Hydraulic Piston Accumulators Service

General

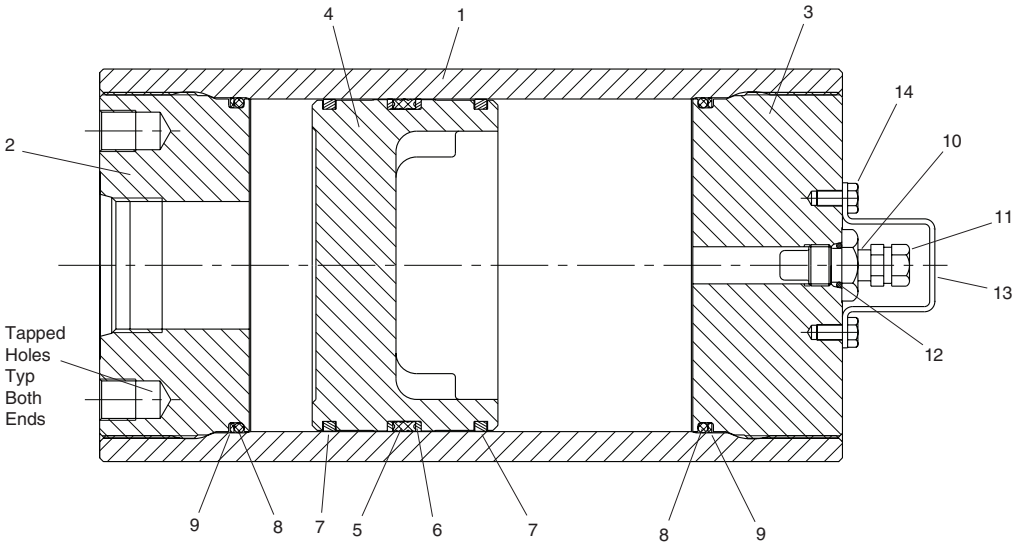
The hydraulic brake systems on Wagner Carry Dozers and Log Stackers require the use of hydraulic piston accumulators. Refer to the hydraulic schematic and parts manual for your machine to determine number, location, and part number(s) of the accumulators on your machine.

The accumulators require a nitrogen pre-charge at all times. Refer to Table 1 for the required pre-charge for your accumulator. Note that some accumulators have a Schrader-type gas valve (see Figure 2), while others have a Poppet-type gas valve (see Figure 4). Charging instructions are slightly different for the two valves. See pages 4-6 for charging instructions.

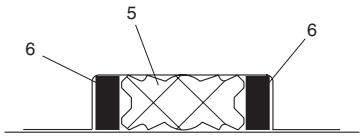
In extreme weather (hot or cold), it may be necessary to apply a correction factor to the pre-charge. This is usually not necessary, but Table 2 on page 7 is provided for reference.

Part Number	Pre-Charge Value	Valve Type
245411	1500 psi	Poppet
250658	975 psi	Schrader
587538	1700 psi	Schrader
587539	1850 psi	Schrader
590153	700 psi	Poppet
590154	975 psi	Poppet
590180	700 psi	Schrader
596338-975	975 psi	Schrader
R15543	2200 psi	Schrader

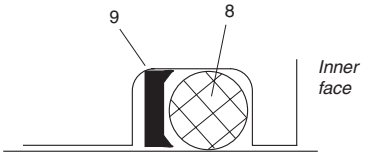
Table 1 Nitrogen Pre-Charge Values



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



Piston V-O-Ring Seal and Back-Up Washers



End Cap O-Ring and Back-Up Washer

Figure 1 Typical Wagner Hydraulic Piston Accumulator (Schrader-Type gas valve shown)

Removal from a Hydraulic System

See Figure 1.

1. Turn the machine off and relieve all hydraulic pressure from the system, making 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 nitrogen bottle is attached to the accumulator, ensure that pressure in the hose is discharged before disconnecting the accumulator. See pages 4-6 for details.

Disassembly

⚠ WARNING

Explosion Hazard. Death or serious injury are possible if the accumulator is disassembled while pressurized. Gas pressure must always be discharged before the disassembly of an accumulator – see pages 4 - 7.

Wagner 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. Discharge gas pressure. See pages 4-7.
2. Position the accumulator horizontally and hold down with a strap wrench, or in a vice.
3. Where fitted, remove the gas valve protector (13) and unscrew the gas valve (10). Remove and discard the O-ring (12).
4. 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.
5. Remove O-rings and back-up washers (8 & 9) from the gas end cap, taking care not to damage the grooves.
6. Repeat steps 3 and 4 for the hydraulic end cap (2).
7. 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.
8. 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

See Figure 1.

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 – order 593471 for accumulators with a 4” bore, and 593472 for accumulators with a 6” bore.

Piston

See Figure 1.

1. Lubricate and fit the new 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 direction, 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 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

See Figure 1.

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.

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 1.
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.
5. Remove the screws threaded into the holes of the cap.

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 18-21 ft-lbs (25-29 N-m). 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 4-7. Where space is restricted, it may be necessary to pre-charge the accumulator before installation.

Checking and Adjusting Precharge Pressure

The precharge pressure of an accumulator may be checked, and nitrogen filled or vented, using the charging kit, Allied part number 256059.

The Charging and Gauging Assembly (see Figure 3) 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 Charging and Gauging Assembly can be connected to the nitrogen source with the supplied hose.

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.

⚠ WARNING

Explosion Hazard. Death or serious injury are possible if the accumulator is charged with Oxygen. ALWAYS charge with Nitrogen.

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 3000 PSI, a pressure regulator must be fitted to the nitrogen bottle.

Maintenance Interval

The precharge should be checked after the first week or 50 hours of operation, whichever occurs first. Thereafter, it should be checked every three months or every 500 hours, whichever occurs first.

Warning – Stabilization

The process of charging or discharging an accumulator with nitrogen causes a temperature change to the accumulator 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.

Accumulators with Schrader-type Valve

See Figure 2 and Figure 3.

1. Remove the gas valve protector (11) and cap (12) from the accumulator, to gain access to the gas valve (13).
2. Make sure that the Bleed Valve is fully closed by turning the Bleed Valve handle clockwise.
3. Make sure that the air chuck is in the fully raised position by turning the T-Handle in a counter-clockwise direction.
4. Install Charging and Gauging Assembly on the accumulator by screwing the air chuck to the gas valve and tighten to prevent any leakage. Turn the T-handle on the air chuck clockwise to depress the valve core. Precharge pressure currently in the accumulator will register 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_o is Correct

1. Screw the air chuck T-handle counter-clockwise to close the accumulator gas valve.
2. Slacken the bleed valve to release pressure in the Charging and Gauging Assembly.
3. Unscrew the Charging and Gauging Assembly from the accumulator gas valve.
4. Make sure that the accumulator gas valve (13) is sealing effectively.
5. Reinstall the gas valve protector and cap on the accumulator.

Nitrogen Pressure p_o is Too High

1. Slightly slacken the bleed valve to slowly 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 once the desired filling pressure is reached.
3. Screw the air chuck T-handle counter-clockwise to close the accumulator gas valve.
4. Slacken the bleed valve to release pressure in the Charging and Gauging Assembly.
5. Unscrew the Charging and Gauging Assembly from the accumulator gas valve.
6. Make sure that the accumulator gas valve (13) is sealing effectively.
7. Reinstall the gas valve protector and cap on the accumulator.

Nitrogen Pressure p_o is Too Low

1. Screw the air chuck T-handle counter-clockwise to close the accumulator gas valve.
2. Connect the hose to the nitrogen bottle regulator.
3. Remove the seal cap and connect the swivel connector on the hose assembly. Hand tighten enough to prevent leakage.
4. Screw the air chuck T-handle clockwise to open the accumulator gas valve

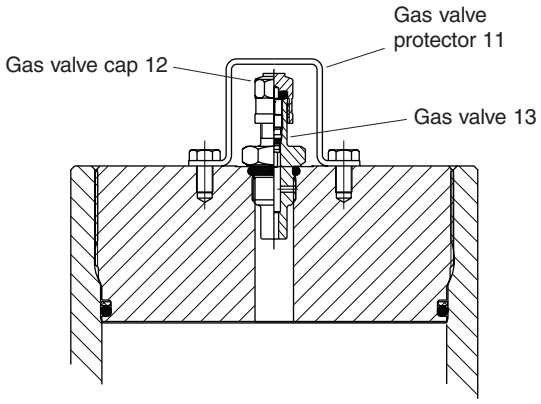


Figure 2 Accumulator with Schrader-type gas valve

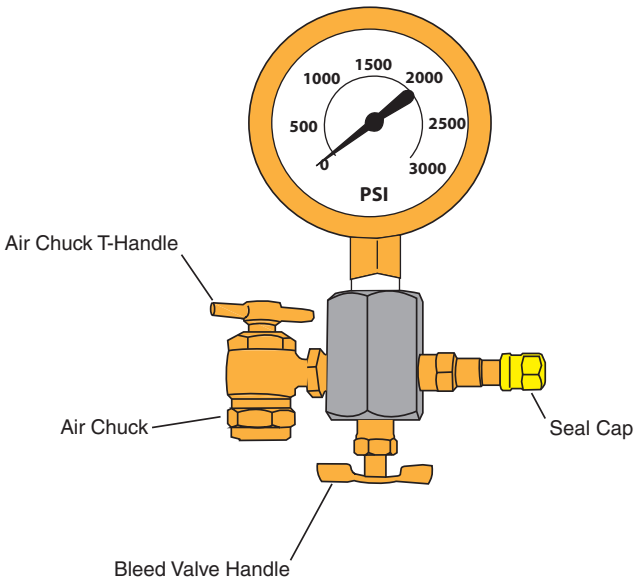


Figure 3 Charging and Gauging Assembly

5. Open the regulator valve on the nitrogen bottle carefully to let nitrogen flow at a slow rate into the accumulator. Proceed to charge until the accumulator reaches desired precharge pressure. Refer to Table 1 to find the required precharge pressure.
6. 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.
7. Screw the air chuck T-handle counter-clockwise to close the accumulator gas valve.
8. Slacken the bleed valve to release pressure in the hose and the Charging and Gauging Assembly.
9. Remove the hose carefully.
10. Unscrew the Charging and Gauging Assembly from the accumulator gas valve.
11. Make sure that the accumulator gas valve (13) is sealing effectively.
12. Reinstall the gas valve protector and cap on the accumulator.

Discharging Gas Pressure

To discharge gas pressure prior to carrying out maintenance on an accumulator, attach the Charging and Gauging Assembly as described at the beginning of this section. Slacken the bleed valve 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.

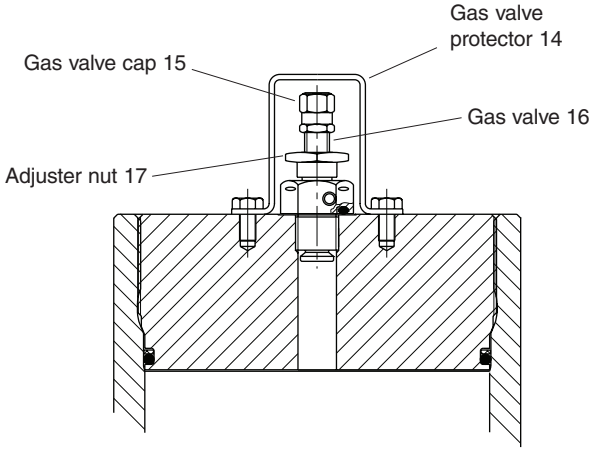


Figure 4 Accumulator with Poppet-type gas valve

Accumulators with Poppet-type Valve

See Figure 3 and Figure 4.

1. Unscrew the gas valve protector (14), where fitted, and gas valve cap (15) from the accumulator gas valve (16).
2. Make sure that the Bleed Valve is fully closed by turning the Bleed Valve handle clockwise.
3. The position of the air chuck T-Handle can be ignored, as it does not affect this procedure.
4. Install Charging and Gauging Assembly on the accumulator by screwing the air chuck to the gas valve and tighten to prevent any leakage.
5. Open the accumulator gas valve by turning the hexagonal poppet valve adjuster nut (17) counter-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_o is Correct

1. Close the accumulator gas valve by turning the poppet valve adjuster nut (17) clockwise.
2. Slacken the bleed valve to release pressure in the Charging and Gauging Assembly.
3. Unscrew the Charging and Gauging Assembly from the accumulator gas valve.
4. Make sure that the accumulator gas valve (16) is sealing effectively.
5. Reinstall the gas valve protector and cap on the accumulator.

Nitrogen Pressure p_o is Too High

1. Slightly slacken the bleed valve to slowly 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 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 to release pressure in the Charging and Gauging Assembly.

5. Unscrew the Charging and Gauging Assembly from the accumulator gas valve.
6. Make sure that the accumulator gas valve (16) is sealing effectively.
7. Reinstall the gas valve protector and cap on the accumulator.

Nitrogen Pressure p_o is Too Low

1. Close the accumulator gas valve by screwing the poppet valve adjuster nut (17) clockwise.
2. Connect the hose to the nitrogen bottle regulator.
3. Remove the seal cap and connect the swivel connector on the hose assembly. Hand tighten enough to prevent leakage.
4. Open the accumulator gas valve by screwing the adjuster nut (17) counter-clockwise, to admit the pressurized gas, taking particular care if the accumulator has a small capacity.
5. Open the regulator valve on the nitrogen bottle carefully to let nitrogen flow at a slow rate into the accumulator. Proceed to charge until the accumulator reaches desired precharge pressure. Refer to Table 1 to find the required precharge pressure.
6. 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.
7. Close the accumulator gas valve by screwing the adjuster nut (17) clockwise.
8. Slacken the bleed valve to release pressure in the hose and the Charging and Gauging Assembly.
9. Remove the hose carefully.
10. Unscrew the Charging and Gauging Assembly from the accumulator gas valve.
11. Make sure that the accumulator gas valve (16) is sealing effectively.
12. Reinstall the gas valve protector and cap on the accumulator.

Discharging Gas Pressure

To discharge gas pressure prior to carrying out maintenance on an accumulator, attach the Charging and Gauging Assembly as described at the beginning of this section. Slacken the bleed valve 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

$$p_0(t_0) = p_0(t_2)\frac{t_0 + 273}{t_2 + 273} = p_0(t_2) \times K$$

where: $p_0(t_2)$ = precharge pressure at working temperature t_2

$p_0(t_0)$ = precharge pressure at precharge temperature t_0

K = correction factor

Operating Temperature t_2 °C \ Precharge Temperature t_0 °C	-20	-10	0	5	10	15	20	25	30	35	40	50	60	70	80	90	100
-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

Table 2 Correction Factors

Example

The satisfactory operation of a hydraulic system requires a precharge pressure of 1500 psi. The operating temperature t_2 is 50°C and the temperature at precharging t_0 is 20°C. From the table, a correction factor of 0.91 should be applied, giving a precharge pressure at 20°C of 1365 psi.

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.

This page is intentionally blank.