas valve (13) and hand tighten.
- 5 Screw the UCA onto the adapter. Position the assembly to permit easy reading of the gauge, then hand tighten the knurled collar (7).
- 6 Open the inflation valve (A) by screwing the handwheel **clockwise** until the inflation pressure registers on the gauge.

Readings and Results

One of three conditions will apply – the precharge pressure in the accumulator will be correct, or it will be too high or too low.

Nitrogen Pressure p_0 is Correct

- 1 Screw the handwheel (A) **anti-clockwise** to close the accumulator gas valve.
- 2 Slacken the bleed valve (B) to release pressure in the UCA.
- 3 Unscrew the UCA from the adapter.
- 4 Unscrew the adapters from the accumulator gas valve.

Nitrogen Pressure p_0 is Too High

- 1 Slacken the bleed valve (B) to vent nitrogen from the accumulator until, after stabilization, the desired pressure p_0 is registered. Nitrogen vents into the air.
- 2 Tighten the bleed valve (B) once the desired filling pressure is reached.
- 3 Screw the handwheel (A) **anti-clockwise** to close the accumulator gas valve.
- 4 Slacken the bleed valve (B) to release pressure in the UCA.
- 5 Unscrew the UCA from the adapter.
- 6 Unscrew the adapters from the accumulator gas valve.

Nitrogen Pressure p_0 is Too Low

- 1 Close the inflation valve (A) by screwing the handwheel **anti-clockwise**.
- 2 Remove the knurled cap on the filling port (8).
- 3 Connect the end of the filling hose (9) to the filling port valve (10).
- 4 Connect the other end of the hose to the nitrogen source.
- 5 Progressively open the valve on the nitrogen source.
- 6 Screw the handwheel (A) **clockwise** to admit the pressurized gas, taking particular care if the accumulator has a small capacity.
- 7 When pressure p_0 is reached, close the valve on the nitrogen source. To allow for the effects of temperature transfer, the accumulator should be allowed to stand for a minimum of 15 minutes to allow the temperature to stabilize before a final reading of the precharge pressure is taken.
- 8 Screw the handwheel (A) **anti-clockwise** to close the accumulator gas valve.
- 9 Slacken the bleed valve (B) to release pressure in the UCA.
- 10 Remove the hose carefully, to release internal pressure.
- 11 Refit the knurled cap (8) to the filling port valve (10).
- 12 Unscrew the UCA from the adapter(s).
- 13 Unscrew the adapters from the accumulator gas valve.

After removing the UCA and adapter(s), make sure that the accumulator gas valve (13) is sealing effectively. Refit the gas valve cap (12) and replace the gas valve protector (11).

Discharging Gas Pressure

To discharge gas pressure prior to carrying out maintenance on an A Series accumulator, attach the UCA as described at the beginning of this section. Slacken the bleed valve (B) to vent nitrogen from the accumulator until the pressure gauge reads zero and the sound of gas escaping has ceased. Nitrogen vents into the air.

A and AP Series Accumulators with Poppet-type Valve Figures 9 & 11

- 1 Unscrew the gas valve protector (14), where fitted, and gas valve cap (15) from the accumulator gas valve (16).
- 2 Assemble the short adapter and adapter insert (3 and 4), and screw onto the gas valve.
- 3 Select the appropriate pressure gauge (5) for the pressure to be checked, remove the protective cap (6) and attach the gauge to the UCA (1). Make sure that the bleed valve (B) is fully closed. The position of inflation valve (A) can be ignored, as it does not affect this procedure.
- 4 Screw the UCA onto the adapter. Position the assembly to permit easy reading of the gauge, then hand tighten the knurled collar (7).
- 5 Open the accumulator gas valve by turning the hexagonal poppet valve adjuster nut (17) **anti-clockwise** until the inflation pressure registers on the gauge.

Note: for 360mm bore accumulators, a 19mm A/F spanner approximately 120mm long should be used to turn the valve adjuster nut (17).

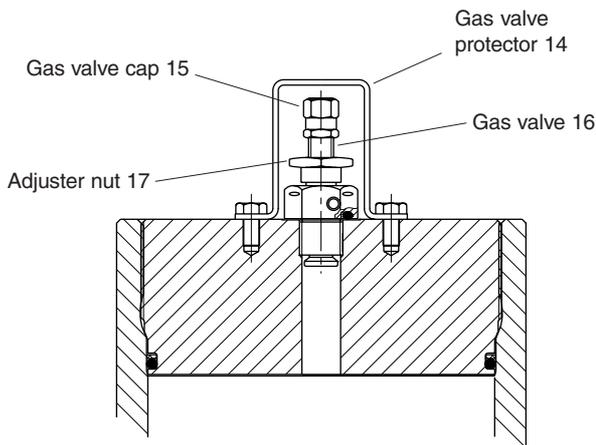


Figure 11 Poppet-type accumulator gas valve

Readings and Results

One of three conditions will apply – the precharge pressure in the accumulator will be correct, or it will be too high or too low.

Nitrogen Pressure p_o is Correct

- 1 Close the accumulator gas valve by turning the poppet valve adjuster nut (17) **clockwise**.
- 2 Slacken the bleed valve (B) to release pressure in the UCA.
- 3 Unscrew the UCA from the adapter.
- 4 Unscrew the adapter (3) and adapter insert (4) from the accumulator gas valve (16).

Nitrogen Pressure p_o is Too High

- 1 Slacken the bleed valve (B) to vent nitrogen from the accumulator until, after stabilization, the desired pressure p_o is registered. Nitrogen vents into the air.
- 2 Tighten the bleed valve (B) once the desired filling pressure is reached.
- 3 Close the accumulator gas valve by screwing the adjuster nut (17) **clockwise**.
- 4 Slacken the bleed valve (B) to release pressure in the UCA.
- 5 Unscrew the UCA from the adapter.
- 6 Unscrew the adapter (3) and adapter insert (4) from the accumulator gas valve (16).

Nitrogen Pressure p_o is Too Low

- 1 Close the accumulator gas valve by screwing the poppet valve adjuster nut (17) **clockwise**.
- 2 Remove the knurled cap on the filling port (8).
- 3 Connect the end of the filling hose (9) to the filling port valve (10).
- 4 Connect the other end of the hose to the nitrogen source.
- 5 Progressively open the valve on the nitrogen source.
- 6 Open the accumulator gas valve by screwing the adjuster nut (17) **anti-clockwise**, to admit the pressurized gas, taking particular care if the accumulator has a small capacity.
- 7 When pressure p_o is reached, close the valve on the nitrogen source. To allow for the effects of temperature transfer, the accumulator should be allowed to stand for a minimum of 15 minutes to allow the temperature to stabilize before a final reading of the precharge pressure is taken.
- 8 Close the accumulator gas valve by screwing the adjuster nut (17) **clockwise**.
- 9 Slacken the bleed valve (B) to release pressure in the UCA.
- 10 Remove the hose (9) carefully, to release internal pressure.
- 11 Refit the knurled cap (8) to the filling port valve (10).
- 12 Unscrew the UCA from the adapter.
- 13 Unscrew the adapter (3) and adapter insert (4) from the accumulator gas valve (16).

After removing the UCA and adapters, make sure that the accumulator gas valve is sealing effectively. Refit the gas valve cap (15) to the accumulator gas valve (16) and replace the gas valve protector (14), where originally fitted.

Discharging Gas Pressure

To discharge gas pressure prior to carrying out maintenance on an AP Series accumulator, attach the UCA as described at the beginning of this section. Slacken the bleed valve (B) to vent nitrogen from the accumulator until the pressure gauge reads zero and the sound of gas escaping has ceased. Nitrogen vents into the air.

Calculation of Correction Factors at Full Pressure

$$p_o(t_o) = p_o(t_2) \frac{t_o + 273}{t_2 + 273} = p_o(t_2) \times K$$

where: $p_o(t_2)$ = precharge pressure at working temperature t_2
 $p_o(t_o)$ = precharge pressure at precharge temperature t_o
 K = correction factor

Table of Correction Factors

		Precharge Temperature t_o °C																
		-20	-10	0	5	10	15	20	25	30	35	40	50	60	70	80	90	100
Operating Temperature t_2 °C	-20	1.00	1.04	1.08	1.10	1.12	1.14	1.16	1.18	1.20	1.22	1.24	1.28	1.32	1.36	1.40	1.43	1.47
	-10	0.96	1.00	1.04	1.06	1.08	1.10	1.11	1.13	1.15	1.17	1.19	1.23	1.27	1.30	1.34	1.38	1.42
	0	0.93	0.96	1.00	1.02	1.04	1.05	1.07	1.09	1.11	1.13	1.15	1.18	1.22	1.26	1.29	1.33	1.37
	10	0.89	0.93	0.96	0.98	1.00	1.02	1.04	1.05	1.07	1.09	1.11	1.14	1.18	1.21	1.25	1.28	1.32
	20	0.86	0.90	0.93	0.95	0.97	0.98	1.00	1.02	1.03	1.05	1.07	1.10	1.14	1.17	1.20	1.24	1.27
	30	0.84	0.87	0.90	0.92	0.93	0.95	0.97	0.98	1.00	1.02	1.03	1.07	1.10	1.13	1.16	1.20	1.23
	40	0.81	0.84	0.87	0.89	0.90	0.92	0.94	0.95	0.97	0.98	1.00	1.03	1.06	1.10	1.13	1.16	1.19
	50	0.78	0.81	0.85	0.86	0.88	0.89	0.91	0.92	0.94	0.95	0.97	1.00	1.03	1.06	1.09	1.12	1.15
	60	0.76	0.79	0.82	0.83	0.85	0.86	0.88	0.89	0.91	0.92	0.94	0.97	1.00	1.03	1.06	1.09	1.12
	70	0.74	0.77	0.80	0.81	0.83	0.84	0.85	0.87	0.88	0.90	0.91	0.94	0.97	1.00	1.03	1.06	1.09
	80	0.72	0.75	0.77	0.79	0.80	0.82	0.83	0.84	0.86	0.87	0.89	0.92	0.94	0.97	1.00	1.03	1.06
	90	0.70	0.72	0.75	0.77	0.78	0.79	0.81	0.82	0.83	0.85	0.86	0.89	0.92	0.94	0.97	1.00	1.03
	100	0.68	0.71	0.73	0.75	0.76	0.77	0.79	0.80	0.81	0.83	0.84	0.87	0.89	0.92	0.95	0.97	1.00
110	0.66	0.69	0.71	0.73	0.74	0.75	0.77	0.78	0.79	0.80	0.82	0.84	0.87	0.90	0.92	0.95	0.97	
120	0.64	0.67	0.69	0.71	0.72	0.73	0.75	0.76	0.77	0.78	0.80	0.82	0.85	0.87	0.90	0.92	0.95	

Example

The satisfactory operation of a hydraulic system requires a precharge pressure of 100 bar. The operating temperature t_2 is 50°C and the temperature at precharging t_o is 20°C. From the table, a correction factor of 0.91 should be applied, giving a precharge pressure at 20°C of 91 bar.

Warning – Stabilization

The process of filling or discharging an accumulator with nitrogen causes a temperature change which is transmitted to the surrounding air as the temperature of the accumulator stabilizes. To allow for the effects of temperature transfer, the accumulator should be allowed to stand for a minimum of 15 minutes to allow the temperature to stabilize before a final reading of the precharge pressure is taken.

Gas Bottle Fittings and Part Numbers

To meet the requirements of different markets, Parker's UCA Charging and Gauging Kits are supplied with an adapter to suit the appropriate gas bottle fitting.

Country	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



WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

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